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ECONOMICS & THE ENVIRONMENT

Motives for Firms to Adopt Solid Waste Management Controls: The Case of Food Processing Sector in Sri Lanka

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Abstract

This study offers an empirical analysis of the economic incentives available for food processing firms in Sri Lanka to adopt environmental controls for solid waste management. We carried out a series of in-depth interviews (n=325) with managers responsible for environmental quality in five types of food processing firms (coconut-based products, essential oils, non-alcoholic beverages, processed fruits and vegetables, and other processed products). We applied Confirmatory Factor Analysis techniques to the data to quantify the effect of six market-based incentives (cost/financial implications, sales, reputation, commercial pressure, human resources and technical efficiency), two regulatory incentives (existing and anticipated government regulations), and the liability incentive on the firm's adoption of solid waste management practices. The results suggest that the level of adoption of environmental practices at the firm level is low – on average firms adopt only 1.2 of a maximum of 8 different possible practices. Costs of adoption and perceived improvements in technical efficiency are two factors that motivate adoption. Liability laws and anticipated future regulations also matter. The analysis suggests that older firms and larger firms are more responsive to environmental considerations. Interestingly, export oriented firms do not do better than domestic firms.

Key Words: Environmental compliance, economic incentives, solid waste management, food processing firms, Sri Lanka.

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1. Introduction

The recent literature on environmental economics suggests that market-based actions can be more effective than government-oriented "first best" solutions in dealing with public goods problems (Segerson and Miceli, 1998; Weersink *et al.*, 1998), Early work by Coase (1960) suggests that economists and policy makers have tended to over-estimate the advantages that come from government regulation. However, under many circumstances, economists as well as policy makers have been in-effective in addressing both the predictable failures of public policy and remedying the market's shortcomings. The inability of both markets and governments to provide efficient remedies for economic hazards, underscores the importance of collaborative action between the two parties for achieving favorable "second best" solutions.

The key result that emerges from the environmental economics literature is that incentive-based policies such as taxes and tradable permits can be more efficient than command and control type regulations such as technology standards that require each and every firm, irrespective of the characteristics of the firm, to adopt the same abatement technology and abate to the same level. Further, this literature suggests that Coasian solutions may not materialize even if property rights can be assigned to victims or firms due to high transactions costs and problems of collective action etc. (Khanna, 2001). Also, it is difficult to formulate a set of appropriate policies that can be put into practice since there is limited knowledge of the level and nature of economic incentives available to firms.

This study seeks to understand why some firms do better than others in managing environmental quality. What explains differences in adoption of enhanced environmental management at the firm level? In adopting environmental practices, do firms respond to external pressures, government regulations or some market based incentives? This study seeks to address these questions in the context of the food processing sector in Sri Lanka. The specific objectives of the study are to: (i) identify the economic incentives for food processing firms in Sri Lanka to adopt various environmental controls to manage solid waste; (ii) to quantify the extent to which these individual incentives motivate firms to adopt different types of controls; and (iii) to assess the impact of firm and of market characteristics on adoption of waste control practices.

Only a limited number of previous studies on firm compliance have examined the issue of solid waste management, particularly in South Asian countries. In Sri Lanka, the food processing industry contributes about 4.5 per cent to the Gross Domestic Product (GDP) and is responsible for around 30 per cent of the total manufacturing value-added. According to the Ministry of Industrial Development of Sri Lanka, there are about 37,000 food processing firms belonging to 18 different sub-sectors operating in Sri Lanka. These firms employed some 198,000 persons in 2004. Unfortunately, the generation and accumulation of solid waste from this sector has become a growing problem. Thus, this study seeks to understand what types of incentives may motivate food processing firms to manage their waste better.

2. Background

The problem of generation and accumulation of solid waste from households and various industries has surfaced as a major concern in Sri Lanka. This problem is exacerbated by an absence of proper management systems at the firm and household levels and by the existence of a large number of food processing industries. According to the Ministry of Environment and Natural Resources, four out of the nine provinces of Sri Lanka (i.e., Western, Southern, Central and North-Western) are responsible for the generation of more than 80 per cent of the solid waste at the

municipal level by both households and industries (see Figure 1). However, data pertaining to waste accumulation from industries reveals that the real problem is the composition of waste and the haphazard disposal practices utilized by individual firms. Some 57 per cent of waste generated in the country is short-term bio-degradable waste and 6 per cent is classified as long-term "bio-degradable" materials. The remaining is more difficult to classify and dispose (MENR, 2005).

The legal framework for SWM in Sri Lanka is provided under the Local Government Act. The local authorities are charged with the responsibility of collection and disposal of solid waste at the municipal, urban and *pradeshiya sabha* (local government) level.[1] Further, under section 12 of the National Environmental Act, the Central Environmental Authority may give directions to any local authority in writing to adopt a course of action that the authority deems necessary for safeguarding and protecting the environment within the limits of such local authority. Despite all the formal regulations in place, effective enforcement of formal regulations aiming the management of solid and liquid waste is very poor. This may be because of poor implementation or because regulations vary across local authorities and provincial governments. We probe these issues further in our survey of firms.

Taking this fact into consideration, the MENR is in the process of designing policies to encourage firms to adopt effective and sustainable solid waste management practices (SWMP) through waste avoidance/reduction, reuse and recycling, and final disposal. The MENR under its recently formulated "National Strategy for Solid Waste Management" has introduced a number of specific procedures. These include: sorting of waste based on the 3R systems (reduce, re-use and recycle), composting, biogas technology, biodegradable packaging materials and sanitary land filling. We specifically assess the extent to which firms have adopted these five different practices in the food processing sector. Discussions with MENR suggest that the 3R system and composting are popular amongst food processing firms because of relatively low costs and time associated with adoption. Further, information with regard to these systems is available freely and widely in relation to the others.

The Sri Lanka Standards Institution offers firms training and certification on adoption of environmentally sound practices such as Good Manufacturing Practices, Waste Auditing and ISO 14000 Environmental Management Systems etc. The general evidence seems to suggest that larger firms, which have the resources and are subject to market pressure, are more able to take advantage of such training. Our survey of firms validates this hunch.

None of the good manufacturing or waste management practices are purely "incentive-based policies" since they do are not relate to specific instruments (e.g. taxes or penalties for non-compliance). They also have characteristics of "command and control" type standards. Nevertheless, these practices are not mandatory and it is useful to ask why firms choose to either adopt some practices or not.

3. Incentives for Firms to Adopt Environmental Controls: the Empirical Evidence

Three types of literature are relevant for the examining why firms comply with environmental standards. These include studies that focus on: (a) different types of government regulations that affect incentives for abatement and the associated costs; (b) informal regulation by citizens and market characteristics that can lead firms to improve environmental performance, and (c) the voluntary adoption of environmental management systems such as ISO 14000. Our focus will be mainly on (c) though we discuss studies in the other areas as well.

Despite claims that the absence of legally binding regulations, limited institutional capacity, and inadequate information hampers formal regulation, in practice, firms in many developing countries, are "fast adopters" of industrial pollution control standards. On the other hand, the high rate of non-compliance" with existing regulatory requirements illustrates that direct government intervention may not be able to fully internalize market failures and can also be subject to policy failures (Pargal and Wheeler, 1996; Hettige *et al.*, 1996). Dasgupta *et al.* (2000), shed light on these issues by examining the effects of regulation, plant-level management policies and other factors that influence environmental compliance of Mexican manufacturers. Interestingly, they found that while many firms in

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[1]   Sections 129, 130 and 131 of the Municipal Council Ordinance, sections 118, 119 and 120 of the Urban Council Ordinance, and sections 93 and 94 of the Pradeshiya Sabha Act provide for the management and disposal of solid waste from the households and industries located in the respective areas.

Mexico avoid complying with regulations because of sporadic monitoring and enforcement, others over-comply with the regulations because their abatement decisions are strongly affected by extra legal factors.

Informal firms can create severe pollution problems in developing countries and are difficult to regulate. Blackman (2000) investigates how environmental policies have fared in four independent efforts to control emissions in the informal sector (e.g., in the context of brick kilns in northern Mexico). The outcome of the analysis suggests that, in general: (i) the conventional command and control process standards are generally only enforceable when buttressed by peer monitoring; (ii) clean technologies can be successfully diffused even when they raise variable costs, in part, because early adopters have an economic incentive to promote further adoption; (iii) boycotts of dirty goods sold in informal markets are unenforceable; (iv) well-organized informal firms can block implementation of costly abatement strategies such as relocation, and (e) private-sector-led initiatives may be the best suited for informal sector pollution control. In an earlier study, Blackman and Bannister (1997) found that community pressure applied by competing firms and private-sector local organizations can generate incentives for adoption even in the informal sector.

A number of studies have tried to address the broader question of what determines firm-level decisions to improve environmental performance. Hettige *et al.* (1996), for instance, test the importance of plant characteristics, economic considerations and external pressure in determining the environmental performance of firms in Bangladesh, India, Indonesia and Thailand using evidence from plant-level abatement practices. Similarly, Hartman, Huq and Wheeler (1997), look at pollution abatement efforts by 26 pulp and paper plants in Bangladesh, India, Indonesia and Thailand. In another study, Pargal and Wheeler (1996) examined the impact of informal regulation on industrial pollution in the context of Indonesia using data from 243 firms from the different sectors. While there are differences in the results from these studies, the evidence suggests that pollution intensity is negatively linked to certain firm characteristics (e.g., new technology) and informal regulations or community pressure and positively associated with public ownership. Different studies find differing associations between pollution intensity and scale.

The public policy literature has paid little attention to evaluating the ability of voluntary environmental programs to generate economic benefits for firms. But increasingly, the literature suggests that the reliance of environmental policy on market-based incentives has led firms to shift from regulation-driven management approaches to proactive strategies involving the voluntary adoption of environmental management systems (EMSs) (Anton *et al.* 2004; Segerson and Miceli, 1998). Liability threats and pressures from consumers, investors and the public seem to be motivating EMS adoption..

Several studies have examined the influence of voluntary compliance policies on firm behavior. Blackman (2008), for example, used plant-level data from more than 60,000 facilities to identify the drivers of participation in Mexico's voluntary Clean Industry Program. He suggests that the threat of regulatory sanctions drives participation in the program and the program did appear to attract relatively dirty firms. Plants that sold their goods in overseas markets and to government suppliers, used imported inputs, were relatively large, and were in certain sectors and states were more likely to participate in the program, all other things equal. In another such study, Powers *et al.* (2008) used detailed plant-level survey data to evaluate the impact of India's Green Rating Project (GRP) on the environmental performance of the country's largest pulp and paper plants. They found that the GRP drove significant reductions in pollution loadings among dirty plants but not among cleaner ones.

Rivera (2002) provides cross-sectional evidence on the participation of hotels in the Costa Rican Certification for Sustainable Tourism (CST program), which is probably the first performance-based voluntary environmental program created by a developing country government. Rivera finds that hotels with certified superior environmental performance have differentiation advantages that yield price premiums. Higher environmental performance is also significantly related to government monitoring, trade association membership and a focus on "green consumers".

Khanna *et al.* (2007) examine the motivations for firms to participate in voluntary environmental programs and to adopt environmental management practices using data gathered from a survey of six industrial sectors in Oregon. They find that larger facilities were more likely to participate in more voluntary environmental programs, but were likely to adopt more EMPs only if environmental issues were of significant concern. Presence of an R&D department stimulates the adoption of more EMPs. In an earlier study, Khanna and Anton (2002) used a behavioral

model of firm decision-making to obtain econometrically testable hypotheses of the factors influencing firms to undertake proactive environmental management. This analysis shows that economic factors such as the threat of environmental liabilities and high costs of compliance with anticipated regulations as well as market pressures on firms that produce final consumer goods and have large capital–output ratios play a statistically significant role in inducing corporate environmentalism.

Basing their study on the incentives given for chemical processing firms in the US to participate in the voluntary 33/50 program, Arora and Cason (1996) and Khanna and Damon (1998) investigated why some firms committed resources to achieving environmental performance beyond mere compliance with environmental regulations. They concluded that firms with more contact with final consumers and greater research and development expenditures were more likely to perform beyond the level of compliance. Henriques and Sadorsky (1996) tested and accepted the hypothesis that environmental regulations represent a main determinant of managerial action to deal with environmental concerns from the perspective of Canadian firms. Klassen and McLaughlin (1996), on the other hand, found public announcement of environmental awards to have an immediate positive impact on the market valuation of firms for shares traded on the NYSE and AMEX. They also found significant negative impacts immediately following an environmental crisis associated with a specific firm.

The survey of literature above suggests, in essence, that neither the market nor the government alone can guarantee a safer environment as both systems are subject to inherent imperfections. A choice between the market and the government is, therefore, not a choice between perfection and imperfection, but a choice between degrees and types of imperfection and between degrees and types of failure. In other words, the "actual choice" is some compromise between imperfect markets and an imperfect government.

4. Methods

4.1 Conceptual Framework

We can conceptualize that there are three social processes, namely: (1) market; (2) political and (3) judicial that can influence firms in implementing environmental management controls (Figure 2). Market processes help coordinate human action of firms through voluntary cooperation because of market pressures. In the case of environmental quality and the food sector, for example, ISO 14000 series of standards and enterprise-oriented and customer-specific practices may be adopted by firms voluntarily or quasi- voluntarily (i.e. based on the recommendation of trade or industry organizations). The political process contributes by offering a legal framework and through enforcement. In Sri Lanka, the public statutory and regulatory requirements of the National, Provincial and Municipal governments satisfy this requirement. Along with these, judicial process contributes through dispute mediation.

We build on Caswell *et al.* (1998) and Segerson (1999) as well as agency models of the firm presented by Jenson and Meckling (1976) and Williamson (1986), to derive the conceptual framework, a set of hypotheses and the empirical model for this study.

Let us assume that the environmental policy of a firm that works to create a 'waste-free non-polluted environment' is characterized by the utility function $U_i = u\,[v\,(D_i | I_{ji}, F_{ki})]$ of the decision maker/management of the firm i (where $i = 1, 2, 3...n$) and $u\,(v)$ is concave in its arguments. The management of the firm is responsible for complying with the regulatory requirements and may also adopt various strategies voluntarily to manage waste. Thus, v represents the overall gains to the firm through its responsible behavior towards environment quality (D).[2]

The responsiveness of a firm towards the environment (D) is reflected by different environmental management practices ($SWMP_i$) adopted by the firm. These practices depend on the individual incentives faced by the decision maker/management (I_{ji}), where j = types of incentives ($j = 1, 2, 3...m$) and the characteristics of the firm (F_{ki}), where k = size or type of the firm. Following Nakamura *et al.* (2001) from the maximization of the utility function, we derive the following empirical expression of the determinants i[th] firm's environmental management practices (where ε_i is an error term):

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[2]   According to Nakamura et al. (2001), this is the 'intrinsic value' the manager derives as she tries to maximize her efforts to behave in a more environmentally friendly manner.

$$SWMP_i = \alpha_i + \beta_j I_{ji} + \gamma_k F_{ki} + \varepsilon_l \qquad (1)$$

An important issue is to identify the incentives that are likely to affect SWMP. Based on the conceptual framework presented above and findings from past studies, we identify nine individual incentives to represent market, regulatory and liability incentives. These include: (1) cost/financial implications of adoption of SWMPs (CST), (2) increased technical efficiency in the firm (TCE) from adoption, (3) increased human resource efficiency in the firm (HRE) as a result of adoption, (4) sales & revenue (SLR) benefits, (5) commercial pressure to adopt SWPMs (CPR) and (6) reputation of the firm (REP). We also selected regulatory incentives such as (7) existing government regulation (EGR) and (8) anticipated government regulations (AGR) and (9) liability incentives, i.e. liability laws (LBL) (Caswell *et al.*, 1998; Jayasinghe-Mudalige and Henson, 2006a; 2006b; Khanna and Anton, 2002; Segerson, 1999).

Our data, discussed in the next sections, allows us to show the link between adoption of SWMPs and various incentives. However, we are unable to measure the actual incentives in place – rather, we establish a connection between adoption and the firm managers' perception of different incentives. We hypothesize that a firm's decisions to adopt SWMPs is likely to be positively associated with the firm's perception that:

- these practices will increase technological efficiency of day-to-day operations (e.g. less by-products, introduction of new technology).
- adoption will contribute to more efficient labor and management of the firm (e.g. staff morale, team work, clear cut work assignments).
- adoption will increase sales and revenue of firms (e.g. through demand for quality products).
- there is commercial pressure from external forces (e.g. customers, trade associations and the neighborhood) for firms to behave in an environmentally responsible fashion
- adoption will enhance the reputation of firm (e.g. promote brand capital, first-mover advantage and by avoiding chances for "name & shame").
- liability laws / judiciary are important to the firm (e.g. fines and compensation, legal costs).
- existing government regulation (i.e. law enforcement, closure of firm) matter.
- stricter anticipated regulation on environmental management (i.e. global standards, mandate) will motivate firms to act sooner than later.

And negatively associated with:

- expected direct costs (e.g. restructuring of the plant, inputs) and other financial implications (e.g. budgetary allocations, access to credits and subsidies) associated with adoption of such practices.

4.2 Econometric Specification of the Model and Confirmatory Factor Analyses

We can extend equation (1) expressed above to specify the following econometric model:

$$SWMP_i = \sigma_0 + \beta_1 * CST_i + \beta_2 * TCE_i + \beta_3 * HRE_i + \beta_4 * SLR_i + \beta_5 * CPR_i + \beta_6 * REP_i + \beta_7 * EGR_i +$$
$$\beta_8 * AGR_i + \beta_9 * LBL_i + \gamma_1 * FT_i + \gamma_2 * FS_i + \gamma_3 * VT_i + \gamma_4 * EX_i + \varepsilon l \qquad (2)$$

where: $SWMP_i$ denotes the dependent variable (i.e., solid waste management practices adopted by a firm). The right hand side variables include: σ_0 = intercept, β_j = coefficients of 9 individual incentives (j = 1, 2...9) considered in the analysis and γ_k = coefficients of characteristics of a firm (F_{ki}) denoted by dummy variables such that FT = firm type [5 types based on the major products processing (see section 5.1)]; FS = firm size [5 categories such as: very large, large, medium, small, very small based on annual returns (see section 6.1)]; VT = Vintage (1 = ≥10 years; 0 = <10 years), and EX = Export orientation (1 = export; 0 = do not export products).

We use the total number of technologies/practices adopted by a firm as our dependent variable ($SWMP_i$). This is a measure of the 'intensity of adoption' of solid waste management measures. MENR has recommended eight solid waste management practices to firms: (1) sorting of waste based on 3R (reduce, reuse and recycle) systems; (2) composting; (3) use of biogas technology; (4) use of biodegradable packaging materials; (5) development of sanitary land filling; (6) good manufacturing practices; (7) waste auditing and (8) ISO 14000. To obtain a measure

of intensity of adoption ($SWMP_i$), we first assessed if any of the MENR strategies (i.e., 1–8) had been adopted by the firm. We then considered the number of SWMPs adopted (i.e., zero, one, or more).

The MENR does not suggest any recommended order in which to adopt solid waste management practices in the food sector. Further, none of these practices is endowed with a higher value over the others. Thus, some firms adopt no practices, others may adopt a single or a few (i.e., two or three) practices at a time, whereas still others may adopt all measures (i.e., seven or eight). Because our dependent variable ranges from zero to eight and we may have a number of zeroes, it is appropriate to use Count Data Regression models for estimating equation (2) (Chowdhury and Imran 2010; Anton *et al.* 2004).

Our independent variables include firm characteristics, firm size, vintage, export orientation and nine incentives. These incentives are very critical to the analyses but the literature suggests that it is not possible to include these nine individual incentives directly in the econometric model as explanatory variables. This is because of three main reasons:

- Mutual Exclusivity and Endogeneity – some of these incentives are not mutually exclusive and are endogenous to the decision making process. Thus, they cannot be included as independent determinants of environmental compliance (Nakamura *et al.*, 2001; Shavell, 1987);
- Subjectivity – the incentives involve subjective assessments that we may need to explore more fully to understand how management perceives the incentives in terms of potential benefits and costs to the firm (Buchanan, 1969); and
- Unobservability – the researcher cannot directly observe the nature of the incentives prevailing at the firm level (Hair *et al.*, 2006).

In order to overcome these difficulties, we use the statistical technique known as Confirmatory Factor Analysis (CFA), which is a part of Structural Equation Modeling (SEM) and is commonly described as the measurement model (MM)[3] of SEM (Hair *et al.*, 2006; Hughes *et al.*, 1986) to develop estimable variables for individual incentives. This is a common practice when important variables or 'constructs' cannot be measured without error. Instead, we identify 'indicators' that can represent these latent constructs. For the purpose of this study, the nine individual incentives are latent construct variables and we specify a set of 'attitudinal statements' reflecting observable characteristics of these incentives as indicators.[4] The data on the attitudinal statements was obtained from the firm survey, which is discussed in the next section.

Once the indicators for our nine constructs were identified, each of these indicators or attitudinal statements was ranked by firms' decision-makers on a Likert–scale. With the help of AMOS and SPSS software we use the scores provided by respondents for each indicator to resolve the empirical problems of non–exclusivity, endogeneity, subjectivity and unobservability[5] (see, sections 5.2.1 and 5.2.2 for details). Once valid and reliable indicators are identified through these tests, the scores given by respondents to these indicators on the multi–point Likert–scale are treated as objective measures of incentives.

Since there are several indicators for each incentive, we don't have an aggregate measure or value for each incentive. To obtain this, we use the scores given by respondents to each indicator i.e. attitudinal statement, to derive an index for the respective incentive (j = 1, 2…9). This is referred to as an Incentive Index (Iji). We do this by taking the aggregate of the scores given by a respondent to all indicators of an incentive on the 5-point Likert Scale and dividing it by the Maximum Potential Score:

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3 MM is a sub-model in SEM that: (i) specifies the Indicators for each Construct, and (ii) assesses the reliability of each Construct for estimating the causal relationships. It is similar in form to factor analysis; however, the major difference lies in the degree of control provided the researcher. In the MM the researcher specifies which variables are Indicators of each Construct, with variables having no loadings other than those on its specified Construct. However, in factor analysis, the researcher can specify only the number of factors although all variables have loadings for each factor.

4 Customarily, researchers use firsthand information gathered from participants to the study (e.g., owners/managers of food processing firms in this particular case) in order to develop the attitudinal statements (i.e., Indicators of the Constructs).

5 Both SPSS and AMOS can be used for this purpose; however, each has its own limitations. AMOS is the best as it considers all these tests (i.e. reliability and validity of data) simultaneously on a single model; but results are unbiased and consistent for large samples only (i.e. >150).

I$_{ji}$ = Aggregate Score (AGS) / Maximum Potential Score (MPS)   (4)

We use MPS in equation (4) to normalize the value of the Incentive Index so that its value ranges from -1 (minimum) to +1 (maximum). In effect, the magnitude of the Incentive Index obtained for each incentive for every firm signals the perceptions and the true behavior of the firm in question in relation to these individual incentives, and we can use it as a proxy to represent those incentives in the econometric model (Henson and Traill, 2000).

5. Survey Design and the Data

5.1 Sampling Framework

The food and food processing industries of Sri Lanka is categorized into 18 sub-categories by the Ministry of Industrial Development.[6] According to the Department of Census & Statistics – Industrial Survey (2003/2004), there were 36,939 firms belonging to these 18 sub-sectors in 9 provinces in Sri Lanka. For data collection purposes, we categorized these firms into five key sub-sectors based on the type of product: (1) processed fruits and vegetables (PFV)]; (2) coconut products (COP); (3) essential oils (ESO); (4) non-alcoholic beverages (NAB), and (5) other processed products (OPP), located in four provinces [i.e., Western (WP), North Western (NW), Central (CP) and Southern (SP)][7]. We focused on four provinces and dropped the other five because of the high population density and larger number of firms in these four provinces.

For preparing the sampling framework, we obtained the mailing lists of food processors that operate at various locations by contacting reputed institutions such as: (a) the Department of Census & Statistics of Sri Lanka; (b) the main and regional offices of the Export Development Board of Sri Lanka; (c) the Ministry of Industrial Development; (d) the Federation and Regional Chambers of Industry and Commerce; (e) National Agribusiness Council of Sri Lanka; (f) Coconut Research Institute of Sri Lanka; (g) Fruit and Vegetable Processors Association of Sri Lanka, and (h) Sri Lanka Standards Institution. Our sampling frame was then created by cross-checking these addresses and identifying a master list of firms based on information provided by these various institutions. The contact details of firms were obtained from the Municipal Council (for urban-based factories) and at *pradeshiya sabha* (for rural-based factories) levels.[8]

5.2 Data Collection and Analysis

We carried out the collection and analysis of data in two phases, namely: (i) the Pilot Study, and (ii) the Main Survey. We provide the purpose of and activities in each phase briefly.

5.2.1 Pilot Study

The purpose of the Pilot Study was to validate the preliminary questionnaire designed to obtain data on SWMPs and individual incentives facing firms. We carried out a series of in-depth face-to-face interviews supported by the structured questionnaire with the top-most executives[9] from 36 food processing firms from July to September 2008. These interviews were followed by an inspection of the site for cases where permission was granted. In the interviews, we obtained information about the respondent, the firm's characteristics and attitudes toward different practices.

The data on attitudinal questions requires careful elaboration. The questionnaire included 81 attitudinal statements (i.e., 8 statements per incentive x 9 incentives + 9 validation items to represent 9 incentives). For

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[6]   These include: (1) food ingredients; (2) fresh fruits and vegetables; (3) poultry/meat; (4) processed meat and fish; (5) dairy products; (6) ethnic foods; (7) biscuit and confectionary; (8) bakery and flour-based products; (9) non-alcoholic beverages; (10) delicatessen products; (11) coconut products; (12) health foods and beverages; (13) frozen foods; (14) canned products; (15) preserved foods (16) essential oils; (17) herbal and organic products, and (18) convenience foods.

[7]   More than 95 per cent of firms in other sub-sectors were very small in nature with less than 5 employees, and was reported using traditional methods to manage waste generate and accumulate at the site (e.g. burning, put into Municipal waste baskets).

[8]   However, direct access to this information was really complicated. Either it was considered confidential or there was a too much bureaucratization. Even in the cases where we were given access, the information provided was incomplete and/or outdated or it was not catalogued systematically.

[9]   These managers possess executive powers to make decisions with respect to environmental quality related aspects of the firm (in certain cases, especially in the small firms, it was the owner).

example, an attitudinal statement such as "*I am really concerned about the costs involved with restructuring this firm to accommodate those SWMPs*" was used to assess attitudes associated with incentive 1 (Cost/financial implications). Following good practice (Hair *et al.*, 2006; Henson and Traill, 2001), these 81 statements were written in such a manner that respondent firms would "agree" (disagree) with a statement, if the phenomenon underpinning it was perceived as a positive (negative) incentive for the firm to act (not to act) on environmental quality. For each such attitudinal statement, respondents were first asked to respond on a two-point Likert scale, i.e., (1) agree (yes), or (2) disagree (no). We then asked the respondent to rate the same statement on a five-point Likert-scale based on the extent to which he/she agrees or disagrees (Oppenheim, 1992).

We subjected the data from 36 firms to CFA techniques to eliminate superfluous indicators out of 81 in the preliminary questionnaire, and in turn, to select the most valid and reliable statements to formulate the final questionnaire.[10] We applied a number of statistical tests specified under the CFA such as: (a) Construct/Scale Reliability (with the *Cronbach alpha*); (b) Unidimensionality (with the *Principle Axis Factoring*), and (c) Construct Validity (with the *Multi-Trait Multi-Method matrix*) individually using the SPSS.[11] These tests are described in Appendix 1.

First, we carried out the Scale Reliability Test, which is used to exclude statements from each incentive based the estimated value of the Cronbach Alpha. The analysis followed several rounds, and based on the values of Cronbach Alpha obtained, we excluded a number of statements from each incentive at the end of each round until we obtained its best value (see Table 1a). At the end, except for 3 incentives (i.e., TCE, SLR and LBL), the value of Cronbach Alpha, was greater than the commonly accepted level of 0.7. However, we retained the statements associated with the 3 incentives as a slight deviation from the accepted value of 0.7 is valid under certain circumstances.[12]

Next we tested for Unidimensionality. The performance of the Principle Axis Factoring on the scales for nine incentives indicated a high level of Unidimensionality all statements except two had Factor Loadings exceeding 0.35 (see Table 1b). Therefore, none of the statements subjected to this test, was removed. At the end of these tests, we used the scores given by respondents to 43 out of 81 statements, which passed both Scale Reliability and Unidimensionality tests, to derive the Incentive Index (I_{ji}) for each of the nine incentives based on equation (4).[13]

Finally, we tested for Construct Validity. We used the values of the Incentive Index derived for each incentive to derive a Multi-Trait Multi-Method matrix (MTMM matrix), introduced by Campbell and Fiske (1959), which represents the correlation between: (i) the value of the Incentive Index derived for each incentive, and (ii) the value of the corresponding single-item Validation variable (Table 2). In this matrix, the values representing the leading diagonal are significantly greater than the correlation coefficients for non-corresponding scales off of the leading diagonal. This proves that the incentive indices based on attitudinal statements are valid measures of the respective incentives as they pass the test for both Convergent and Discriminant Validity.

At the end of this three-stage CFA process, we selected 43 statements to be included in the final questionnaire (see Table 1b).

5.2.2 Main Survey

The main survey was carried out from January to September 2009 and used to collect data from 325 firms. Given the large sample size (i.e. >150 firms), we decided to use SEM in Analysis of Moment Structures (AMOS) version

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[10]   Before commencing the CFA, we re-inverted the scores given to certain statements that were inverted purposely in the questionnaire.

[11]   It must be noted that we have resolved to carry out the statistical testing for reliability and validity in the Pilot Study using individual tests available in the SPSS, but not the AMOS, due to small sample size (<150 firms).

[12]   These include, amongst the others: (i) the high degree of the heterogeneity of firms that responded to the statements; (ii) the relatively small number of responses assessed that may not be sufficient to increase the overall reliability amongst all statements (n = 36), and (iii) considering the fact that the said values were above 0.67 (i.e., just -0.03 lower than the accepted value).

[13]   Assume that the incentive (Construct) concerned comprised 5 statements (Indicators) and the "Firm Q", for example, has agreed ("yes") with the phenomenon stated in 3 statements (Indicators) and rated them by scoring 2, 3 and 5 on the five-point Likert scale and disagrees ("no") with the other 2 statements and rated them by scoring 1 and 4 on the same scale. The Aggregate Score (AGS) of the 5 statements would, therefore, be 2 + 3 + 5 – 1 – 4 = 10 – 5 = 5. The Maximum Potential Score (MPS) for this incentive was 5 x 5 = 25 (i.e., the firm very strongly agrees with all the statements and score 5 on the five-point scale). The value of the Incentive Index for this particular incentive for Firm Q was, therefore, 5 / 25 = 0.20. Further, assume that another firm ("Firm R") agreed with 2 statements specified for the same incentive by scoring 1 and 3 on the five-point Likert scale and disagreed with the rest of the statements and scored 3, 2 and 5 on the scale. The Aggregate Score was 1 + 3 – 3 – 2 – 5 = 4 – 10 = – 6 and the value of Incentive Index was – 6 / 25 = – 0.24.

16 to formulate the Measurement Model shown in Figure 3 and estimated it using Maximum Likelihood Estimation (MLE) techniques to make sure whether the indicators chosen were adequate measures of the nine incentives. We summarize the results below.

The results from AMOS suggest that the MM is significant at r=0.01, since the ratio of overall model X^2 to degrees of freedom (df), i.e. $X^2/df = 19 = 2.308$ is below the accepted cut-off value of <3.00. An analysis of other recommended goodness-of-fit measures too shows reliable model fit[14]. This proves the unidimensionality of the model (Hair *et al.*, 2006). The resulting Standardized Factor Loadings (λ), which is given as "Regression Weights" in AMOS, can be used to evaluate reliability and validity (see Table 1b). Hair *et al.*, (2006) recommend that λ should be 0.5 or higher or ideally 0.7 or higher. In our analysis, all loadings of the estimated model were significant 31 out of 43 statements had λ above 0.7 and only 5 statements with λ below 0.5.

Once the model fit is established, the next step is to test for Construct Validity by evaluating the Convergent validity and Discriminant validity (see Appendix 1). To facilitate evaluating the former, we estimate two specific measures, namely Construct Reliabilities (CR) based on the formulae $(\Sigma\lambda_j)^2/(\Sigma\lambda_j)^2+\Sigma(1-\lambda_j)^2$ and Average Variance Extracted (AVE) based on the formulae $\Sigma\lambda_i^2/n$, where λ = Standardized Factor Loading and n = Number of Items (Garver and Mentzer, 1999). The results from AMOS show that for all, but two incentives (EGR and AGR), CR is above the ideal 0.7 cutoff but even these two incentives are above the generally acceptable 0.6 cutoff (see Table 1a). For AVE, a value of 0.5 or higher suggests adequate convergence while the scale has higher distinct validity (Fornell and Larker, 1981). Only three incentives of the AVE (CPR, EGR and AGR) are below the 0.5 cutoff. This has resonance with the low Regression Weights obtained for indicators of these incentives (Dunn *et al.*, 1994). The satisfaction of conditions for all the Regression Weights, CR, and AVE support the Convergent Validity of the MM to a reasonable extent, and this, at the same time, proves scale reliability.

The recommended approach for establishing Discriminant Validity is to compare the Squared Correlation between two constructs with either of their individual AVE estimates. The AVE estimates should be greater than the squared correlation estimate. Table 3 shows that 27 out of the 36 inter-construct combinations satisfied the criterion and only 9 inter-construct correlations (highlighted in yellow) exceed the AVEs of either of the Latent Constructs (Hair *et al.*, 2006).

The descriptive statistics pertaining to all attitudinal statements used in the analysis are reported in Table 1b. The negative and positive values of the means indicate the extent to which, on average, firms perceive the positive or negative role of particular incentives. For example, statement 1.1: "*I do not mind about the costs associated with implementing these SWMPs in this firm*" has a mean of -0.9 implies that the decision makers in general see cost to be a negative incentive hindering adoption. Also the statement 8.4: "*Around the globe, there are many changes to environmental policies and these things will come to us in the near future*" has a mean of 3.44, which implies the fact that firms, as a whole, perceive anticipated environmental regulation as a positive incentive on the adoption.

6.   Results and Discussions

6.1   Characteristics of Firms in the Sample

We collected data from 325 firms categorized them into five types on the basis of their produce: Coconut Products [COP] (9.5%), Essential Oils [ESO] (18.2%), Non-Alcoholic Beverages [NAB] (22.2%), Other Processed Products [OPP] (21.5%) and Processed Fruits and Vegetables [PFV] (28.1%) (see Figure 4).

Figure 5 categorizes firms along the value of annual sales. 25 per cent of the firms were very small (< Rs. 100,000), 22 per cent were small (Rs. 100,000 – 500,000), 15 per cent were in the medium category (Rs. 500,000 – 1,000,000), 17 per cent were in the large category (Rs. 1,000,000 – 5,000,000) and 21 per cent of firms were very large (> Rs. 5,000,000). Interestingly, the majority of firms producing essential oils (64.4%) and other processed products (67.1%) were either small or very small. On the other hand, the firms engaged in producing coconut products (48.3%) and non-alcoholic beverages (65.2%) were either large or very large.

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[14]   Comparative Fit Index (CFI) = 0921 > 0.90; Tucker Lewis Index (TLI) = 0.914 > 0.90; Root Mean Sqaure Error of Approximation (RMSEA) = 0.064 < 0.07.

Nearly 40 per cent of firms were involved in international markets (i.e., exporting). Further, about 50.5 and 46.5 per cent of firms traded with wholesalers and direct customers (see Figure 6). Nevertheless, a significant variation was observed with regard to size of the firm and the type of customer they dealt with. Almost 71 and 59 per cent of very large and large firms, respectively, exported their products while only 23 and 1.3 per cent of small and very small firms did so.

6.2   Types of SWMPs Adopted by Firms and the Strength of Individual Incentives

Figure 7 illustrates that "Composting" (31%), "3R system" (24%) and "Good Manufacturing Practices" (24%) were popular as measures to control solid waste generated in the firm as compared to "Bio Gas Unit" (4%) and "ISO 14000 series" (5%). Out of the 325 firms contacted, however, 47 per cent of the firms did not adopt a single SWMP suggested by the MENR. Another 26 per cent adopted only 1, 2 or 3 out of the 8 practices. Only 5 per cent of firms have more than 5 SWMPs in place.

The number of SWMPs adopted by a firm varied to a great extent vis-à-vis the type of the firm and its size. Firms that produced non-alcoholic beverages and processed fruits and vegetables tended to adopt a higher number of SWMPs in comparison with those that processed essential oils and coconut products. In fact, nearly 75 per cent, 63 per cent and 61 per cent of essential oil, other processed products and coconut product processing firms, respectively, did not adopt a single SWMP. With regard to firm size, large firms, not surprisingly, tended to adopt a higher number of SWMPs. For example, nearly 29 per cent of very large firms adopted more than 4 such practices in the firm compared to 71 per cent of very small firms who did not adopt a single practice.

Table 4 reports the values of the Mean Incentive Index (MII) for each of the 9 incentives considered, while Figure 8 illustrates MII vis-à-vis the number of SWMPs adopted. It shows that for firms either without or with only one or two SWMPs, the value of the MII of most market-based incentives (e.g., CST, HRE, TCE, SLR, REP) is either negative or only slightly positive (e.g. CPR). Further, the values of the MII of regulatory and liability incentives are positive irrespective of the number of SWMPs in place. The magnitude of the Incentive Index, which ranges from –1 to +1 and reflects the relative strength of an incentive, is on average between -0.5 to 0.5. This indicates that on average firms do not consider incentives as very important in their decision to adopt SWMPs. Overall, the firms' average level of adoption of SWMPs is relatively low at 1.2 practices (given that 8 practices are recommended by the Ministry of Environment).

6.3   Outcome of the Count Data Model

The first step towards a Count Data Analysis was to examine the excess zeros and over-dispersion of the data. The results showed that the data were distributed with a Mean (Standard Deviation) of 1.153 (± 1.559) (i.e., Variance = ± 2.430). This shows that there is an over-dispersion. Therefore, we decided to estimate a model other than the Poisson model in which the two are constrained to be equal. Also the histogram of the response variable obtained shows that the number of zeros is excessive (Figure 9). These suggest that it is best to estimate the econometric model with other options available, including Zero-Inflated Poisson (ZIP) and Zero-Inflated Negative Binomial (ZINB) models that could account for this over-dispersion. We report the statistical outcomes of the ZIP and ZINB models in Table 5.

The Vuong statistic (V=3.36) compares the ZIP and PR models. Since it is significant, we prefer ZIP to the PR model. Where NBM is considered, the Vuong *t*-test (V=4.64) result further suggests that the ZINB outperforms its parent specification, the Negative Binomial model (NB). This test is also supported by the Likelihood Ratio (LR) test that we carry out to investigate whether or not the ZINB model reduces to the ZIP model. The results from this test demonstrate that the LR test statistic favors the ZINB model over the ZIP model.

As Table 5 shows, the coefficient of CST is negative for both ZIP and ZINB models and significant at 5 per cent implying that with every unit increase in the cost of adoption there is decrease in the adoption of recommended practices at the firm level. However, as cost is a negative incentive, if the firms are financially supported there is a higher potential to increase the adoption.

TCE is statistically significant in both models, which implies that the perceived improvements in technical efficiency of the firms act as a positive incentive leading to a higher adoption rate. For most firms, especially for small and medium-scale firms, technical efficiency can be a critical factor for implementation of SWMPs as it has a direct impact on their production.

Interestingly, the coefficients of all other perceived incentives Human resource efficiency, Sales and revenue, Reputation and Commercial pressure (HRE, SLR, REP and CPR) are not statistically significant. Thus, firms do not see human resource changes or reputational issues as important reasons for adopting SWMPs. This is contrary to the outcomes reported in previous research on environment and food quality management in the context of developed and developing countries. In the larger literature, market-based incentives such as reputation, commercial pressure and increased human resource efficiency play a greater role (relative to our study) when it comes to motivating firms to adopt environmental management measures.

The regulatory incentive of existing government regulation (EGR) is not statistically significant. It is possible that existing failures in government policy may lead firms towards non-compliance. It is also possible that firms simply do not have clear information on government policies. However, anticipated government regulations (AGR) do motivate firms to adopt SWMPs. Anticipated changes in government regulations lead the firms to act today as they anticipate stricter regulation in the future. Firms also respond to legal liabilities – they adopt more environmental management practices as they perceive that liability from non-compliance matters. Both models show there is a significant positive impact from liability laws on firm behavior.

Where different sectors are concerned, there were no sector wise (i.e. firm type) significant effects on the adoption decision. However, the scale of the firm (i.e. firm size) has an impact. The ZINB model shows that, in relation to very small scale firms, all other firm showed higher affinity towards the adoption of SWMPs. The very large firms display the highest adoption rate. The number of years a firm has been in existence (Vintage) does have a significant impact on the adoption decision – the more the years of existence of a firm, higher the rate of adoption. This interestingly suggests that, as a firm establish themselves, the sense of responsibility towards environmental quality increases. However whether the firm is a product exporting company or not does not have a significant impact on the adoption. This is because environmental standards, unlike food quality standards, do not critically affect exports.

The results, in effect, reject the hypothesis that a firm's adoption decision is triggered by market-based incentives. The outcome suggests that firms in Sri Lanka, in general, do not take into account market incentives or disincentives in the form of reductions in volume of sales and profits, negative customer reactions, loss of reputation and inefficiencies associated with the management of physical and human resources, etc., when adopting environmental measures. However, costs associated with adoption seem to be the one market based incentive that matters. Firms also adopt less in the current period in anticipation of future laws. However, stronger current legal liability associated with non-compliance seems to motivate adoption. Further, the outcome of the analysis accepts that the relative strength of an individual incentive faced by a firm is not the same across all firms – larger and older versions are more likely to adopt SWMPs.

7.   Conclusions

In this study, we examined the adoption of environmental, specifically, solid waste management, practices in the food processing sector in Sri Lanka. To do so, we gathered data from 325 firms. The information gathered suggests that a majority of firms adopt very few solid waste management practices. The government of Sri Lanka has recommended that this sector adopt eight different practices – however only 1.2 practices were adopted by firms in our sample.

Composting, the 3R (reduce, reuse and recycle) based system and Good Manufacturing Practices are popular as measures to control solid waste as compared to adoption of Bio Gas Units and ISO 14000 series. For example, only five per cent of the firms adopted ISO 14000 suggestions versus 31 per cent who adopted composting. As expected, larger firms tend to adopt more practices while smaller firms do not. In terms of the type of industry, our findings suggest that firms that produced non-alcoholic beverages and processed fruits and vegetables tended to

adopt a higher number of SWMPs in comparison with those that processed essential oils and coconut products. Export oriented firms did no better than non-export firms in terms of adoption. This is because environmental standards seem to matter less than food safety standards in the export market.

Do firms facing greater market or regulatory incentives adopt more environmental controls? The cost of adoption and perceived improvements in technical efficiency are the two market based incentives that seem to influence firm decisions to adopt environmentally responsible practices. Thus, subsidies for different environmental management technologies may motivate firms to adopt them. Firms are more amenable to better environmental practices if they think these practices make them more efficient. Contrary to findings from other empirical studies conducted in developing counties (e.g. Hettige *et al.*, 1996; Pargal and Wheeler, 1996), firms disregard several other market-based incentives. Incentives associated with reputation, commercial pressure or increases in sales don't seem to matter as yet in Sri Lanka.

The results on the role of regulatory incentives in influencing adoption of SWMPs are also mixed. Current regulations don't seem to motivate adoption – thus, the current government information provision, monitoring and regulatory roles don't matter very much yet. Firms do tend to adopt practices when they anticipate that there may be stricter regulations in the future. Thus, the *idea* of stricter regulations seems to matter but current regulations seem to be too weak to make a difference. However, legal liability does influence a higher degree of adoption.

It is imperative to design private and public sector initiatives to achieve a higher level of environmental quality at the firm level. However, such initiatives should factor in differing industry structures and sizes of firms. Our results suggest that larger and older firms adopt more environmentally responsible practices. Thus, particularly in newer sectors, there may be a lag between policy declaration and actual adoption. Firms and the industry may need to reach a degree of maturity before they become more environmentally compliant.

In Sri Lanka, regulations may need to be altered at the provincial government level to overcome current shortcomings in the regulatory system. It is also possible that the situation would improve if firms were more carefully consulted during the process of establishing regulations and setting standards. Industry and trade organizations could also be more engaged to help facilitate the process of adoption. The government would also have to play a more facilitative role in augmenting firm-level incentives.

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Tables

Table 1a: Summary of Statistics from CFA

Incentive (Construct)	PILOT SURVEY				MAIN SURVEY	
	No. of Indicators Used	Excluded After CFA	Selected for Main Survey	Value of Cronbach Alpha	AVE	CR
CST	9	5	4	0.905	0.8716	0.9643
TCE	9	4	5	0.677	0.8586	0.9680
HRE	9	3	6	0.907	0.6641	0.9220
SLR	9	5	4	0.605	0.4609	0.8338
REP	9	5	4	0.823	0.8232	0.9489
CPR	9	3	6	0.896	0.6256	0.8696
EGR	9	4	5	0.925	0.3112	0.6480
AGR	9	5	4	0.778	0.3299	0.6259
LBL	9	4	5	0.640	0.5680	0.8590
Total	**81**	**38**	**43**			

Source: Pilot survey data (n = 36); Main survey data (n = 325)
Note: AVE – Average Variance Extracted; CR – Construct Reliabilities

Table 1b: Summary of Statistics from CFA

Incentives and Attitudinal Statements (Constructs and Indicators)	PILOT SURVEY		MAIN SURVEY		
	Principle Axis Factoring		Std. Factor Loadings	Descriptive Statistics of Indicators	
	No of Iterations	Factor Loading		Mean	Std. Dev.
(1) Cost/Financial Implications (CST)					
1.1 – I do not mind about the costs associated with implementing these SWMPs in this firm.	7	0.743	0.987	–0.90	3.87
1.2 – I have no hesitation in expensing at least 5 per cent of my earnings to adopt and maintain these SWMPs.	7	0.566	0.987	–1.37	3.51
1.3 – I am really concerned about the costs involved with restructuring this firm to accommodate those SWMPs.	7	0.360	0.879	–2.65	2.38
1.4 – There is nobody to finance my business to implement those SWMPs; so how can we adopt these practices?	7	0.744	0.875	–2.50	2.64
1V – *The costs involved with implementing SWMPs is, in general, my major concern.*	7	0.575		1.46	3.70
(2) Technical Efficiency (TCE)					
2.1 – More controls means less by-products; so, I am really interested in implementing better SWMPs at my firm.	7	0.743	0.933	–1.64	3.25
2.2 – It is difficult to produce a quality product without backing from this type of SWMPs.	7	0.566	0.905	–2.75	2.50
2.3 – Waste control and technical efficiency are two different things! I don't know how one can increase the other.	7	0.360	0.885	–2.53	2.64
2.4 – If all these SWMPs in place, I will be in a big trouble, as I will loose my freedom to control the production of this firm.	7	0.744	0.966	–1.76	3.61
2.5 – Adoption of these SWMPs always brings new technology into the firm.	7	0.744	0.942	–1.15	3.51
2V – *The increased technical efficiency generate by adopting SWMPs is, in general, my major concern.*	7	0.575		–0.58	3.38

(3) Human Resource Efficiency (HRE)

3.1 - These SWMPs help us to boost the morale of our production staff.	7	0.743	0.835	-2.49	2.20
3.2 - Then, I don't need to guide my employees every time, everywhere; that saves both their and my time.	7	0.566	0.861	-2.10	2.82
3.3 - I hate record keeping on these practices; therefore, these advanced SWMPs are not in the master plan of this firm.	7	0.744	0.861	0.30	3.53
3.4 - We have to think deeply about training of our employees; that is a difficult task with my workforce.	7	0.744	0.763	-0.58	3.31
3.5 - Having sound SWMPs in this place increase the ability of my employees to work as a result oriented team.	7	0.744	0.741	0.76	2.87
3.6 - These controls create additional work for my employees; so, I am worry about their resistance.	7	0.744	0.821	-2.28	2.44
3V - *Increased efficiency of human resources created by the proposed SWMPs is, in general, my major concern.*	7	0.575		-2.08	2.37

(4) Sales and Revenue (SLR)

4.1 - Our decision to implement recommended SWMPs is not a threat for profitability of this business.	7	0.743	0.797	-2.85	1.65
4.2 - A cleaner environment created by these controls helps us to produce a quality product; that would increase our sales.	7	0.566	0.735	-3.25	1.52
4.3 - I am really happy that I can see a positive relationship between volume of sales and level of environmental controls that I have adopted in this firm	7	0.575	0.824	-3.27	1.54
4.4 - How many things we can do to increase our volume of sales other than expensing our valuable resources on SWMPs.	7	0.744	0.805	-3.15	1.11
4V - *Increased volume of sales and profits resulting from which is, in general, my major concern.*	7	0.575			

(5) Commercial Pressure (CPR)

5.1 - We cannot compete in the markets that we serve today, if we do not conform to the SWMPs proposed to us.	7	0.744	0.790	-2.49	2.30
5.2 - Our major customers laid down some requirements with respect to these SWMPs.	7	0.744	0.469	-1.67	1.87
5.3 - The day that my major customers require me to implement sophisticated SWMPs, I will decide to leave the industry	7	0.744	0.706	1.04	2.80
5.4 - Those enhanced SWMPs may be required for competing in international markets, but that pressure is yet not with us.	7	0.744	0.716	0.36	2.61
5.5 - We want to be in compliance with certain environmental standards to be a member of certain trade associations and Chambers of Commerce.	7	0.744	0.643	1.26	2.61
5.6 - Why should I bother about SWMPs? My customers or neighbors have never questioned me about them.	7	0.744	0.705	0.55	2.34
5V - *Pressure from my customers and neighborhood to act environmentally friendly is, in general, my major concern.*	7	0.744		-1.28	2.69

(6) Reputation (REP)

6.1- We need to be in line with recommended environmental controls in order to protect our "brand capital".	7	0.743	0.934	-2.79	2.25
6.2 - General public respects our company as a "first-mover" in this industry on environmental quality.	7	0.744	0.928	-1.75	3.40
6.3 - My aim is to be one of the most eco-friendly companies in this area to our size; so, adoptions of SWMPs are inevitable.	7	0.360	0.933	-2.78	2.36
6.4 - I adopt these SWMPs, because I don't like those TV crews and journalists "name and shame" me and my company regarding our negligence on environment.	7	0.744	0.830	-2.52	2.29
6V. *Our reputation as a company is pretty much depending on us implementing these SWMPs; that's my major concern.*	7	0.575		-2.78	2.43

(7) Existing Govt. Regulation (EGR)

7.1 – We always strive to adopt strictly the latest government regulation with respect to SWMPs.	7	0.743	0.679	3.08	0.95
7.2 – Currently, we don't have any pressure from the Ministry or any government agency to do that and this.	7	0.566	0.352	0.40	2.74
7.3 – The Pradeshiya Sabha or government can close my plant, if I do not compliance with their requirements.	7	0.360	0.101	3.47	0.99
7.4 – I am not much concerned about meeting those recommended controls to manage solid waste in this firm; I am doing what I can, what I want, that's it!	7	0.744	0.709	2.43	1.61
7.5 – Nobody knows what regulations govern this industry; it is neither written properly nor enforced adequately.	7	0.744	0.677	0.17	3.22
7V – *Government regulations to comply with certain environmental standards are, in general, my major concern.*	7	0.575		2.30	1.20

(8) Anticipated Govt. Regulation (AGR)

8.1 – The Pradeshiya Shaba's, Provincial and National governments modify the SWMPs require us to implement very frequently; so, we must keep ahead of them.	7	0.743	0.645	-0.03	3.03
8.2 – It is not only today, but we have to build our SWMPs by taking into consideration of what the government will ask us tomorrow also.	7	0.566	0.551	3.47	0.75
8.3 – I don't think that government would take any further initiative to mandate these SWMPs.	7	0.360	0.757	2.25	1.75
8.4 – Around the globe, there are many changes to environmental policies and these things will come to us in the near future.	7	0.744	0.165	3.44	0.87
8V – *We anticipate strict government regulations on SWMPs and that is, in general, my major concern.*	7	0.575		3.40	0.92

(9) Liability Laws (LBL)

9.1 – If you do not have these SWMPs in place, you face a lot of risk if somebody will sue you.	7	0.743	0.964	0.50	3.37
9.2 – I have never heard about an owner of a firm like mine has been jailed for his misconduct on environment; so, why do I fear without reason?	7	0.566	0.541	2.21	1.48
9.3 – Those "fines" and "compensations" imposed by judiciary on environmental action will have a marginal effect on my firm.	7	0.360	0.448	2.39	1.54
9.4 – These SWMPs prevent anybody take my firm to courts by alleging that we are polluting the neighborhood.	7	0.744	0.923	0.39	3.36
9.5 – The time and money that I will have to expense on judicial matters far exceed that I will have to expense on adopting these SWMPs.	7	0.744	0.752	0.31	2.75
9V – *Liability laws governing a better environment are, in general, my major concern.*	7	0.575		2.80	1.86

Note: V – Validation Item of each Construct (j = 1, 2...9)

Table 2: Multi-Trait Multi-Item Matrix for the Pilot Survey

| | | Validation Item | | | | | | | | |
		V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	V_9
Index Values	CST	-.934**	.438**	.644*	-.079	.211*	.325*	-.187	.099*	.577*
	TCE	-.643**	.769**	.794**	-.213*	.452*	.577**	.232*	.491*	.222*
	HRE	-.762**	.743**	.903**	-.297*	.571**	.577**	-.039	.401	.204
	SLR	-.721*	.511**	.562*	-.301*	.467**	.652**	-.328	.156	.447*
	CPR	-.422*	.691**	.551*	-.623*	.910**	.439*	.596**	.559*	.502*
	REP	-.688**	.634**	.710**	-.581**	.721**	.729**	-.478*	.401	.662**
	EGR	-.211*	.483*	.467*	-.344*	.590**	.298*	.884**	.725**	.491*
	AGR	-.578**	.775**	.751**	-.461*	.872**	.455*	.782**	.732**	.509*
	LBL	-.453*	.629**	.565**	-.678*	.559*	.601**	.672*	.572*	.728**

Note: V = Validation item representing corresponding incentives

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).
a Cannot be computed because at least one of the variables is constant.

Table 3: Estimates of Squared Correlations to Establish Discriminant Validity

	CST	TCE	HRE	SLR	CPR	REP	EGR	AGR	LBL
CST									
TCE	0.91								
HRE	0.81	0.81							
SLR	0.68	0.70	0.79						
CPR	0.77	0.94	0.75	0.70					
REP	0.84	0.81	0.74	0.61	0.73				
EGR	0.46	0.39	0.57	0.68	0.47	0.35			
AGR	0.43	0.34	0.42	0.45	0.36	0.35	0.45		
LBL	0.79	0.71	0.67	0.59	0.68	0.61	0.33	0.38	
	CST	**TCE**	**HRE**	**SLR**	**CPR**	**REP**	**EGR**	**AGR**	**LBL**
AVE	*0.87*	*0.86*	*0.66*	*0.63*	*0.82*	*0.46*	*0.31*	*0.33*	*0.57*

Table 4: Mean Values of the Incentive Index of Variables

	CST	TCE	HRE	SLR	CPR	REP	EGR	AGR	LBL
Total Sample	-0.74	-0.57	-0.25	-1.05	0.01	-0.78	0.72	0.85	0.50
Based on Type of the Firm									
COP	-0.20	-0.05	-0.26	-0.55	-0.47	0.08	0.47	0.55	0.37
ESO	-0.59	-0.35	-0.59	-0.69	-0.65	-0.20	0.32	0.41	0.10
NAB	-0.01	0.09	0.00	-0.52	-0.20	0.18	0.44	0.51	0.42
OPP	-0.63	-0.43	-0.67	-0.71	-0.67	-0.14	0.32	0.35	0.06
PFV	-0.36	-0.24	-0.40	-0.62	-0.48	-0.03	0.38	0.48	0.24
Based on Size of the Firm									
Very Small	-0.89	-0.70	-0.87	-0.85	-0.85	-0.30	0.19	0.25	-0.15
Small	-0.86	-0.55	-0.81	-0.78	-0.80	-0.28	0.28	0.40	-0.03
Medium	-0.44	-0.22	-0.57	-0.63	-0.58	-0.05	0.45	0.56	0.31
Large	0.12	0.11	-0.06	-0.55	-0.42	0.11	0.44	0.50	0.49
Very Large	0.38	0.45	0.45	-0.25	0.24	0.44	0.59	0.62	0.67

Table 5: Outcome of Count Data Analysis

Covariates	Zero Inflated Poison (ZIP)		Zero Inflated Negative Binomial (ZINB)	
	Coefficient	Probability	Coefficient	Probability
Incentives				
CST	- 0.946**	0.003	- 0.785**	0.020
TCE	0.767**	0.035	0.678**	0.048
HRE	0.132	0.631	0.021	0.939
SLR	0.308	0.452	0.189	0.594
CPR	0.240*	0.240	0.165	0.618
REP	0.138	0.665	0.161	0.622
EGR	0.177	0.538	0.138	0.630
AGR	0.247**	0.022	0.133**	0.032
LBL	0 .081**	0.035	0.136**	0.048
Constant	-3.047	0.117	4.758	0.651
Sector Dummies				
ESO	0.961	0.095	0.540*	0.108
NAB	-0.459**	0.405	-0.097	0.717
OPP	-0.498	0.384	-0.162	0.623
PFV	-0.122	0.822	-0.235	0.380
Scale Dummies				
Very Large	1.108	0.056	0.839** .	0.048
Large	1.056**	0.015	0.817**	0.015
Medium	0.889**	0.012	0.781**	0.010
Small	0.650**	0.028	0.600 ** .	0.026
Vintage (VT)	0.926**	0.000	0.958**	0.000
Export (EX)	-0.080	0.543	0.075	0.580
Log likelihood	-375.196		-403.39	
LR chi2(18)	245.18**		2.09**	
No Obs				
No of Zero				
Inflation model	logit		logit	
Vuong test	3.36**		5. 65 **	
Likelihood Ratio Test			2.09**	

Note: *** Significant at prob. = 0.01; ** Significant at prob. = 0.05; * Significant at prob. 0.10

Figures

Figure 1: Generation of Solid Waste in Sri Lanka in different Provinces

Source: Database of Municipal Solid Waste in Sri Lanka, MENR of Sri Lanka
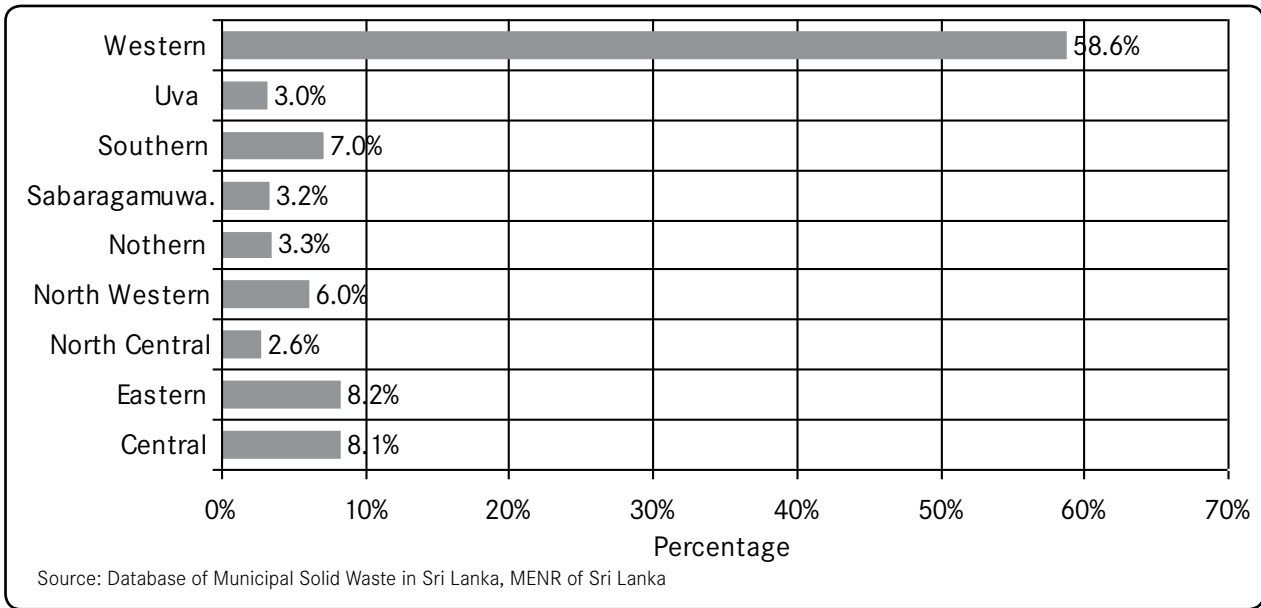
Figure 2: Conceptual Framework
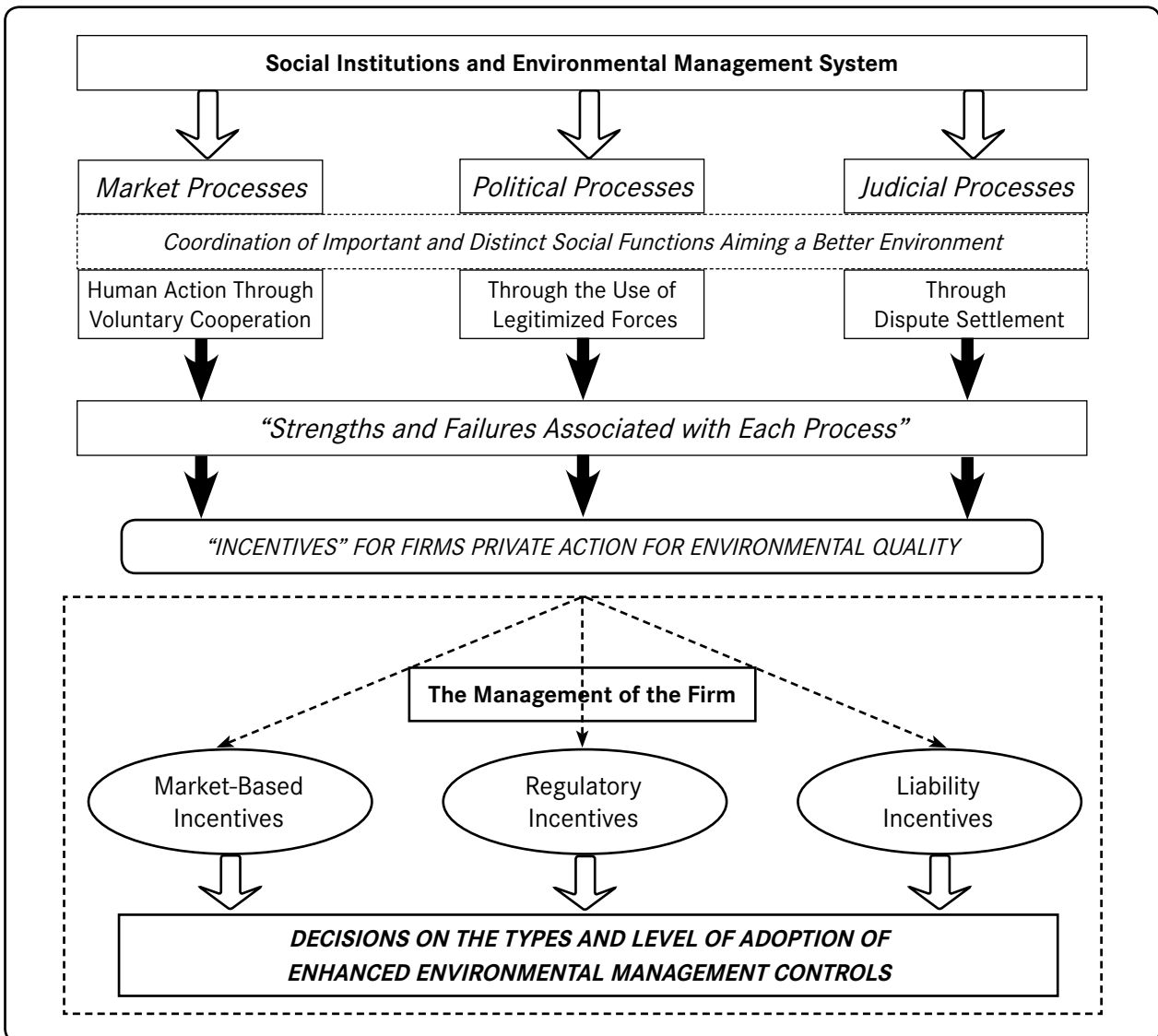
Figure 3: Measurement Model in SEM (Using AMOS)
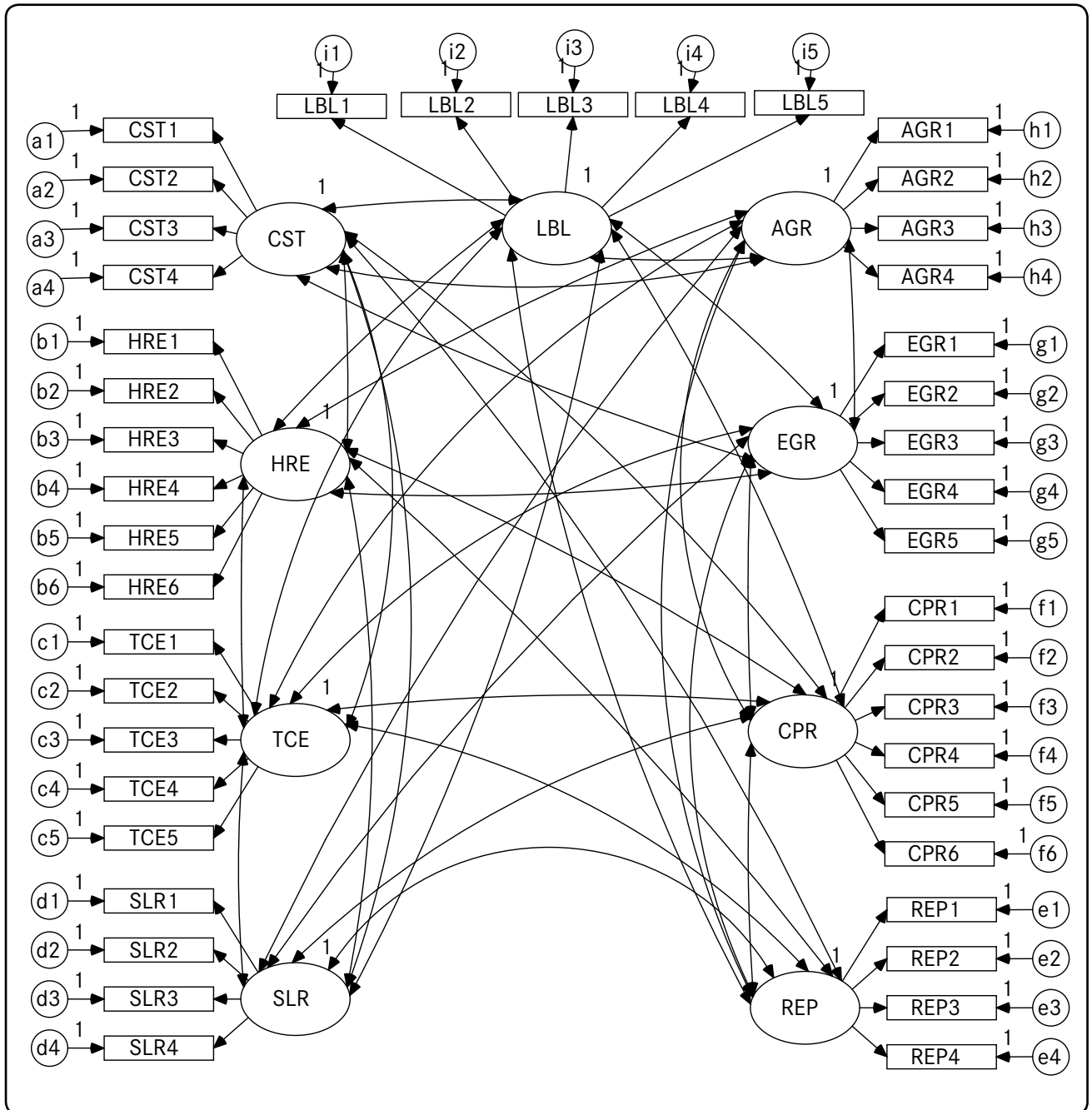
Figure 4: Per centage of Firms by Type
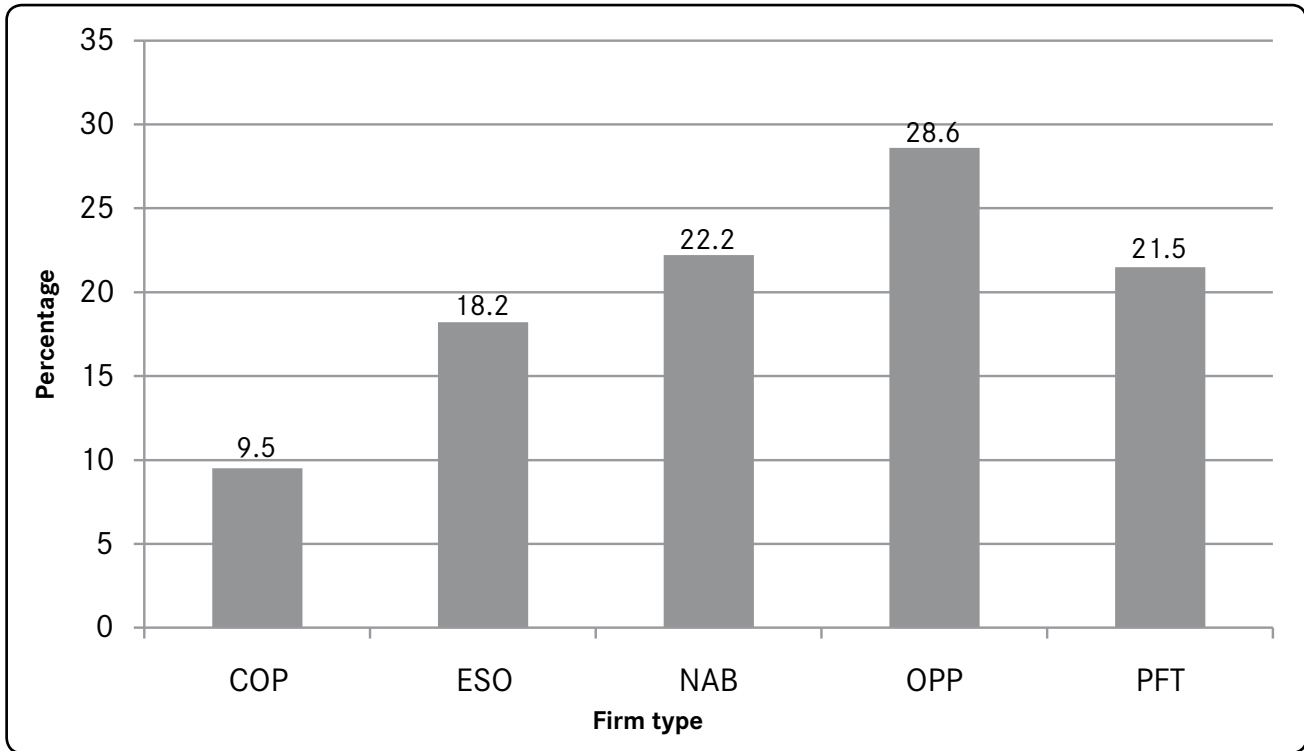
Figure 5: Per centage of Firms by Size
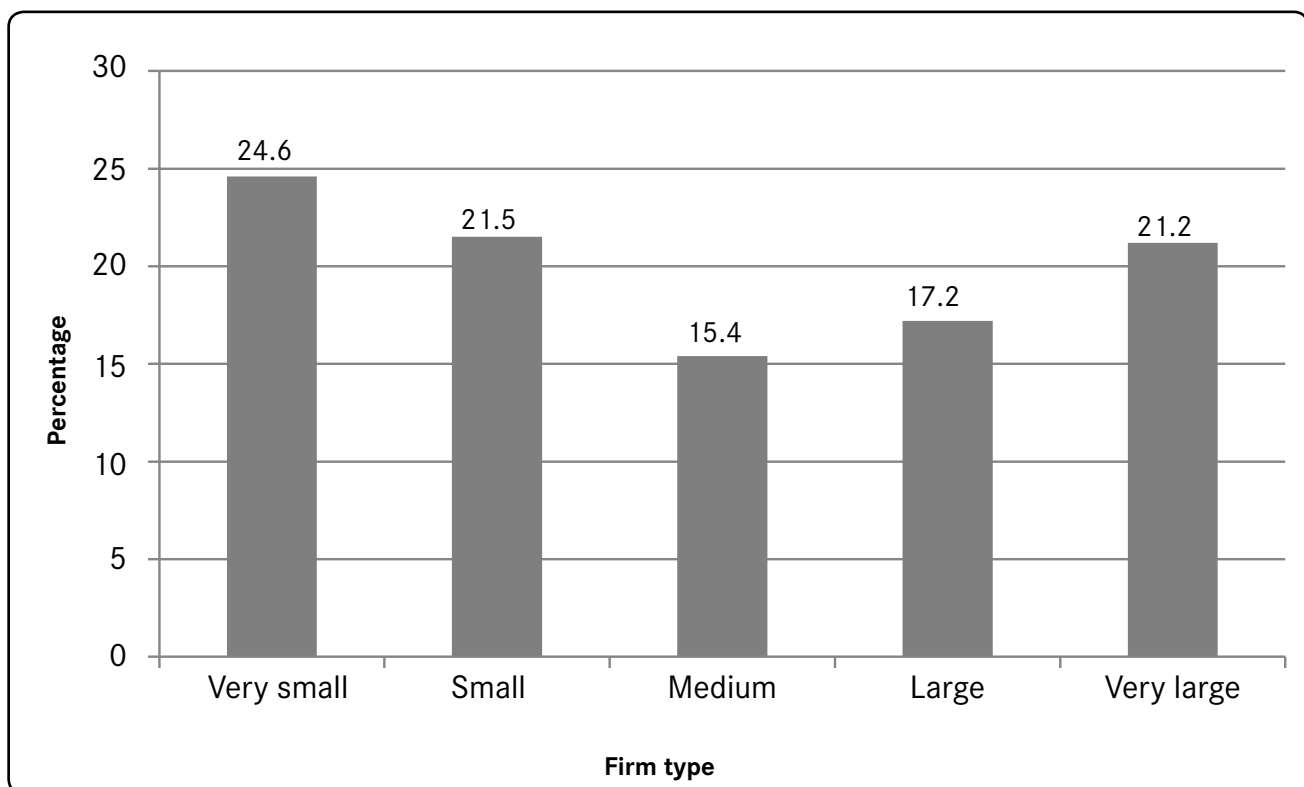
Figure 6: Types of Customers of the Firms
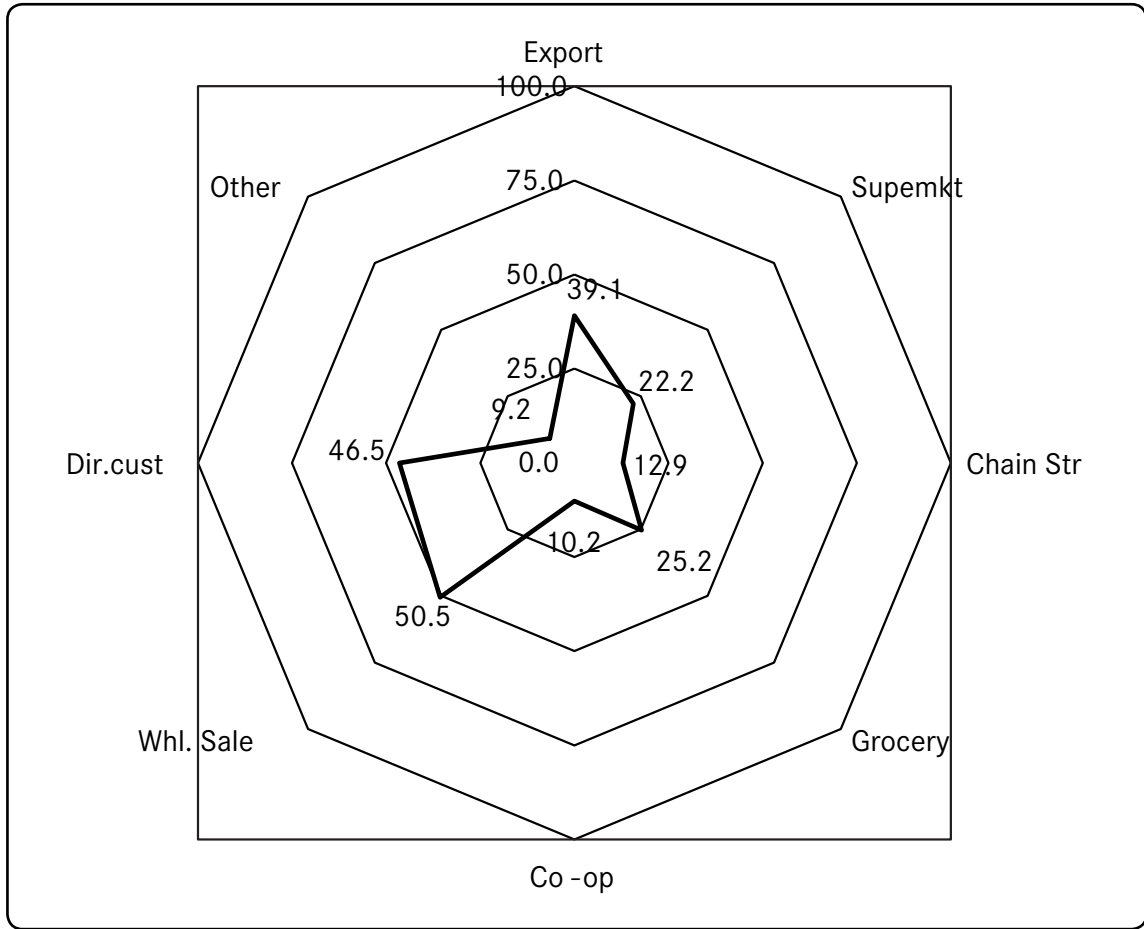
Figure 7: Different Types of SWMPs Adopted by Firms
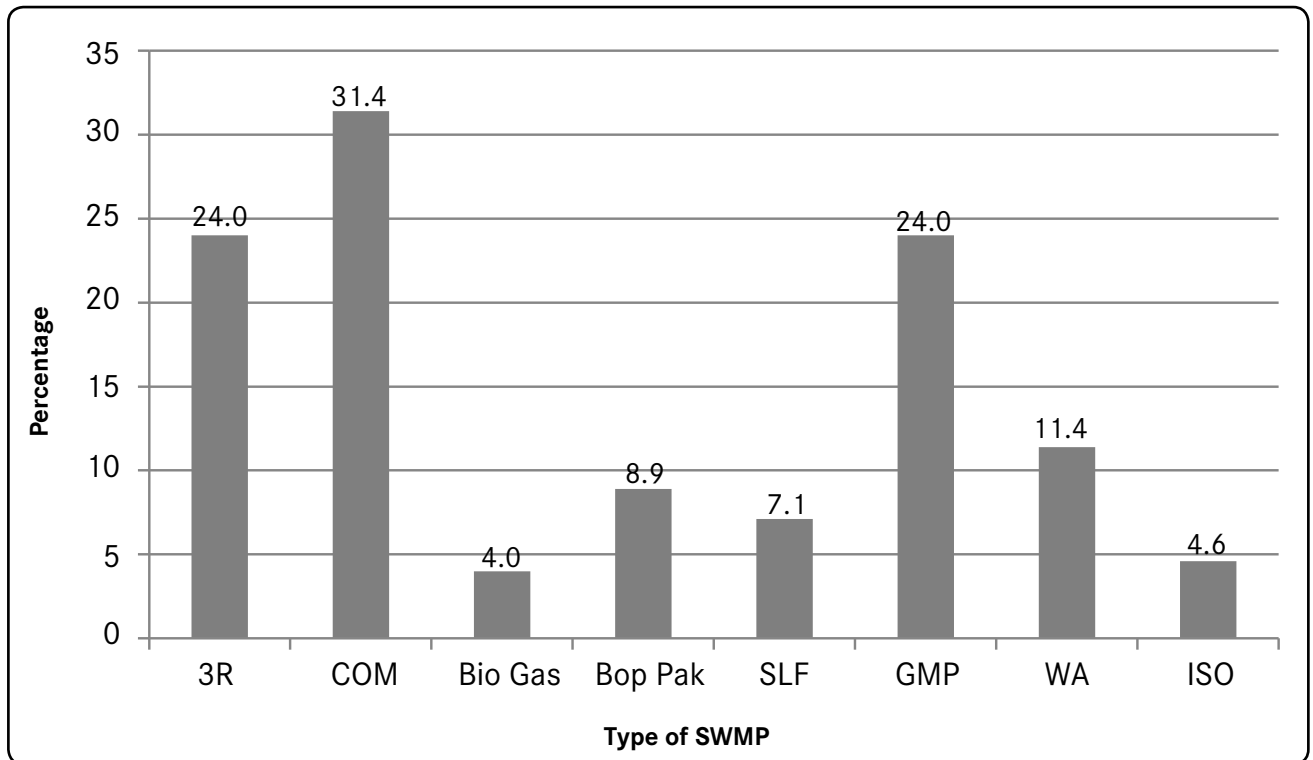
Figure 8: No. of SWMPs Adopted by a Firm and Value of Incentive Index
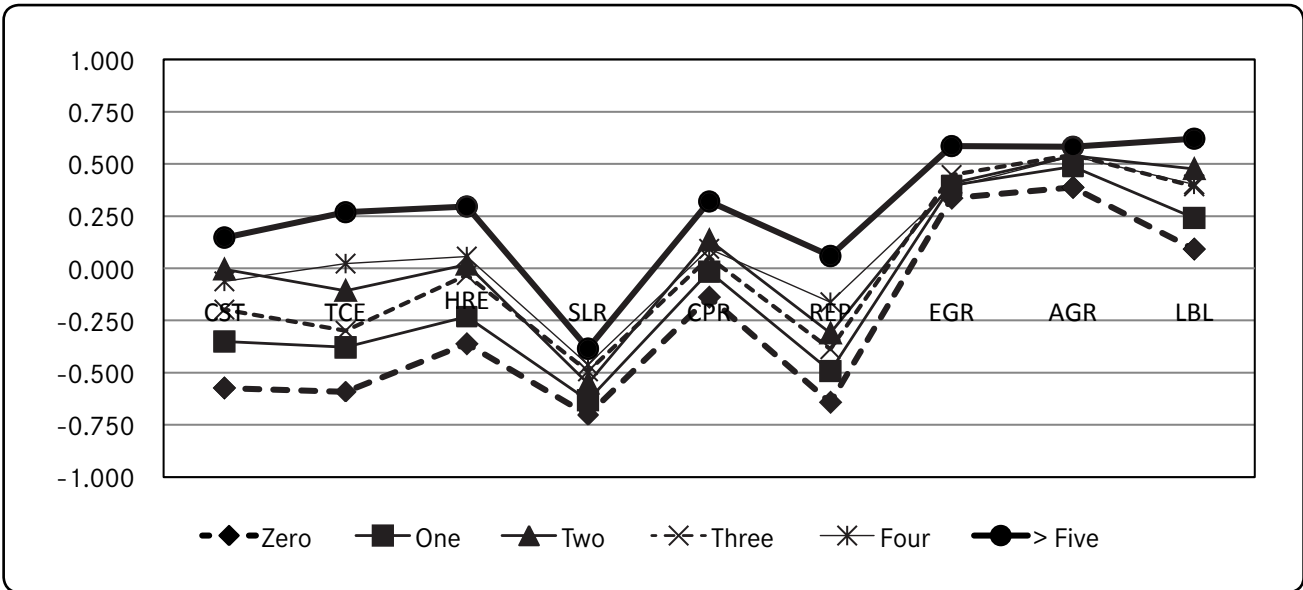
Figure 9: Total Number of Different SWMPs Adopted by Firms

Mean = 1.15
Std. Dev. = 1.552
N = 325
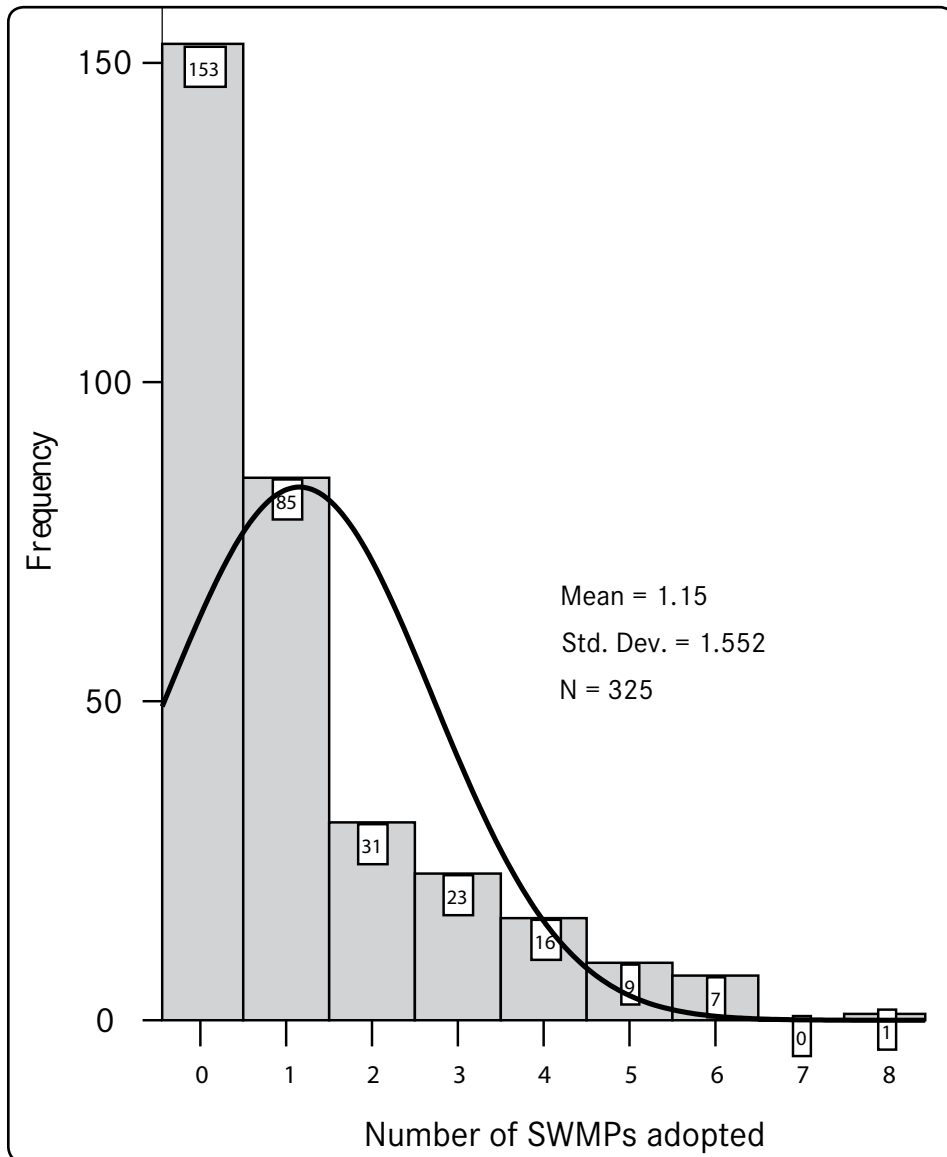
Appendix 1

Statistical Testing for Reliability and Validity

Scale Reliability and Unidimensionality:

Reliability measures whether a set of Indicators representing a Construct are consistent in their measurement and it is customary to use the *Cronbach's alpha* (α) (Cronbach, 1951) to prove this phenomenon. We use λ, i.e. standardized factor loadings (in AMOS, this is referred as "regression weights") to estimate scale reliability based on the formulae $(\Sigma\lambda)^2 / (\Sigma\lambda)^2 + \Sigma(1-\lambda j^2)$. Since the aim of the test is to maximize the value, researchers generally accept the values of which above 0.7 as demonstrating that a scale is internally consistent[15] (Hair *et al.*, 2006; Lord and Novick, 1968; Nunnally, 1978). Unidimensionality is evaluated by examining the loading of Indicators on to factors with a view to determining whether one broad or several specific constructs characterize the set of Indicators. It is common to use the *Principal Axis Factoring* Technique to examine this effect (De Vellis, 1991). While there is no rigorous criterion specified in this technique that can be applied to assess when factor loadings are significant, Spector (1992) suggests that a minimum value of around 0.30 to 0.35 indicates that an Indicator loads onto a factor.

Construct Validity:

This refers to the ability of Indicators of a Construct to accurately measure the concept under study[16] (De Vellis, 1991). Researchers assess this in terms of number of criteria, including: (a) "*Face Validity*" (that is, content and meaning of the attitudinal statements in relation to their associated incentives), and can be established early, i.e., during the development of the questionnaire and scales for assessment; (b) "*Convergent Validity*" (that is, indicators of a specific incentive should converge or share a high proportion of variance in common); (c) "*Discriminant Validity*" (that is, the extent to which an incentive is truly distinct from other incentives), and (d) "*Nomological Validity*" (that is, whether the correlations among the incentives in the measurement theory makes sense). Researchers frequently use the *Multi-Trait Multi-Method matrix* (MTMM matrix), introduced by Campbell and Fiske (1959), to assess Construct Validity, which reports the correlation between different Constructs used in the analysis and an alternative measure used to evaluate the same phenomenon (e.g., Validation Items)[17] (Henson and Traill, 2000). Given two or more Constructs and two or more ways of measuring each, we can expect a high correlation between these two different measures when they are used to evaluate the same Construct, but a low correlation between these measures when used for different Constructs, or in statistical terms this satisfies the both conditions of Convergent Validity and Discriminant Validity (Campbell and Fiske, 1959). The results from the AMOS can also use directly to estimate Convergent Validity by taking Factor Loadings and Variance Extracted (VE) $= \Sigma\lambda^2 / [\Sigma\lambda^2+\Sigma(1-\lambda j^2)]$. To verify Discriminant Validity, VE per centages for any two constructs can be compared with the square of the correlation estimate between these two constructs.

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[15] It is difficult to justify a proposed Indicator of a Construct in exploratory research if its reliability were less than 0.5, because in that case more than 50 percent of its variance would be an error variance

[16] It concerns the theoretical relationship of a variable to other variables, and it is the extent to which a measure behaves in the way the Construct it is hypothesized to measure should behave with respect to established measures of other Constructs.

[17] Following the standard guidelines for constructing a validation item for the CFA, we included 9 validation items in the questionnaire to represent corresponding individual incentives (constructs).

Appendix 2

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QUESTIONNAIRE
For the Research Project:
"Motives for Firms to Adopt Solid Waste Management Controls:
Case of Food Processing Sector in Sri Lanka"

Conducted by the
Dept. of Agribusiness Management of the Wayamba University of Sri Lanka

Funded by the
**South Asian Network for Development & Environmental Economics (SANDEE)
(2008 – 2010)**

</div>

Dear Sir / Madam:

The Dept. of Agribusiness Management of the Wayamba University of Sri Lanka is currently undertaking a program of research on the title above, which is funded by the *South Asian Network for Development & Environmental Economics* (SANDEE). This is the first time in Sri Lanka that this issue is examined at the firm level. The outcome of the analysis will be used to discuss about the potential role of the public and private institutions to augment the adoption of solid waste management controls in this particular sector and to develop an incentive-based policy framework in this respect.

This questionnaire is used to collect information in this respect from an Owner / Senior Management of various food processing firms in Sri Lanka. It would be of great value to this project if you could find the time to complete the enclosed questionnaire. It will take just a few minutes from your busy time. If you have questions or concerns about these questions, please do not hesitate to **talk to the Research Assistant** who accompanied the questionnaire or to me using the contact details given below.

Please be assured that all responses to the survey will be confidential to the research team and not divulged to any third party. Further, the results of the survey will only be reported as sample average. Individual responses will not be made public. In recognition of your contribution to the research, we would be happy to call a representative of your company to the "Results Dissemination Seminar" and send you a summary of the results. Also, you will have an access to the international and local publications to be worked out to explore the outcome of the research. I would like to thank you for your assistance in anticipation.

Thanking You;

Yours sincerely;

Udith K. Jayasinghe-Mudalige, PhD
Head / Senior Lecturer, Department of Agribusiness Management
Principle Investigator of the Project
E-mail: udith@hotmail.com
Telephone: (071 or 077) 362 8911
Fax: 031 - 229 9246

Part 1.1 – About yourself

1.1.1	**Name:**	Mr. ☐ Ms. ☐ _____ First name Surname
1.1.2	**Managerial Position:**	
1.1.3	**Do you have executive powers to make decisions with respect to environmental quality?**	Yes ☐ No ☐
1.1.4	**Year of Birth:**	19 ☐☐
1.1.5	**Date of Appointment:**	Day ☐☐ Month ☐☐ Year ☐☐☐☐
1.1.6	**Telephone:**	
1.1.7	**Fax:**	
1.1.8	**Email:**	Personal	
		Official	

Part 1.2 – About your firm

1.2.1	**Name of the Firm:**			
1.2.2	**Location of the Firm:**	Number:		
		Street:		
		Town / City:		
		Province / Postal code:		
1.2.3	**Major Products & their Per centage (%) of Contribution to the Total Production**	**Product Category**	**Major Products**	**%**
		1. Fresh Fruit & Vegetables	1)	
			2)	
			3)	
		2. Processed Fruits & Vegetables	1)	
			2)	
			3)	
		3. Non Alcoholic Beverages	1)	
			2)	
			3)	
		4. Preserved Products	1)	
			2)	
			3)	
		5. Health Foods	1)	
			2)	
			3)	
		6. Coconut Products ☐☐☐☐	1)	
			2)	
			3)	
1.2.4	**Year of Establishment:**			
1.2.5	**No of Employees:**	☐ a) Less than 10	☐ d) 51 to 100	
		☐ b) 10 to 25	☐ e) More than 100	
		☐ c) 26 to 50		
1.2.6	**Capacity of the Firm:**	☐ a) Please indicate the units		
1.2.7	**Type of Ownership:**	☐ b) Sole proprietorship		
		☐ c) Limited liability		
		☐ d) Public shares		
		☐ e) Corporative		
		☐ f) Corporation		
		☐ g) Other		

1.2.8	Major Customers and percentage (%) of Your Products Supply to Each Customer	Type of Customer	%
		☐ a) Export Market	
	(Please tick the appropriate boxes and indicate the corresponding percentages)	☐ b) Chain Stores	
		☐ c) Grocery Stores	
		☐ d) Co-operative shops	
		☐ e) Wholesalers	
		☐ f) Direct to customers	
		☐ g) Other(Specify)	

1.2.9	Which customer group listed in Question 1.2.8 above most concerns about your practices related to environment?	Please indicate the CORRESPONDING LETTER of the groups (e.g. a, d, e)	

1.2.10	Value of Sales in 2007 (Rs.) (Please tick the appropriate box)	☐ Less than 50,000	☐ 50,001 – 100,000
		☐ 100,001 – 200,000	☐ 200,001 – 500,000
		☐ 500,001 – 1,000,000	☐ 1,000,001 – 2,000,000
		☐ 2,000,001 – 5,000,000	☐ More than 5,000,000

Part 2.1 – Types of Solid Wastes Generate in the Firm

2.1	Indicate the types of solid waste material generated in the firm & their Per centage (%) (Please tick the appropriate boxes and indicate the corresponding per centage)	**Type**	%
		☐ a) Paper	
		☐ b) Plastic	
		☐ c) Organic waste	
		☐ d) Glass	
		☐ e) Ceramic	
		☐ f) Iron	
		☐ g) Wood	
		☐ h) Toxic material	
		☐ i) Other (specify)	

Part 2.2 – Firm's Initiatives Regarding Solid Waste Management Practices (SWMP)

2.2.1	Is there a separate department / specific team responsible for waste management in your firm?	No ☐ Yes ☐ ➝ ↓ **Go to Q 2.2.2**	Year established	☐☐☐☐
			Number of staff members appointed	....

2.2.2	Does your company possess a documented policy on SWMP?	No ☐ Yes ☐ ➝ ↓ **Go to Q 2.2.3**	Year of documentation	
			Frequency of reviewing the document	
			Is it available to the public, if requested formally?	No ☐ Yes ☐

2.2.3	Are you aware of the SWMP recommended by the Ministry	No ☐ Yes ☐ ➝ ↓ **Go to Q 2.2.4**	From where / How did you get know?	....
			When did you get to know?	....
			Do you possess a published version of recommendations	No ☐ Yes ☐

2.2.4	Does the firm allocate funds for the purpose of environmental management?	No ☐ Yes ☐ ➝ ↓ **Go to Q 3.1**	How much money is allocated for this year?	Rs. ....
			What is the Per centage (%) of which from the total operating budget?	.... %

Part 3.1 – Status of the Firm on Recommended SWMP

(Please go through 3.1-1 to 3.1-8 and state whether you have adopted one or more of the following practices)

3.1.1	Do you use "3R System" (i.e. Reduce, Reuse, Recycle) to sort solid waste in your firm?	No ☐ Yes ☐ ⟶ **Go to Q 3.1.2**	**Please answer to the following questions**	
			Year implemented	
			No of employees assigned	
			No of places the system is established	
			Total area utilized (m²)	
			What do you do with the output?	
			Did you receive any support from another party? If Yes, from where?	No ☐ Yes ☐
			Any other information regarding 3R SYSTEM	
3.1.2	Do you practice "Composting" with the solid waste generated in your firm?	No ☐ Yes ☐ ⟶ **Go to Q 3.1.3**	Year implemented	
			No of employees assigned	
			Method of composting	
			Total area utilized (m²) OR No of pits?	
			What do you do with the final product?	
			Did you receive any support from another party?	No ☐ Yes ☐
			Any other information regarding COMPOSTING	
3.1.3	Have you established a "Biogas Unit" to utilize your solid waste more effectively	No ☐ Yes ☐ ⟶ **Go to Q 3.1.4**	Year implemented	
			No of employees assigned	
			Total area utilized (m²)	
			Who developed the unit?	
			How much did it cost?	
			What do you do with the output?	
			Did you receive any support from another party?	No ☐ Yes ☐
			Any other information regarding BIOGAS UNIT	
3.1.4	Do you use "Biodegraded Packaging Materials" to minimize the amount of solid waste?	No ☐ Yes ☐ ⟶ **Go to Q 3.1.5**	Year implemented	
			No of employees assigned	
			From where do you get these materials?	
			For what products?	
			Cost as a per cent of total sales income	
			What do you do with the output?	
			Did you receive any support from another party?	No ☐ Yes ☐
			Any other information regarding BIODEGRADEDABLE PACKAGING	
3.1.5	Do you possess a "own site to fill your solid waste" with appropriate sanitary measures (i.e. Sanitary Land Filling)	No ☐ Yes ☐ ⟶ **Go to Q 3.1.6**	Year implemented	
			No of employees assigned	
			Total area utilized (m²)	
			Who developed the unit?	
			How far it from the source of:	Drinking water: _____ m. Closest neighbor: _____ m
			To where you move once the site is full?	
			Did you receive any support from another party?	No ☐ Yes ☐
			Any other information regarding SANITARY LAND FILLING	

3.1.6	Do you adopt a set of "Good Manufacturing Practices" (GMP) for waste management in your firm?	No ☐ Yes ☐ ⟶ ↓ **Go to Q 3.1.7**	**Please answer to the following questions**	
			Year implemented	
			Was GMP based on written code?	No ☐ Yes ☐
			How many GMP are included in the plan?	
			Who has prepared the plan? At what cost?	
			Were these GMP accredited by the SLSI?	No ☐ Yes ☐
			In how many places have you published the plan?	
			Did you receive any support from another party to implement GMP?	No ☐ Yes ☐ If yes, what type of support? ....
			Any other information regarding GM	
3.1.7	Do you adopt a system of "ISO 14000" in your firm?	No ☐ Yes ☐ ⟶ ↓ **Go to Q 3.1.8**	Year implemented	
			Who has prepared the plan? At what cost?	Person / Institution .... Initial Cost Involved: ....
			Who accredited the system?	
			How many "EMS Auditors" work in the system?	
			Did you receive any support from another party?	No ☐ Yes ☐ If yes, what type of support? ....
			Do you get any information technology support (i.e. electronic documentation)?	No ☐ Yes ☐ If yes, from where? ....
			Any other information regarding ISO 14000	
3.1.8	Have you adopted a system of "Waste Auditing" in your firm?	No ☐ Yes ☐ ⟶ ↓ **Go to Q 3.2**	Year implemented	
			Who carries out waste auditing?	Person / Institution
			How many audits carried out per year?	
			Do you have records of previous audits	No ☐ Yes ☐
			Any other information regarding WASTE AUDITING	

If your answer is "NO" to ANY of the questions 3.1.1 to 3.1.8 on the recommended SWMP, please GO TO PART 3.2. If your answer is "YES" to ALL of those questions, please GO TO PART 3.3

Part 3.2 – If your answer is "NO" to ANY of the questions 3.1.1 to 3.1.8, please select those SWMP from the list below and select the most appropriate answer out of the 3 options given

3.2	Recommended SWMP	(i) In a Process of Implementation	(ii) Have a Prepared Plan to Implement Within Next 3 Years	(iii) No Plan to Implement Within Next 3 Years
	(3.1.1) - 3R System			
	(3.1.2) - Composting			
	(3.1.3) - Biogas Unit			
	(3.1.4) - Biodegraded packaging			
	(3.1.5) - Sanitary land filling			
	(3.1.6) - GMP			
	(3.1.7) - ISO 14000			
	(3.1.8) - Waste Auditing			

Part 3.3 – Other SWMP Use in the Firm

3.3.1	If you implement any special type/s of controls for waste management in your firm, please provide the details:		
	Description	**Method 1**	**Method 2**
	a) What technique /method that you have adopted?		
	b) When was it implemented?		
	c) Who recommended it?		
	d) Who designed it?		
	e) Is there any 3rd party involvement to operate the system?		
	Any other information regarding this practice		
3.3.2	Other types of waste generated in the firm (Please tick the relevant boxes)	**Type**	**Method of Disposal**
		☐ a) Liquid	
		☐ b) Gas	
		☐ c) Hazardous	

Part 4.1 – Institutional Support for Waste Management

4.1.1	Do you take the support of a 3rd party contractor to manage waste in your firm?	No ☐ Yes ☐ ⟶ ↓ **Go to Q 4.1.2**	a) Who is the agent?	
			b) How frequently they remove waste?	.... per week / month/year
			c) What is the cost involved?	.... Rs/month
			d) Why did you get the support of an external agent	
4.1.2	Do you take the service of Pradeshiya Sabha / Municipality to manage your waste?	No ☐ Yes ☐ ⟶ ↓ **Go to Q 4.1.2**	a) How frequently do they remove waste?	.... per week / month
			b) What is the cost involved?	.... Rs/month
			c) Do you sort the waste before submitting to them?	No ☐ Yes ☐ On what basis: ....

Part 4.2 – Sources of Information and Satisfaction About Waste Management:

4.2.1	Sources of Information about SWMP (Please tick the appropriate boxes)	**Source**	**Who / What are the 3 Major Contributors (Please RANK using 1,2 and 3)**
		☐ a) Electronic Media (TV / Radio)	
		☐ b) Print Media (Newspapers / Magazines)	
		☐ c) Internet	
		☐ d) Employees / Friends	
		☐ e) Ministry of Environment / CEA	
		☐ f) Non and Semi Government Organizations	
		☐ g) Similar Firms in the Industry	
		☐ h) Universities	
		☐ i) Trade Associations	
		☐ j) Major Buyers	
		☐ k) Major Input Suppliers	
		☐ l) Other (Specify)	
4.2.2	How satisfied are you with the existing practices for solid waste management in your firm? (Please tick the appropriate box)	**Type**	
		☐ a) Very Satisfied	
		☐ b) Satisfied	
		☐ c) Neither Satisfied Nor Dissatisfied	
		☐ d) Dissatisfied	
		☐ e) Very Dissatisfied	

Part 4.3 – Environmental Indicators Used in Firm

4.3	Indicate the common indicator/s used to make decisions with respect to environmental performance of your firm (Please tick all the relevant boxes)	**Measure**	**What is Your Standard / Threshhold Level?**	**Do You Keep Records?**
		☐ a) Total waste generated in a given time period		No ☐ Yes ☐
		☐ b) Total waste generated per unit inputs used		No ☐ Yes ☐
		☐ c) Output to waste ratio		No ☐ Yes ☐
		☐ d) Costs involve with disposal of waste		No ☐ Yes ☐
		☐ e) No of mandays involve with waste management		No ☐ Yes ☐
		☐ f) Amount of water needed for cleaning for a given period of time		No ☐ Yes ☐
		☐ g) No of complaints made by outsiders with respect to management of environment		No ☐ Yes ☐
		☐ h) Other: …………………………		No ☐ Yes ☐
		☐ i) Other: ………………………		No ☐ Yes ☐

Part 5 – Training / Rewards / Penalties on Environmental Performance:

5.1.1a	Did you or any top level employee in your firm receive or currently undergoing training on waste management within last 3 years (i.e. since 2005)?	No ☐ Yes ☐ ——→ ↓ **Go to Q5.1.2a**	**Indicate the "Source of Training" from the list below:** ☐ Ministry of Environment & Natural Resources (NSWMSC) ☐ National Cleaner Production Center (NCPC) ☐ Sri Lanka Standard Institute (SLSI) ☐ Chambers of Commerce: ………………….……… ☐ Other: ………………………………………………… **Please GO TO Question 5.1.1b**

5.1.1b	Please provide the details with respect to the two most important training programs that you/other manager underwent or currently following	**Please answer to the following questions**	**Training 1**	**Training 2**
		☐ Specific area of training?		
		☐ What is the duration?		
		☐ What is the cost?		
		☐ Who funded? Own (O) / Company (C) / External Source (E)		

5.1.2a	Has your firm received any of these rewards on environmental performance within last 10 years?	No ☐ Yes ☐ ——→ ↓ **Go to Q5.1.3a**	**Indicate the "Name of Award":** ☐ National Cleaner Production Award ☐ Sri Lanka Environmental Award ☐ Community Leader Award ☐ Other: ………………………………………………… ☐ Other: ………………………………………………… **Please GO TO Question 5.1.2b**

5.1.2b	Please provide the details with respect to the two most important rewards that your firm received	**Please answer to the following questions**	**Reward 1**	**Reward 2**
		a) Why was it offered?		
		b) Who awarded it?		

5.1.3	Did your firm subject to any penalties related to environmental performance within last 5 years?	No ☐ Yes ☐ ——→ ↓ **Go to Q6.1**	**Please answer to the following questions**	**Penalty 1**	**Penalty 2**
			a) What is the reason?		
			a) What is the penalty?		
			a) Who impose the penalty?		

Part 6 – Reasons for and Problems Associated with Adoption of SWMP

Please use the FIVE-POINT LIKERT SCALE shown below to answer the questions in Part 6.1 to 6.3

VI = Very Important; IM = Important ; NU = Neither Important Nor Unimportant; UI = Unimportant;
VU = Very Unimportant

6.1	**HOW IMPORTANT each FACTOR listed below for your firm to adopt SWMP in the firm?**

(Please RANK the INDIVIDUAL INCENTIVES in ORDER in the 1st Column AND indicate the DEGREE of importance of each incentive using the five-point scale given above)

	RANK	VI	IM	NU	UI	VU
a) Cost / financial implications		☐	☐	☐	☐	☐
b) Reputation of firm		☐	☐	☐	☐	☐
c) Technical efficiency		☐	☐	☐	☐	☐
d) Sales and revenue		☐	☐	☐	☐	☐
e) Human resource efficiency		☐	☐	☐	☐	☐
f) Commercial pressure		☐	☐	☐	☐	☐
g) Existing govt. regulations		☐	☐	☐	☐	☐
h) Anticipated govt. regulations		☐	☐	☐	☐	☐
i) Liability laws		☐	☐	☐	☐	☐

6.2	**HOW IMPORTANT the PRESSURE CREATED by the following GROUPS, in general, for your firm to adopt SWMP?**

(Please RANK the EACH FACTOR in ORDER in the 1st Column AND indicate the DEGREE TO WHICH each group create a pressure on your firm using the five-point scale given above)

	RANK	VI	IM	NU	UI	VU
a) Major input suppliers to the firm		☐	☐	☐	☐	☐
b) Major buyers of the products of firm		☐	☐	☐	☐	☐
c) People in the neighborhood of the firm		☐	☐	☐	☐	☐
d) NGOs work on environment quality		☐	☐	☐	☐	☐
e) The Pradheshiya Sabha / Municipality		☐	☐	☐	☐	☐
f) Other:		☐	☐	☐	☐	☐
g) Other:		☐	☐	☐	☐	☐

6.3	**HOW IMPORTANT is each of the following CONSTRAINTS TO YOU in adopting SWMP in your firm?**

(Please RANK each constraint in ORDER by taking into account of its SEVERITY in the 1st Column AND indicate DEGREE TO WHICH it acts as a constraint using the five-point scale given above)

	RANK	VI	IM	NU	UN	VU
a) It is needed to **retrain** the staff in new practices		☐	☐	☐	☐	☐
b) Negative **attitudes**/motivation of the staff		☐	☐	☐	☐	☐
c) **Inflexibilities** associated with the production process		☐	☐	☐	☐	☐
d) It is needed to **renovate** the plant with new equipment		☐	☐	☐	☐	☐
e) Lack of reliable **information** about environmental controls		☐	☐	☐	☐	☐
f) Lack of **financial** support from external sources		☐	☐	☐	☐	☐
g) Lack of space to accommodate new practices		☐	☐	☐	☐	☐
h) Other:		☐	☐	☐	☐	☐

Part 7 – Attitudanal Statements Showing Incentives for Adoption of SWMP:

The statements given below reflect some potential opinions of owners / managers and/or people involved with environmental quality assurance (i.e. somebody similar to you) in food processing firms in Sri Lanka with respect to adoption of environmental management controls in their firms. The aim is to explore extent to which you "agree or disagree" with these views.

Please take into account the following instructions when you answer to this part of the questionnaire:

First:

Indicate whether you AGREE ("YES") or DISAGREE ("NO") with each statement (given below) by taking into account of your decisions as well as your firm's performance with respect to your firm's actions / achievements towards environmental quality (*tick the appropriate cage using "X"*).

Yes ☐   No ☐

Next:

Indicate extent to which you AGREE or DISAGREE with each statement on the following five-point scale (*tick the appropriate cage using "X"*).

For example:

a)   If you "Agree" (i.e. your answer is "Yes")

1 = Agree a bit	2	3	4	Completely agree = 5
☐	☐	☐	☐	☐

b)   If you "Disagree" (i.e. your answer is "No")

1 = Disagree a bit	2	3	4	Completely disagree = 5
☐	☐	☐	☐	☐

Read the following statements carefully. Select the "best" answer for each statement on the scale given by taking into account of your decision/s with respect to adoption OR not adoption of enhanced solid waste management practices in this firm....

ITEMS	YES	NO	SD	DA	NAD	AG	SA
Many top managers in my firm are personally and actively involved in developing environment protection policies and monitoring their implementation.	○	○	☐	☐	☐	☐	☐
My company has a written environmental policy that states goals for improving our environmental performances.	○	○	☐	☐	☐	☐	☐
Clear and strong signals have been sent from our top managers that better environmental management is a requirement in our firm, not a choice.	○	○	☐	☐	☐	☐	☐
My firm has a long term plan to lower our pollution control costs in order to be more competitive in the market.	○	○	☐	☐	☐	☐	☐
Environmental protection is an integral part of my company's culture.	○	○	☐	☐	☐	☐	☐
Ideas on pollution management are shared freely among lower, middle, and upper levels within my firm.	○	○	☐	☐	☐	☐	☐
Humans have the right to modify the natural environment to suit their needs.	○	○	☐	☐	☐	☐	☐
Advances in technology will eventually solve the problem of environmental degradation.	○	○	☐	☐	☐	☐	☐
My firm's contribution to environmental pollution is small and hardly makes a difference.	○	○	☐	☐	☐	☐	☐
Polluters should pay fully for the damage they cause, and be responsible for cleaning up their pollution.	○	○	☐	☐	☐	☐	☐
A certain amount of environmental damage is tolerated if there is to be economic growth.	○	○	☐	☐	☐	☐	☐
I feel it is my personal responsibility to ensure that my organization improves its environmental performance.	○	○	☐	☐	☐	☐	☐

Read the following statements carefully. Select the "best" answer for each statement on the scale given by taking into account of your decision/s with respect to adoption OR not adoption of enhanced solid waste management practices in this firm....

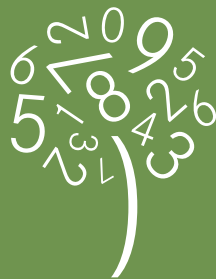| ITEMS	YES	NO	SD	DA	NAD	AG	SA
Our major customers laid down some requirements with respect to these SWMPs.	○	○	☐	☐	☐	☐	☐
Around the globe, there are many changes to environmental policies and these things will come to us in the near future.	○	○	☐	☐	☐	☐	☐
These SWMPs prevent anybody take my firm to courts by alleging that we are polluting the neighborhood.	○	○	☐	☐	☐	☐	☐
Then, I don't need to guide my employees every time, everywhere; that saves both their and my time.	○	○	☐	☐	☐	☐	☐
I do not mind about the costs associated with implementing these SWMPs in this firm.	○	○	☐	☐	☐	☐	☐
Increased volume of sales and profits resulting from which is, in general, my major concern.	○	○	☐	☐	☐	☐	☐
Adoption of these SWMPs always brings new technology into the firm.	○	○	☐	☐	☐	☐	☐
These SWMPs help us to boost the morale of our production staff.	○	○	☐	☐	☐	☐	☐
General public respects our company as a "first-mover" in this industry on environmental quality.	○	○	☐	☐	☐	☐	☐
If you do not have these SWMPs in place, you face a lot of risk if somebody will sue you.	○	○	☐	☐	☐	☐	☐
We anticipate strict government regulations on SWMPs and that is, in general, my major concern.	○	○	☐	☐	☐	☐	☐
I am not much concerned about meeting those recommended controls to manage solid waste in this firm; I am doing what I can, what I want, that's it!	○	○	☐	☐	☐	☐	☐
I have no hesitation in expensing at least 5 per cent of my earnings to adopt and maintain these SWMPs.	○	○	☐	☐	☐	☐	☐

Read the following statements carefully. Select the "best" answer for each statement on the scale given by taking into account of your decision/s with respect to adoption OR not adoption of enhanced solid waste management practices in this firm….

ITEMS	YES	NO	SD	DA	NAD	AG	SA
A cleaner environment created by these controls helps us to produce a quality product; that would increase our sales.	○	○	☐	☐	☐	☐	☐
I adopt these SWMPs, because I don't like those TV crews and journalists "name and shame" me and my company regarding our negligence on environment.	○	○	☐	☐	☐	☐	☐
We want to be in compliance with certain environmental standards to be a member of certain trade associations and Chambers of Commerce.	○	○	☐	☐	☐	☐	☐
I am really concerned about the costs involved with restructuring this firm to accommodate those SWMPs.	○	○	☐	☐	☐	☐	☐
Government regulations to comply with certain environmental standards are, in general, my major concern.	○	○	☐	☐	☐	☐	☐
More controls means less by-products; so, I am really interested in implementing better SWMPs at my firm.	○	○	☐	☐	☐	☐	☐
I am really happy that I can see a positive relationship between volume of sales and level of SWMPs adopted.	○	○	☐	☐	☐	☐	☐
We have to think deeply about training of our employees; that is a difficult task with my workforce.	○	○	☐	☐	☐	☐	☐
Currently, we don't have any pressure from the Ministry or any government agency to do that and this.	○	○	☐	☐	☐	☐	☐
The costs involved with implementing SWMPs is, in general, my major concern	○	○	☐	☐	☐	☐	☐
The time and money that I will have to expense on judicial matters far exceed that I will have to expense on adopting these SWMPs.	○	○	☐	☐	☐	☐	☐
I don't think that government would take any further initiative to mandate these SWMPs.	○	○	☐	☐	☐	☐	☐
It is difficult to produce a quality product without backing from this type of SWMPs.	○	○	☐	☐	☐	☐	☐

Read the following statements carefully. Select the "best" answer for each statement on the scale given by taking into account of your decision/s with respect to adoption OR not adoption of enhanced solid waste management practices in this firm….

ITEMS	YES	NO	SD	DA	NAD	AG	SA
The day that my major customers require me to implement sophisticated SWMPs, I will decide to leave the industry	○	○	☐	☐	☐	☐	☐
Our reputation as a company is pretty much depending on us implementing these SWMPs; that's my major concern.	○	○	☐	☐	☐	☐	☐
I hate record keeping on these practices; therefore, these advanced SWMPs are not in the master plan of this firm.	○	○	☐	☐	☐	☐	☐
Why should I bother about SWMPs? My customers or neighbors have never questioned me about them.	○	○	☐	☐	☐	☐	☐
We always strive to adopt strictly the latest government regulation with respect to SWMPs.	○	○	☐	☐	☐	☐	☐
Those enhanced SWMPs may be required for competing in international markets, but that pressure is yet not with us.	○	○	☐	☐	☐	☐	☐
Liability laws governing a better environment are, in general, my major concern.	○	○	☐	☐	☐	☐	☐
Having sound SWMPs in this place increase the ability of my employees to work as a result oriented team.	○	○	☐	☐	☐	☐	☐
How many things we can do to increase our volume of sales other than expensing our valuable resources on SWMPs.	○	○	☐	☐	☐	☐	☐
The Pradeshiya Sabha or government can close my plant, if I do not compliance with their requirements.	○	○	☐	☐	☐	☐	☐
We need to be in line with recommended environmental controls in order to protect our "brand capital".	○	○	☐	☐	☐	☐	☐
Pressure from my customers and neighborhood to act environmentally friendly is, in general, my major concern.	○	○	☐	☐	☐	☐	☐
There is nobody to finance my business to implement those SWMPs; so how can we adopt these practices?	○	○	☐	☐	☐	☐	☐

Read the following statements carefully. Select the "best" answer for each statement on the scale given by taking into account of your decision/s with respect to adoption OR not adoption of enhanced solid waste management practices in this firm

ITEMS	YES	NO	SD	DA	NAD	AG	SA
Waste control and technical efficiency are two different things! I don't know how one can increase the other.	○	○	☐	☐	☐	☐	☐
Our decision to implement recommended SWMPs is not a threat for profitability of this business.	○	○	☐	☐	☐	☐	☐
Increased efficiency of human resources created by the proposed SWMPs is, in general, my major concern.	○	○	☐	☐	☐	☐	☐
It is not only today, but we have to build our SWMPs by taking into consideration of what the government will ask us tomorrow also.	○	○	☐	☐	☐	☐	☐
My aim is to be one of the most eco-friendly companies in this area to our size; so, adoptions of SWMPs are inevitable.	○	○	☐	☐	☐	☐	☐
I have never heard about an owner of a firm like mine has been jailed for his misconduct on environment; so, why do I fear without reason?	○	○	☐	☐	☐	☐	☐
These controls create additional work for my employees; so, I am worry about their resistance.	○	○	☐	☐	☐	☐	☐
The increased technical efficiency generate by adopting SWMPs is, in general, my major concern.	○	○	☐	☐	☐	☐	☐
Nobody knows what regulations govern this industry; it is neither written properly nor enforced adequately.	○	○	☐	☐	☐	☐	☐
The *Pradeshiya Shaba's*, Provincial and National governments modify the SWMPs require us to implement very frequently; so, we must keep ahead of them.	○	○	☐	☐	☐	☐	☐
Those "fines" and "compensations" imposed by judiciary on environmental action will have a marginal effect on my firm.	○	○	☐	☐	☐	☐	☐
We cannot compete in the markets that we serve today, if we do not conform to the SWMPs proposed to us.	○	○	☐	☐	☐	☐	☐
If all these SWMPs in place, I will be in a big trouble, as I will loose my freedom to control the production of this firm.	○	○	☐	☐	☐	☐	☐

Thank You So Much for Your Kind Support to Complete this Questionnaire.