VOLUNTARY ACTION OF A FIRM ON ENVIROMENT MANAGEMENT: AN EMPIRICAL ASSESSMENT ON SRI LANKAN FOOD PROCESSING FIRMS' RESPONSE TO THE PRIVATE AND REGULATORY INCENTIVES

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ABSTRACT

The effect of a set of private/market (i.e. financial implications, internal efficiency, market response) and public/non-market (i.e. government regulation, judiciary/legal system) incentives for a firm to act voluntarily on environmental quality is examined. It uses the levels of adoption of five solid waste management practices [SWMPs], namely: (1) 3R system; (2) Composting; (3) Good manufacturing practices; (4) Biogas unit, and (5) ISO 14000 by food processing sector in Sri Lanka in response to the prevalence of each incentive at the firm as the case. The data collected from 325 firms through in-depth interviews and site inspections and supported by a validated structured questionnaire were analyzed using the principles of Structural Equation Modeling. The "*Analysis of Moment Structures*" (AMOS) software was used to establish the relationships between the levels of adoption of SWMPs and the strength of each incentive. The results show that firms' response to environment is relatively low, i.e. 49.2% did not adopt a single practice, while only 28%, 12%, 7.4%, 3.1% and 0.3%, respectively, have adopted 1, 2, 3, 4 or all practices. Firms tend to adopt a higher number of SWMPs as the relative strength of an each incentive perceived by the decision maker of firm gets increases. Firms put a higher weight on the impact on regulation and legal system than the private incentives and the firm size has a substantial impact on its response to the environment. The results highlight the importance of bringing the current public regulatory regimes in developing countries like Sri Lanka towards co-regulation, which is practiced by developed countries like Australia and Canada to facilitate businesses to come up with own solutions for environmental and food quality, as the outcome of this analysis points out that firms' compliance to the recommended SWMP was not triggered satisfactorily by the private/voluntary action.

Keywords:
Environment management, Food processing sector in Sri Lanka, Incentives, Regulation, Solid waste management, Voluntary adoption

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Introduction

The recent literature on environmental economics shows that market-based actions are, in general, more effective than government-oriented "first best" solutions to deal with the problems associated with public goods. In the context of environmental policy, however, it is difficult to formulate a set of appropriate policies that can be put into practice at the firm level, due to the limited knowledge of the level and nature of economic incentives available, in both a market and non-market context, for firms to comply with and/or adopt such controls at the firm level (Khanna, 2001; Segerson and Miceli, 1998).

The focal point of interest of this research study was to examine this economic problem from an empirical point of view using data from the food processing sector in Sri Lanka, which contributes about 4.5 percent to the Gross Domestic Product (GDP) of Sri Lanka and is responsible for around 30 percent of the total manufacturing value-added in Sri Lanka and the recent statistics show that the generation and accumulation of solid waste from this sector has become a growing problem of immense magnitude in Sri Lanka. According to the *Database of Municipal Solid Waste in Sri Lanka*, published by the Ministry of Environment and Natural Resources (MENR) in Sri Lanka, 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 percent of the solid waste at the municipal level by both households and industries.

The legal framework required for SWM in Sri Lanka is provided under the Local Government Act. The local authorities are charged in terms of the act with the responsibility of collection and disposal of solid waste at the municipal, urban and *pradeshiya sabha* or local government level. Despite all the formal regulations in place, many stakeholders in the food processing sector claim that the implementation and effective enforcement of formal regulations aiming the management of solid and liquid waste generated in this sector is very poor since regulations themselves vary significantly across local authorities as well as at the level of the provincial governments.

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 in an environmentally sound manner. The MENR under its recently formulated “National Strategy

for Solid Waste Management" has introduced a number of specific procedures that firms in the food processing sector should adopt in order to mange the solid waste generated in a firm, including, amongst the others: (1) "*Sorting of waste based on 3R System*" – Establishment of necessary infrastructure facilities in appropriate places and allocating labor for the purpose; (2) "*Composting*" – The conversion of solid waste materials into composts, in which the heavy metal composition should be maintained below the recommended standards; (3) "*Biogas technology*" – Establishing units in accordance with the guidelines provided by the Ministry, and further the firms can obtain guidelines, proper training, and certification to adopt environmentally sound practices such as (4) a set of "*Good Manufacturing Practices*" (GMP), and (5) "*ISO 14000 Environmental Management System*". Nevertheless, the adoption of these practices at the level of firm is not mandatory, thus, an individual business can select either one or a combination of these practices or any other appropriate mechanism that they deem to be effective in rectifying the problems associated with the generation of waste in their premises.

There is scarcity of literature that paid attention to evaluating the ability of voluntary environmental programs to generate economic benefits for firms. Yet, given their voluntary nature, provision of economic benefits to firms is a necessary condition for these programs to become effective environmental policy instruments. However, little is known about why firms operating in developing countries would participate in these initiatives. The outcomes of few such studies are provided below to provide an insight into the problem discussed in this paper.

Hettige *et al.* (1996) 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 drawn from plant-level abatement practices. The results suggest that pollution intensity is negatively associated with scale, productive efficiency and the use of new process technology while it is strongly and positively associated with public ownership. Amongst the external sources of pressure, the presence or absence of community action (informal regulation) emerges as a clear source of interplant difference. 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. Based on an economic framework explaining the relationship between environmental demand and supply under informal regulation, the study shows that in the absence of without

any formal regulations, equilibrium levels of emissions vary strongly across firms and regions in response to differences in scale, regional input prices, firm characteristics and the degree of informal regulation by local communities. According to this study, firm and plant characteristics appear to have an impact on pollution intensity. It shows firms in the food and paper sectors to have the highest pollution intensity.

Blackman and Bannister (1997) carried out an econometric analysis to determine the role of community pressure and clean technology among traditional brick makers in Mexico. According to the major findings of the study: (i) it is possible to successfully promote the adoption of a clean technology by intensely competitive informal firms even when the new technology significantly raises variable costs, and (ii) community pressure applied by competing firms and private-sector local organizations can generate incentives for adoption. On the presumption that command and control environmental regulation has failed to achieve efficient solutions, Blackman and Harrington (1999) reviewed the prospects and consequences of using certain economic incentives in developing countries to combat air pollution. They discussed the advantages and disadvantages of using a number of instruments of economic incentives, including the emission fees, tradable permits and environmental taxes in Sweden, the United States, China, and Poland for this purpose, and asserted that both design deficiencies and pervasive constraints on monitoring and enforcement impede the effectiveness of such instruments in these countries. They it concludes that tradable permits are generally not practical while emission fee policies may probably be more appropriate.

Dasgupta *et al.* (2000) examine the effects of regulation, plant-level management policies and several other factors on the environmental compliance of Mexican manufacturers. They found that while many firms in 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. They capture both these possibilities in a model of decision-making under uncertainty, which shows that a firm minimizes expected pollution-related costs by setting emissions intensity (i.e., emissions/output) at the point where the marginal abatement cost (MAC) is equal to the expected marginal penalty (EMP) for polluting. In a similar study, Blackman *et al.* (2000) calculate the benefits and costs of pollution control in the informal sector of Mexican brick kilns and found that a number of control strategies produce very significant net benefits. They concluded therefore that informal polluters should be a priority for environmental regulations.

Rivera (2002) provides cross-sectional empirical evidence about 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. The outcome of analysis indicates that hotels with certified superior environmental performance show a positive relationship with differentiation advantages that yield price premiums. Participation in the CST program alone is not significantly related to higher prices and higher sales. The evidence also indicates that participation in the CST program was significantly related to government monitoring, trade association membership and hotels focus on "green consumers". Potoski and Prakash (2004) examined the cross-national divergence in adoption rates of ISO 14001 based on the data from 59 countries and found that the adoption rates were likely to be higher in countries whose trading partners have adopted this non-governmental regime, which are embedded in international networks of non-governmental organizations, whose governments flexibly enforce stringent environmental regulations with a less adversarial and litigious stance towards firms, and where consumers want mechanisms for identifying environmentally progressive firms.

Blackman *et al.* (2008) used plant-level data from more than 60,000 facilities to identify the drivers of participation in Mexico's Clean Industry Program. It suggests that the threat of regulatory sanctions drives participation in the program and the program did appear to attract relatively dirty firms. It also found that 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. Powers *et al.* (2008) used a 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. It found that the GRP drove significant reductions in pollution loadings among dirty plants but not among cleaner ones. Further, it stated that the plants located in wealthier communities were more responsive to GRP ratings, as were single-plant firms.

In light of this, the specific objectives of the study are, therefore, to identify and quantify the extent to which a system of economic incentives that comprised of both market and non-market incentives motivate food processing firms in Sri Lanka to adopt various environmental controls aiming solid waste management (SWM) at the firm level, and to assess the impact of firm and of market-specific characteristics of firms on this behavior.

Methods

Econometric Specification of the Model

It could be assumed that the environmental policy of a firm that works to create a 'waste-free non-polluted environment' is characterized by the utility function $U_i = u\,[v\,(D_i \mid I_{ji}, F_{ki})]$ of the decision maker/management of the firm *i* (where $i = 1, 2, 3 \ldots n$) and u (v) is concave on its arguments. The management of the firm is responsible for complying with the regulatory requirements of the government. At the same time, the firm may decide to adopt various types of strategies voluntarily to manage the waste generated in the firm. Consequently, the term *v* in the above equation represents the overall gains to the firm through its responsible behavior towards the quality of environment where it operates (Caswell *et al*., 1998; Jensen and Meckling, 1976; Segerson, 1999; Williamson, 1986).

It could in turn be stated that the degree of responsiveness of a firm towards the environment is reflected by the types of levels of environmental management controls and practices ($SWMP_i$) adopted by the firm *i*, which depend on the individual incentives faced by the decision maker/management in this respect (I_{ji}), where *j* = types of incentives ($j = 1, 2, 3 \ldots m$). The relative strength of an individual incentive (*j*) on this behavior possesses a relationship with characteristics of the firm (F_{ki}), where *k* = size and type of the firm, etc. Given the above notations, through the maximization of the utility function, the following regression form of an expression for an empirical analysis (where ε_i is an error term) can be derived:

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

Equation (1) expressed above can be extended to specify the following econometric model (see, Nakamura *et al.*, 2001):

$$SWMP_i = \sigma_0 + \beta_1 * CST_i + \beta_2 * INE_i + \beta_3 * MRF_i + \beta_4 * REF_i + \gamma_1 * FT_i + \gamma_2 * FS_i + \gamma_3 * VT_i + \gamma_4 * EX_i + \varepsilon_i \qquad (2)$$

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 4

individual incentives (j = 1, 2, 3 and 4) considered in the analysis such that CST = cost/financial implications; INE = internal efficiency (both human resource and technical); MRF = market forces (i.e. sales & revenue, reputation, and commercial pressure), and REF = regulatory forces (i.e. existing and anticipated government regulations, liability laws), and γ_k = coefficients of characteristics of a firm (F_{ki}) such that *FT* = firm type; *FS* = firm size (based on annual returns); *VT* = vintage, and *EX* = export orientation (Caswell *et al.*, 1998; Jayasinghe-Mudalige and Henson, 2006a; 2006b; Khanna and Anton, 2002; Segerson, 1999).

Specification of the Dependent Variable ($SWMP_i$)

For the purpose of this analysis, it was presumed that the number of SWMPs adopted by a firm reflects its degree of responsiveness towards environmental quality, since the MENR does not suggest any recommended order in which to adopt the practices listed above in a food processing firm and none of which is endowed with a higher value over the others. Under these circumstances, there is a possibility that certain firms may decide to adopt a single or two practices at a time, whereas others may even go beyond (i.e., four or five) depending on the gains to the firm by doing so. On the other hand, there may be firms that do not adopt a single practice out of the list given above. In such case, an analyst may come up with a series of zeros as she works on a scale of: *Adoption* = 1; *Non-adoption* = 0 to report the status of adoption of these practices in the firm on an individual basis. At times, the analyst may therefore experience excess zeros. Principles of Count Data Regression models were hence employed to estimate the coefficients of the econometric model specified above, which uses the number of SWMPs adopted by a firm as the estimable dependent variable ($SWMP_i$) (Chowdhury and Imran, 2010).

Specification of Explanatory Variables (I_{ji})

It is unable to include the 4 individual incentives listed above directly into the econometric model specified as its explanatory variables, mainly due to: (a) Mutual Exclusivity and Endogeneity – the prevalence of an individual incentive as an element of the system (Nakamura *et al.*, 2001; Shavell, 1987); Subjectivity – the management of the firm perceives these incentives in terms of potential benefits and costs to the firm (Buchanan, 1969); and Unobservability – the management cannot directly observe the nature of the incentives

prevailing at the firm level (Hair *et al*., 2006). In order to overcome these difficulties, the Confirmatory Factor Analysis (CFA) techniques [i.e., a multivariate data analysis technique that comes under Structural Equation Modeling (SEM)] were employed to develop estimable variables for the 4 individual incentives (j = 1, 2…4), which combines the features of two models: (i) Measurement Model, and (ii) Structural Model into a simultaneous statistical test (Hair *et al*., 2006; Hughes *et al*., 1986). The MM specifies a series of relationships that suggests how 'measured variables' represent a Latent Construct. The measured variables of a Construct included in the MM are, in turn, referred to as Indicators that reflects exactly the observable characteristics of the firm with respect to the Construct that underlines it. In this study, the four individual incentives are such latent variables and are defined as Latent Constructs of the MM. In turn, a set of 'attitudinal statements' reflecting observable characteristics of these incentives were specified as the Indicators of the model. Once the Constructs and their corresponding Indicators are identified, the Analysis of Moment Structures (AMOS) [version 16] statistical software was performed to construct the MM as shown in Figure 1.

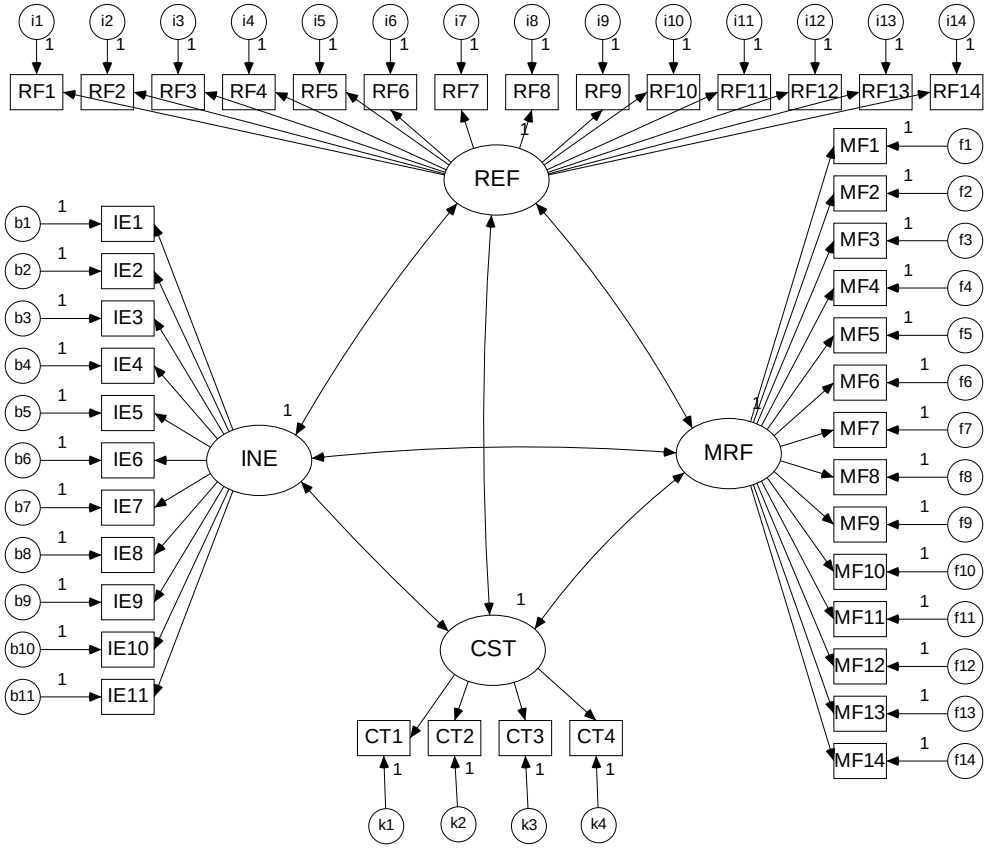

Figure 1: Measurement Model in SEM (Using AMOS)

The scores provided by respondents to each Indicator on the multi-point likert-scale was analyzed with the AMOS and the Statistical Package for Social Sciences (SPSS) [version 14] to get rid of the empirical issues cited above (i.e., non-exclusivity, endogeneity, subjectivity, unobservability, etc.) by applying a number of statistical tests specified under the CFA, including: (a) *Construct/Scale Reliability* – measures whether a set of Indicators representing a Construct are consistent in their measurement based on the formulae $(\Sigma\lambda)^2 / (\Sigma\lambda)^2 + \Sigma(1-\lambda_j^2)$, and is customary to use the Cronbach's alpha (α) (Cronbach, 1951) for this purpose. Since the aim of the test is to maximize α, researchers generally accept values above 0.7 as demonstrating that a scale is internally consistent; (b) *Unidimensionality* – 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, and is common to use the Principal Axis Factoring Technique to examine this effect (De Vellis, 1991), where a minimum value of around 0.30 to 0.35 indicates that an Indicator loads onto a factor (Spector, 1992), and (c) *Construct Validity* – the ability of Indicators of a Construct to accurately measure the concept under study (De Vellis, 1991). The Multi-Trait Multi-Method matrix (MTMM matrix), introduced by Campbell and Fiske (1959) is used 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) (Henson and Traill, 2000).

Once the valid and reliable Indicators of each Construct were chosen through CFA, the scores given by respondents to these indicators on the multi-point likert-scale were considered as objective measurements or, in other words, free from those empirical issues listed elsewhere, and proceed with further analysis. The scores given by respondents [i.e., every firm included in the sample (i = 1, 2…n)] were then used to the Indicators of a Construct (i.e., attitudinal statements of an individual incentive) in order to derive an index for the respective incentive (j = 1, 2…4) – referred to here as Incentive Index (I_{ji}) – by taking the aggregate of the scores given by a respondent to all Indicators of an incentive on the 5-point Likert Scale (AIS) and dividing it by the Maximum Potential Score (MPS) to normalize the value of the Incentive Index so that its value ranges from -1 (minimum) to 1 (maximum) as: I_{ji} = Aggregate Score (AGS) / Maximum Potential Score (MPS).

Collection and Analysis of Data

The data from 325 food processing firms belonging to 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)] were used. The contact details of firms were obtained from the Municipal Council (for urban-based factories) and at p*radeshiya sabha* (for rural-based factories) levels and the Export Development Board of Sri Lanka; the Ministry of Industrial Development; the Federation and Regional Chambers of Industry and Commerce; National Agribusiness Council of Sri Lanka, and Fruit and Vegetable Processors Association of Sri Lanka etc.

A series of in-depth face-to-face interviews were carried out supported by the structured questionnaire, which was piloted using 36 firms, with the top-most executives followed by an inspection of the site for cases where permission was granted from January to September 2009. Each respondent was first asked to rate his/her perception about the observable characteristic explained in each statement (i.e., Indicator) with respect to the current performance of his/her firm on a two-point Likert scale, i.e., (1) *agree* ("yes"), or (2) disagree ("no") having instructed the respondent to rate the same statement on a five-point Likert-scale by taking into account of the extent to which he/she agrees (if they say "yes" in the 1st rating) or disagrees (if they say "no" in the 1st rating) with this particular statement (Oppenheim, 1992).

The Measurement Model (MM) constructed through the *Analysis of Moment Structures* (AMOS) [version 16] software (see Figure 1) using the Maximum Likelihood Estimation (MLE), considering the recommendations of Hair *et al*., (2006) to assess the validity of MM in terms of both Model Fit and Construct Validity. The summary of goodness-of-fit measures obtained highlights that the overall model X^2 is 1901.67 with 824 degrees of freedom (df). The probability value associated with this result is 0.000 and the model is significant at ρ = 0.001. Also the ratio of X^2/df was 2.308 (i.e., 1901.67/824), which was below the accepted cut-off value of <3.00. At the end of this process, all the attitudinal statements included in the questionnaire were considered to derive the Incentive Index of each incentive.

Results and Discussions

Characteristics of Firms in the Sample

Figure 2 and 3 illustrates the distribution of firms in the sample for the five different types and sizes. Further, nearly 40 percent of firms were involved in international markets (i.e., exporting). Figure 4 illustrates that "Composting" (31.4 percent), "3R system" (24 percent) and "Good Manufacturing Practices" (24 percent) were popular as measures to control solid waste generated in the firm as compared to "Bio Gas Unit" (4 percent) and "ISO 14000 series" (4.6 percent). Out of the 325 firms contacted, however, 153 firms (47.1 percent) did not adopt a single SWMP suggested by the MENR.

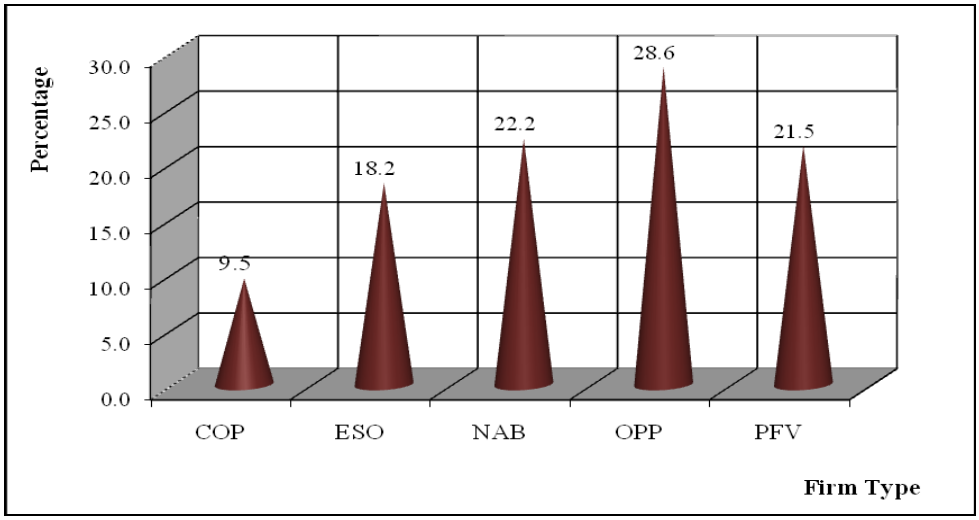

Figure 2: Percentage of Firms by Type

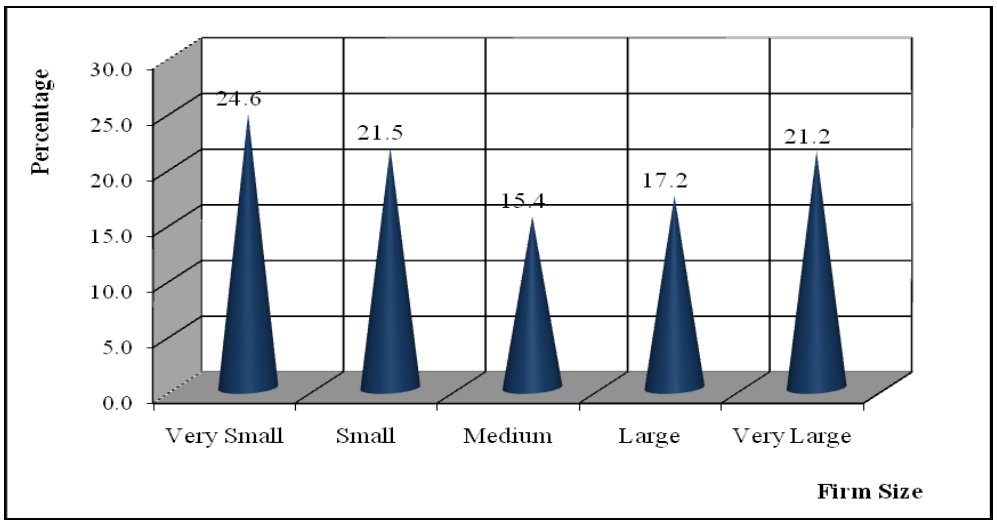

Figure 3: Percentage of Firms by Size

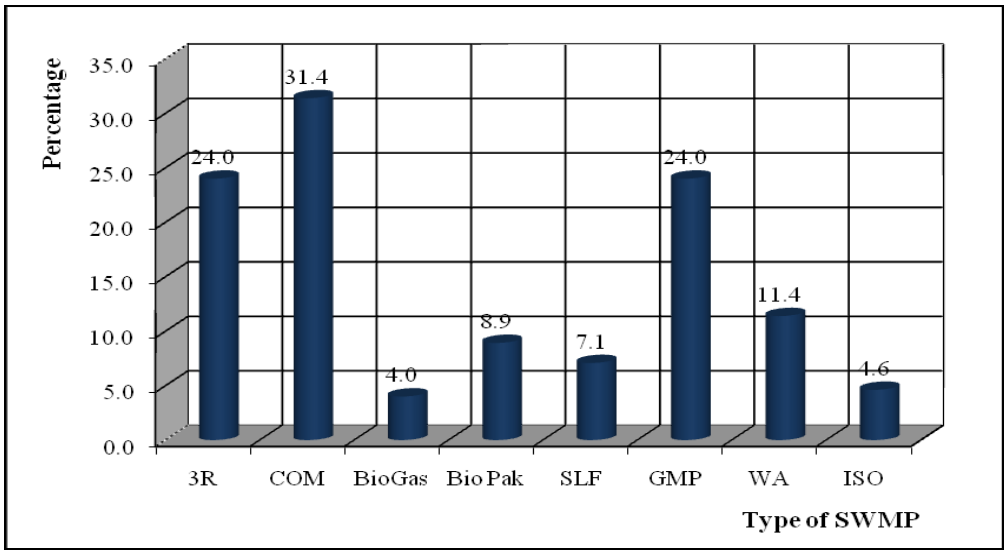

Figure 4: Different Types of SWMPs Adopted by Firms

Outcome of Count Data Analysis

The first step towards a Count Data Analysis was to examine the excess zeros and over-dispersion of the data. The results show that it was 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, it was 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 (see Figure 7) shows that the number of zeros is excessive. These suggest that it is best to estimate the econometric model with other option/s available, including Zero-Inflated Poisson (ZIP) and Zero-Inflated Negative Binomial (ZINB) models that could account for this over-dispersion. The statistical outcome of ZIP and ZINB models is presented in Table 1.

The Vuong statistic (V=3.36) compares the ZIP and PR models. Since it is significant, ZIP model is preferred the PR model. Where NBM is considered, the Vuong *t*-test (V=3.00) result further suggests that the ZINB outperforms its parent specification, the Negative Binomial model (NB). The appropriate model for the data on adoption counts suits more with the ZIP or ZINB model. This test is also supported by the Likelihood Ratio (LR) test which tests whether or not the ZINB model reduces to the ZIP model. The results from this test demonstrate that the LR test statistic computed as LR =−2[LVZIP −LVZINB)], where LV

stands for log-likelihood values and distributed as Chi-square with one degree of freedom, favors the ZINB model over the ZIP model.

Table 1: Outcome of the Count Data Models

Covariates	Zero Inflated Poison (ZIP)			Zero Inflated Negative Binomial (ZINB)		
	Coe.	*SE*	*Prob.*	*Coe.*	*SE*	*Prob.*
CST	-0.556	0.239	0.020	-0.537	0.288	0.042
INE	1.170	0.324	0.000	1.235	0.398	0.002
MRF	-0.403	0.425	0.343	-0.481	0.534	0.368
REF	1.049	0.434	0.016	1.014	0.5145	0.049
Constant	-11.433	6.384	0.073	12.511	6.533	0.056
COP	4.928	1.225	0.000	0.131	0.376	0.027
ESO	-0.583	0.330	0.077	-0.553	0.384	0.150
NAB	-0.187	0.252	0.458	-0.172	0.297	0.562
OPP	-0.759	0.277	0.056	-0.756	0.317	0.067
PFV	0.132	0.243	0.587	0.131	0.291	0.653
Large	0.931	0.130	0.000	0.906	0.147	0.000
Small	0.467	0.211	0.067	0.379	0.241	0.116
VT	0.937	0.137	0.000	0.921	0.147	0.000
EX	0.132	0.132	0.174	0.180	0.145	0.214
Log likelihood	*-424.553*			*-416.511*		
Inflation model	*logit*			*logit*		
Vuong test	*3.36***			*3.00* **		
Likelihood Ratio Test				*3.01***		

The negative sign of the cost in both ZIP and ZINB models implies that the CST acts as a negative factor hindering the adoption of the recommended SWMPs in their firms highlighting the importance of financial assistance which would aid voluntary adoption. The Internal efficiency has a positive impact on adoption as the firms believe that the increase of human resource efficiency and technical efficiency are in general their major concern affecting the implementation as these control measures in place would help the employees to handle the production and the disposal measures to comply with the production standards. However, interestingly, firms do not believe market forces such as consumer pressure, increase in sales & revenue and reputation of the firm to be important factors affecting adoption as many believed that having these technical standards in the firms did not specifically help in competing in the local or international market nor increase in their profitability. Since the waste standard for most exportations are not mandatory, these firms including exporting firms did not perceive the adoption necessary to international trade which

gave them very low or no consumer pressure stimulating adoption. Many firms on the other hand perceived the regulatory framework to be important and specifically stressed on the anticipated regulations to be made mandatory by the government and were responsive to the fines and compensation aiming stricter regulation can increase the level of disposal or abatement practices at the firm level. Where the product types are of concern, only the coconut producers had a significant relationship with the rate of adoption. This may be due to the fact that most of these firms handle the production from the initial stage to value addition in the same location leading to huge amounts of solid waste per day.

However the firm size showed significant impact. In relation to the small scale firms, large firms showed a significant adoption rate as many firms required these controls in place for a continuous and efficient large scale production. The number of years the firm has been in operation represented by the variable vintage showed a significant impact implying the increase in the sense of responsibility towards cleaner production in the firms over time. Whether firm exports its products or not did not pose a significant and positive impact on the adoption which may have been due to the fact that waste management methods have not been made a requirement in most of the food and beverage products exported from Sri Lanka

The results, in effect, reject the hypothesis that a firm's adoption decision is triggered by potential losses to the firm resulting from its failure in the market due to non-responsivenes to market-based incentives and that this effect is greater than the potential gains to the firm resulting from those failures in government policy that would account either for its degree of compliance or total non-compliance. However, firms recognized potential failures in government policy and inefficiencies associated with the legal system. In sum, it is the less significant losses in the market combined with the relatively high gains due to failures in government policy that provide an opportunity for firms, by and large, to not respond positively to environment quality by adopting advanced environmental management controls. However, 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 and is associated significantly with both the characteristics of the firm and the regulatory regime.

Conclusions and Policy Implications

The results of this analysis suggest that it is important to design private and public sector initiatives, which aim at achieving a higher level of environmental quality at the level of firm that are incentive-based in order to augment the low levels of market-based incentives currently prevailing at the firm level. However, such initiatives should factor in the differing industry structures and sizes of firms. The results of the analysis can be used to develop a common format for decision-making with respect to the level of solid waste management controls adopted by the Sri Lankan food processing enterprises, in which both the national and provincial governments on one hand allows for producers to take advantage of potential market opportunities that exist while strengthening controls by the judicial system on the other.

The findings of the study suggest that the firms under study are anticipating much stricter regulations in the near future. It is clear that this perception on government regulation, together with their desire to respond to market-based and liability incentives, can effectively regulate these firms. In fact, the differing performance levels of these firms with respect to the different solid waste management practices proposed suggest that the majority of firms perform poorly in one or more important areas, for example, in the adoption of waste management systems and audit procedures that are required to assure a higher level of environmental quality. It is therefore imperative that regulations be altered at the provincial government level to overcome these shortcomings in the current regulatory system.

The discriminatory behavior of public regulatory bodies at the national and provincial levels raises the question as to what criteria are appropriate in controlling the level of environmental quality. The government, together with the other sectors in the market (such as industry and trade organizations), can act as a facilitator and mediators for firms to develop appropriate environmental quality management programs that reflect their private incentives. Trade and other industry organizations, as an integral part of the market, can in turn play an extensive role in this connection to minimize the problems faced by firms. Policy makers could use the 'carrot and stick' approach suggested by Segerson (1999) which imposes voluntary and mandatory public food safety controls at the firm level as the basis for designing appropriate regulation for environmental controls, which, in turn, could produce an incentive-based regulatory system for all firms. An alternative would be a 'bottom-to-top' approach (i.e.,

firm-to-regulator approach) that would reflect the individual incentives faced by firms and takes into account the characteristics of firms and of the market in which they operate.

As a 'stick', the government could develop a more stringent 'command and control type environmental quality management program for all firms and apply it irrespective of the characteristics of the firm such as its size or whether it functions in the domestic or international markets. Hence it is important to bring current public regulatory regimes in developing countries like Sri Lanka towards co-regulation, which is practiced by developed countries to facilitate businesses to come up with own solutions for environmental and food quality, as the outcome of this analysis points out that firms' compliance to the recommended SWMP was not triggered satisfactorily by the private/voluntary action. This course of action could be strengthened with a set of penalties (i.e., fines, license suspension and temporary closure, etc.), as well as the emplacement of an effective system to expose those firms that do not comply. This kind of approach may act as an incentive-based regulatory system and at the same time, non-compliance would entail the credible threat of direct government intervention. Last but not least, one of the most important implications of designing regulation in this manner is that it provides the right to determine the boundary between the market and the government not only to the government but to the market institutions themselves as well.

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