FACTORS AFFECTING THE ADOPTION DECISION OF VOLUNTARY ENVIRONMENTAL MANAGEMENT SYSTEMS IN THE APPAREL INDUSTRY IN SRI LANKA

Hemchandra D W K *(kinkini2009@gmail.com)*

University of Sri Jayewardenepura

ABSTRACT

Textile and apparel industry represents41% of total export earnings and 52% of industrial export earnings in Sri Lanka.There are about 350 BOI registered textile and apparel manufacturing factories located islandwide including 16 textile and fabric manufacturing firms. The textile and apparel factories produce sportswear, lingerie, loungewear, bridal wear, safety worker's wear, swimwear, childrens wear. Apparel manufactured in Sri Lanka are considered as high quality, reliable, socially and environmentally accountable. Specially, Sri Lankan apparel manufactures are considered as pioneers in environmental friendly apparel producers in the world.

Therefore, the study aims to examine the factors that affect the adoption decision of voluntary environmental management practices among textile and apparel manufactures in Sri Lanka. Using a pre-tested, and structured questionnaire primary data were collected from 55 factories randomly in the Western province. Volunatry environmental management practices are considered as the dependent variable and regulatory pressures, buyers pressure, competitors pressure, and firm's characteristics are considered as the independent variables. I measure the effects of each independent variable to the adoption decision based on Poisson Model estimation. The study found that factory chracteristics and buyers pressure are the most significant factors for the firms to adopt voluntary EMS.

Keywords: *Environmental Management Practices, Apparel and Textile Industry, Central Environmental Authority, ISO 14001, Board of Investment*

INTRODUCTION

Textile and apparel export industry represents 58% of total industrial export earnings (Central Bank of Sri Lanka, 2013) and 52% of the industrial sector labour force in Sri Lanka (Department of Census and Statistics). USA (43%) and Europe (46%) are the major export markets of Sri Lankan apparel industry. We produce a variety of clothing from T-shirts to cotton skirts. It is common for well-known brands such as Victoria's Secrets, Nike, Gap, and Pierre Cardin to sell garments produced in Sri Lanka.

However, this industry also contributes to significant level of water pollution due to industrial operations (World Bank Indicators, 2014).Textile and apparel factories undertake different types of activities: fabric manufacturing, washing, dyeing, weaving, knitting and sewing. Washing and dyeing are the most damaging the environment and the wastewater they generate may include high concentrations of chemicals (World Bank Indicators, 2014).

Textile and apparel industry was commercially started in the 1960s and was producing only for the local market. The sector started attracting investors and producing for export following the economic liberalization policy in the early 1970s. The low labour cost and the

establishment of the Board Of Investment (BOI) and subsequent Export Processing Zones (EPZs) attracted foreign investments to the industry. The BOI is a governmental agency which aims at attracting foreign and domestic investments to Sri Lanka by providing advice and assistance to potential investors. The BOI is in charge of administering EPZs which offer investors a number of benefits such as tax holidays or preferential rates, exemption from customs duty and foreign exchange controls. The EPZs also benefitted from modern infrastructure such as access roads, water and sewerage facilities, security as well as a range of business services. There are currently nine EPZs in Sri Lanka.

As of today 326 factories operating in the textile and apparel manufacturing sector are registered with the BOI, including 168 factories with more than 250 employees. 42 out of these 326 factories (13%) are located within an EPZ. BOI-registered firms are for the vast majority exporting firms since they represent 96% of total apparel export earnings in Sri Lanka. There are only 16 textiles and fabric manufacturing factories and nine finishing factories in operation, which represent less than 5% of all establishments registered with the BOI (BOI and Central Bank of Sri Lanka, 2013).

The forthcoming empirical analysis will focus on BOI-registered establishments, which are for the most part large-scale export-oriented companies operating in the apparel sector. BOI-registered factories represent a small share of the total number of factories engaged in textile and apparel manufacturing. The textile and apparel sector recorded US$ 4.5 billion income in 2013 through their export earnings. These manufacturers produce: sportswear, lingerie, loungewear, bridal wear, safety worker's wear, swimwear, and children's wear. These are also classified as knitted or crocheted, not knitted and worm clothing (see Figure 1).

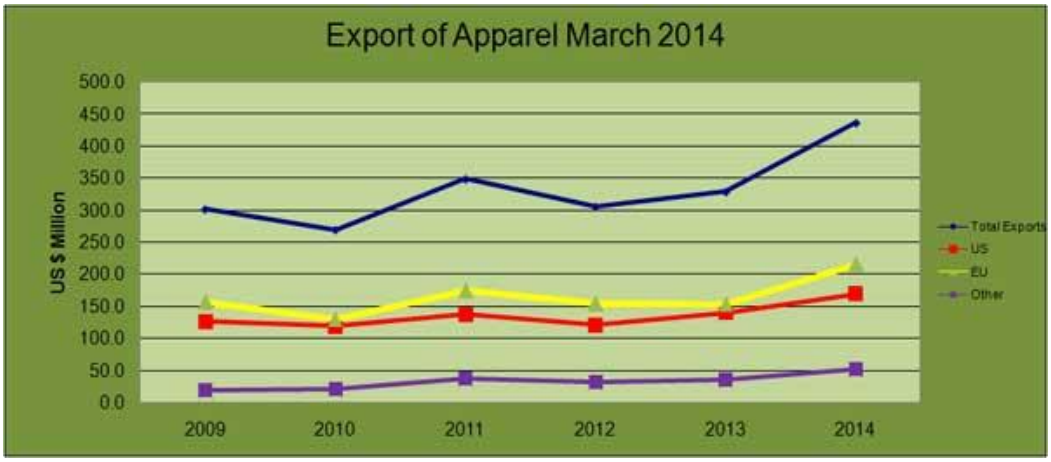

Figure 1 Export earnings from 2009 to 2014 (March records)

The textile and apparel industry recently faced a number of challenges including the suspension of the Generalized System of Preference plus (GSP +) by the European Union (that provided tax free access for Sri Lankan's garments) because of human rights conventions, high cost of skilled labour and imported raw materials, and competition from regional manufacturers. As a consequence the industry reacted by specializing in high quality products and developing a number of labels such as "Ethically Manufactured Garments", "Garments without Guilt Certification" and "Sustainable Environmental Friendly Manufacturing" in order to build a reputation of high quality finished products.

In this article we study factors driving voluntary adoption of EMPs in the Sri Lankan textile and apparel sector, with a focus on large-scale export-oriented companies. We present an empirical analysis based on survey data in order to identify factors driving adoption of EMPs by textile and apparel manufacturers in Sri Lanka. Our analysis suggests that buyers' pressure and firm's characteristics such as firm's size, export orientation, and type of activities undertaken at the factory are the most significant factors influencing firms' decision to voluntarily adopt EMPs.

LITERATURE REVIEW

In order to control and monitor industrial pollution most countries use some form of command and control instruments (Anton et al.,2002; Delmas and Toffel, 2003; Hart, 1995; Priyadarshani and Gupta, 2003; Dasgupta et al.,2000). However, regulations have not always proved effective in reducing industrial pollution in the developing world (Anton et al.,2002; Blackman and Sisto, 2005; Maxwell and Lyon, 2000). On the other hand, firms are also known to voluntarily adopt different environmental management practices (EMPs) to help manage the potential impacts of business strategies on the environment (Anton, 2005; Jayasinghe et al., 2011; Uchida and Ferraro, 2007; Florida and Davison, 2001; Pulvor, 2001).

Environmental concerns of any industry are guided by legal requirements and their volunteer practices. Jayasinghe et al.(2011) have examined voluntary environmental practices in the food processing sector in Sri Lanka. A study by Uchida and Ferraro (2007) has examined the voluntary development of environmnetal management systems among Japanese manufacutures. Anton (2005) has also examined the factors which move companies to follow environmental management systems. Florida and Davison (2001)have also examined the environmental management practices among the businesses which manage their business goals and environmental performances.

Kanitta, Andreas and Madhu has examined the role of FDI and export orientaion on ISO 14001 adoption in Thailand. This study has tested the factors influencing the adoption of ISO14001from the developig countries point of view. Using bivariate probit model, they found that FDI is a statistically significant factor for determining voluntary environmnetal systems. In addition, firm size, product type, having ISO 9000, obstacles and number of pollutatnts are statistically significant for firms decision. However, export orientation was not significant for the decision to adopt EMS. (Kanitta et al., 2011)Ervin et al.(2006) have studied the economic and institutional factors affecting business environmental management. Based on assumption of maximizing facility manager's utility function the model was developed. They found two dependent variables such as environmntal management practices and pollution prevention and also found that pro environmnetal management attitudes affect the EMP and pollution prevention among firms. Surprisingly they found that consumer pressures, environmental interest groups' pressure and firms' characteristics are not significant for EMPs. (Ervin, et al. 2006)Delmas and Toffel argue that there are different types of practices of environmnetal management among firms due to different organizational characteristics other than the institutional pressures. According to their literature review there are pressures from non-market constituents and market based constituents. They found that organizational characteristics moderate the institutional pressures on organizations to adopt voluntary practices. (Delmas and Toffel 2010)

Anton, Deltas and Khanna have examined the firms decisions on environmental self-regulations and environmental performances in the toxic industry. They have addressed two

objectives of examining the factors affecting the quality of EMSs adopted by firms and to find the impact of quality of EMS on toxic releases. They found that threat of liabilities and market based pressures are significant for the decision on adoption of EMS. Adoption of higher quality EMS has a significant impact to reduce the toxic emissions to reduce in the organizations. However niether market based nor regulatory pressures do not have a direct significant impact on the pollution intensity among firms. The effects are found to be indirect through the adoptation of EMS. (Antonet al., 2002)

According to the study by Jayasinghe et al., (2011), the regulatory presurres are significant for adopting environmnetal practices. According to them private incentives and the firm size are important factors for firms to decide their environmental concerns.Uchida and Ferraro (2007) has examined the driving forces for voluntary environmnetal practices among Japanese manufatures. Their study found that regulatory pressures and consumer pressures are the most influencing factors for firms to move to environmental managemt systems. According to the study, government has a significant role to play for this movements. According to Anton (2005), firms environmental management practices are influenced by potential liability cost of thefirms. According to her study, regulatory pressures are not generally found from the data analysis. The competitive pressures strongly influenc firms to adopt environmnetal management practices. The stuudy has found that consumer pressures are strongly related to EMPs of firms.

Foulan et al.(2002) have tested the impact of both traditional enforcement and information strategies among the pulp-producers in British Columbia and Canada. They have found that information disclosure strategy has a significant impact on emission levels and compliance levels than the tradtional strategies in. Foulona et al.(2002) andJayasinghe and Weerasink(2004) studies have found that EMSs are mainly affected by the level of urbanization and the government regulations in the crop and livestock farms in Canada. They have also examined the impact of human capital, financial and social characteristics of the farmers on the application of EMS in their farms. Both young and rich farmers would also practice more EMSs compared to the others. They found that those voluntary EMSs are prominent among them due to the market forces and not merely because of legal requirements. Florida and Davison(2001) found that environmnetal management systems can provide a systematic and comprehensive strategy to solve environmental issues.

According to these literature, consumer pressures and legislative pressures are considered as the main factors influencing environmnetal management practices among firms. (Jayasinghe et al., 2011; Uchida and Ferraro 2007) Potential liability cost is another factor influencing environmental management systems in firms. (Anton 2005). The firm's size plays an important role when desiging their environmental management practices. (Jayasinghe et al., 2011). Therefore, these factors can be used to achieve the objectives of the study. The above mentioned empirical studies have found the importance of the pressures from the shareholders and government and also the mixed results on the effects of consumers, industry structure and financial stabilities of the companies.

METHODOLOGY

This study aims to find out why firms voluntarily comply with environmental standards. In this section, we discuss the methods used in achieving the research objective of identifying the factors that influence BOI registered textile and apparel manufactures to adopt EMPs in their factories.

Our firm-level data comes from a survey of 55 BOI-registered firms in the Western Province of Sri Lanka, where a majority of textile and apparel factories are located.[1]Our objective is to identify the factors that induce firms to voluntarily adopt environmental management practices. We focused on BOI-registered firms because the value addition to GDP and export earnings from this sector is significant. It should however be kept in mind that BOI-registered firms are large-scale, export-oriented companies that operate primarily in the apparel sector. We randomly selected 65 factories out of the 221 BOI-registered factories which operate in Western province.[2] We then emailed a questionnaire to the managers and also hand-delivered a copy to the highest officer in charge of safety and compliance. Following up with frequent telephone reminders, we were finally able to gather 55 questionnaires.[3]

The survey recorded information on a number of factors including location, years in operation, type of company, share of foreign exports, monthly sales, number of employees and types of activities undertaken at the factory. Managers were also interviewed about certifications received by the factory, EMPs and presence of environmental audits at the factory level. In addition to factory's characteristics, we were interested in the impact of regulatory practices and external pressures. Managers were, thus, questioned about inspections by environmental officers and fines they may have received. Finally, they were asked to evaluate the level of pressure (on a scale from 1 to 5) for compliance with environmental regulations and/or adoption of EMPs, they may have received from i) the Apparel Exporters Association (AEA); ii) the Central Environmental Authority (CEA); iii) the local community; iv) the buyers, and v) the owners. The full list of variables and their definitions are given in Table 1.

Table 1 List of variables and their definitions

Variable	Definition
i_Colombo	Equal to 1 if the factory is located in Colombo district, 0 otherwise
i_Gampaha	Equal to 1 if the factory is located in Gampaha district, 0 otherwise
i_Kaluthara	Equal to 1 if the factory is located in Kaluthara district, 0 otherwise
i_boiepz	Equal to 1 if the factory is located in a BOI or EPZ zone, 0 otherwise

[1]Some two-thirds (221) of all the BOI-registered factories are located in Western province (Colombo, Gampaha and Kalutara districts)

[2]Colombo district records the highest number of factories (163 BOI- registered factories) and the highest per capita income compared to other districts in Sri Lanka. There are 44 BOI-registered textile and apparel manufacturers and five EPZ in Gampaha district and 14 factories and one EPZ registered in Kalutara district.

[3]25 are located in Colombo district, 23 in Gampaha, and 7 in Kalutara districts; and 33 are located within anEPZ.

Yearsestab	Number of years since establishment of the factory
i_solep	Equal to 1 if the company is in sole proprietorship, 0 otherwise
i_partner	Equal to 1 if the company is in partnership, 0 otherwise
i_ltdliab	Equal to 1 if the company is a limited liability company, 0 otherwise
i_group	Equal to 1 if the company belongs to a group of companies, 0 otherwise
i_brforeign	Equal to 1 if the company is a branch of a foreign company, 0 otherwise
Nofactories	Number of factories owned by the company
i_foreignexp	Equal to 1 if more than 90% of sales are exported, 0 otherwise
i_salesgr15	Equal to 1 if average monthly sales are greater than 15 M Rs, 0 otherwise
Totalemployees	Total number of employees in the factory
sh_managers	Proportion of managers
i_dye	Equal to 1 if dyeing activities are done at the factory, 0 otherwise
i_wash	Equal to 1 if washing activities are done at the factory, 0 otherwise
i_weaving	Equal to 1 if weaving activities are done at the factory, 0 otherwise
i_apparel	Equal to 1 if apparel is produced at the factory, 0 otherwise
i_accesso	Equal to 1 if accessories are produced at the factory, 0 otherwise
i_embroid	Equal to 1 if embroidery activities are done at the factory, 0 otherwise
Nostaffems	Number of staff involved in EMS
i_degree	Equal to 1 if the highest qualified person in charge of EMS has a degree, 0 otherwise
i_iso14001	Equal to 1 if the factory is ISO 14001-certified, 0 otherwise
i_iso9001	Equal to 1 if the factory is ISO 9001-certified, 0 otherwise
i_recycle	Equal to 1 if the factory is doing some water recycling, 0 otherwise
i_reuse	Equal to 1 if the factory is reusing any material (e.g. fabric, paper, or water), 0 otherwise
i_envaudit	Equal to 1 if the factory has undertaken some environmental audit, 0 otherwise
i_fines	Equal to 1 if the factory had to pay fines due to noncompliance with environmental regulations, 0 otherwise
i_inspect	Equal to 1 if the factory has been inspected, 0 otherwise
AEApressure	Level of pressure from the Apparel Exporters Association (AEA), scale from 1 (no pressure) to 5 (highest level of pressure)
CEApressure	Level of pressure from the Central Environmental Authority (CEA), from 1 to 5
Communitypressure	Level of pressure from the community, from 1 to 5
Buyerpressuree	Level of pressure from the buyers, from 1 to 5
Ownerpressuree	Level of pressure from the owners, from 1 to 5
av_pressure	Average level of pressure, from AEA, CEA, community, buyers, and owners

Study by Jayasinghe et al.(2011) have used seven variables to measure the level of voluntary environmental management practices used in the food manufacturing industry in Sri Lanka. They used 3 R concept, composting, bio gas unit, biodegraded packing materials, and site ownership to dump solid wastes, good manufacturing practices, ISO 14001, and waste auditing as the dependent variables. Another study by Anton has also used four EMPs such as conducting environmental audits, environmental reporting, implementing total quality

management standards and conducting environmental risk evaluation of suppliers. (Anton, 2005)

Legislative pressure means the pressures for which firms strategically react to future and present legislative pressures on environment protection. Some of the past studies by Jayasinghe et al.(2011)and Uchida and Ferraro (2007)have found that legislative pressures are important for moving to voluntary environmental practices. According to Nakamura et al. (2001) legislative pressures directly influence firms to obtain ISO14001 certificate. There are two variables used to test the legislative pressure such as inspections by the authority, fines paid by the firm, pressures from CEA and availability of EPL.

Pressures from the customer are used as another explanatory variable in this study. As Arora and Gangopadhyay (1995) state, there is generally a positive relationship between the voluntary environmental practices and customer pressure. In our study, customer pressure is defined as demand from the customers to operate their production with EMPs. Type of customer and share of sales to export market are used as explanatory variable to identify customer pressures.

Firm's Characteristics are used as another explanatory variable. Among these variables location, size, type of operation, availability of ISO 9001, are taken as another explanatory variable in the study. These measures of the technical and financial abilities of the company may influence them to practice these voluntary EMPs. Studies by Coglianese and Nash (2001) as cited by (Uchida and Ferraro 2007) has shown a positive relationship between the voluntary EMPs and companies abilities. Technical abilities are measured in terms of availability of technical officers and technical knowhow where as financial ability is measured from the spending on research and development expenditures. Larger amount of research and development expenditures influences firms to adopt voluntary measures according to Anton et al. (2002). Size of the firm is an important variable because small and large firms will differ in their ability to comply with EMPs. According to the findings of Jayasinghe et al., (2011), the size matters for the companies to change their EMPs.

Table 2 Descriptive Statistics

Variable	Mean	Min	Max
i_Colombo	0.45	0	1
i_Gampaha	0.42	0	1
i_Kaluthara	0.13	0	1
i_boiepz	0.60	0	1
yearsestab	16.85	2	35
i_solep	0.15	0	1
i_partner	0.11	0	1
i_ltdliab	0.33	0	1
i_group	0.29	0	1
i_brforeign	0.13	0	1
nofactories	8.49	1	40
i_foreignexp	0.91	0	1
i_salesgr15	0.78	0	1

totalemployees	843.20	35	3,808
sh_managers	0.04	0	0.23
i_dye	0.25	0	1
i_wash	0.27	0	1
i_weaving	0.11	0	1
i_apparel	0.71	0	1
i_accesso	0.07	0	1
i_embroid	0.16	0	1
nostaffems	12.29	0	240
i_degree	0.53	0	1
i_iso14001	0.27	0	1
i_iso9001	0.38	0	1
i_recycle	0.42	0	1
i_reuse	0.87	0	1
i_envaudit	0.67	0	1
i_fines	0.00	0	0
i_inspect	0.98	0	1
AEApressure	2.22	1	5
CEApressure	3.44	1	5
communitypressure	2.29	1	5
buyerpressuree	3.96	1	5
ownerpressuree	3.76	1	5
av_pressure	3.13	1	5

Descriptive statistics shown in Table 2 indicate that around 60% of the surveyed firms are located within an EPZ and 91% are export-oriented (i.e., more than 90% of their sales are made outside the domestic market). The average factory in our dataset was 17 years old and had 843 employees (ranging from 35 to 3,800). Per Sri Lanka's industry laws, a factory is considered large scale if it has at least 25 employees. Thus, 100% of the firms surveyed are large firms per their number of employees. Furthermore, 90% of factories are classified either as A or B categories as there are more than 200 employees per shift.

In order to quantify the impact of various factors on the prevalence of EMPs, we define the variable EMP as the number of practices undertaken at the factory level (Uditha 2010). We consider four practices: 1) ISO 14001-certification[4], 2) water recycling[5], 3) material re-

[4]ISO 14001 certification represents a voluntary action of taken by factories. This certificate ensure the factories have taken voluntary actions to set targets, implement strategies, evaluations and compare with targets and make necessary adjustments to minimize the environmental impacts due to their production process.. There are certification bodies with international accreditation to issue ISO 14001 and 9001 standards in Sri Lanka.

[5] In the paper, water recycling means that factories have taken necessary steps to recycle the used water/ waste water before discharging it to the municipal waste or before using for some other purposes such as toilet flushing or gardening. Some factories have established their own waste water treatment plants where as others have given this as a contract to a third party.

use[6], and 4) environmental audits[7]. Hence the variable EMP can take five possible values: 0, 1, 2, 3 and 4, where 0 refers to no EMP, 1 indicates that only one of these four EMPs is undertaken, etc.

The reason for taking four factors to measure the level of EMPs is that there are only 23 factories having ISO 14001certified and 18 factories belongs to one large scale local firm. In order to avoid the biasness in sample selection, we use more variables to measure the adoption of EMPs.Most of survey studies on voluntary environmental management practices and their adoption reported the problem of self selection bias. Many of the empirical studies tried to address this issue by introducing an instrumental variable. (Blackman, 2007; Blackman 2009) In this study also 65 factories were selected and only 55 questionnaires were completed.

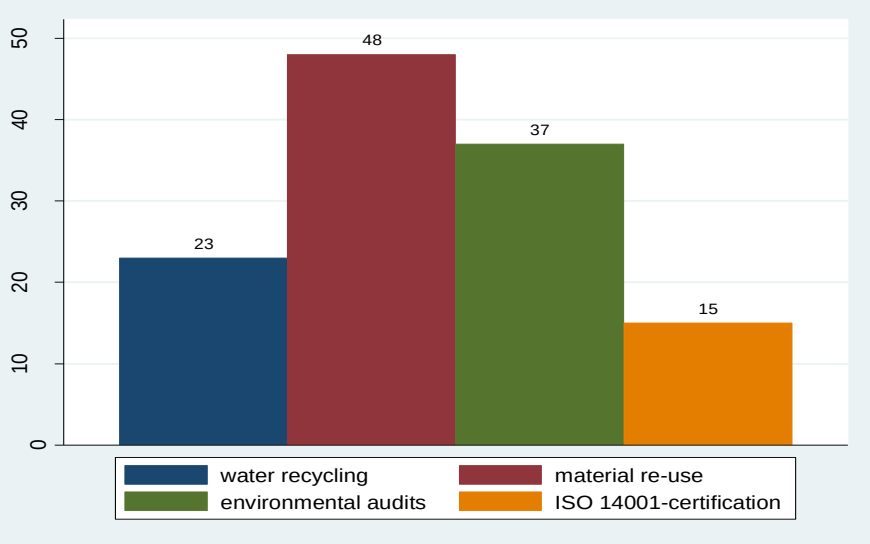

Figure 2 Number of factories adopting each of the four EMPs

Figure 2 depicts environmental management practices among the surveyed firms: 27% (15 factories) are ISO 14001-certified, 42% do water re-cycling, almost all (87%) re-use material (e.g. paper and fabric), and 37% have had environmental audits. Only two factories do not undertake any EMP, while 10 out of the 55 are ISO 14001-certified, recycle water, reuse material, and have been audited on their environmental practices (Table 5). Of those factories undertaking only one EMP, the most common practice is material reuse (11 out of 15 factories), as shown in Table 3 and Table 4.

[6] Different types of waste materials are generated such as fabric waste , cones, bulbs, water, dye, paper, cardboard, tires, food, etc. Some of these waste materials are used for the second time by factories. For example; fabric wastes are used at the canteen, factory floor, for boilers etc. Used cones are reused for the same purposes. Paper waste is used for making bags, and canteen as welfare services. Tires and plastic cans are used for gardening purposes.

[7] Environmental audits are conducted by two parties. Internal audits are carried out by compliance department, maintenance department or engineering department. They compare the energy targets, and environmental related targets with the actuals. The external audits are conducted by either certification bodies or buyers, or agents from buying office.

Table 3 Number of EMPs undertaken by factories

No of EMPs	Freq.	Cumulative Freq.	Percent	Cumulative Percent
0	2	2	4	4
1	15	17	27	31
2	16	33	29	60
3	12	45	22	82
4	10	55	18	100

Source: Based on survey

Table 4-Type and number of EMPs undertaken by the factories (55 observations)

Type of EMPs	Number of factories
single EMP	
Water recycling only	0
Material reuse only	11
Environmental audit only	4
ISO 14001 only	0
two EMPSs	
Water recycling & material reuse	4
Water recycling & environmental audit	0
Water recycling & ISO 14001	0
Material reuse & environmental audit	12
Material reuse & ISO 14001	0
Environmental audit & ISO 14001	0
three EMPs	
Water recycling & material reuse & environmental audit	7
Water recycling & material reuse & ISO 14001	1
Water recycling & environmental audit & ISO 14001	1
Material reuse & environmental audit & ISO 14001	3

Source: Based on survey

In Figure 3, we report the proportion of factories undertaking each of the four EMPs for factories outside an EPZ (22 observations) and factories located within an EPZ (33 observations). This graph shows that, on average, the factories that are located within an EPZ engage voluntarily more often in water recycling, are more often audited, and are more likely to have an ISO 14001 certification. Simple statistics show that factories located within an EPZ have more employees on average than factories located outside an EPZ but the difference is not statistically significant.

In Figure 4, we compare factories with washing and dyeing operations (10 observations) with the group of factories not doing any washing and dyeing (45 observations). Dyeing and washing are activities that require large quantities of water and contribute the most to water pollution in the textile and garment sector. The graph suggests that the ten factories which do washing and dyeing operations are more likely to adopt voluntarily the four EMPs.

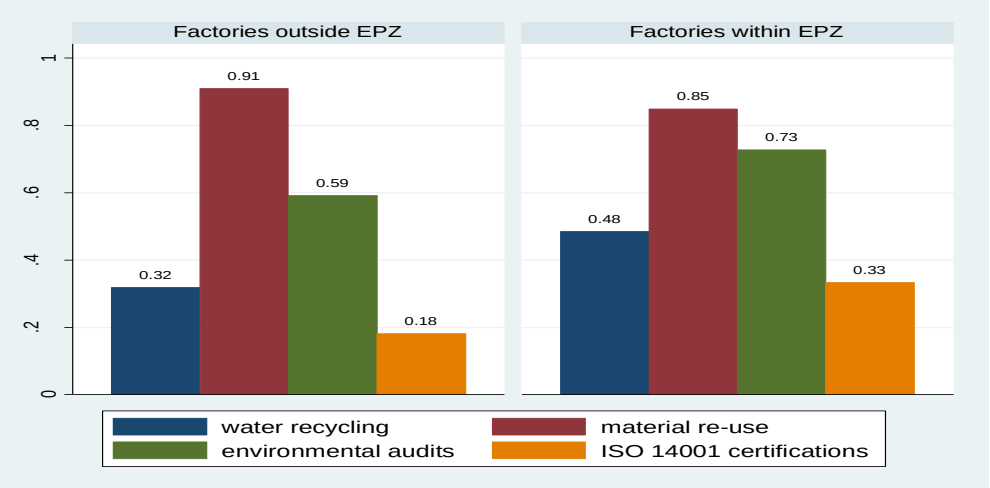

Figure 3 Comparison of EMPs adopted by factories within and outside EPZ

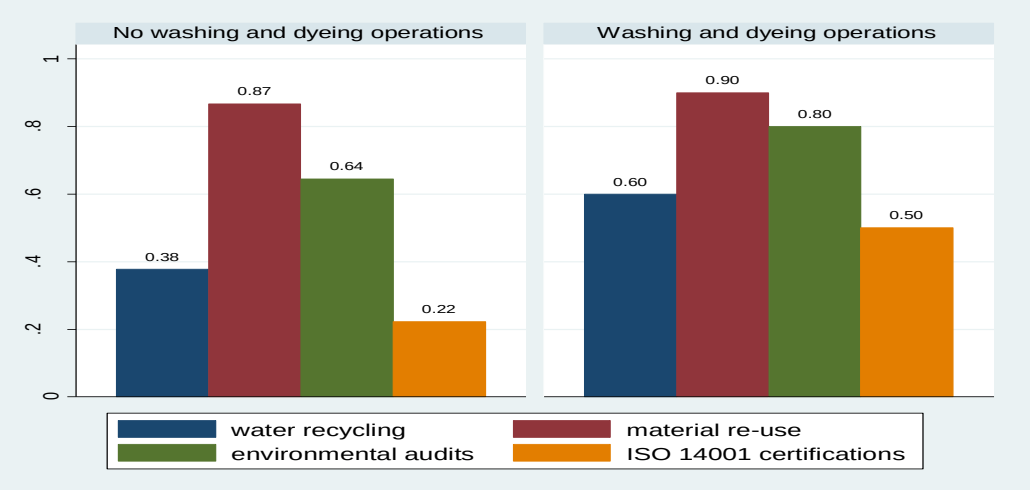

Figure 4 Proportion of factories adopting each of the four EMPs, for factories with and without washing and dyeing operation

Managers believe that they are under a moderate pressure to comply with environmental regulation: pressure is around 3 on average, on a scale from 1 to 5. The strongest pressure comes from the buyers (3.96 on average) followed by the owners (3.76), while AEA and the community exert the least influence on factory managers' compliance decisions. Our hypothesis is that factors such as firm size, location, type of ownership, market-orientation, type of activities undertaken, and pressures from different parties affect firm behaviour. Unfortunately we will not be able to measure the role of monitoring and enforcement since none of the 55 factories has been fined even though 54 out of 55 have been inspected.

In order to assess the influence of different factors on adoption of EMPs, we regress the EMP variable on the factors hypothesized to influence it. As the dependent variable is a count variable, we estimate a Poisson model:

$$\Pr(EMP = y) = \frac{e^{-\mu}\mu^{y}}{y!}, \qquad y=0, 1, 2, 3 \text{ or } 4,$$

where μ is called the intensity or rate parameter. The Poisson model is estimated by Maximum Likelihood. Estimation results (including robust standard errors) are shown in

Table 6. The Wald test indicates overall significance of the model even if the Pseudo-R^2 is only 0.09. The average marginal effects indicate the expected change in the number of EMPs following a one-unit change in the corresponding explanatory variables. A number of models have been estimated and we present here the results of the most satisfactory model in terms of overall significance and significance of the individual coefficients. A number of variables had to be excluded because of multicolinearity problems.

Table 5 Poisson model, Maximum Likelihood estimation results (55 observations)

	Coef.	Robust Std. Err.	P>z		Average marginal effect	P>z
nofactories	0.011***	0.004	0.007		0.024***	0.008
i_foreignexp	0.693***	0.169	0.000		1.200***	0.003
i_dye	0.853***	0.167	0.000		2.437***	0.000
i_wash	-0.450***	0.152	0.003		-0.945***	0.000
i_weaving	0.257	0.194	0.184		0.640	0.236
i_apparel	0.334**	0.147	0.023		0.717*	0.051
i_embroid	-0.159	0.139	0.252		-0.337	0.218
i_iso9001	0.287***	0.107	0.007		0.655**	0.014
av_pressure	0.021	0.071	0.762		0.048	0.761
i_boiepz	0.207*	0.108	0.055		0.453*	0.088
Constant	-0.610*	0.357	0.088			
Wald chi2(10)	74.73					
Prob>chi2	0.0000					
Pseudo R2	0.0851					

, **, * indicate significance at the 10, 5, and 1 percent level, respectively*.

Table 5 shows that factories belonging to larger groups (as measured by the number of factories belonging to the group) are more likely to undertake more EMPs. The type of activities undertaken by the factories also has a significant impact on the number of EMPs: factories that run dyeing operations, the most polluting activity, adopt 2.4 additional EMPs on average, while washing is associated with a reduction in the number of EMPs (-0.9 on average). Factories that produce apparel are also more likely to engage voluntarily in EMPs (the marginal effect in terms of EMPs is estimated at 0.7). As expected, a higher proportion of sales directed towards the foreign markets is associated with an increase in EMPs (the marginal effect is estimated at 1.2), which may reflect pressure from foreign customers to adopt environment-friendly production processes. ISO 9001-certification is associated with 0.7 additional EMPs, which is likely to reflect the fact that factories which are used to get certifications from external bodies also adopt a higher number of EMPs. Finally being located in an EPZ increases the number of EMPs voluntarily adopted by 0.5 on average.

DISCUSSIONS AND CONCLUSIONS

The textile and apparel industry in Sri Lanka is dominated by apparel manufacturing which involves activities that are, in general, less damaging for the environment than activities of the textile industry (such as dyeing). This is probably one reason why the level of compliance to environmental regulations in the textile and apparel sector in Sri Lanka seems

to be quite high. In a survey of 55 firms, we found that 96% had implemented at least one environmental management practice and that almost all had been inspected but never fined. Further, discussions with officials from the Central Environmental Authority and BOI also suggest that compliance is moderately good.

One of the main reasons for Sri Lankan textile and apparel sector to operate with high environmental standards is because of international buyers (specially from Europe and the USA) as they put pressure on Sri Lankan manufacturers to comply with environmental regulations. (Kanitta et al., 2006) Almost all the firms surveyed had gone through environmental audits conducted by representatives of the major brands.

A factory that belongs to a group of firm adopt more EMPs relative to single factory. (Jayasinghe & Udugama, 2011; Delmas & Toffel, 2003; Blackman, 2009) Furthermore, factories that engage in more polluting activities (such as dyeing and washing) also adopt more EMPs. (Arora & Cason, 1995) This may reflect the fact that they are usually under greater pressure from their international consumers and possibly under greater monitoring from Sri Lankan environmental officers as well. The product type is also an important factor for the adoption decision. Since apparel is a dry production process, most of the apparel producers voluntarily adopt EMPs. Factories are more volunteered to adopt EMPs based on their previous product certification. It is also interesting to note that factories within export processing zones are far better than those outside these in terms of their environmental performance.The public policy literature has little evidence on the reasons for adoption of voluntary environmental mechanisms. (Jayasinghe and Udugama, 2011)

The message for the policy maker is that that the buyers pressure is important for such voluntary practices. Therefore, it is a requirement of the policy formulating and monitoring bodies to make awareness program for the customers. The study also highlights that some of the most common EMPs can be practiced by other local textile and apparel manufacturers. And also this study highlights the benefits of practicing such EMPs to factories such as savings from water recycling, energy use monitoring and energy efficiency mechanisms. In addition, the study concludes the strategies to attract customers and strategies to capture a niche market for rest of the textile and apparel manufactures in the country. When factories adopt such voluntary mechanisms they automatically adhere to the present legal requirements set by the Act. The study found that adoption of voluntary mechanisms increase the competitiveness of the products in the export market. This is an interesting point to be highlighted to the industries with export market orientation. This will promote the producers to adopt more voluntary mechanisms which could attract more foreign customers.

REFERENCES

Anton, W. R., Deltas, G., & Khanna, M. (2002). *Incentives For Environmental Self-Regulation And Implications.* National Center for Environmental Research and Quality Assurance.

Anton, W. R. (2005). The Choice of Management Practices: What Determines the Design of an Environmental Management System? *American Agricultural Economics Association Annual Meeting.* Providence, Rhode Island,.

Arora, S., & Cason, T. N. (1995). An Experiment in Voluantry Environmental Regulation: Participation in EPA's 33/50 Program. *Journal of Environmental Economics and Management*, 28(3): 271-286.

Blackman, A. (2009, June). Alternative Pollution Control Policies in Developing Countries: Informal, Informational and Voluntary. Resource for the Future pp. 9-14.

Blackman, A. (2007). Can voluntary environmental regulation work in developing countries. Washing DC: Resource for the Future.

Blackman, A., & Sisto, N. (2005). *Muddling Through while Environmental Regulatory Capacity Evolves: What Role for Voluntary Agreements?* Resources for the future.

Central Bank of Sri Lanka. (2013). Annual Report. Colombo.

Dasgupta, S., Hettige, H., & Wheeler, D. (2000). What improves environmental compliance? Evidence from Mexican Industry. *Journal of Envrionmental Economics and Management* , 39: 39-66.

Department of Census and Statistics . (2012). Retrieved July 2013, from Census and Statistics LK: http://www.statistics.gov.lk/industry/ASI%202012%20report.pdf

Delmas, M. A., & Toffel, M. W. (2003). Institutional Pressure and Environmnetal Management Practices. *11th International Conference of the Greening of Industry Network* . San Francisco .

Ervin, David. What Motivates Business Environmental Management: Sticks, Carrots or Both? November 15, 2006.

Florida, R., & Davison, D. (2001). Why do firms adopt advanced Environmnetal Practices (And do they make a differnce). Environmental Management Systems and the New Policy Agenda . Coglianese C, Nash J, editors, Washington, DC: Resource for the future: 2001

Foulona, J., Lanoie, P., and Laplante, B. (2002). Incentives for pollution control: Regulation or Information? Journal of Environmental Economics and Management. 44 (1): 169- 187

Hart, S. L. (1995). A Natural Resource based View of the Firm. *Acadamy of Management Review* , 986-1014.

Jayasinghe, U., & Udugama, M. (2011). Motives for firms to adopt solid waste management controls: The case of food processing sector in Sri Lanka. Kathmandu: SANDEE.

Jayasinghe, Udith K M, and Weersink, A. (2004). Factors Affecting the Adoption of Environmental Management Systems by Crop and Livestock Farms in Canada. *Sri Lankan Journal of Agricultural Economics*, 6 (1): 25-37.

Maxwell, J. W., and Lyon, T. P. (2000). Self Regulation and Social Welfare: The Political Economy of Corporate Environmentalism. *Journal of Law & Economics, 43*: 583 - 619.

Ministry of Environment and Renewable Energy. (1980). *National Environment Act* . Colombo: Government press.

Ministry of Environment and Renewable Energy. (1988). *National Environmental (Amendment) Act, No. 56 of 1988.* Colombo: Government Press.

Ministry of Environmnet and Renewable Energy. (2000). *National Environmental (Amendment) Act, No. 53 of 2000.* Colombo: Government Press .

Nakamura, M., T. Takahashi and I. Vertinsky. (2001). Why Japanese firms choose to certify: a

study of managerial responses to environmental issues? *Journal of Environmental Economics and Management.* 42: 23-52.

Priyadarshini, K., & Gupta, O. K. (2003). Compliance to Environmental Regulations: The Indian Context. *International Journal of Business and Economics* , 2(1): 9-26.

Pulvor, S. (2002). Green Expectations: The Intended and Unintended Consequences of Implementing A Voluntary Environmental Management Code. *American Sociological Association.* Environmental Sociology. Chicago

Uchida, Toshihiro, and Paul J Ferraro.(2007) Voluntary development of environmental management systems: motivations and regulatory implications*Journal of Regul Econ* DOI 10/ 1007