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Environmental Regulations and Compliance in the Textile Processing Sector in Pakistan: Empirical Evidence

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Abstract

The textile industry is the largest manufacturing industry and the second largest employment generating sector in Pakistan. In this paper, we seek to understand why firms in the garment and textile sector choose to comply with or ignore Pakistan's environmental regulations and effluent standards. Based on survey of 60 firms, we find that there are nine different environmental management practices adopted in the textile sector. While only 12% of our sample adopted all nine practices, 50% embraced more than five practices and some 87% of firms adopted at least two environmental management practices. The most common environmental practice adopted is evaluation of any chemical hazards. We find that institutional deficiencies in implementation such as inadequate monitoring and fines hinder enforcement and compliance. However, non-regulatory pressures from international customers and competitors act as a major un-official source of influence. Local factors such as community and local media stressors seem to have limited impacts. As expected, larger firms are more likely to adopt environmental management practices relative to medium sized firms. We propose three strategies to improve environmental compliance – installation of effluent treatment technology matched with improved monitoring, creating a rating system to trigger competition among firms and offering firms training and information services at the district-level.

Key words

Pakistan, textile production, environmental regulations, compliance, pollution, firm survey

Environmental Regulations and Compliance in the Textile Processing Sector in Pakistan: Empirical Evidence

1. Introduction

Pakistan has a dynamic, vigorous and export oriented textile industry with a large economic footprint. The textile industry is the largest manufacturing industry and the second largest employment generating sector in Pakistan. Notably, Pakistan is the 8th largest exporter of textile products in Asia, the 4th largest producer of cotton with the third largest spinning capacity in Asia and contributes 5% to the global spinning capacity (APTPMA, 2012). While the textile sector in Pakistan is large, in this paper, our focus is on understanding environmental compliance in the textile wet processing sector. There are 600-800 textile wet processing units in the country, which turn grey fabric into finished fabric. These are major industries, which contribute to almost 50% of total exports, 38% of the manufacturing labor force about 9.5% of GDP (FCCI, 2012a, 2012b). While engines of economic activity, wet processing units, are also highly polluting factories. This is because their dyeing, printing and finishing activities result in large discharges of waste water, often without clean-up, into drains and rivers.

In response to growing pollution, most developed countries have been somewhat successful in enacting environmental laws. However, developing countries face significant challenges in implementing regulations. There is certainly overwhelming evidence that inadequate environmental compliance is leading to increasing urban and rural pollution (Dasgupta, 1997; Pargal, 1997; Dasgupta, Hettige and Wheeler, 2000; Khanna and Anton, 2002). Pakistan is no exception to the prevailing trend of increasing regulations and increasing pollution. While it has a strong set of national environmental quality standards (NEQS), air and water pollution are major problems, particularly in urban industrial areas (MoIP-Pakistan, 2010).

There are many reasons for poor environmental compliance in the developing world. When firms do comply, it is because of a variety of pressures pushing them to improve their environmental performance. Regulatory, stakeholder and market pressure all play a role (Blackman, 2010; Dasgupta et al., 2010; Greenstone, List and Syverson, 2012). National regulations related to emission and equipment standards, price and entry controls and inspections and penalties are important for environmental compliance (Cohen, 1999; Blackman, 2007). More recently policy makers have also been turning to voluntary agreements because of their potential to save on compliance, administrative, and other transaction costs (Segerson and Miceli, 1998; Wu and Babcock, 1999; Blackman and Sisto, 2005). However, voluntary pollution control agreements can both motivate and be undermined by the gaps in the legal and institutional infrastructure needed to make formal regulation effective (Blackman, 2007).

Often, firms become environmentally compliant when they face informal regulations or community pressure (Dasgupta et al., 1999; Pargal et al., 1997). For example, Pargal et al. (1997) assesses that when formal regulations of pollution are not adequate, affected communities are able to negotiate abatement from plants in their locality through informal regulations. Studies show that factors that induce firms to comply are correlated with community income, education, the size of the exposed population, the local economic importance of the plant, and its visibility as polluters (Julie et al., 2003; Garcia et al., 2008).

Increasingly, it is also clear that markets and the structure of the industry have an impact on firm-level compliance. Firms change their behavior based on internal (management, employees) and external (consumers, competition) pressures (Julie et al., 2003; Garcia et al., 2008). There are many examples of firms voluntarily undertaking environmental management practices because of investor and consumer preferences (Khanna and Anton, 2002; Blackman, 2010).

Understanding the effectiveness of environmental regulations in developing economies is a challenge because of the complex array for factors that affect compliance and the limited data available to tease these factors apart. The main purpose of our study is to examine the reasons underlying environmental compliance in the textile sector in Pakistan. Thus, we seek to first understand whether and how well existing environmental rules and regulations apply to the textile sector. We assess the challenges faced by the government in implementing existing laws and the textile sector in fully complying with these laws. The study also examines the role of voluntary and non-regulatory pressures that lead firms to comply. Our analyses is based on a review of the laws, interviews with industry and government officials, case studies of 10 textile processing units and a survey of 60 large and medium textile processing firms.

2. The Textile Sector in Pakistan

The textile sector in Pakistan can be divided into eight types of units. These include spinning, composite, independent weaving, finishing, garment, terry towels and knitwear units (see Table 1). While many of these activities are undertaken separately, some composite factories combine these different tasks.[1] The most water pollution appears to be generated from wet processing within composite firms.[2] Though it is difficult to assess exact the level of effluents in different sub-processes, "bleaching and dyeing" are known to contribute significantly to waste water pollution. Thus, our research focuses on composite firms with wet processing activities (bleaching, dyeing, printing and washing).

The Ministry of Industries and Production estimates a total industrial discharge of waste water of 7,590 million cubic meters (m^3) per annum or 21 million m^3 per day, of which 30 percent originates from the textile industry (MoIP-Pakistan, 2010). Table 2 shows that the wastewater concentrations for the textile-processing sector are higher than national standards. Indicators of water pollution such as the annual average values of Biological oxygen demand (BOD) and Chemical oxygen demand (COD) exceed NEQS (National Effluent Quality Standards) by 76 and 84 percent (see Table 2).

Textile-processing units are mainly located in and around the major cities of Karachi (350), Lahore (200), and Faisalabad (250). Our study focuses on the industrial estates of Faisalabad and its suburban area of Khurrianwala in Punjab province. Of the 475 registered members of the Pakistan Textile Processing Mills Association (APTMA),[3] 135 members are in Faisalabad. In fact, production from Faisalabad constitutes more that 65% of overall value of textiles exported from Pakistan (APTPMA, 2012; FCCI, 2012a, 2012b). Faisalabad is a hub for all types of textile production. But, factories associated with ginning, spinning and weaving are found in large numbers because of easy access to raw cotton. Faisalabad's contribution to pollution through wastewater discharge is also rising (MoIP-Pakistan, 2010).

3. Study Design

In order to understand environmental compliance in the textile industry in Pakistan we first undertook a review of environmental regulations, followed by expert interviews. We also undertook a survey of sixty firms to obtain quantitative data on compliance and reasons for non-compliance and ten detailed case studies.

3.1 Review of Environmental Regulations

The Government of Pakistan has six major environmental legislations (see Appendix-1) and detailed National Environmental Quality Standards (see Appendix-2) that apply to textile industries. The federal environmental protection agency (EPA) classifies industries into three categories A, B and C on the basis of the level of pollution released. The textile processing sector lies in category A for liquid effluents.

NEQS (2001) establish standards for liquid effluents, gaseous emissions and ambient air quality and the legislations

[1] The industry's production capacity is 670 million units of garments, 400 million units of knitwear, and 53 million kg of towels (Pitigala et al., 2010).
[2] Industry experts views, and http://textilelearner.blogspot.com/2012/02/what-is-textile-basic-textiles-uses-of.html
[3] http://www.aptpma.com/

lay out the regulations for monitoring and compliance. Table 2 identifies the main NEQS pertaining to liquid effluents released by the textile processing sector. The pollution parameters that are a priority include effluent flow, temperature, pH, COD, Total suspended solids (TSS), Total dissolved solids (TDS), BODS, Copper, Chromium, Chlorides, traces of Arsenic, Cadmium, and Nickel. We reviewed most of the regulatory documents relevant to the textile sector's environmental compliance.

3.2 Key Informant Interviews

We undertook key informant interviews with the Chairman, Faisalabad Region, APTPMA, Secretary General and Director R&D-Faisalabad Chamber of Commerce and Industry (FCCI), District Environment Officer (DEO)-Environment Protection Agency (EPA) in Faisalabad (district office). This information is organized in the form of 10 Key Informant Interviews (Table 3).

We also obtained secondary information from Annual Reports, Quarterly/Monthly Bulletins and/or Research Reports, documents on textile policy etc. from some of the firms and concerned departments of Ministry of Textile, EPA, FCCI and APTPMA. We also collected inspection and monitoring reports from the EPA in Faisalabad. Besides, interview sessions done with district environment officers and environmental inspectors provided information on compliance and regulatory processes.

3.3 Survey of Firms

We surveyed 60 large and medium textile-processing firms from a list provided by Faisalabad Chamber of Commerce and Industry (FCCI). We selected these firms using stratified random sampling to ensure that firms were evenly distributed in each size class. We identified large and medium firms with the help of FCCI and APTPMA, based the number of employees working in the firm/factory as well as the number of processing production units.[4] We excluded small firms as few adopted any EMP(s). We selected medium and large wet processing firms, which undertake bleaching, dyeing, printing and finishing as sub-processes.

We contacted firms with the help of FCCI and APTPMA. A detailed survey questionnaire (Appendix 4) comprising of qualitative and quantitative questions was used to collect primary data. Apart from the basic information- such as number of employees, amount, type and value of product generated, different types of textile sub-processes undertaken by the firm and presence of environmental officers, information on inputs, i.e., technology, water, materials etc. were incorporated. We also asked indirect questions relevant to environmental management.

3.4 Case Studies

We obtained information from 10 textile firms, which were randomly selected from a list provided by Faisalabad Chamber of Commerce (FCCI). These firms are members of FCCI and registered with Security and Exchange Commission of Pakistan (SECP), which is the premiere government body for registering and regulating the corporates, private companies and firms.

In our ten case studies, six are large firms, three medium and one small. We distinguished between large, medium and small firms/factories on the basis of the number of employees working in the firm/factory as well as the number of processing production units.[5] These firms produce outputs such as home garments, bed sheets, terry towels and processed fabric. To identify cases, we contacted Chief Executive Officers (CEOs), Technical Directors and General Mangers (GMs) - Processing formally by telephone and then emailed our research concept note and some details on Sustainable Development Policy Institute (SDPI's) Research Ethics. Personnel were contacted again and formally asked for the appointments for interviews. The check list designed for the case study firms is presented in Appendix 4.

[4] This criterion is developed by FCCI and APTPMA. A large firm (LF) has 3,000 to 5,000 workers, usually 3 to 4 processing units and export base with larger production and market size. A medium firm (MF) has 1,000-3,000 workers and 2-3 processing units selling to domestic and foreign markets. A small firm (SF) has 100-1,000 employees and usually a single processing unit manufacturing for local/domestic market, has small production and market size.

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4. Environmental Regulatory Framework

The Pakistan Environmental Protection Act (PEPA) (1997) establishes a comprehensive regulatory framework for the protection, conservation, rehabilitation and improvement of the environment, prevention and control of pollution, and promotion of sustainable development.

Industrial environmental activities are regulated in multiple ways. First, PEPA's (2000) environmental examination (IEE) and environmental impact assessment (EIA) regulations specify the requirements for a plant-level preliminary environmental review of impacts. The EIA, undertaken by a firm, is expected to be given to the EPA, relevant industry associations, local chambers and the library. The EIA report includes aspects such as prediction of impacts, alternatives, evaluation and monitoring arrangements.

Firms are expected to follow NEQS, self-monitor and report measurement of effluents voluntarily to the EPA on a monthly basis (Appendix 3, NEQS, 2001). Effluent samples have to be examined and verified by an EPA certified laboratory. The federal EPA is also authorized to establish laboratories to conduct research, measure effluents and report pollutants to the EPA/environmental tribunal

In order to ensure compliance, PEPA (2001) allows federal authorities to levy a pollution charge on non-compliant firms and calculate charges by dividing the established discharge rate by the units of production (see Appendix 3). The Environmental Tribunal Rules (1999), further, give the federal government the mandate to establish environmental tribunals.

4.1 Monitoring and Enforcement Challenges

The Environmental Protection Agency (EPA) is the 'Regulator' assigned with the task of monitoring and implementing environmental laws. The EPA performs two independent roles: field monitoring (through district offices) and regular monitoring (through laboratories).[6]

Monitoring is done through different processes. First, before firms are established, the EPA issues a notice in local newspapers to assess if the public has reservations against construction of plants. Next a public hearing is held to explain the purpose of the firm and usefulness of treatment plants, if are effluents being released. All wet-processing textile firms need to obtain an environmental license when they start up. A No Objection Certificate (NOC) is issued to firms after EIA completion. Effluent treatment plants (ETPs) are expected to be setup within four months of establishing wet processing units.

Once firms are functional, they have to mandatorily send the EPA a monthly report on effluent treatment. Generally, an EPA inspector also samples waste water by visiting firms before and after installation of ETPs; but there is no provision on the "number of inspections". Waste water samples are collected and sent to an EPA certified laboratory. If the values of pollution indicators exceed the NEQS limits, legal proceedings are initiated. In case of failing to fulfill compliance requirements, industries in Faisalabad are fined 50,000 PKR to 0.5 million PKR, depending on the size of the firm.

In reality, the system of monitoring does not work very well. The EPA is deficient in funds, vehicles and most importantly in manpower, mostly hiring on an ad-hoc basis and contractual basis. The Faisalabad EPA, for instance has a staff of 23 to inspect a total of 250,000 firms in a year. The District Environment Officer (DEO) explained that inspection goes on for a year at the installation stage (instead of four months), but this is often inadequate.

In 2010, the 18th Amendment of Pakistan's constitution resulted in devolving authority over environmental issues to the state or province level. However, thus far there is no change in budgets and the distribution of resources. At this point, while much of the responsibility for environmental management is at the state level, a major part of budget still goes to the federal Ministry. This has further constrained the ability of regulators to examine compliance.

[6] For example, the EPA-Faisalabad has one district environment officer (DEO), two deputy district officers, ten inspectors and ten field assistants, who are responsible for all inspections.

5. Firm-level Evidence on Environmental Management Practices

In this section, we first examine firm level data environmental practices to understand what environmental management practices are adopted and whether there are differences between large and medium firms. We then discuss a conceptual model that allows us to explain why firms may adopt certain environmental management practices (EMPs). We follow this with an empirical estimation of a statistical model to understand what factors may be more or less important in influencing firm-level adoption of environment practices.

5.1 Environmental Management Practices among Large and Medium Firms

Table 4 presents shows that the average firm in our sample is nearly 20 years old, has 2393 employees, produces 27 mm meters of fabric and generates 14,244 cubic meter amount of waste water per day. Large firms are older with an average age of operation at around 24 year, while medium firms are around 10 years old. Large firms provide greater employment by undertaking all sub processes – they have, on average, 4 production units. Medium firms undertake 62% of all the processes.

Our data includes information on nine Environmental Management Practices (EMPs) adopted by firms. Table 5 shows the frequency of adoption of different practices. Thirty two percent of firms have an environmental policy in place, 72% adopt Total Quality Control (TQC) and Total Quality Management (TQM) in production and 62% of the firms consider environment as subject of TQM Principles. Some 55% of the firms do environmental risk evaluation of suppliers and 92% of the firms evaluate chemical hazards. Further, some 70% of the firms provide environmental training to their employees in some form and 85% undertake environmental audits. Some 20% of the firms had Effluent Treatment Plant, while only in 15% of the firms is the ETP operational. Figure 1 shows that 87% of firms adopt up to 2 of the 9 environmental practices identified, 50% adopt 3 to6 practices, and 12% adopt more than 6 EMPS.

Figure 2 shows that more large firms adopt EMPs relative to medium firms. The one EMP that both large and medium firms consistently adopt is evaluation of chemical hazards. Most firms (92%) are careful about this. The adoption gap is largest between large and medium firms when we consider adoption of environmental policies. 72% of large firms have an environmental policy but only 14% of medium firms have one.

Interestingly, some 83% of large firms include environmental issues as subject of total quality management, while only 52% of medium firms that undertake TQM have environment as a subject. Another significant difference between large and medium firms is in their evaluation of suppliers' environmental risks. Apparently, nearly 90% of large firms examine supply chain environmental risks, relative to only 40% of medium. The one area where medium firms do better than larger firms is with undertaking environmental audits. 90% of medium firms versus 78% of larger firms have undertaken environmental audits. This is because EPA enforces more regular monitoring of medium and small firms as compared to large firms.

Figure 3 focuses on firm compliance to regulatory measures. It suggests that large firms comply more with mandatory measures. Nearly 90% of large firms received some environmental impact assessment prior to starting operations, while far fewer medium firms obtained one. Almost all large firms received a 'No objection certificate' or environmental clearance, while half the medium firms had one. A large percentage of large firms had an environmental audit and were also subject to some form of penalty, relative to medium firms. In general, over 90% of large firms agreed that they felt some form of regulatory pressure, while only half of the medium firms seemed to feel the burden of regulatory pressure. As expected, large firms find it less costly to comply. For example, many of them are able to obtain their environmental clearances fairly quickly, while this process seems to take longer for medium firms.

Figure 4 identifies voluntary actions related to the environment. A good number of large firms published their audit reports, while this is not the case for medium firms. Over 50% of all firms produce weekly waste related reports but hardly any medium firms report back on environmental or waste issues. Some 22% of the large firms state that they provide pollution information on a voluntary basis regularly to the EPA. A majority of large firms (72%) have an official environmental policy and display environmental material (89%) on their premises. Interestingly, nearly 50% of medium firms also display some form of environmental material but very few have an official environmental policy.

Environmental training appears to be an essential part of large firms' environmental policy, which is not the case in medium firms.

Figure 5 shows that large firms perceive more pressure from international buyers relative to medium firms. This result is similar to findings from other countries (Christmann and Taylor, 2006). This pressure is mostly in 3rd party audits some 89% of the larger firms are subject to international third party audits, relative to 38% of medium firms. Interestingly, in nearly a third of the large firms surveyed, EMPs were subsidized by their international customers.

Figure 6 suggests, medium firms are subject to more community pressure relative to large firms. Nearly half the firms say that they are subject to community complaints about pollution while only about one fifth of the large firms make this same claim. Further, large firms seem to feel no media pressure. This, despite the fact that nearly all of firms dispose their waste into common drainage systems. It is of course, possible that the waste disposed by large firms is cleaner than that disposed by medium firms. Finally, Figure 7 displays that the biggest challenge firms facing to environmental compliance is limited financial resources.

5.2 Analyzing Adoption of Environmental Management

In this section, we discuss a simple conceptual model that allows us to empirically examine the factors that influence firm adoption of different environmental management practices. We assume that firms are profit maximizers and that they adopt environmental practices only if their expected long-term profits with adoption (Π^A) is higher than their expected profit without adoption of environmental practices (Π^{NA}). Expected long-term profits are called *latent* variables since they are not observed by the econometrician. We assume that they depend linearly on a number of observable firms' characteristics (X):

$$\Pi^A = X'\beta^A + \varepsilon^A \text{ and } \Pi^{NA} = X'\beta^{NA} + \varepsilon^{NA},$$

with β^A and β^{NA} the corresponding unknown parameters, and ε^A and ε^{NA} two randomly-distributed error terms.

We only observe the decision of the firm to adopt environmental practices or not and we assume that adoption occurs under the following condition:

$\Pi^A > \Pi^{NA}$ which can be equivalently written as $X'\beta + \varepsilon > 0$ where $\beta \equiv \beta^A - \beta^{NA}$ and $\varepsilon \equiv \varepsilon^A - \varepsilon^{NA}$. Incorporating probabilities, we have:

$$\text{Prob(adoption)} = \text{Prob}\,(\Pi^A > \Pi^{NA}) = \text{Prob}\,(X'\beta + \varepsilon > 0) = \text{Prob}\,(\varepsilon > -X'\beta) \text{ and, similarly,}$$

$$\text{Prob(non-adoption)} = \text{Prob}\,(\Pi^A > \Pi^{NA}) = \text{Prob}\,(X'\beta + \varepsilon > 0) = \text{Prob}\,(\varepsilon > -X'\beta).$$

In order to estimate the above probability model, we assume that the error term ε is normally distributed of mean 0 and variance σ^2. We have:

$$\text{Prob(adoption)} = \text{Prob}\,(\varepsilon > -X'\beta) = \Phi\,(X'\beta)$$

where $\Phi\,(.)$ is the standard normal probability distribution and σ has been normalized to 1. We empirically estimate three separate *Probit* models to obtain Maximum Likelihood estimations of the probability that factories adopt three main environmental practices: Total Quality Environmental Management (TQEM) and Environmental Risk Evaluations of Chemical Suppliers (SRISK) and Environmental Training (ETRAINING).

We also undertake an additional exercise that includes all nine environmental management practices. To examine what factors influence the number of EMPs undertaken by a firm, one possible approach is to count the number practices in each firm and use this count as the dependent variable (Anton et al., 2005). Another approach is give scores to the firms on the basis of their environmental management (Dasgupta et al. 2000). In this approach we need to build 4 or 5 groups of firms depending on the level of adoption, which is not really feasible with such a small sample of 60 firms. Therefore, we use the count data approach to investigate the factors that influence the likelihood of increases in number of EMPs adopted by a firm. The dependent variable is the number of practices undertaken by the firm, which would vary from 0 to 9. We can use two empirical models (Poisson or Negative binomial) to estimate the influence of different factors on the dependent variable.

In the empirical analyses, the dependent and explanatory variables are the following (see also Table 6):

Total *Quality Environmental Management (TQEM), Environmental Risk Evaluations of Chemical Suppliers (SRISK) and Environmental Training (ETRAINING)*: TQEM refers to whether firms consider environment as a subject in Total Quality Management principles followed at the firm. SRISK is defined as whether firm does environmental risk evaluation of suppliers. ETRAINING identifies whether all or some employees in the firm received formal/informal environmental training. Each dependent variable is a 1/0 variable and equals 1 if a firm undertakes the EMP.

Count of EMPs adopted: The dependent variable is number (from 0 to 9) of EMPs the firms adopts from 9 EMPs.

Number of Employees: The number of employees is an indicator of the scale of operations of the firm. The larger the firm, the more likely it is to adopt EMPs.

All Processes: There are 8 sub-processes undertaken in this industrial sector, namely dyeing, printing, finishing, desizing, washing/scouring, bleaching, neutralization and drying. Firms that undertake all sub-process are larger firms and this scale effect is expected to positively impact adoption.

International pressure: Export firms are influenced by their international buyers to improve their environmental performance through third party audits or in other in indirect ways (Hemachandra, 2015; Christmann and Taylor, 2006). Firms that say that they feel international pressure are more likely to adopt EMPs.

Peer pressure: If competitors and peers adopt EMPs, firms may also take on EMPs as they do not want to be singled out as laggards or environmentally unfriendly (Anton and Khanna, 2002; Guler et al., 2002).

Community Pressure: When formal regulations are weak, firms may still adopt EMPs if they feel some pressure from nearby communities. Thus, firms that perceive such pressure are hypothesized to be more likely to adopt EMPs.

Informational or Financial Incentives: Pecuniary or non-pecuniary incentives (such as tax rebates, subsidies or awareness seminars & brochures, technical assistance in pollution abatement etc.) are likely to increase EMP adoption (Blackman, 2007).

Penalty: Firms subject to penalty are expected to invest more in pollution abatement technology to avoid the likelihood of increasing penalties in future (Anton, 2005). Thus, this variable is expected to have a positive effect on EMP adoption.

Faisalabad: Firms are located in Faisalabad Town or the industrial zone of Khurrianwala. Khurrianwala has better facilities in terms of availability of land and opportunities to install treatment plants and better disposal facilities, when compared with Faisalabad city, where most of the old industrial units are located.

5.3 Econometric Analyses

In this section, we discuss results of regressions to investigate the factors that influence the adoption of environmental management practices (EMPs) by the firms. We estimate four regression models: three Probit models and one count data model. For Probit models, we use three different measures of EMPs, namely TQEM, SRISK and ETRAINING, as a dependent variable.

In the count data model we consider Negative binomial and Poisson models. The Poisson model assumes that mean of the count dependent variable equals its variance, but the negative binomial relaxes this assumption and becomes a less restricted model (Greene, 2012). When we compare the mean of the count dependent variable (5.16) with its variance (5.80) in our case, we find that the variance is greater than the mean, referred to as over-dispersion, which does not satisfy the basic assumption of the Poisson model. Thus, we estimate the count data model using negative binomial regression model.[7]

[7] Because the assumption of equality of mean and variance in the Poisson model is considered as a major shortcoming, the negative binomial model is most commonly selected alternative (Greene, 2012). Furthermore, the Poisson model tends to under predict the probability of zeros and large counts because the actual variance is usually greater than the variance predicted in the Poisson model (Davidson and MacKinnon, 2003).

Table 7 presents the marginal effects of the regression for each model. In our three Probit regression models, the Pseudo R^2 for TQEM, SRISK and ETRAINING is 0.46, 0.28 and 0.44, respectively. The percentage of correct predictions of adoption and non-adoption of the three EMPs i.e. TQEM, SRISK and ETRAINING among all adopter and non-adopter firms are 85%, 78% and 87% respectively. The last column in Table 7 presents the marginal effects for the Negative Binomial count data model. In this count model, the Pseudo R^2 is 0.15.

The results show that the size of firm, measured as number of employees, is statistically significant and the sign of the coefficient is positive in all the Probit models. Thus, as firm size increases by one thousand employees, the probability of adoption of TQEM increases by 15 percent points and that of SRISK and ETRAINING increases by 11 and 12 percent points, respectively. The Negative Binomial results show that firm size is statistically significant at the 10% level and the sign of the coefficient is positive.

The explanatory variable 'all processes' also measures the scale of firms in terms of number of sub-processes in production. The partial effect of 'all processes' is statistically significant at the 10 percent level only in the model with ETRAINING as the dependent variable. Thus, whether firms adopt all processes or not does not hugely influence adoption of EMPs.

Pressure from international buyers has a strong positive and significant impact on SRISK and ETRAINING in the Probit models. The probability that a firm adopts SRISK and ETRAINING increases by 32% and 41% points, respectively, if it receives international pressure. In the Negative Binomial estimates, international pressure is statistically significant at the 1% level – if a firm receives international pressure, the number of EMPs adopted by the firm increases by 2.36. Thus, firms who sell to international buyers may face the risk of losing their contracts if they do not comply with buyers' requirements. Our findings reinforce results obtained by Hemachandra (2014) and Tambunlertchai (2013), who find similar results in the textile and apparel industry in Sri Lanka and Thailand.

Peer pressure has a positive and significant impact on TQEM, but it has no impact on SRISK and ETRAINING. It does have a positive and significant impact (at the 5% level) on the number of EMPs adopted. Negative binomial results show that if firm receives peer pressure, the number of EMPs adopted increases by 2.52. Results show that community pressure and informational or financial incentives have no significant impact on EMP adoption.

The imposition of penalties on firms has a positive and has statistically significant impact on adoption of SRISK and ETRAINING at 10% and 5% significance levels, respectively. Negative binomial marginal effects show that penalty has statistically no significant impact on the number of EMPs adopted by firms.

The dummy variable for firms located in Faisalabad city is statistically significant only in the model with TQEM as a dependent variable. Adoption of TQEM by firms located in Faisalabad is lower by 42 percent points as compared to the firms in Khurrianwala region. This dummy variable controls for other location specific factors, such as age of firms and infrastructure facilities.

5.4 Discussion

Several interesting results emerge from the analyses of firm level data. First, firms do adopt a number of environmental management practices. On the whole, 87% of firms in the surveyed sample adopt more than two environmental management practices, 50% adopt more than five practices, and 12% adopt all nine identified EMPS.

Second, it is clear that large firms behave differently from medium firms. Large firms are more likely to adopt numerous EMPs and are likely to have an overall environmental policy. They are also likely to feel more pressure from international buyers, while medium firms are more likely to be responsive to community pressures. However, on the whole there appears to be more pressure on firms from international sources rather than local sources to adopt environmental practices.

Regulations have limited impacts. Econometric analyses indicates that penalties seem to have an effect on whether or not firms evaluate environmental risks posed by their suppliers and whether they provide environmental training to their employees.

Overall the Negative Binomial model reinforces the results of Probit regression models. Both show that firms have a higher probability of adopting EMPs with increases in the number of employees, international pressure and peer pressure.

6. Case Study Findings on Compliance

As previously noted, we also undertook case studies of six large firms, three medium firms and one small firm to get a deeper understanding of firm behavior. As Table 8 shows, a majority of the large firms (4 out of 6) are located in Khurrianwala-Faisalabad. Large firms employ 4250 workers on average, have 3 to 4 production units and exported, on average, 72 million USD worth of textiles during 2012. They undertook all five types of processing (i.e. bleaching, washing, dyeing, printing, finishing).

The medium forms we studied are based in Khurrianwala (2) and Faisalabad city (1). They employ an average of 2000 workers and usually have two production units, undertaking the 'printing' sub-process only.[8] Average annual exports were at 15 million USD. Our final case study was of one small firm located in Khurrianwala, with 250 workers, one production unit and undertaking the "printing" sub-process. The firm sold its output in the local market.

6.1 Environment and Water Management

In terms of environmental management, firms follow different environmental management practices in different degrees (see Table 8). Three of the large firms don't have any specific code of conduct but follow a corporate policy, while one has its own environmental management system as its code of conduct and has SA 8000[9] in place. Only one large firm has a compliance department focusing on the firm's code of conduct.[10]

All the six large firms and three medium firms have senior management and front line managers who are well educated and aware of environmental regulations. The large firms conduct workshops/campaigns to inform the labor force about health/hygiene/safety/waste management issues in collaboration with APTPMA and EPA.

Five of the six large firms undertake regulatory and/or non-regulatory liquid waste assessments as a result of their international customer requirements. These assessments involve identification of disposal of total waste water discharged by firms. Five of the six large firms also undertook compliance appraisals on a regular basis. Such appraisals provide evaluation of the firms' actions taken on protecting environment which is done by internal auditors/firms' managers. The remaining five firms did not conduct such assessments.

Nearly all firms in the sample dispose treated/untreated waste in a dedicated main drain line provided by government. This waste then directly enters into rivers and tributaries. Five of the six large firms have a functioning ETP (see Table 8) and indicated that they had invested 416 m PKR, on average, in treating wastewater during 2013. Only one of three medium firms has an ETP, which it claimed to have installed at a cost of 100 m PKR. One medium firm claimed that its' wastewater first goes for semi-treatment in the CETP, but this ETP is still not fully functional as identified by APTPMA and FCCI.

All large firms use borewell water. In addition, two large firms use supplemental canal water, while one obtains water from Water and Sanitation Agency (WASA). All medium firms use borewell water; one medium firm supplements this with water sourced from private agencies and another obtains water from WASA. The average consumption and discharge of water is 12,599 cubic meter/day. Large firms for which data are available indicate that they discharge, on average, 18,308 cubic meter/day of wastewater.

Higher water usage/wastewater discharge for large firms is because of mass production for international and domestic markets and use of water for dilution of wastewater pollutants to meet up national wastewater quality standards. ETPs are used not for treatment but dilution.

[8] The main sub-processes undertaken in medium firms are bleaching, dyeing and printing.
[9] SA800 is social accountability standard 8000.some exporters have this certification as their international customer ask them workers wages and working conditions.
[10] ISO14001 needs a firm to have a Code of Conduct for the firm to operate and maintain environment. Items inside CoC have not been listed in ISO14001.

Firms using bored water need to install reverse osmosis (RO) plants to soften the water. Four large firms have installed reverse osmosis (RO) plants[11] and a fifth is constructing such a plant because of strict EPA monitoring of these firms. Two medium firms have installed RO plants. Small firms have no RO plants or ETPs.

6.2 Regulatory and Local Stakeholder Pressure

According to both firms and EPA, the six large firms were inspected once in in a year, the three medium firms are inspected two to four times a year (every three to six months), and the small firm is inspected every month or every two months. The frequency of inspections is lower for large firms because many of them meet international set of regulations and standards, hence by default they expected to be complying with NEQS. Managers' at large firms mentioned that they were visited by environmental officers mainly at the time of the installation of effluent treatment plants (ETP) and when environmental impact assessment (EIA) reports were prepared during the initial development of the factory/unit/plant.

In terms of environmental notices, the six large firms indicated that they had never received any notices or warning letters from EPA, as EPA believes these firms are complying with international environmental standards. The other four firms did receive such warnings from time to time. None of the six large firms have ever been fined, but the other four firms have been fined by the Environmental Tribunal after EPA filed cases against them in the high court.

EPA notices, penalty, amount of fine and other actions like sending warning notices about meeting NEQS parameters or fine on failure to comply, are more infrequent. In our sample, large firms did not receive any notices/ warning letters from EPA, as EPA believes these firms follow international environmental standards. Medium and small firms have received such warning notices from time to time. In our sample, large firms did not receive any fine but environmental tribunal has fined medium and small firms after EPA filed cases against them in high court.

No community or association pressure exists on large firms because they are considered to be self-responsible for complying with regulations. Such pressure does exist for medium and small firms as some community complaints and negative media reports are observed for medium and small firms.

All ten firms regularly participate in meetings arranged by trade associations such as Faisalabad Chamber of Commerce and Industry and APTPMA. These meetings bring together multiple stakeholders to one platform where environment is discussed as a subject of mutual interest. APTPMA has conducted research and several campaigns to educate the industry and identify collective solutions for effluent treatment. A recent decision on constructing a combined effluent treatment plant in Khurrianwala-Faisalabad is an outcome of this effort.

6.3 Compliance with International Standards

There are several ways in which firms seem to comply with international norms and standards. Five of the six large firms have acquired international certifications i.e. such as ISO 14001 and Eco-Labeling. Of these, the most important from an environmental perspective is ISO 14001.

Five of the six large firms use only chemicals and dyes that are imported and certified internationally. Two of the medium firms perceive pressure from international customers; therefore they have to take preventive measures to avoid high levels of effluents. They comply by either importing certified chemicals and/or by testing their final fabric products at certified international laboratories. Finally, the small firm releases high levels of effluents as it uses locally manufactured chemicals/dyes/paints and waste water is discharged directly into the sewer system without any treatment.

6.4 Discussion

There are several criteria for judging whether the case study firms are complying with Pakistan's environmental laws. While we do not have direct data on effluent discharge, which would be the best indicator, we have information on the presence of ETPs, existence of different environmental management practices, international certification, and the type of chemicals used in the manufacturing process.

[11] RO plants are necessary to soften input water. If firms do not soften the input water, it results in using excess chemicals/dyes/pigments while processing.

By these criteria, as expected, large firms are in much better environmental compliance than smaller firms (see Table 9). Four out of six large firms have functional ETPs, but only one medium firm had an ETP. All large firms have international certification of a variety of sorts, suggesting that they were in compliance on a subset of practices. None of the other four firms had international certification. In terms of certified dyes and paint, all large and one of the medium firms used internationally certified, less toxic dyes and chemicals. Large firms also undertake environmental management practices as a result of international pressure i.e. self-appraisals, third party audits, social accountability checks such as SA 8000. Though all large firms claim that ETP is functional, discussions with firms' managers indicate that firms may run these mainly when auditor/customers visit.

In terms of the underlying motivation for being environmentally compliant, as identified in the previous econometric analyses, large firms appear to feel some pressure from international customers. They were clear about this during our interviews with them and there is evidence of international certifications, which are not required by the law in Pakistan. Large firms seemed to feel little pressure from local authorities.

Some medium firms do seem to respond to international pressure. For example, this pressure is felt by medium firms that are working for exporters or those who are directly exporting to Middle East, China, India, Russia and Central Asia. Medium/small firms are also subject to some local stakeholder pressure. However, this is limited because communities and their livelihood is also dependent on these firms.

Medium and small firms are much more subject to inspections and monitoring from regulators. They have also been fined by the Environmental Tribunal. However, firm managers, the APTPMA chairperson and EPA officials all suggest that these firms do not comply with the laws. The main reason for this is because fines are low and it is possible to bribe EPA officials to withdraw charges.

According to firms, one major challenge in complying with NEQS is the difference between current standards and actual values of firms' discharged effluents. According to managers, current standards are unrealistic and stringent and first world standards cannot be implemented in third world. Notably, effluent standards are higher in Pakistan relative to its neighboring countries.[12] Large firms point out that treating water in their ETPs is useless as rest of the untreated industrial discharge mixes and treated water becomes toxic. They argue that all firms, not just large ones, should be subject to laws if the government is serious about pollution.

7. Conclusions and Recommendations

Six major environmental regulations in Pakistan have oversight over environmental practices in the textile sector. Pakistan also has National Environmental Quality Standards that would apply to many of the effluents released by the textile sector. However, a number of institutional deficiencies hinder proper enforcement and implementation of these regulations. While the EPA does inspect and take actions against non-compliant industries through legal proceedings in the local high court and environmental tribunals, the fines charged appear to be too low to change firm behavior. On the implementation side, the EPA has a dearth of human resources, which makes monitoring difficult. These budgetary and human resource challenges have been aggravated since the Federal Government decentralized its environmental monitoring functions to state EPAs in 2010.

There are generally nine different environmental management practices that are adopted in the textile industry. These range from environmental policies to environmental training for employees to international certification. Our survey of firms suggests that 87% of firms in our surveyed sample adopted more than two environmental management practices, 50% adopted more than five practices, and 12% adopted all nine identified EMPS.

Within the textile industry, large firms follow different environmental practices relative to medium firms. Large firms are likely to have an overall environmental policy and are more likely to take on more environment related management practices. They are also likely to feel more pressure from international buyers relative to medium firms.

[12] Current NEQS for pH, BOD, COD and TDS of the waste water discharge into inland water and sea are 6-9, 80, 150 and 3500 respectively in Pakistan (EPA-Pakistan) as compared to 6.5-8.5, 60-200, 250-600 and 50-500 in Sri Lanka (MoERE-Sri Lanka, 1980), 6.5-9, 150, 200 and 2100 in Bangladesh (MoEF-Bangladesh, 1997) and 5.5-9, 150, 250 and 100 in India (MoEF-India, 2005).

In general, firms perceive more pressure from international sources and competitors rather than local sources to adopt environmental practices. Both statistical analysis and case study interviews reinforce this finding. Non-regulatory pressures such as community and media stressors have a limited influence. The effect of regulations is also limited, but they do matter. Penalties seem to influence whether or not firms evaluate environmental risks posed by their suppliers and whether they provide environmental training to their employees.

There are three main strategies for improving environmental compliance. First, firms can be encouraged to install effluent treatment technology. Currently, many large firms install ETPs in order to please customers, but do not use these all the time. Effluent treatment plants are available in various designs and can be subsidized and developed to suit the needs of smaller industries. However, unless the EPAs are better resourced and incentivized to monitor ETP use, this will not help.

Another strategy for would be for the government to publicize environmental impact reports or create a rating system to reward firms based on their environmental performance. Peer pressure does seem to matter. Thus, a rating system that creates some competition may enhance performance.

Finally, environmental management in small and medium industries would also improve with better access to training and information. APTPMA, EPA, WASA and the Ministry of Textiles could join hands and train managers and EPA staff at the district level to improve industrial environmental performance.

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Tables

Table 1: Nature of Textile Industry in Pakistan

Sub Sectors	Processing Sector =P	Large No. of Units	Medium No. of Units	Small No. of Units
Spinning Units	–	458	–	–
Composite Units	P	50	–	–
Independent Weaving Units	–	150	425	–
Finishing Units	P	155	635	–
Garments Units	–	800	–	5000
Terry Towels	–	–	–	800
Knitwear	–	–	–	1200

Source: Planning Commission of Pakistan, Export Plan 2007-2013

Table 2: National Environmental Quality Standards (NEQS), Liquid Effluents (mg/l, unless otherwise defined)

Parameters	Existing Standards	Revised Standards			Actual Discharge (Annual Avg.)
		Into inland water	Into sewage treatment	Into sea	
pH value	6-10	6-9	6-9	6-9	6-12
Biochemical Oxygen Demand (BOD)	80	80	250	80	110-1070
Chemical Oxygen Demand (COD)	150	150	400	150	365-2500
Total Suspended Solids	150	200	400	200	–
Total Dissolved Solids	3,500	3,500	3,500	3,500	1,000-8,000
Chloride	1,000	1,000	1,000	SC1	–
Copper	1	1	11	1	–
Chromium	1	1	1	1	–

Source: NEQS, Environmental Protection Agency (EPA), Pakistan

Table 3: Profile of Textile Processing Firms

	Large Firms						Medium Firms			Small Firm
Firms' Characteristics	**Case Study 1**	**Case Study 2**	**Case Study 3**	**Case Study 4**	**Case Study 5**	**Case Study 6**	**Case Study 7**	**Case Study 8**	**Case Study 9**	**Case Study 10**
Classification of the firms	Large firm (LF)	Large firm (LF)	Large firm (LF)	Large firm (LF)	Large firm (LF)	Large firm (LF)	Medium Firm (MF)	Medium Firm (MF)	Medium Firm (MF)	Small Firm (SM)
Region	Khurrian Wala	Khurrian wala	Fsd City	Fsd- Khurrian Wala, Lhr	Fsd-Lhr	Khurrian wala	Khurrian wala	Fsd City	Khurrian wala	Khurrian wala
No. of Employees	5,000	3,000	5,000	3,000	3,500	5,000	2,500	1,500	2,000	250
No. of Prod. Units	4	3	4	3	4	3	2	2	2	1
Types of textile sub-processes undertaken	Bleaching, Washing, Dyeing, Printing, Finishing	Bleaching, Washing, Dyeing, Printing, Finishing	Bleaching, Washing, Dyeing, Printing, Finishing	Bleaching, Washing, Dyeing, Printing, Finishing	Bleaching, Washing, Dyeing, Printing, Finishing	All but now only Printing, Finishing	Bleaching, Dyeing, Printing	Bleaching, Dyeing, Printing	Bleaching, Dyeing, Printing	Printing
Total Exports	100 million USD (Approx.)	100 million USD	55 million USD (Approx.)	10 million USD	416 million USD Faisalabad unit is 40% (166 million USD)	2011- 60 million USD 2012-3 million USD	per year 5 million USD	2.87 million USD in June, 2011, a decrease of 30-35% in year 2012 (0.98 million USD)	40.5 million USD	Nil

- Considering "100 PKR equals to 1 USD" after rounding-off. All figures here are in USD for better understanding, where (1USD=100.01PKR), Conversion Rate (for converting PKR into USD) = 0.009999 as calculated on 13 Jul 2013 from www.exchange-rates.org

Source: Discussion with firms' Chief Executive Officers (CEOs), Technical Directors, General Mangers (GMs) and Managers - Processing of textile industry

Table 4: Summary of Firms in Sample

No.	Variable	Unit	Summary Statistics		
			Total	Large	Medium
1	Percentage distribution of Sample firms		100	30	70
2	Years of operation	Number of Years	19.766	23.66	9.76
		Mean	(15.83)	(18.23)	(15.69)
3	Employment in all production units.	Mean	(2,393)	(4,933)	(1,305)
4	Prod. Units within the Firm	Number of units	2.03	3.72	1.52
		Mean	(1.275)	(1.382)	(0.86)
5	Total Production 2013	Million meters/year	27.35	23.44	8.93
		Mean	(19.15)	(17.37)	(19.80)
6	Total waste water generated	Cubic Meter/day	14,243.85	18,307.94	12,598.86
		Mean	(10,815.62)	(12,468.87)	(9,756.424)

Note: Table 4 shows averages for firm level characteristics. First row gives percentage distribution of large and medium firms in the sample. 'Variable column' gives short description of firm level characteristics. 'Unit column' indicates the measuring unit i.e. averages and means for variable stated in variable column. 'Summary statistics column' has three sub columns indicating averages and means for 'total' for both type of firms, 'large' for large firms and 'medium' for medium firms.

Table 5: Frequency of Adoption of Environmental Management Practices

Variable	Total (N=60)	Large (N= 18)	Medium (N=42)	Percent of firms adopting EMP	Percent of large firms adopting EMP	Percent of Med Firms adopting EMP
Environmental Policy	19	13	6	32%	72%	14%
TQC and TQM in Production	43	17	26	72%	94%	62%
Environment as subject of TQM Principles	37	15	22	62%	83%	52%
Environmental risk evaluation of suppliers	33	16	17	55%	89%	40%
Evaluated the chemical hazards	55	18	37	92%	100%	88%
Provided Environmental Training	42	16	26	70%	89%	62%
Undertook Environmental Audits	51	14	38	85%	78%	90%
Have Effluent Treatment Plant	12	9	3	20%	50%	7%
ETP in Operation	9	7	2	15%	39%	5%
Firms with upto 2 EMPs	52	17	35	87%	94%	83%
Firms with 3 to 6 EMPs	30	15	15	50%	83%	36%
Firms with more than 6 EMPs	7	6	1	12%	33%	2%

Table 6: Definitions of Variables and Summary Statistics

No	Variable	Measurement	Mean	Std. Dev	Min	Max
1	TQEM	1 if environment is part/subject of Total Quality Management Principles followed at the firm, 0 otherwise.	0.62	0.49	0	1
2	SRISK	1 if firm does environmental risk evaluation of suppliers, 0 otherwise.	0.7	0.46	0	1
3	Environmental Training	1 if all or some employees have received formal/informal environmental training, 0 otherwise.	0.7	0.46	0	1
4	Count of EMPs adopted	Number of EMPs firm adopts from 9 EMPs.	5.17	2.41	0	9
5	Number of Employees	Total number of employees in the firm in thousands.	2.39	2.92	0.6	20
6	All Processes	1 if the firm is undertaking all sub-processes, 0 otherwise.	0.73	0.44	0	1
7	International pressure	1 if the firm received any conditions/pressure imposed by intl. buyers/customers regarding environmental compliance, 0 otherwise.	0.58	0.49	0	1
8	Peer pressure	1 if local competitors follow environmental friendly business/ production practices, 0 otherwise.	0.83	0.37	0	1
9	Community pressure	1 if the firm received any community complaints on environmental pollution, 0 otherwise.	0.38	0.49	0	1
10	Informational or Financial Incentives	1 if firm received financial assistance or informational incentives for improving its environmental performance in the last 5 years, 0 otherwise.	0.25	0.44	0	1
11	Penalty	1 if firm has been subject to penalty, 0 otherwise.	0.72	0.45	0	1
12	Faisalabad	1 if the firm is located in Faisalabad city, 0 otherwise.	0.62	0.49	0	1

Table 7: Marginal effects of various exogenous variables on adoption of EMP

Dependent Variables VARIABLES	TQEM Probit Model	SRISK Probit Model	ETRAINING Probit Model	Count of EMPs adopted Negative Binomial Model
Number of Employees	0.15**	0.11**	0.12***	0.13*
	(0.07)	(0.05)	(0.04)	(0.08)
All Processes	-0.20	0.06	-0.15*	0.11
	(0.12)	(0.13)	(0.09)	(0.69)
International Pressure	0.21	0.32**	0.41***	2.36***
	(0.16)	(0.15)	(0.16)	(0.70)
Peer Pressure	0.73***	0.17	0.22	2.52**
	(0.19)	(0.18)	(0.21)	(1.06)
Community Pressure	0.02	0.18	0.18	0.16
	(0.17)	(0.13)	(0.12)	(0.73)
Informational or Financial Incentives	0.13	-0.01	-0.11	-0.18
	(0.14)	(0.13)	(0.15)	(0.66)
Penalty	0.14	0.30*	0.32**	0.76
	(0.19)	(0.16)	(0.15)	(0.77)
Faisalabad	-0.42***	0.08	-0.02	-0.06
	(0.13)	(0.15)	(0.13)	(0.64)
Observations	60	60	60	60
Pseudo R^2	0.46	0.28	0.44	.15
Percentage of Good Predictions	85	78	87	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Waste Management related Inputs

Firms' Specificities	Case Study 1	Case Study 2	Case Study 3	Case Study 4	Case Study 5	Case Study 6		Case Study 7	Case Study 8	Case Study 9	Case Study 10
International certifications	yes	yes	yes	yes	yes	yes		no	no	no	no
Presence of environmental officers	At the time of installation of ETP/EIA	At the time of installation of ETP/EIA	Irregular	Irregular	At the time of installation of ETP/ EIA	Irregular		Regular	Regular	Regular	Regular every month
Code of Conduct	EMS	Part of corporate policy	Part of corporate policy	SA 8000	Part of corporate policy	Compliance Dept.		Nil	Nil	Nil	Nil
Total Vol. of Raw Water (CM)	0.7 m3 per day	100 m3 per day	200 m3 per day		500 m3 per day			480 m3 per day	0.5 m3 per day	above 170 m3 per day	No flow meters
Sources of Water	Bored water/ WASA supply	Bored water	Canal/Bored water	Bored water	Canal/Bored water	Bored water		Bored water/ WASA supply	Ground water/ buying from Gaye Soap	Bored water	Bored water
Total Vol. of Waste Water(CM)	0.6 m3 per day	100 m3 per day or less	150 m3 per day		400-430 m3 per day			less than 480 m3 per day y	0.4 m3 per day	170 m3 per day	No flow meters
ROs – Costs	Installed/ Cost Unavailable	1.5 m USD	multimillion PKR/ 1 m USD		Under Construction	1 mill USD	Installed / Cost Unavailable	Installed/ Cost Unavailable	Not Installed	Installed	Not Installed
ETPs – Costs	2 million USD	0.8 million USD	10 million USD	Built in 1980s – 10,000 USD	Installed –Jan 2013		Installed / Cost Unavailable	Not Installed	Not Installed	1 million USD	Not Installed

- Considering "100 PKR equals to 1 USD" after rounding-off. All figures here are in USD for better understanding, where (1USD=100.01PKR), Conversion Rate (for converting PKR into USD) = 0.009999 as calculated on 13 Jul 2013 from www.exchange-rates.org

Table 9: Case Studies' Findings

Issues	No. of Cases
Compliance Appraisals (Yes, No)	Yes – 5/10 of total sample (5/10 LFs) No – 5/10 of total sample (1/10 LFs, 3/10 MFs, 1/10 SFs)
Level of Effluent/Pollutants (Lo, Med, Hi)	Lo – 5/10 of total sample (5/10 LFs) Med – 4/10 of total sample (3/10 MFs & 1/10 LFs) Hi – 1/10 of total sample (1/10 SFs)
International customers' pressures (Hi, Med/Lo, Nil)	Hi – 6/10 of total sample (6/10 LFs) Med/Lo – 3/10 of total sample (3/10 MFs) Nil – 1/10 of total sample (1/10 SFs)
Regulatory and/or Non-regulatory Liquid Waste Assessments (Yes, No)	Yes – 5/10 of total sample (5/10 LFs) No – 5/10 of total sample (1/10 LFs, 3/10 MFs, 1/10 SFs)
Awareness and Education (Yes, No) (i.e. on waste management among firm managers)	Yes –9/10 of total sample size (6/10 LFs, 3/10 MFs) No – 1/10 of total sample size (1/10 SFs)
International Certifications (Yes, No)	Yes – 6/10 of total sample (6/10 LFs) No – 4/10 of total sample (3/10 MFs, 1/10 SFs)
ETP Installed/Not-Installed/Functional/Not-functional	Installed – 6/10 of total sample (6/10 LFs) Not-Installed – 4/10 of total sample (3/10 MFs, 1/10 SFs) Functional – 5/10 of total sample (5/10 LFs) Not-functional – 1/10 of total sample (1/10 LFs)
EPA Notices (Yes, No)	No– 6/10 of total sample (6/10 LFs) Yes – 4/10 of total sample (3/10 MFs, 1/10 SFs)
Inspections (Yes , No)	Yes – 10/10 of total sample (6/10 LFs, 3/10 MFs, 1/10 SFs) No – Nil
Subject: Installation of ETPs, Untreated Effluent drained, Stagnant water, Epidemics outbreaks e.g. dengue, hepatitis-c	Installation of ETPs – 6/10 of total sample (6/10 LFs) Untreated Effluent drained, Stagnant water, Epidemics outbreaks – 4/10 of total sample (3/10MFs, 1/10 SFs)
No. of Inspection/Year:	LFs – once in 1 to 3 year, MFs – twice/thrice a year (every 3 to 6 months), SFs – 6 to 12 times a year (every 1 to 2 months)
Year of Inspections:	2011, 2012, 2013 (till Feb)
Penalty (Yes, No):	No – 6/10 of total sample (6/10 LFs) Yes – 4/10 of total sample (3/10 MFs, 1/10 SFs)
Amount of Fine:	50 thousand PKR to 500 thousand PKR
Citizen Complaints and Negative Media Reports (Yes, No)	No – 6/10 of total sample (6/10 LFs) Yes – 4/10 of total sample (3/10 MFs, 1/10 SFs)
Pressure from Local Communities, Industrial Associations or Regulators (Yes, No)	No – 6/10 of total sample (6/10 LFs) Yes – 4/10 of total sample (3/10 MFs, 1/10 SFs)
Regular Participation in Trade Associations (Yes, No)	Yes – 10/10 of total sample (6/10 LFs, 3/10 MFs, 1/10 SFs) No – 0

Figures

Figure 1: Distribution of firms according to number of EMPs adopted in Last Five Years

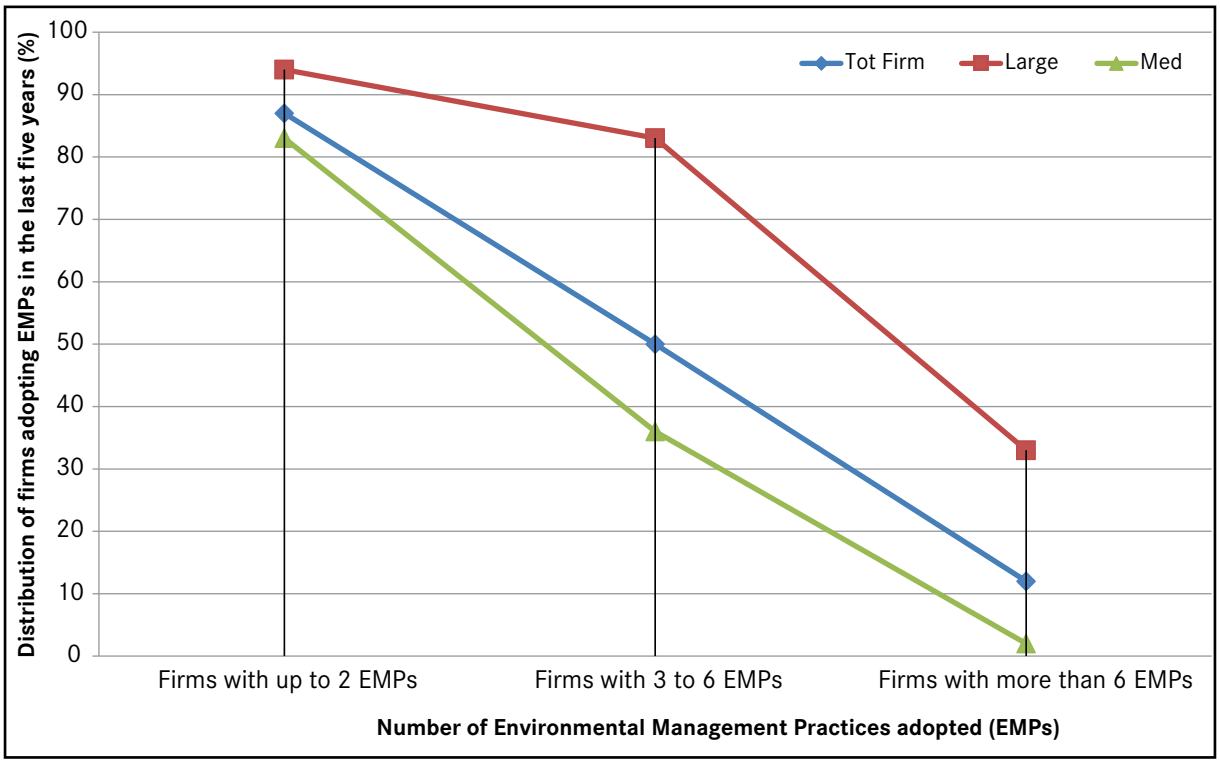
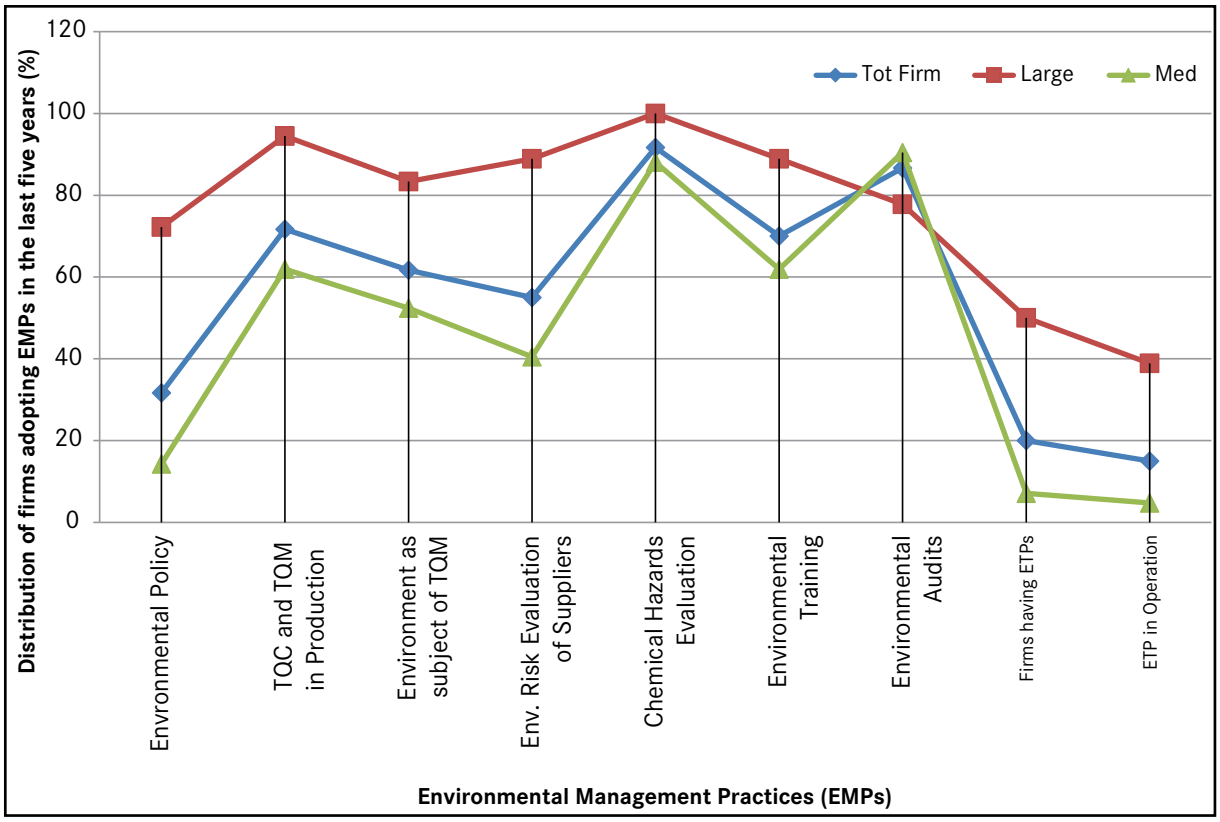


Figure 2: Distribution of firms according to the EMPs adopted in Last Five Years



Source: BLSS 2007 and BLSS 2012

Figure 3: Regulatory Measures

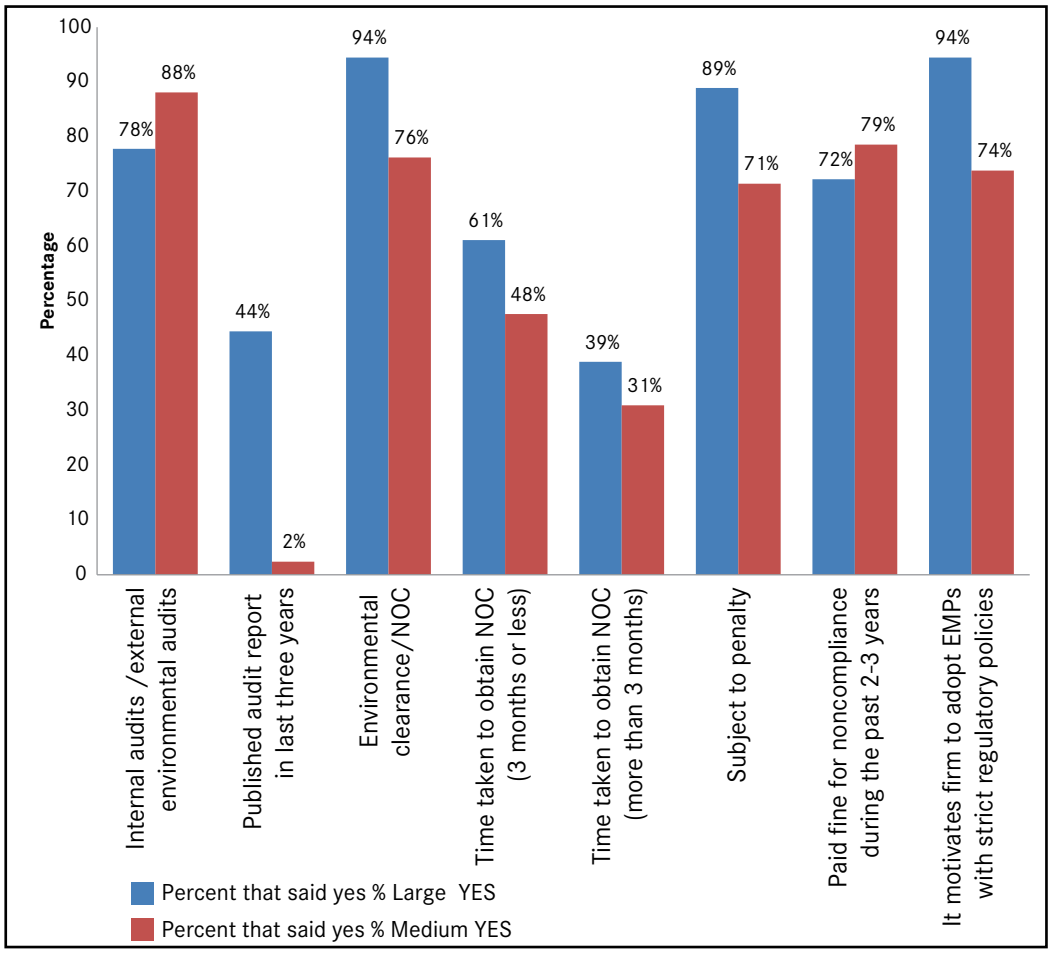


Figure 4: Voluntary Measures

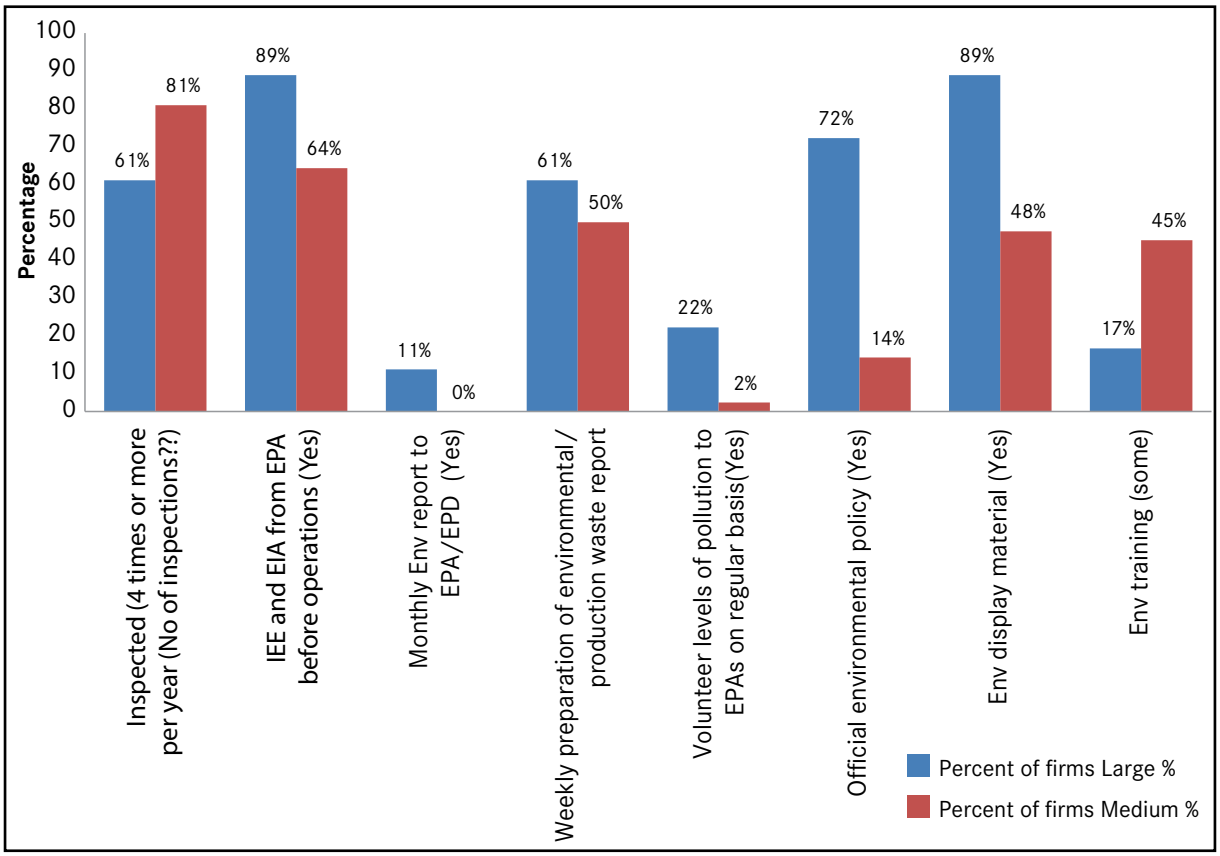


Figure 5: International Pressure

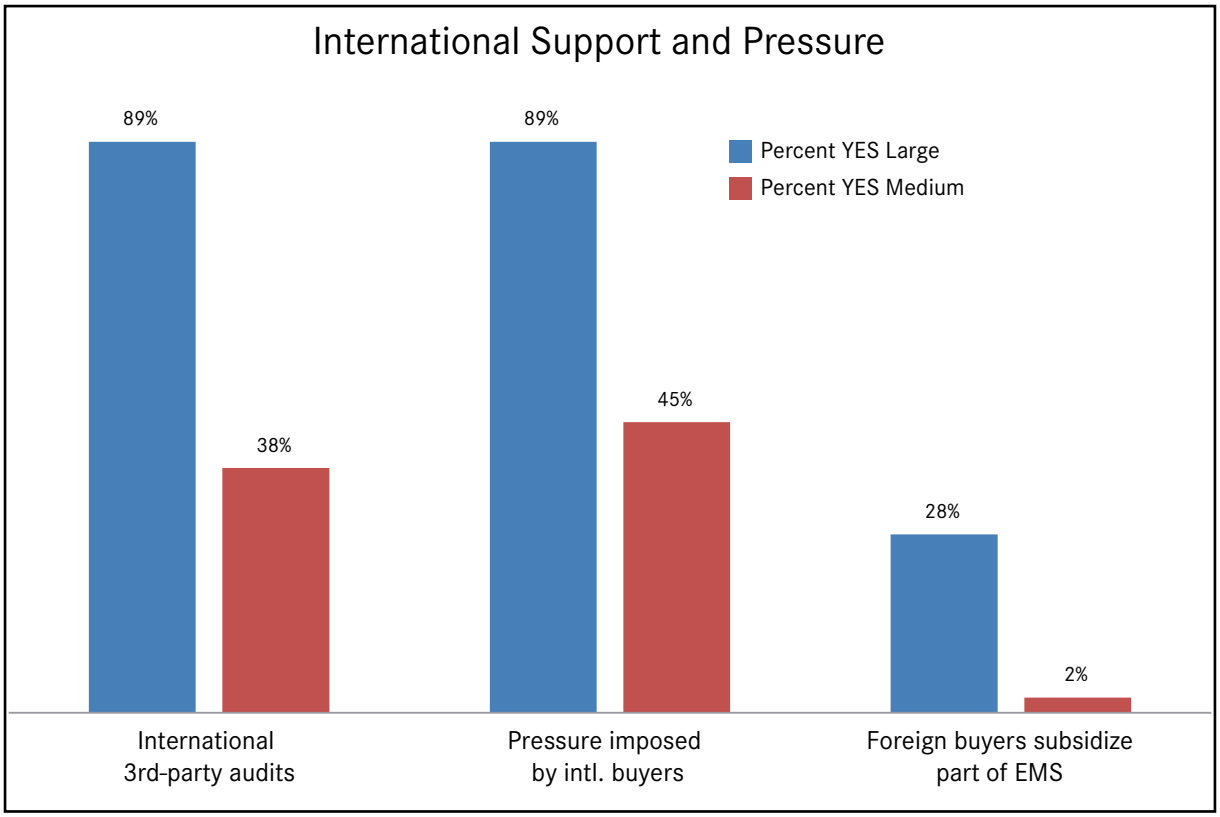


Figure 6: Community Pressure

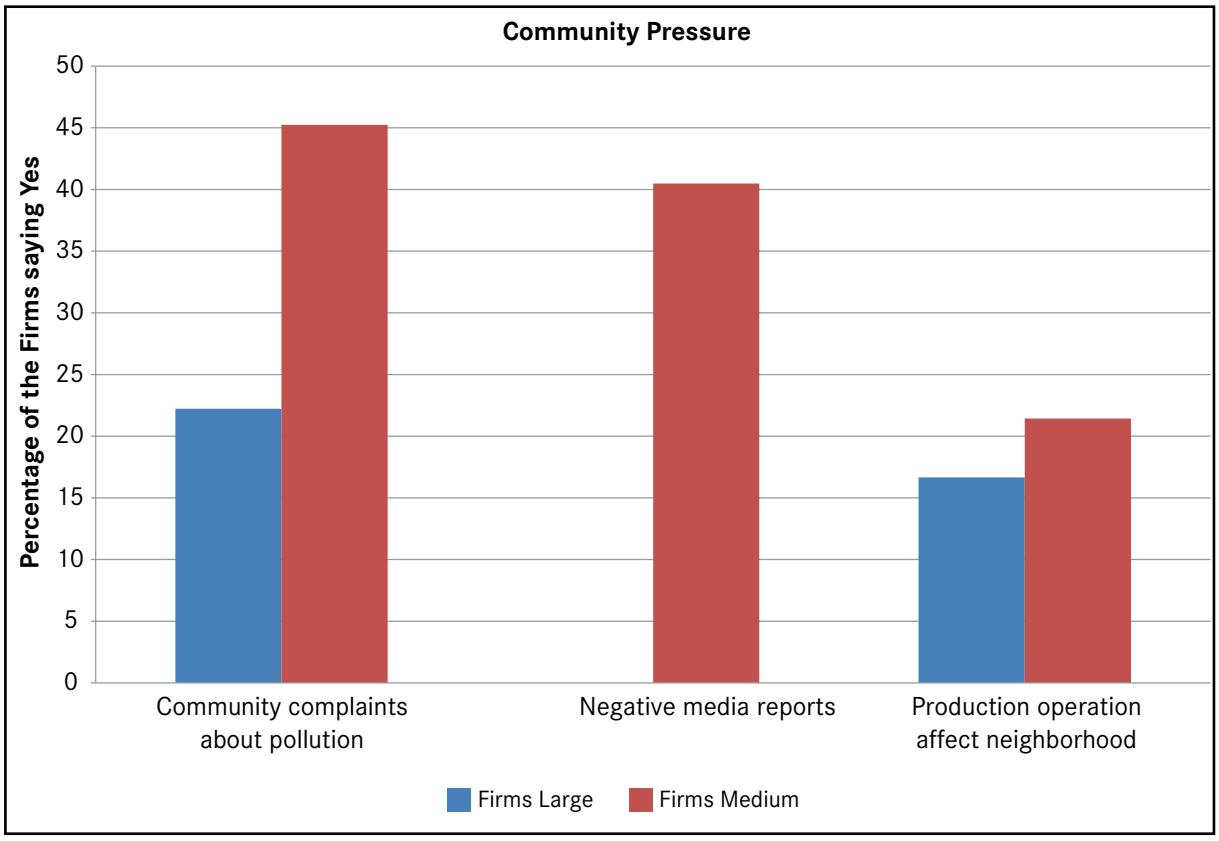
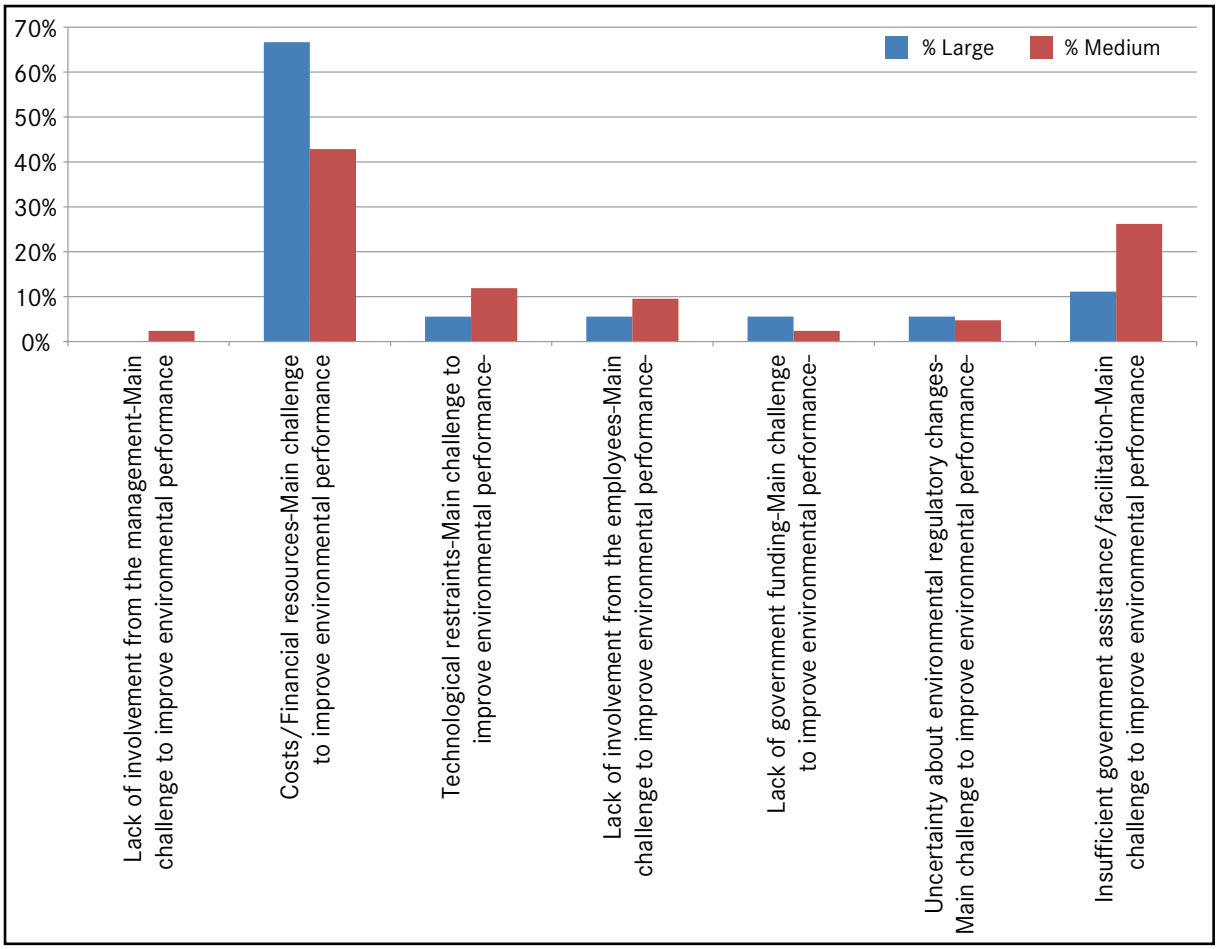


Figure 7: Challenges to Environmental Compliance



Annex 1: Major Environmental Laws, Rules and Regulations in Pakistan

Environmental Law & Major Provisions for Environmental Monitoring and Reporting	**Section/Sub-Section No./Clause No.**	**Explanation**
Pakistan Environmental Protection Act (PEPA) 1997		An Act to provide for the protection, conservation, rehabilitation and improvement of environment, prevention and control of pollution, and promotion of sustainable development.
NEQS, Self-Monitoring and Reporting Rules (2001)		Under "Self-Monitoring and Reporting System" industry will voluntarily provide their levels of pollution to EPAs on regular basis in which NEQS-Self Monitoring and Reporting Rules-01 for classification, priority parameters both for liquid & gaseous emissions and environmental monitoring &reporting format are given.
PEPAs, Sampling Rules (2001)	Section (7) of PEPA-1997(clauses "h" and "i")	An authorized person taking samples shall divide the sample into three portions in the presence of person from whom the sample is taken and take samples of any materials, products, articles or substances or of the effluents, wastes or air pollutants being discharged or emitted or of air, water or land in the vicinity of the discharge or emission/arrange for test and analyses of the samples at a certified laboratory.
PEPAs, Pollution Charges and Collection Rules (2001) -	Sub-section (2) of Section 11 of the PEPA Act- 1997	"Pollution Charge" means the pollution charge payable, collection of which should be done through industrial associations and Chambers of Commerce and Industry (see Pollution Charge-Calculation Rules-01).
NEQS, Certification of Environmental Laboratories, Regulations (2000) –	Section-6, Sub-section (2), and Clause (e) of PEPA Act- 1997	Functions of the federal agency, establish and maintain laboratories to help in the performance of its functions under this Act and to conduct research in various aspects of the environment and provide or arrange necessary assistance for establishment of similar laboratories in the private sector.
PEPAs, Initial Environmental Examination (IEE) Regulations (2000) -		These regulations may be called the Pakistan Environmental Protection Agency Review of IEE-"initial environmental examination" means a preliminary environmental review of the reasonably foreseeable qualitative and quantitative impacts on the environment of a proposed project to determine whether it is likely to cause an adverse environmental effect for requiring preparation of an environmental impact assessment,
PEPAs, Environmental Impact Assessment (EIA), Regulations (2000) -		EIA-"environmental impact assessment" means an environmental study comprising collection of data, prediction of qualitative and quantitative impacts, comparison of alternatives, evaluation of preventive, mitigatory and compensatory measures, formulation of environmental management and training plans and monitoring arrangements, and framing of recommendations and such other components as may be prescribed.
Environmental Tribunal Rules (1999)-	Section 20, Sub-section (1) of PEPA Act- 1997	"Environmental Tribunal" means the Environmental Tribunal constituted under the Act i.e. The Federal Government may by notification in the official gazette, establish as many Environmental Tribunals as it considers necessary and, where it establishes more than one Environmental Tribunal it shall specify territorial limits within which, or the class of cases in respect of which each one of them shall exercise jurisdiction under this Act.

Annex 2: National Environmental Quality Standards for Municipal and Liquid Industrial Effluents (mg/l, unless otherwise defined)

Parameter	Existing Standards	Revised Standards		
		Into Inland Waters	Into Sewage Treatment (5)	Into Sea (6) Waters
Temperature or Temperature Increase*	40°C	=<30°C	=<30°C	=<30°C
pH value	6-10	6-9	6-9	6-9
Biochemical Oxygen Demand (BOD)5 at 200C(1)	80	80	250	80
Chemical Oxygen Demand (COD) (1)	150	150	400	400
Total suspended solids (TSS)	150	200	400	200
Total dissolved solids (TDS)	3,500	3,500	3,500	3,500
Chloride (C^{l-})	1,000	1,000	1,000	SC
Sulphide (S^{2-})	1.0	1.0	1.0	1.0
Ammonia (NH3)	40	40	40	40
Cadmium (4)	0.1	0.1	0.1	0.1
Chromium (trivalent and hexavalent) (4)	1.0	1.0	1.0	1.0
Copper (4)	1.0	1.0	1.0	1.0
Nickel (4)	1.0	1.0	1.0	1.0
Arsenic (4)	1.0	1.0	1.0	1.0
Chlorine	1.0	1.0	1.0	1.0

Explanations:

1. Assuming minimum dilution 1:10 on discharge, lower ratio would attract progressively stringent standards to be determined by the Federal Environmental Protection Agency. By 1:10 dilution means, for example that for each one cubic meter of treated effluent, the recipient water body should have 10 cubic meter of water for dilution of this effluent.

4. Subject to total toxic metals discharge should not exceed level given at S.No.25.

5. Applicable only when and where sewage treatment is operational and BOD5=80 mg/l is achieved by the sewage treatment system.

6. Provided discharge is not at shore and not within 10 miles of mangrove or other important estuaries.

* The effluent should not result in temperature increase of more than 30oC at the edge of the zone where initial mixing and dilution take place in the receiving body. In case zone is not defined, use 100 meters from the point of discharge.

Annex 3: Details of Calculation of Pollution Charge for Liquid Effluents

Determination of Pollution Level

The pollution level in a production unit shall be measured once a year. The measurement shall be carried out jointly in the presence of at least one representative each from the production unit and the concerned EPA. Interested NGOs shall be allowed to accompany EPAs on such visits to ensure transparency and neutrality in the process. The production of the unit during the determination period shall also be recorded to ensure that normal operational conditions of the unit prevail. Alternatively, pollution charge may also be figured out on the basis of self-monitoring reports submitted under NEQS (Self-Monitoring and Reporting by Industry) Rules, 2001, in mutual agreement with the concerned EPA.

Calculation Procedure

1. The effluent flow of a production unit shall be measured for a limited period, ranging from a minimum of a day to about a week, under normal operating conditions.
2. During this period, effluent samples shall be taken at regular intervals, ranging from once an hour to once in eight hours and the concentration of pollutant parameters of concern shall be established through laboratory analysis.
3. Net quantity of pollutant being discharged (in kg) shall be calculated by dividing the net quantity of pollutant being discharged by the amount defined as one pollution unit for the parameter under consideration.
4. Number of pollution units for each parameter shall be calculated by dividing the net quantity of pollutant being discharged by the amount defined as one pollution unit for the parameter under consideration.
5. The number of pollution units per unit of production shall be calculated by dividing the number of pollution units with production in the period during which tests were carried out.
6. Number of pollution units shall be calculated on the basis of production in the period for which pollution charges are to be paid.
7. The amount to be paid, as pollution charge shall be calculated by multiplying the chargeable pollution units with the applicable rate for a pollution unit for the year.

Schedule for payment of pollution charge

Pollution charge shall be payable on a biannual basis, calculated according to the established discharge rate per unit of production, and the actual production of the unit in the preceding six months.

Calculation of Pollution Charge in USD (Example):

NEQS Parameters.		Recorded.	Effluent levels.
COD.	150 mg/l	5200	mg/1
TSS	150 mg/l	500	mg/1

Annual Operating Day.	160 Days.	
Product Rate	6,000 Tons	
Effluent flow rate	5,300 m^3/day or 848,000 m^3/year	Chargeable

Actual Pollution Level.		Annual Pollution Load.	Net Chargeable Units.
COD	5,200 mg/1	4,282,400 kg	85,648
TSS	500 mg/1	296,800 kg	5,936
Total Units Chargeable.	91,584 Units		

Base Rate per Unit.	*1 USD./Unit (For example)			
Total Pollution Charge	Year 1	Year 2	Year 3	
USD/year	18,316.80	36,633.60	54,950.40	

*Considering "100 PKR is used as base rate per unit" as an example for calculating Pollution charge given in "The Pollution Charge For Industry (Calculation And Collection) Rules, 2001". All figures here are in USD for better understanding, where (1USD=100.01PKR), Conversion Rate (for converting PKR into USD) = 0.009999 as calculated on 13 Jul 2013 from www.exchange-rates.org

Annex 4: Survey Questionnaire Textile-Processing Sector

Survey Questionnaire, 7th Feb, 2012

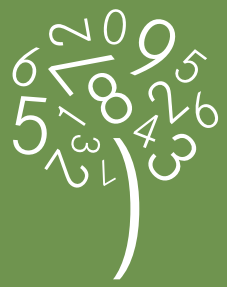
1. Environmental laws and regulations

- Has your company's processing unit done appraisal of your likely compliance status? If so is there any check list available which involves self-accountability regarding protection of your local environment in which the plant is located?
- Do you have any Code of conduct for your industry? What is included in the Code of Conduct regarding pollution management practice?
- What is your firm's level of awareness to be environmentally compliant and your point of view of the enforcement activities in practice (e.g. getting license, environmental clearance i.e. Do you have environmental clearance? If yes, when did you apply for the clearance? When did you receive the clearance? e.g. regular lab tests of the water/soil samples, compliance reports etc.)
- What is the volume of the total waste water generated? Where do you dispose your waste?
- What are the volumes of the generated wastes in terms of Ph, BOD, COD measurements, etc.) and their respective volume?
- What is your water consumption per month? And what is your major source of water?
- Is local government fully prepared to assist you in minimizing the amount of wastes that you generate? If so what steps they have taken so far to help you in this regard? Have they given you any technical assistance to especially reduce the liquid wastages?
- What your firm/factories have to do in order to be compliant with the regulation once they start their operations? (e.g. Renewal of license, water/soil samples to be sent, reports to be written etc.)
- What is your share of exports to major consumers globally? Have you been ever pressurized by your consumers regarding conformance to international environmental standards?
- Have there been any regulatory or non-regulatory liquid waste assessments done so far? Have they identified the options to reduce /abate or eliminate these waste streams polluting the environment in terms of water or soil pollution?
- Whether a license or any environmental clearance has to be obtained before starting any new activity (e.g. what are the rules and conditions? How much it cost you to be compliant?)
- Has your firm faced any challenges to fulfil the compliance regulations? Are those regulations realistic and in use globally and /or in other cities of Pakistan? Is government is of any help or assistance and facilitating the whole process in order to stay environmentally compliant?(e.g. challenges (e.g. lack of funds, understaffed agencies, corruption/bribery etc.)
- Have you been ever given any notices on account of regulatory actions (e.g. whether the plant has been inspected in the past. When was the last time it was inspected? How many times has it been inspected in last two years? What were the subjects of inspection? E.g. Waste water drainage & Sludge management or any other like technical issues, labor regulations etc. Has your firm been subject to penalty? If yes, what was the amount of fine?
- What is the share of the local workforce employed by your plant? Is your plant participating regularly in a trade association? Has your plant voluntary done or is planning to do any environmental agreement?
- Have you received citizen complaints? Or are there any negative media reports about your plant causing pollution in the locality?
- Do you experience complaints/pressure from local communities, industrial association or regulators with regard to contaminating local natural resources i.e. land or water?

- Are there any specific environmental laws and regulations that regulate the polluting activities specifically related to the textile wet processing sector in Faisalabad region?
- What in your point of view are the most important/relevant pollutants and corresponding standards (e.g. BOD, COD, and pH in water and particulate matters)
- What is your category in terms of water based wastes' classification? (e.g. red/orange category) and corresponding requirements?

2. Monitoring and enforcement

- Who is in-charge of environmental regulation enforcement? (e.g. his profile, size of the service in charge, number of staff, number of factories to be inspected in Faisalabad region.
- Point of view of the regulatory body Environmental Protection Agency in Pakistan) including information on the number of inspections, number of fines etc.Do you have any Code of conduct for textile industry? What is included in the Code of Conduct regarding pollution management practice?
- What are the steps which are involved in facilitation process in order to stay environmentally compliant? Is the process too costly and/or too complicated?
- What are the inspection procedures (e.g. choice of firms to be inspected, inspection process, level of the fines, etc.)What were the subjects of inspection? (E.g. Waste water drainage & Sludge management or any other like technical issues, labor regulations etc.)
- What is the level of awareness in EPA-M&E and related Govt. Dept. about environmental regulations audits compliance (e.g. compliant/non-compliant textile firms) and you r point of view of the enforcement activities in practice (e.g. licensing/environmental clearance i.e. what does involve environmental clearance? How much time does it take to apply for the clearance and receive the clearance? e.g. regular lab tests of the water/soil samples, compliance reports etc.)
- Do firms have to face any challenges to fulfil the compliance regulations? Are those regulations realistic and in use globally and /or in other cities of Pakistan? Is government is of any help or assistance and facilitating the whole process in order to keep these firms stay environmentally compliant? (e.g. challenges (e.g. lack of funds, understaffed agencies, any other legal/documentation issues etc.)
- Are textiles processing plants voluntary doing or planning to do any environmental agreement?
- Have you received citizen complaints? Or are there any negative media reports about these plants causing pollution in the locality?
- Do you experience complaints/pressure from local communities, industrial associations or regulators with regard to these plants contaminating local natural resources i.e. land or water?



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