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Implementable Recommendations for Cleaner Production Programs in Pakistan

Executive Summary

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TASK OFFICER:
Javaid Afzal, Senior Environment Specialist
World Bank Resident Mission
Islamabad–Pakistan
Off: +92- 51- 9090161
Cell: +92-346-5304070

CONSULTANT:
Ch. Laiq Ali
345, Street-33, Sector F-11/2
Islamabad–Pakistan
Off: +92- 51- 2113452 and 2103463
Cell: +92-300-5008239

1. Introduction

The Government of Pakistan (GoP) under the leadership of the Ministry of Industries and Production (MoI&P), is planning to adopt an industrial policy that will foster broad collaboration between the public and private sectors and provide incentives for sustainable private investments. The GoP has requested non lending technical assistance from the World Bank to support the development of such policy. One of the specific areas where Bank assistance has been requested consists of providing guidance to the GoP to mainstream sustainability considerations in the industrial policy under preparation, taking into account the strong linkages between environmental protection, sustainable use of natural resources, technological innovation and diffusion, and business competitiveness. The terms of reference (ToRs) for this study focus on the aspect of the bank's technical assistance that concerns evaluation of Cleaner Production (CP) Programs in Pakistan. MoI&P has requested the World Bank to help in preparing implementable recommendations of the CP programs that are in-line with the National Industrial Policy.

The concept of CP was first introduced by UNEP in 1989[1]. CP is aimed at minimizing possible environmental impacts by changing the entire product itself or by improving the efficiency and life cycle. In Pakistan, Cleaner Production Center (CPC) Sialkot, Cleaner Production Institute (CPI) Lahore (through its office in Lahore, Faisalabad and Karachi) and National Cleaner Production Center - Foundation (NCPC-F) Rawalpindi have played a vital role in introducing the CP concept but still a lot remains to be done. The idea of CP got attention of the industry owners as it is cost efficient way of meeting environmental and legislative requirements. Further, the investments involved in CP implementation are paid back through process and improvement in cost efficiency.

This purpose and major focus of this assignment was to achieve the following two objectives:

1. Review Pakistan's Draft National Industrial Policy and to evaluate Pakistan's experience with CP programs.
2. Make specific recommendations regarding interventions that GoP can carry out to strengthen CP efforts to serve the following two purposes:
    a. Enhancing the firms' competitiveness; and
    b. Contributing to meeting Pakistan's environmental priorities.

The information gathering strategy was based, in part on, (i) review of Draft National Industrial Policy; and (ii) review of CP reports (World Bank supported studies) and other secondary data available for CP programs.

The specific implementable recommendations have been prepared duly backed up by evidence from the various data gathering activities described above and are in conformity to the draft national industrial policy. To establish the soundness of this policy advice, the recommendations have been substantiated by critically evaluating the results from the survey and case study work.

2. Survey Results

A survey of firms and related stakeholders of those firms in leather, textile processing, pulp & paper, sugar and oil & gas sectors in which CP interventions have been introduced with the help of various CP centers was carried out in 2009-10. Detailed survey results and its analysis are delineated in Survey Results section, however a brief summary of results is indicated below:

[1] According to UNEP, waste is considered as a "product" with negative economic value. So any approach that eliminates or reduces waste generation increases the productivity of a business by decreasing the negative economic value.

2.1 Overall Manufacturing Industries of Pakistan

In Pakistan, Large Scale Manufacturing at 12.2% of GDP dominates the overall sector. It accounts for 66% of the sectoral share whereas Small Scale Manufacturing accounts for 4.9% of total GDP. The third component of the sector is slaughtering, which accounts for 1.4% of overall GDP. During 2009-10 sectoral contribution to growth from services sector was 59%, industry 30%, and agriculture 11%.

Pakistan's share of world exports have declined from 0.16% in 2002 to 0.13% in 2008 and its economy has suffered heavily since 2001, due to heavy cost paid for Global War on Terror as a frontline state. The visible impact on Pakistan's economy is in the form of: (i) decline in GDP growth, (ii) reduction in investment, (iii) lost exports, (iv) damage/destruction of physical infrastructure, (v) loss of employment and incomes, (vi) diversion of budgetary resources to military and security related requirements, (vii) cutbacks in public sector development funds, (viii) capital and human capital flight, (ix) reduction in capital and wealth stock, (x) energy supply constraints and (x) exchange rate depreciation and inflation. As a result it is estimated that a loss of approximately 2.0% to 2.5% of GDP occurred in 2009-10[2].

The factors responsible for decline in exports are: (i) loss of export orders / trade diversion to competitors; (ii) *"Permanent"* removal of Pakistan from global production and marketing chain of international brands/large buying houses; (iii) relegation to low value added commodity products; (iv) a substantial decline in price/unit value for products; (v) increase in cost of doing business; (vi) loss of design and technological transfer; (vii) a loss of entrepreneurial capital due to capital flight and brain drain; (viii) higher shipment, insurance and security costs; (ix) a reversal of trend towards greater economies of scale; and (x) loss of income, new investment and jobs.

Several CP initiatives have been implemented during the last decade with focus on *Need Assessment, Energy Audits*, provision of *Technical Assistance (TA)* to industry, awareness raising, and implementation of selected CP measures. According to survey findings CP programs are well received and their contribution for meeting Pakistan's environmental priorities, enhancing competitiveness of industrial products, and meeting the challenges in international markets are acknowledged.

2.2 Leather Industry in Pakistan

In Pakistan there are more than 2300 leather processing units that provide employment to about 500,000 people. Leather is a fast growing industry in Pakistan. Production and present capacity of leather sector is reflected in the following Table:

Commodity	Production Capacity	Present Capacity*
Tanned Leather	90 million ft^2	60 million ft^2
Leather Garments / Apparel	7 million pieces	5 million pieces
Leather Gloves	10 million pairs	5 million pairs
Leather Footwear	200 million pairs	100 million pairs
* The difference in production capacity and present capacity is due to various reasons. Reasons have been discussed in later sections of the report.		
		Source: Pakistan Tanners Association

At present major export markets of Pakistani leather are Italy, Spain, Portugal, South Korea, Germany, France, UK, USA and UAE. These markets are extremely volatile and demand highest quality of the merchandise[3]. In Global Leather Trade of US$ 98 billion Pakistan's share is only 1.29%. 75% of leather sector raw material needs are met from local sources and 25% through imports. The technology levels indicate that Pakistan's leather industry mostly relies on the old machines that were imported from various countries in 1970s. Leather industry faces multiple problems, e.g., good quality leather is mostly exported and is not available for value addition. As a result most of the garments are made from low

[2] Economic Survey of Pakistan 2009-10
[3] PAKISTAN's LEATHER DILEMMA by Asad Ali, by UTrade on Tuesday, April 20, 2010

quality leather. Industry is suffering due to inadequate skills, poor knowledge, poor livestock quality and inadequate infrastructure. Due to poor slaughtering and storage practices and diseases 20-25% of hides and skins are damaged.

Cost of Production is very high as compared to close competitors like China and India due to (i) high cost of various inputs such as utilities (electricity and gas), raw materials and labor; (ii) latest leather technologies are not available, they are expensive and there is very poor knowledge about the technologies. Industry is suffering due to multiple taxes, monopoly on supply chain of process chemicals, energy issues, absence of energy efficient technologies, high waste of energy due to poor maintenance practices, etc. In addition, heavy volumes of high pollution wastewater, high volumes of solid waste and air emissions pose a huge environmental challenge.

Cleaner Production interventions have been implemented by Cleaner Production Center (CPC) in Sialkot and by Cleaner Production Institute (CPI) in Punjab and Sindh. Understanding of the CP concept has been assessed; in Sialkot mostly the industry is in Small and Medium Enterprises (SME) sector, has general/no concept of CP, owners are mostly interested in free support and are illiterate/less educated. In Lahore, firms are large, well organized and have clear concept of CP and in Karachi both large firms and SMEs exist. In SMEs owners are less educated and have very little understanding of the CP concept. However, there is wide spread acceptance, owners clearly see the benefits of CP due to its benefits like cost savings, lucrative paybacks, quality improvement, improved health and safety conditions, role of CP for NEQS compliance and image enhancement. Factors that hamper CP implementation included high implementation cost; lack of skills, guidance, supportive infrastructure, CP technologies & poor knowledge.

Firms see huge monetary and other benefits in the form of cost savings; visible improvements towards environmental conditions, working environment within industries, health and safety of workers; compliance to regulatory requirements and enhanced competitiveness for the businesses. Case Study firms indicated an overall decrease of up to 80% in water use due to implementation of water conservation measures. Firms also calculated savings of approximately PKR1.3 million per year due to reduction in thermal and energy losses. Motivational factors for implementation of CP measures were role of CP towards environmental improvement, legal environmental compliance, resource conservation and monetary benefits. However, the impediments faced during implementation of CP were mostly in SME sector that can be addressed through awareness raising, capacity building, strengthening of financial sector and through supportive government policies.

Leather industry is highly pollution oriented; firms in Lahore and Karachi have implemented CP measures, but still were unable to comply with National Environmental Quality Standards (NEQS) requirements. For full compliance they had to install primary and secondary level end of pipe treatment and same is the situation in case study firm of Sialkot. The other important finding is that Pakistan Environmental Protection Agency's (Pak-EPA's) NEQS are very stringent and there is a need for their revision to achievable levels based on the lessons learnt from other regional countries. The reason for non-compliance to NEQS in Sialkot area is that majority of the industry is in SME sector, mostly the industry owners are illiterate and at the same time they are unable to make heavy investments for installation of Effluent Treatment Plants (ETPs). NEQS compliance issue can be addressed through supportive government policies, awareness raising about the CP interventions, specific policies for resource conservation particularly water and energy; and through provision of centralized supportive infrastructure by the government.

All large size firms and the SME's that are export oriented are fully competitive. The factors that contribute for their competitiveness are basically their survival in the international market. They have to be competitive to stay in the market. At the same time there is customer pressure and they have to satisfy the customer demands.

Environmental Management Systems (EMS) implementation in Sialkot is almost non-existent. Majority of the SMEs are not implementing EMS and according to them it is not required in their case as they only work in the local sector. However, in large industries either EMS has already been implemented or they are in the process to implement. Big firms are fully aware about the benefits of EMS and the Certification to ISO 14001.

Survey findings repeatedly indicate that there is a need for establishment of Effluent Treatment Plants (ETPs); in this regard there is a concern that establishment of ETPs is a step towards promoting end of pipe treatment approach; at the same time there are two most compelling factors for this demand, i.e., (1) Pak-EPAs NEQS are very stringent as compared to the standards being followed in other regional countries and their compliance is not possible for most of the tanneries in SME sector (which is almost 90% in the country). (2) Particularly the SME sector is not in position to set aside heavy investments for this purpose when there is no pay back expected and mostly this is considered a dead investment in the industry.

According to survey respondents most of the government's environmental and industrial policies related to the leather sector are not developed in a coordinated fashion and they are not based on the realities faced by those in the sub-sector. Consequently, the policies are neither productive nor implementable Survey respondents felt that in order for policies to be effective, they should ensure a well-defined role for various stakeholders, and either subsidies or legally enforceable financial penalties should be provided. Suggestions from survey respondents are for the enhanced role of government, by having policies encouraging provision of well-designed and well equipped infrastructure for the treatment and disposal of industrial solid and liquid waste. SMEs in Sialkot emphasized the need for centralized effluent treatment plants, and in their view, such treatment plants represent the only way they can meet NEQS. The case study firm in Lahore implements CP measures and at the same time has also installed ETP; as a result it is in full compliance to NEQS.

The survey respondents complained about the poor attitudes and non-professional behavior of staffs within organizations implementing environmental and industrial policies. Concerns were raised about dishonesty, unabated corruption, and unethical approaches that seem driven by the desire for personal gain. Concerns were also raised about those in the tannery sector itself, and these included challenges associated with illiteracy, lazy personal habits and insensitivity of staff members toward the environment. Indeed, many of those within the sector apparently have no knowledge of environmental and industrial policies at all.

2.3 Textile Processing Industry in Pakistan

In Pakistan there are more than 700 textile processing units. Share of textiles and made-up is over 60% of Pakistan's total exports. This sector provides employment to 38% of the total manufacturing labor force in Pakistan and contribution to GDP is 8.5%.

Cleaner Prodution Institute (CPI) thorugh its offices in Lahore, Faisalabad and Karachi has implemented CP interventions in textile processing sub-sector in Punjab and Sindh. In textile processing sub-sector all firms in Lahore and Karachi have the general concept whereas in case of Faisalabad about 1/3rd of the sampled firms have no concept that is mainly due to their low education levels and poor vision about CP. Survey results indicate that CP concept has been well introduced by CPI, it is a good beginning and it was through specific CP related interventions like Program for Industrial Sustainable Development (PISD) and may fade away with the completion of project.

Majority of the firms are implementing most of the CP measures that have been offered and demonstrated to them. CPI services to the firms included; technology identification, evaluation, cost benefit analysis, preparation of technical specifications, general guidance and subsequently the implementation. Factors instrumental for implementing the CP measures are (i) role of CP towards environmental improvement, cost savings, quality improvement, health and safety of workers, compliance to NEQS, enhanced

competitiveness, and lucrative paybacks; (ii) information/knowledge/guidance/training provided by CPI was convincing; (iii) vision of the management, strong in-house technical base, own interest of the industry owners / top management's positive approach encouraged for CP implementation, and (iv) contribution of CP for streamlining of systems and image enhancement. At the same time there are some factors that hamper the implementation of CP measures like, (i) high cost, e.g., replacement of old motors with high efficiency motors; (ii) lack of appropriate technical skills; (iii) non-facilitative role of implementing agencies; (iv) non-availability and high cost of CP technologies; and (v) for compliance to existing NEQS levels and to international customer demands installation of wastewater treatment plant (WWTP) is considered essential, whereas installation of WWTP is heavy investment with no returns – so it is considered a dead investment.

According to respondents in Lahore, Faisalabad and Karachi Textile Processing Sector (TPS) firms, proper calculations/cost benefit analyses were carried out based on real data and under the guidance of CPI staff. Comparative analyses were carried out based on the baseline information collected as part of environment and energy audits. CPI provided the proper training for conducting the related costs and benefits analyses to the participating firm. Some of the costs and benefits received by the firms are indicated below:

a. **Lahore:** Cost for installation of *Caustic Recovery Plant* was PKR 3.8 million; It resulted in significant savings, e.g., in one of the firms upto PKR 1.5 million per month.
b. **Faisalabad:** Cost for implementing CP measures was PKR 9 million that resulted in energy savings of PKR 27 million per year.
c. **Karachi:** The cost for installation of three OGDEN pumps for condensate recovery was PKR 6.5 million for each pump. And, the capacity to recover condensate was at the rate of 6500 kg/hr by each pump, which is a big saving as compared to investment.

The findings clearly indicate that implementation of CP measures significantly contribute for improvement to environmental conditions, compliance to legal requirements, image enhancement of firms, international customer satisfaction, cost savings, consistency in quality and quality improvement and improvement to work environment. This perception has been endorsed by the case study firms in Faisalabad and Karachi. However, generally the impediments faced were; production loss due to shut downs for implementing CP measures; high cost / financial constraints; lack of motivation in owners; implementation of CP measures at complex locations; non-facilitative attitude/behavior of government implementing institutions; and poor planning while implementing CP measures; etc.

73% firms in Lahore are not in compliance to NEQS, 14% in Faisalabad and 40% in Karachi are in full compliance. There is a need for policy intervention in this area to conduct in-depth analysis for not working towards NEQS compliance particularly in Lahore. At the same time government has to look into the situation for investments in areas like establishment of centralized ETPs. As the perception given by the firms during interviews was that the compliance to NEQS is not possible without installation of ETPs. According to case study firm in Karachi they are not in compliance to NEQS because they do not have the ETP, however, the firm is currently in process to install the ETP and expects that they will be in compliance to NEQS in future.

100% firms in Karachi, 43% in Faisalabad and only 9% in Lahore are competitive. The reason for 100% competitiveness in Karachi is the fixed customer base and in-house capability to implement CP measures such as energy/water conservation measures and good housekeeping practices, whereas the reason for non-competitiveness in Lahore and Faisalabad is the impact due to current law and order situation, increasing cost of raw material and labor, frequent load shedding, high tariffs/non-availability of electricity and gas that leads to high production cost. According to case study firms their competitiveness has enhance due to implementation of CP measures through enhanced image at international level, improved quality and decrease in cost of production.

45% firms in Lahore, 36 % in Faisalabad and 80% firms in Karachi are implementing the EMS. The main reason for EMS implementation is the demand from international customers and subsequently the new international business for the firms. To reap the benefits of CP program and EMS, there is a need to introduce sustained efforts towards awareness about the benefits attached to EMS for its 100% introduction as a policy and as part of CP program. Firms understand the benefits of EMS and are working for certification to ISO 14001.

2.4 Sugar Industry in Pakistan

There are 84 sugar mills in Pakistan. Sugarcane acreage in Pakistan is 5th in the World and it is grown on over 1 million hectares. Pakistan ranks 15th in the World for sugarcane production[4], it also produces by products like (i) Alcohol (used by pharmaceutical industry), (ii) Ethanol (used as a fuel) – have the capacity to produce over 2.5 million metric tons of molasses available for processing into ethanol; have exported 273,000 tons of ethanol in 2007, (iii) Bagasse (used for paper and fuel, raw material for chipboard manufacturing).

CPI offered 37 CP options to 11 sugar mills in Punjab and 17 sugar mails in Sindh. In sugar sector of Pakistan mostly the concept of CP is well understood and they fully understand the benefits of CP in the form of its role for environmental protection, cost savings and eventually on the cost of sugar production that contributes to the competitiveness of firms.

Survey results reveal that in Punjab and Sindh there is wide scale acceptance of CP program due to various benefits to the firms in the form of cost savings, environmental improvement, efficiency improvement, impacts on workers health and safety conditions, etc. Comparatively the acceptance of CP program was more in Sindh than in Punjab (one reason for this outcome is that in Punjab the sufficient information could not be obtained).

Survey results indicate that in Punjab, the participating firms did not use any specific methodology to estimate costs and benefits rather rough estimation was carried out, e.g., general estimation of the bagasse quantities at the start and end of the crushing season was taken to estimate the savings. However, the firms in Sindh carried out the proper "Cost Benefit Analysis" with investments vs payback comparison for each CP option that they implemented. For example as a thumb rule the steam savings are 2kg of steam produced per one kg of bagasse use with insulation of bare hot surfaces.

In Punjab, it was the public pressure to improve the environmental conditions. In Sindh province, the mill owners and the managements are fully aware of the benefits of CP program towards environment, health and safety issues, social responsibility concerns and benefits like cost savings and believe that it can be achieved through implementation of CP program. Generally there were no impediments; however, the only impediment indicated in Sindh was that designing /installation of Composting Plant was a new experience. Knowledge and help for designing and installation was requested from other sources.

Sugar sub-sector firms both in Punjab and Sindh have the awareness about environmental concerns and are working in this direction by taking appropriate measures. However, none of them is in compliance to NEQS yet. All firms are responsive towards CP program and are fully aware of its role towards environmental compliance.

Sugar sub-sector firms in both the provinces are fully competitive. Implementation of CP measures like installation of economizer was instrumental for significant cost savings that has an impact in the form of reduction in the cost of production.

Sugar sub-sector firms in both the provinces have knowledge about EMS and are working in this direction as part of CP program. However none of them is ISO 14001 certified yet.

[4] USDA Foreign Agriculture Service, GAIN Report No. PK 1104, Pakistan Sugar Annual 2011

2.5 Pulp & Paper Sub-Sector

CPI had just picked up this sub-sector for CP interventions when the survey was carried out in May 2009. Only one firm in Lahore area was visited during the survey. The findings in this particular firm were that they have a complete understanding of the CP concept. And the mill ownership/technical management are fully qualified, educated and very well skilled people. Proper systems were in place and mill's operations were being managed very well in accordance with the latest technological developments.

2.6 Oil and Gas Sub-Sector[5]

NCPC-F is serving the Oil and Gas sub-sector firms with the implementation of CP options like process design modifications, good housekeeping, life cycle assessment of products, energy/water conservations practices, hydrocarbon emissions quantification and reduction, training through demonstration projects, soil & ground water remediation, waste minimization audits, flue gas dispersion modeling, caustic disposal, etc.

As per survey of the firms the implementation of CP measures has shown significant savings. Attock Refinery Limited (ARL) recycles/reuses 3% – 4% (approximately 10 million gallons) of its effluent water. By implementing energy conservation and efficiency improvement measures during the year 2007-08 it saved the following:

1.	Reduction in Fuel Gas Consumption due to minimization of Hydrogen Rich Gas Flaring	1,556,074	lb/year
2.	Reduction in Furnance Oil Consumption by optimizing steam production	9,926,379	lb/year
3.	Reduction in Fuel Oil Consumption by installing new heaters	1,185,419	lb/year
4.	Reduction in CO_2 emissions by installing solar water heaters	23.1	Metric Tons
5.	CO_2 Emission reductions through electric power reductions	0.49	kWh/BBL

The main motivational factors that encouraged the firms to implement the CP measures included the consistency in the quality of the final products, CP's impact on the environment, cost savings and its role towards enhancing the competitiveness.

Refinery operations are very complex to run without proper planning and technical knowledge for day to day solutions. ARL targets for zero effluents, the use of RO plant did not prove successful due to oily water and sludge. The firm is facing lot of technical problems that are being sorted out. In addition, crude oil comes from three wells in Kohat area, before transportation segregation of crude is carried out. Attock Refinery Limited (ARL) and Oil and Gas Development Corporation (OGDC) have jointly carried out testing, analysis and lot of research for segregation of crude oil that took about six months. It is calcium based crude and first experience for Pakistan (very rare and poses a lot of challenge).

ARL is in full compliance to NEQS parameters. Implementation of Caustic Control measures has helped ARL to achieve compliance to NEQS priority parameters that has enhanced the comfort level of ARL.

ARL operates in sellers market. Whatever is produced, market is always ready to accept it (there is no competitiveness problem). ARL quality is always good, it exports Naphtha and so far has not faced any problems. ARL is certified to ISO 14001 and has its own Health, Safety, Environment and Quality Policy.

[5] Five sampled firms were included in the survey (3 Oil and Gas + 1 Pharmaceutical and + 1 Glass manufacturing industry). From Oil and Gas sub-sector survey of two firms could be conducted. One firm has general concept of CP whereas the other firm has complete concept of CP. 13 different CP measures have been offered to the firms by NCPC-F. Out of two sampled firms; one firm is implementing 7 CP measures and the other is implementing all 13 CP options.

In Oil and Gas sub-sector firms, generally the industry owners/managers are aware of Government policies. Pakistan is facing big challenge in meeting its ever growing energy needs due to expanding population and economic growth. Energy demand is projected to grow to 147 million tons of oil equivalent (MTOE) by 2022 reflecting a phenomenal increase of 245% as compared to 2008[6]. Gas being largest component of energy supply is also projected to decline from existing 4.2 Billion Cubic Feet per Day (BCFD) to 1.6 BCFD in 2022 giving rise to deficit of 7 BCFD. To meet the identified targets, Pakistan's oil and gas industry will need to explore, discover and produce greater amounts of oil and gas than we are today. Increasing exploration is the first and essential step in this process. Exploration and development activity is critical to the long-term energy security of Pakistan and the growth of Pakistan's oil and gas industry. The GoP is committed to accelerate an exploration and development programme in order to reverse the decline in crude oil production, to increase the domestic gas production and supply and to reduce the burden of imported energy which otherwise will have adverse effect on the balance of payments & trade. In the current global energy price environment, Exploration and Production (E&P) Policy has to be dynamic to meet the new challenges faced in meeting energy needs of the country at least cost option and to minimize the adverse effects.

2.7 Performance of CP Centers

A. ***Cleaner Production Center (CPC) – Sialkot***: CPC has emerged as a good institution, it offers good services however, there is lot of room to improve its capacity, e.g. capacity/resources for sustained follow-up and frequent visits to the industry; CPC strengthening in terms of staff capacity building and provision of adequate staff; enhancement/strengthening of laboratory capabilities, etc. is required for its sustainability.

B. ***Cleaner Production Institute (CPI) – Lahore***: CPI has played a very active role for introducing the CP programs both in Punjab and Sindh. CP programs produced excellent results in the form of energy savings, cost savings and environmental improvement/protection. The feedback was that CPI staff strengthening particularly in areas like water/energy conservation, field monitoring and visits, international exposure to learn about latest technology developments is required. Further there is a need that it should develop its capabilities to indentify the funding sources and suppliers for the CP equipment and should work for its sustainability.

C. ***National Cleaner production Center – Foundation (NCPC-F)- Rawalpindi***: NCPC-F enjoys an excellent reputation in the industries, however, it requires improvement in areas like setting-up of an accredited environmental laboratory, has very limited pool of experts that requires strengthening and needs to be built-up so that it has the capacity to provide one window and standalone support for different services on sustainable basis. NCPC-F is not adequately staffed; people are inducted on need basis. Whenever they have more work they start searching for experts or the work is out-sourced. NCPC-F need more environmental engineers to cater the merging needs and as such cannot handle the rush work. An incinerator has been set-up through in-house resources and incinerates the hospital and other solid waste on commercial basis whereas there is a need to set-up state-of –the-art incinerator.

3. Analysis of Cleaner Production and Competitiveness

This section analyzes the correlation between CP and lowering the cost of production, increasing productivity, access to international markets, enhanced international competitiveness and industrial profits. Conclusion of analysis indicates that CP embodies the more efficient use of natural resources and thereby minimizes waste and pollution as well as risks to human health and safety by tackling the problems at their source rather than at the end of the production process. Moreover, implementation of CP measures improves both profitability and environmental performance of firms with no or very little cost. Normally SMEs overlook the environmental and financial benefits of cleaner production activities. For example cost incurred on per ton of steam production decreases from PKR 1030 to PKR 940 per ton

[6] Personal Communication with ARL staff

through proper implementation of CP measures like insulation of bear stream surfaces, condensate recovery, installation of heat recovery boilers, etc.[7] The savings of PKR 27 million by optimizing the consumption of gas, electricity and steam is another example. On the other hand introduction of improved recipes and use of state-of-the-art technologies improve the quality of products. Quality improvement and reduced cost of production significantly enhance competitiveness of firms.

The competitiveness of an economy is closely associated with the productivity of its industry, particularly at the firm level. Strong growth in productivity is essential for maintaining export share in an increasingly competitive world market. Analysis indicates that export oriented firms in leather and textile sub-sectors of Pakistan have started the implementation of CP programs to satisfy their requirements for access to international markets. In spite of the fact that challenges like energy crisis and law and order problems exist in Pakistan, some firms are competitive by implementing CP measures that mostly focus on energy and water conservation and good housekeeping. Proper implementation of CP programs eventually results in industrial profits.

4. Alternatives for Cleaner Production to Increase Productivity and to Enhance International Competiveness

This section provides the analysis of the data gathered particularly the discussion on the alternatives that focus on the factors that are responsible for higher production cost and how the production cost can be lowered and what are the international market requirements that can be instrumental for access to international markets and can enhance the competitiveness of Pakistani industries. The analysis concludes that the competitiveness of an economy is closely associated with the productivity of its industry. Strong growth in productivity is essential for maintaining export share in an increasingly competitive world market. Analysis of different alternatives indicates that CP plays a vital role in this direction.

The supply and price of process chemicals in sectors like leather, textiles, pulp & paper is monopolized, this situation has serious impact on the cost of production and quality of products that eventually affects the export orders and competitiveness of the firms. Steps like direct import of process chemicals by the industry are required to break such monopolies.

Government of Pakistan needs to encourage and facilitate the local leather industry to introduce high tech / energy efficient machines and create a more competitive environment so that monopoly of foreign buyers like China of quality raw materials from Pakistani markets is minimized.

The administrative burden of government regulations can be considered as part of the transaction costs that the regulations brings about and can have ultimate impact on the cost of production. There is a need to design policies for strengthening and smooth functioning of systems to minimize associated transaction costs and the deep rooted corruption in the systems.

Provision of basic CP training to SME sector can significantly enhance the productivity and can effectively contribute towards competitiveness at international level. In Pakistan, SMEs employ about 80 % of the non-agricultural labor force and make a contribution to GDP of about 40% and produce 25% of exported manufacture[8]. The SME sector is suffering from many constraints including lack of access to finance, limited access to markets, lack of infrastructure, hostile business environment, corruption and red tape, weak management and lack of access to skilled labor. Also, many of the government policies are devised from the perspective of large firms and not SMEs. The implementation of SME policies in Pakistan is fragmented and limited and needs to be more effective in light of the SME sector's importance and contribution. Government bodies like SMEDA should take up the role for capacity building of SMEs on the basis of cost of production costing calculation, etc.

[7] Survey findings and personal communication with owners/managers in TPS Faisalabad
[8] www.sbp.org.pk/bpd/Conference/Day_One/SME_in_Pakistan.ppt (6th May, 2010)

The manufacturers of high value-added and superior quality products that can compete in international markets require up-gradation of technology in all segments of the industry. Since the lack of funds for investment in new technology has been identified as a major constraint in technological up-gradation, a technology up-gradation fund should be established that should provide long-term financial support for the installation of modern machinery and equipment.

Diversification of export markets is important for Pakistani industry particularly leather and textile. Pakistan should have two pronged marketing strategy of simultaneously targeting low price and high quality markets.

ISO 14001 standard provides several benefits to the certified firms that opens multiple avenues for the firms in the form of enhanced productivity, competitiveness, more business and more responsiveness for compliance to the local and international environmental standards. Government should encourage SMEs for certification to ISO 14001 as part of Cleaner Production programs by creating awareness, trainings and incentives.

No textile and footwear items can enter EU countries since 01 July 2009 without REACH certification. Government of Pakistan should encourage business community to register themselves with REACH so that their products should be tested and certified and they ensure their share of business in the international markets.

Majority of the developed countries are spending in the range of 2-4 percent of GNP on R & D and even some of the developing countries are spending up to one per cent of their GNP on scientific research and development, whereas the research and development expenditure in Pakistan has been less than 0.25 percent of GNP over the past many decades.[9] There is a need to strengthen research and development efforts with concentrated focus and increased budgetary allocations to research and development organizations.

5. Analysis of Cleaner Production and Environmental Sustainability

This section provides the analysis with focus on Cleaner Production and Environmental Sustainability. The analysis has been carried out keeping in view the correlation of Cleaner Production approaches to meet Pakistan's environmental priorities, industrial development priorities, role of CP for compliance to environmental regulations, correlation of CP with establishment of industrial estates, and land-use zoning. This chapter also analyzes environmental regulations in CP perspective and the required institutional infrastructure for CP implementation. And, finally analysis has been carried out for the required policies and the way forward.

Analysis for implementing the Cleaner Production approaches to meet Pakistan's environmental priorities indicates that introduction of CP programs in the industrial subsectors leather, sports, textile processing, pulp & paper, sugar, steel, power, oil & gas, etc. can play a vital role to manage Pakistan's environmental problems particularly for reduction towards water and urban air pollution. For example water conservation techniques implemented in a leather sector firm in Lahore reduced 80% of effluent load which is an important step towards meeting Pakistan's environmental priorities to control water pollution. The other example is implementation of energy conservation measures that significantly contributed towards Urban Air Pollution control. Analysis also indicated that ensuring quality and efficient use of raw inputs in a production cycle leads to productivity enhancement, value addition, quality improvement, competitiveness enhancement and more sustainability of businesses.

Analysis indicated that Cleaner Production is less likely to be economically attractive within a legal framework that do not place a strong emphasis on environmental regulations or in an economic system that have under-priced or "free" natural resources like water and energy. However, even when regulations

[9] Dr. Shahzad A. Mufti, Chairman, Pakistan Science Foundation

have been established, lack of enforcement minimizes the regulatory intention, e.g., the implementation of NEQS in Pakistan particularly the tannery sub-sector in Sialkot.

Land Use and Zoning Laws are made up of a set of a regulations and policies that implement community goals and protect community resources while guiding new development. In Pakistan, both federal and provincial governments have since 1959 tried to stimulate industrial activity in areas with abundant natural resources and man-power and/or where economies of scale, agglomeration economies as well as markets for industrial outputs are available. Although regulations for controlling both the type as well as extent of industrial activity exit to avoid conflicts with other types of land use, these are sometimes overlooked. Government of Pakistan's National Industrial Policy 2010 emphasis for development of Industrial Estates, Special Economic Zones and Export Promotion Zones.

After more than two decades of experience with environmental legislation and policy development, Pakistan's environmental management framework is relatively mature. Despite this experience, however, significant aspects of institutional design and policy direction remain to be resolved, in particular related to the delineation of authorities, and the promotion of local and mainstream initiatives. An in-depth evaluation of environmental legislative framework and policies in Pakistan with specific focus on framework conditions in the country; internal consistency between PEPA 1997 and its rules and regulation; external consistencies between PEPA 1997 and other related legislations; environmental challenges faced by the country; and provision of environmental legislation and capacity and capability of environmental authorities and other stakeholders especially industry has been carried out in a recent report.[10] It indicates that PEPA 1997 could only be implemented in the range of 5 – 10% only during the last 13 years since its enactment which is very poor performance.

Effective delivery of CP content are orchestrated through regional cooperation strategies, articulation of CP with EMS, and national level centers, the most prominent of which are the Cleaner Production Centers, e.g., CPC Sialkot, CPI Lahore and NCPC-F Rawalpindi. The CP centers have played a vital role in introducing the CP concept and have demonstrated the benefits of CP to the industry and as a result there is wide spread acceptance of CP also. But somehow, due to some policy and other constraints the expected results has not been achieved so far. In 1989, the United Nations Environment Program (UNEP) first introduced the concept of Cleaner Production (CP). The Dutch government extended support to private sector for promotion of CP in Pakistan industries. This resulted in the institutional development, e.g., establishment of CPI and institutional capacity building of industrial associations. It also generated large scale environmental and energy efficiency investments in Pakistan industry and created a huge market for environmental products and services.

Currently, Pakistan's draft industrial policy has been prepared and has been circulated for review and comments. At the same time for the last fifteen years several CP initiatives have been implemented in Pakistan. There is a need to streamline the CP promotion process and put it on the right track. It is the right time to prepare a National Cleaner Production Strategy (NCPS) that can become an integral part of Pakistan's Industrial Policy. Based on international and national experience in cleaner production NCPS should propose a framework for continuing Pakistan's cleaner production activities.

6. Analysis of Alternatives for Promoting Cleaner Production to Address Pakistan's Environmental Priorities

This section presents an analysis of alternatives for promoting CP to address Pakistan's environmental priorities based on the findings and analysis laid out in earlier chapters. An analysis for amending environmental regulations to address environmental priorities and industrial competitiveness needs indicates that economic growth, permitted in a way that does not take into account environmental concerns will not be sustainable in the long term. Similarly, environmental protection which comes at the expense and sacrifice of basic human needs is unacceptable. Implementation of CP programs has a close

[10] Khan, A., (2010), "Evaluation of Industrial Environmental Management in Pakistan", Study prepared for The World Bank, Washington, D. C.

linkage for satisfactory compliance to environmental regulations. To ensure effective compliance the task of the government should be to continue and improve the existing regulations and their enforcement, thus encouraging enhanced environmental performance and implementation of cleaner technologies. Analysis further indicates that domestic market is not ready to pay the cost of environmental compliance and NEQS could not be enforced due to their inherent technical, institutional, and financial limitations.

Analysis indicates that land use laws and regulations exist in Pakistan but their implementation is very poor and industrial zoning and infrastructure is significantly deficient in Pakistan. The export processing zones of Pakistan have met with only limited success. To promote the growth of existing and resource-based industries the government should create industrial estates and agro processing zones at the identified 'hot spots' of economic activity. This should be done while preserving agricultural lands and observing municipal zoning laws.

Analysis indicates that Polluter Pays Principle (PPP) is an environmental policy principle which requires that the costs of pollution be borne by those who cause it. Implementation of SMART program in Pakistani industry is a measure in this direction that could not produce the desired results. It should be re-assessed based on the lessons learnt so far and implemented in consultation with the industry.

The analysis indicates that Energy Service Companies (ESCOs) can effectively help in introducing the CP concepts in Pakistani industry. Some good energy companies and CP centers exist in Pakistan and can take up the role as ESCOs with very little effort.

7. Recommendations

Based on the analysis of findings some implementable recommendations to promote cleaner production programs in Pakistan have been grouped in six groups. Summary of the recommendations is indicated below:

1. Cleaner Production Interventions to Enhance Pakistan's Competitiveness

The competitiveness of an economy is closely associated with the productivity of its industry. Strong growth in productivity is essential for maintaining export share in an increasingly competitive world market. Analysis of different alternatives indicates that CP plays a vital role in this direction. To enhance competitiveness of Pakistan's economy following is recommended:

A. Process Chemicals

In Pakistan process chemicals are imported only through few license holder entities that have the complete hold and the monopoly in the market. As a result, there are serious concerns in the industry, e.g., poor quality of chemicals that have the potential to ruin the quality, timely availability of process chemicals cannot be ensured which is again a serious concern for the industry - a direct impact on the cost of production and the competitiveness of the firms. Leather, textile processing, pulp and paper sector industries are among the biggest consumers of process chemicals and they heavily rely on the imported chemicals due to quality and environment friendliness reasons. There is an urgent need to ensure availability of quality environment friendly process chemicals on competitive market based rates for decrease in cost of production, enhanced competitiveness at international level, more sustainability and more business. For this purpose specific recommendations are made in this section.

B. Leather Raw Material

Good quality leather is mostly exported and is not available for manufacture of value added leather garments & leather products in Pakistan. As a result, most of the leather garments are made from low grade & medium grade leather. Moreover, lack of proper training and inadequate skills in slaughtering are among the most important factors that lead raw hides and skins towards lower grades or even to rejection. Ensuring quality and efficient use of raw inputs in a production cycle leads to productivity enhancement,

value addition, quality improvement, competitiveness enhancement and more sustainability of businesses. To address this important issue specific recommendations are made in this section.

C. Operating and Maintenance Costs and Cleaner Production Training for SMEs

In Pakistan, SMEs consists of about 90% of the Pakistan industry and make a contribution to GDP of about 40% and produce 25% of exported manufacture. In Pakistan particularly among SMEs there are no conscious efforts to determine operation and maintenance costs. By determining actual operating and maintenance costs SMEs can adequately price their products and assess the business profitability. In addition, provision of basic CP training to SME sector can significantly enhance the productivity and can effectively contributes towards competitiveness at international level. Government bodies like SMEDA should take up the role for capacity building of SMEs on the basis of cost of production costing calculation, etc. To address this important issue specific recommendations are made in this section.

2. Cleaner Production Interventions to Address Pakistan's Environmental Priorities

Implementation of Cleaner Production programs significantly contribute towards environmental sustainability. Cleaner Production approaches play a vital role to meet Pakistan's environmental priorities. According to recent estimates (World Bank, 2008), the total cost of the effects of environmental risk factors on Pakistan's economy and populace is now estimated at PKR 968.9 billion per year, or about 15.6% of GDP. It indicates both direct and indirect costs associated with environmental degradation due to water pollution, forest degradation, agricultural soil salinity and erosion, and lead exposure. Ambient air pollution is one of the main categories of environmental degradation; direct costs from high concentrations of particulate matter amount to 1% of annual GDP (for more details refer to section 5.2 in this report). Moreover, contaminated water, urban air pollution and indoor air pollution are the major challenges for Pakistan that have significant health impacts particularly to the 35% of its population living in urban centers. Based on the analysis of survey findings, to address Pakistan's environmental priorities, areas like energy conservation; water pollution, solid waste management, etc. are analyzed and subsequently implementable recommendations are provided in this section on these environmental priorities.

3. Amending Pakistan's Acts and Regulations

Implementation of CP programs has a close linkage for satisfactory compliance to environmental regulations. To ensure effective compliance the task of the government should be to continue and improve the existing regulations and their enforcement, thus encouraging enhanced environmental performance and implementation of cleaner technologies. Based on the analysis following is a brief of the recommendations in this regard:

a) Government should continuously review and improve the existing regulations to encourage enhanced environmental performance and implementation of cleaner technologies and ensure their compliance by enforcing regulatory measures.

b) Implement basic command and control regulatory programs by using economic instruments, voluntary programs, transparency and disclosures;

c) Create awareness and introduce the concept of Polluter-Pays-Principal slowly and gradually in consultation with industrial associations. Re-assess and ensure the implementation of SMART based on lessons learnt in consultation with industry.

d) For effective compliance to PEPA 1997 particularly in SME sector, establish Central Effluent Treatment Plants (CETPs) on public-private partnership basis by activating Sustainable Development Fund (SDF) mechanism.

e) Facilitate industry through soft loans for environmental/clean technology investments and other regulatory measures like zero import duty on environmental equipment; etc.

f) Formulate comprehensive health based air quality standards (AQS) based on a review of existing standards in other regional countries and WHO guidelines.

4. Institutional Re-structuring for Cleaner Production

CP implementation represents a series of actions that go beyond technological changes to policy frameworks, societal attitudes, education systems and business perspectives. In Pakistan the CP concept requires mainstreaming and subsequently the institutional restructuring for its integration in all industrial sectors. To address this important issue following is a brief of the recommendations in this regard:

a) All industrial sectors through their respective industrial associations should form co-operations, partnerships or alliances between businesses, government, NGOs and others to develop the economic, regulatory and political frameworks within which innovation is stimulated. This will allow the firms to deliver more value and performance with fewer resources and less waste, and result in greater business efficiency.

b) While it is industry that implements cleaner production and eco-efficiency, government should provide the environment to encourage industry to move ahead by providing cleaner production friendly environment through regulatory reforms and use of economic instruments.

5. Development of Business Plans to Promote Cleaner Production

In Pakistan SME sector that comprises 90% of the industries, do not have the knowledge, awareness, skills and professional attitude for developing business plans. As a matter of fact, they are absolutely ignorant and do not understand the usefulness/efficacy for developing business plans for the role that they can play in the long run for business sustainability. There is a need to carry forward this capability of SMADA. Following is recommended to promote development of business plans duly integrated with the concept of cleaner production.

a) Government should facilitate existing CP centers to develop and strengthen their capabilities as a service provider to the SMEs;

b) Industrial associations should create awareness about the usefulness and efficacy of the business plans in all industrial sectors;

c) Encourage/facilitate in the form of grants to the consultancy firms, and ESCOs for strengthening their resource pools to offer such services.

d) *As a regulatory measure make it mandatory for every industry to develop a business plan and its implementation should be ensured through a facilitative role and appropriate monitoring through organizations like CP centers, industrial associations and ESCOs.*

6. Monitoring and Evaluation Program for Cleaner Production

Findings of this study indicate that although CP programs have been introduced in selected industrial sectors by the CP centers but somehow to gauge the impact and give the CP programs a policy direction an established centralized monitoring and evaluation mechanism at government level does not exist, which is required for policy direction, integration, and to mainstream the CP concept in all industrial sectors of Pakistan. Following is recommended for this purpose:

a) *Ministry of Industries and Production should establish a dedicated unit within the ministry to keep a regular liaison to receive feedback and updated status on the CP activities from different industries through active involvement of CP centers and industrial associations. This unit should regularly monitor and evaluate the progress and give policy direction to the government for future actions.*