

Pakistan Value Chain Analysis

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Acronyms

ATC	Agreement on Textiles and Clothing
CLCV	Cotton Leaf Curl Virus
CTF	Consultant Trust Fund
DFID	Department for International Development (U.K.)
DGMM	Directorate General Mines and Minerals
EU	European Union
FAO	Food and Agricultural Organization
FATA	Federally Administered Tribal Areas
FFMP	Fat Filled Milk Powder
FIAS	Foreign Investment Advisory Service
FOB	Free On Board
GDP	Gross Domestic Product
GDS	Global Development Solutions
GM	Genetically Modified
GoP	Government of Pakistan
GOT	Ginning Outturn
GPS	Global Positioning Satellite
ICAC	International Cotton Advisory Committee
IFC	International Finance Corporation
IFCN	International Farm Comparison Network
IVCA	Integrated Value Chain Analysis
KG	Kilogram
MFA	Multi-Fiber Agreement
MoF	Ministry of Finance
NMP	National Mineral Policy
NWFP	NorthWest Frontier Province
OH	Overhead
OECD	Organisation for Economic Cooperation and Development
PRGMEA	Pakistan Ready Made Garments Manufacturers and Exporters Association
PSC	Punjab Seed Corporation
SASFP	Finance and Private Sector Development (Department of the World Bank)
SPS	Sanitary and Phytosanitary Standards
SMEDA	Small and Medium Enterprise Development Authority
SSB	Single Sideband
SSC	Sindh Seed Corporation
TCP	Trade Corporation of Pakistan
TRIPS	Trade Related Intellectual Property Rights
UN	United Nations
US	United States
VCA	Value Chain Analysis
WTO	World Trade Organization

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Foreword

The Foreign Investment Advisory Service (FIAS) and the World Bank's South Asia Finance and Private Sector Development (SASFP) Department were invited to assist the Ministry of Finance (MoF), and the Government of Pakistan (GoP) more generally, in analyzing the cost parameters of a few representative products in the economy so as to understand and alleviate any critical policy bottlenecks to their competitiveness.

The value chain analysis (VCA) methodology quantifies the costs associated with getting a product to market, from sourcing of raw materials and intermediate inputs to production of the final good and logistics of getting it to the end consumer. The study provides a lens for understanding the inefficiencies along the entire supply chain of selected products in Pakistan, with a focus toward prioritizing key sector specific impediments and identifying cross-cutting policy interventions to improve competitiveness. By advocating reforms to strengthen microeconomic sources of competitiveness, the study hopes to contribute to facilitating private investment, growth, and employment generation.

The sectors, and products within these sectors, selected for study were based on their economic importance (in terms of contribution to GDP, employment, and exports), geographic coverage (factory sites were visited in Lahore, Islamabad, Karachi, Peshawar, Swat, and Multan for firms that have operations in other areas of the country as well, including Balochistan and FATA), diversity in range of products and manufacturing processes, exposure to policy and market impediments, existing or potential exportability, and linkages between small and large firms as well as rural and urban markets.

Complete value chains have been constructed and analyzed for four products: a standard pair of denim jeans (from the textiles & garments sectors), powdered milk (dairy sector), processed shrimp (fisheries sector), and marble (quarrying & mining sectors). For each of these products, absolute costs as well as the share of total costs for each process in the value chain has been identified, from sourcing raw materials to the factory gate cost. In addition, logistics costs associated with transferring the good at the vessel (FOB cost) have also been presented. Data presented is based on field work undertaken during February – May 2005.

The value chain for the final product is presented first, broken down into production processes; for each value chain, the three highest cost processes are further broken down into sub-value chains to determine the factors driving their high costs. In some instances, the high share of these costs in the total cost of the product is merely a reflection of the cost structure of the industry – for instance, fresh milk (raw material) is bound to be a major cost in producing powdered milk. However, the real value of the study is in identifying parameters that can be influenced to reduce overall product cost – for instance,

even though cost of fresh milk is a significant share of total powdered milk cost, it is disproportionately higher than international benchmarks and can be lowered by reducing the collection costs associated with sourcing fresh milk. In addition to looking at the three highest cost processes in each product value chain, data is also presented in Annex A on the three highest “cross-cutting costs” – i.e., aggregated input costs in producing the final product (e.g., labor cost, aggregated across all individual production processes).

Factors impeding an individual product’s competitiveness are often barriers to business activity in the economy more broadly. Even just among the four products analyzed in this study, common issues emerge and are presented in the first chapter. By using the value chain methodology, the study aims to identify various reform options that the Government of Pakistan can consider in attempting to enhance product competitiveness, actions that will also impact the overall business environment.

A brief analysis of radiators (from the auto parts & light engineering sectors) has also been included in this report. However, since the product analysis indicates that protectionist policies have stunted the sector’s technological development, the complete value chain for the product has not been presented here so as not to make recommendations on reducing costs on the margin when the technology needs to be completely overhauled.¹

Global Development Solutions (GDS), a private consulting firm based in the United States, was retained by FIAS to undertake the field work and associated data gathering for this project over the period February to May 2005. The current report,² based on the data collected and processed by GDS, has been written by Tom Maxwell, a prominent trade economist retained by FIAS, with inputs from Fatima Shah, Roy Pepper, Uma Subramanian, and James Crittle at FIAS as well as Moazzam Ahmed at the IFC’s Karachi office and Anjum Ahmed and his team at SMEDA. The report also benefited from an interim stakeholder workshop carried out in March 2005 collaboratively with MoF, SMEDA, SASFP, and FIAS. However, since final findings in this report have not been discussed with stakeholders, it is recommended that further consultation be built in to the solution design stage prior to implementation of recommendations.

¹ A value chain for apple juice was also constructed in an earlier iteration of this report (and can be found in the World Bank’s NorthWest Frontier Province Economic Report, December 2005). However, it was found that apple farmers were producing apples at a loss and were switching to harvesting peaches. As such, this value chain has been omitted from the current analysis.

² These consultant inputs were funded by FIAS (56%), Consultant Trust Fund managed by the World Bank’s Investment Climate Department (37%), and a DFID Trust Fund managed by the World Bank’s PREM Department (7%).

1 Cross-cutting Issues

This chapter summarizes and discusses issues that were common to at least two of the 5 products analyzed: automobile radiators, denim jeans, marble tiles, processed milk and processed shrimp. It briefly describes the nature of the issue as it is manifested in each product/ sector. Recommendations and reform options can be found at the end of each product specific chapter.

The principal objective of the Study is to examine, quantify and prioritize key microeconomic factors affecting Pakistan's competitiveness through analysis of the cost structures for a few representative products/ sectors and thereby identify important policy, administrative and regulatory factors affecting the costs of production. The value chain analysis (VCA) methodology used in this report quantifies the costs of each stage of processing a product and delivering it to the market. A representative firm³ in the middle of the chain (e.g. processing stage) is identified with the assistance of domestic sectoral associations. Backward and forward links are then examined to develop a complete cost structure (value chain) for the final product and to delve into some of its high cost parameters. This technical analysis is placed into context by examining the economic, administrative and regulatory environment in which the firm is operating since the broader business environment is, of course, central to firm performance. The result is thus a blend of detailed micro-analysis embedded in a broader macro-analysis.

This approach yielded different results in each of the sectors as a reading of the individual sector chapters will reveal. The case of **automobile radiators** provides a salutary lesson on the dangers of protection since attempts to "force-feed" a domestic auto-radiator industry by linking it to domestic automobile assembly coincided with the emergence of a new technology in the rest of the world. By shielding the manufacturers from technological changes embedded in imported parts, the domestic auto-radiator industry has become technologically obsolete internationally and only able to supply radiators for cars assembled in Pakistan under the current highly protective regime.

The analysis of **denim jeans** shows the need to continuously enhance technical labor skills if product diversification and the move to up-market (higher value) products are to be successful. The upstream elements (cotton, ginning, spinning, etc.) demonstrate the importance of uninterrupted electrical supplies and the need for improved farming techniques, including the continuous development of new disease and virus resistant seed varieties. The value chain also exposes a subsidy in cotton prices due to a lack of impartially

³ In some instances, more than one firm example is presented when the sector exhibits tiers of firms with important differing characteristics – e.g., in the dairy sector, a small (herd size) farmer and a large farmer are both examined; similarly, in the garments sector, cost structures are presented for a large integrated denim jeans producer as well as a medium sized non-integrated jeans producer.

administered cotton grading standards and a subsidy in irrigation water prices. Correcting these will result in more efficient cotton growing and ginning but will place price pressures on the jeans manufacturers, who in turn will have to increase expenditures on upgrading their technical abilities. Finally, the analysis highlighted the issue of inefficient water use and the need to move towards economic pricing of the resource.

The analysis of the **milk processing** sector reveals that even though Pakistan has internationally competitive cost of milk at the farm, losses in collection (due to a large number of geographically dispersed small scale farmers and rudimentary chilling methods) reduces its competitiveness by the time the milk has been delivered to the processors. While roadside chilling technology is available it requires power (not always available in rural areas) and is expensive. A similar story can be told for small scale portable chillers for use during collection. Key constraints include a lack of affordable technology to reduce losses during collection, a widespread lack of knowledge about dairy herd management, and the constraint placed on the growing of green fodder by the current irrigation system, all of which result in poor milk yield per animal. Any reduction in losses (or increases in production) in the near term are, however, likely to be absorbed by the domestic fresh milk market (an unfilled domestic demand for fresh milk exists) rather than fuel an export sector since trade in dairy products is skewed by heavily subsidized sectors in the EU, US, and Canada. In addition, Pakistan will need to meet international sanitary and phytosanitary requirements if it wants to develop an export sector.

The value chain for **marble tiles** shows the importance of secure mineral extraction rights, for insecurity in stone extraction rights leads to not only the use of wasteful stone extraction methods (resulting in a 65% loss before initial cutting) but also hinders the financing of new modern more efficient methods. The processing sub-sector is hindered by expensive and unreliable electricity, inferior machinery, and a lack of skilled labor. When combined with losses incurred during transportation of the raw block from the mine to the processor and then of the semi-finished tile to a second processor, these factors result in an overall loss rate approaching 85%, among the highest in the world.

The **shrimp sector** is facing severe financial pressure from rising diesel prices (the major cost element) and from low catch rates. While there is strong circumstantial evidence supporting the hypothesis of an overall decline in fish stocks, only a full fish stock survey could answer this question fully. As under current conditions, Pakistan is a high cost producer compared to such countries as Bangladesh and Indonesia, both of which are aquaculture based, the analysis suggests that a move towards aquaculture should be seriously considered. While the analysis identifies areas where greater efficiencies in catching wild shrimp (89.2% of the cost of processed shrimp is raw material) are possible, these improvements will not be sufficient to offset the high costs faced by the sector. If aquaculture is adopted, the economics of catching wild

shrimp will need to be re-examined to see how (and if) it could be made competitive with farmed shrimp.

The issues that were common to at least two of the four sectors studied in detail are identified in Table 1 below and are discussed in the text following. In so far as it is possible to determine priorities from the analysis, they are arranged in descending order of importance.

Table 1: Cross Cutting Issues

Issue	Dairy	Jeans	Marble	Shrimp
Waste	●	x	●	●
Water	o→●	o→●	o→●	x
Training, Skills and Knowledge	o	●	●	o→x
Standards	o→●?	x	●	●
Finance	x	x	x	x
Electricity		●	●	
Protectionism and Trade Barriers	●	x		

Note: ●-Very Important, o-Important, x-Secondary, and blank-not mentioned

Waste

The phenomenon of high wastage rates, while attributable to different causes in each sector, is an important factor in all four sectors.

In **dairy**, the losses during the collection process (from the farm to the processing factory) due to lack of proper chilling techniques (the ice used is often contaminated), are 20% — sufficient to offset Pakistan’s advantage of being a relatively low cost producer.

In **marble**, where 85% of the stone quarried is lost in the conversion to finished tiles, the main source is the inappropriate extraction techniques currently in use (due to a combination of uncertainty about property rights leading to “quick and dirty” blasting techniques, and ignorance of modern efficient extraction techniques), compounded by losses during processing resulting from dilapidated equipment and subsequent damage during transport to finished and semi-finished cut stone (partly attributable to a lack of proper packing).

There are significant losses (35%) between the point **shrimp** are caught and purchased by the processor. These are attributable to bad catch handling techniques, contaminated ice (in both the fish hold and the auction area), and a lack of hygiene in the auction area.

In **jeans** production, the issue of wastage occurs principally in the cotton and ginning sectors, where higher quality cotton gets blended with lower quality cotton.

Water

Issues concerning the availability, price and quality of water appear to varying extents in all four sectors.

The quality of water, principally caused by contaminated ice, is responsible for a significant portion of the wastage in the dairy and shrimp sectors, as discussed above. However, the issue of the availability (and hence price of water) is also a rapidly emerging issue in all of the sectors studied. In **dairy**, where it is impossible to have green fodder (and hence higher milk yields) year-round without irrigation, the inadequate supply of water in the canal system is forcing farmers to drill and operate their own wells.

The problem is more pronounced in the production of **jeans** where inappropriate and wasteful use of water is hindering cotton growing (chapter 2 contains a fuller discussion).

Polishing **marble** requires copious amounts of pure water and since public supply is inadequate, marble processors are forced to pump and purify their own water.

Proper hygiene in the **shrimp** auction hall requires copious amounts of water, well beyond the current capabilities of the public system.

Training, Skills and Knowledge

Inadequate investment in labor skills is a recurrent issue in all the sectors studied.

In the **dairy** sector, a lack of knowledge about proper herd management techniques is causing milk yields to fall below potential. Also a shortage of veterinarians and technicians results in poor herd health, high calf mortality and long intervals between calves (and hence milk bearing periods) due to ineffective artificial insemination techniques.

In **jeans**, a lack of in-house design capabilities and skilled workers to implement new washing, dyeing, finishing, stitching and embroidery techniques is hindering their ability to move up-market to higher value jeans. The lack of training and skills adversely affects productivity levels in the smaller and medium scale jeans makers.

The lack of skills and knowledge is likely most pervasive in the **marble** sector. Even in areas where there is a *de facto* security of extraction rights, a

lack of knowledge of modern efficient extraction methods is perpetuating the use of inefficient blasting techniques and the consequent waste (there are currently no qualified quarry masters in Pakistan). A lack of skills when combined with dilapidated cutting and polishing machinery hinders their ability to meet international standards.

In the case of **shrimp**, even though the scale of sustainable fishing is uncertain, a lack of knowledge of efficient fishing and catch handling techniques is resulting in a below potential catch (though the extent of this is difficult to determine in light of the lack of knowledge of fish stocks).

Standards

Problems in meeting the standards demanded by international buyers emerge as very important issues in three sectors (marble, shrimp, and dairy) and a latent one in jeans.

In the **dairy** sector, not currently an important exporter, sanitary and phytosanitary standards are a domestic health issue. However, once (and if) Pakistan starts to export dairy products to countries with rigorously enforced sanitary and phytosanitary standards, meeting them will become an issue; with the current system of many dispersed small herds, it will be very difficult to enforce standards at the farm level.

The problem in the **shrimp** sector also concerns meeting sanitary and phytosanitary standards. One of the causes is the use of contained ice (discussed above) not only in the fish holds but also in the auction hall. Further, half the hall is not roofed over and hence exposed to the sun, and also worker hygiene (spitting and smoking) is lax. Even though the future size of the shrimp fishing industry is uncertain, a move towards aquaculture would increase sector output and possibly export, requiring that these concerns be addressed.

The issue is quite different in **jeans**, where a lack of impartial and trusted implementation of existing cotton grading standards is distorting the market and resulting in a depressed price for lint. While this may appear to be to the advantage of jeans manufacturers (who only need coarse cotton), in the longer run it disadvantages the farmers and those other manufacturers who need higher grades of cotton.

The problem in **marble** arises from the inability of the gang saws currently in use to cut marble slabs to international tolerances. For example, slabs can vary by as much as 3-4mm, while international buyers will only accept deviations of 0.5-1mm.

Finance

While collateral and access to finance appear as issues constraining all several sectors in some way, the specific circumstances in each sector (e.g., significant cash flow problems as in the case of the fishermen in the shrimp sector) make it difficult to determine whether the problem reflects a rational decision by lenders not to lend, or a failure of financial markets. Still, the analysis clearly points to the lack of options faced by small scale enterprises or farmers in terms of choices of finance.

While direct exporters are able to use their past export performance as a basis for obtaining credit, the same does not apply to indirect exporters (that sell intermediate products, e.g., woven fabric, to firms that use them to make export products, e.g., **jeans**). Establishing credit history is, of course, much harder for small scale cotton farmers and **shrimp** fishermen who rely on agents to purchase their crop/ catch in advance and then lend the farmer/ fisherman the money to purchase the needed inputs and cultivate the crop, or catch the shrimp. If small scale lending institutions were trained in evaluating such loans and the farmer's and fisherman's past repayments were recorded in the credit registry, then instead of being forced to sell his crop/catch to an agent, the farmer/ fisherman could sell it on the open market. While the risk of the transaction (e.g., a crop failure or a bad catch) would remain the same, the farmer/ fisherman would have the choice of assuming the risk himself or by selling in advance to a middleman and so shedding some of this risk, albeit at the cost of a higher implied interest rate.

Access to (rather than choice of) finance will become a greater problem in the future once some of the sector-specific constraints have been removed so that some of the sectors are financially more viable (e.g. marble, shrimp, and dairy sectors). In the case of **marble**, the establishment of secure extraction rights combined with the necessary training will justify the use of modern extraction methods and the associated new investments. The increased supply of regularly dimensioned rocks will in turn require additional investments in modern processing equipment. All of this will require credit which the current system is not well placed to deliver. Similarly, finance will play a role in the **dairy** sector once consolidation, coops, or extension services to farmers lead to reduction in collection costs, increases in output, and viability of investments in chilling technology to reduce transportation losses.

Electricity

Both the price and unreliability of electricity are important issues in the jeans and marble sectors.

In the case of **jeans**, the concern starts upstream at the ginning sector, where the price of electricity is blamed for a lack of drying of the lint. The spinners are adversely affected by both the price and the unreliability in the supply of

electricity, in some cases being forced to resort to self-generation with extra costs. Concerns were expressed throughout the sector about the costs of interruptions in the electricity supply which in some of the cases studied were between 3 and 10 times per day.

While the remote location of the marble mines almost necessitates self-generation, the machines used to cut and polish **marble** at the processing facilities (located in more developed areas) are heavy users of electricity. The finishing techniques currently in use are labor intensive, but the modern mechanized processes needed to meet international standards require intensive use of electricity; hence their adoption will be hindered by high electricity prices.

Protectionism and Trade Barriers

This is front stage and center in the case of automobile **radiators** in which misguided Government policies to protect the domestic industry have severely handicapped the sector (see chapter 6).

Trade barriers have also had an effect on **jeans** manufacturing, in which imported inputs used in washing and dyeing are important. These chemicals are expensive but essential and while the import duty paid is eventually refunded, the resulting interest-free loan to the Government has a negative effect on cash-flow.

The issue of trade barriers is different in the **dairy** sector, where developed countries dominate global trade through a system of domestic subsidies and import restrictions.

2 Constraints to Competitiveness in the Textile and Garment Sectors: A Denim Jeans Example

Pakistan, partly aided by subsidized cotton prices, has succeeded in developing an export based jeans industry. However, a lack of technical expertise in some aspects of manufacturing higher value jeans (design, washing, finishing etc.) is constraining the sector from moving up-market. Problems in the cotton growing, ginning and spinning sectors are also adversely affecting the industry. Raw cotton is vulnerable to a number of pests and viruses and there is a shortage of new resistant varieties, leaving the harvest vulnerable to an attack by the Cotton Leaf Curl Virus. While farmers are getting irrigation water at below the economic cost (a major factor in the subsidy), inefficiencies in irrigation techniques and shortages of water are adversely affecting their crops. A failure to impartially implement cotton grading standards, and hence to financially reward higher quality cotton, has resulted in inferior quality lint, which in turn causes higher losses during ginning. While this has had little effect on jeans, which use lower quality cotton, it adversely affects the cotton sector as a whole (e.g., other potential exporters planning to use higher quality cotton fabrics).

Introduction

This chapter explores the constraints facing the Textile and Garments sectors in Pakistan. The garments sector is export oriented and produces different types of products, principally from domestically grown cotton, but also from imported cotton and small amounts of synthetics. This diversity presents an analytical and presentational challenge, and rather than conducting a broad survey of the sector, this chapter analyzes in detail the value chain of a representative product.

The VCA examines and quantifies the constraints faced by jeans manufacturers. These constraints, while specific to the product being examined, will in many cases be relevant to the whole sector. Further, in view of backward and forward linkages in the sector and the competitive advantage provided by low priced domestic cotton, the analysis extends upstream to the cotton weaving, spinning, ginning and farming sector.

The chapter flows as follows. First an overview of the global market and Pakistan's relative position in it, and then the detailed value chain analysis of two jeans manufacturers, one small and one large, chosen as being representative of the sector. The VCA is then extended upstream to textiles production, ginning, and finally cotton farming. The final section sums up the challenges facing the sector and presents options for addressing them.

Overview of the Global Market and Pakistan's Competitive Position

The garment sector faces a highly competitive and price-sensitive global market where large scale end buyers such as Wal-Mart, Gap and Levi's define the price, quality and delivery requirements and source competitively from a number of suppliers. On the other hand, Pakistan's domestic market for garments is limited to lower end products as well as cheap informal imports from China and other countries. Considering the low average purchasing power of Pakistanis, one of the few domestic market segments that could show growth opportunities is the urban middle-class. None of the major exporters of garments interviewed exhibited any two-tiered approach towards addressing both the export and domestic markets – their focus is exclusively on export markets. The domestic markets are serviced by different companies who purchase rejects and/or failed rework pieces.

There are at least two market drivers at work in the global market: the post-MFA quota-free trade environment, and the trend towards mass customization and increased leverage of buyers. The ability of producers to respond quickly and effectively to these demands and to the rivalry of competitors defines the competitiveness of players in these sectors.

The post-MFA quota-free trade environment

The most important event that the global textile and garment industry has seen in a generation has been the lifting of quotas according to the Agreement on Textiles and Clothing (ATC) that came into effect on January 1, 2005. Under the previous quota regime, countries were allocated quotas and individual producers in exporting countries were assured access to markets in the US and EU if they managed to acquire quotas and could produce within the price and quality range required by foreign buyers. The quota-free regime is a complete paradigm shift in terms of competitiveness for it has removed the quota shield from exporters, and access to and success in foreign markets is now purely based on who can supply products based on competitive price, quality, and delivery time.⁴ In other words growth can take place only via improved competitiveness, rather than through increase in quota volumes and access to them. It is widely believed that Pakistan is well placed to make this transition as its past performance was less dependent on quotas than countries like Bangladesh and Sri Lanka.⁵ Its strengths are not only cheap labor costs, but also easy access to low priced raw cotton.⁶

⁴ The "purity" of the post quota regime is still far from perfect in that countries and trading blocs, most notably the EU, tend to still resort to protectionist measures by evoking various types of safeguards. It should also be noted that US and China have a bilateral agreement that restricts China's exports until 2008, which means that the true extent of Chinese competition in the US market will be seen after 2008.

⁵ At the time the quota system was introduced, the Pakistani economy was outperforming many others and as quotas were also viewed as a development tool, the Pakistani quota allocation was proportionally less than say Bangladesh. While both Bangladesh and Sri Lanka

Mass-customization and increased leverage of buyers

The global cotton-to-garments market is driven by a number of fundamental trends that producers from all countries must respond to in a cut-throat environment, namely:

- Demand drivers are heading toward multiple fashion trends in one season as well as mass customization, which requires some in-house design and even greater in-house technical capability, and a coordinated response across the entire supply chain,⁷
- Large retailers exercise their dominant buying position by continuing to place downward pressure on prices, while at the same time demanding compliance to strict quality standards, and
- Shortened order-to-delivery lead times.

In the case of denim jeans, manufacturers in Pakistan are facing the challenge of exporting higher-end products. Competitors around the world are adding value to new designs with enzyme, dirt, bleach and stone washes as well as with special finishes such as sandblasting, grinding, water-resistant and fire-retardant. The latest releases of denim fabric also include fancy models with bold stripes and designs that feature increased elasticity.

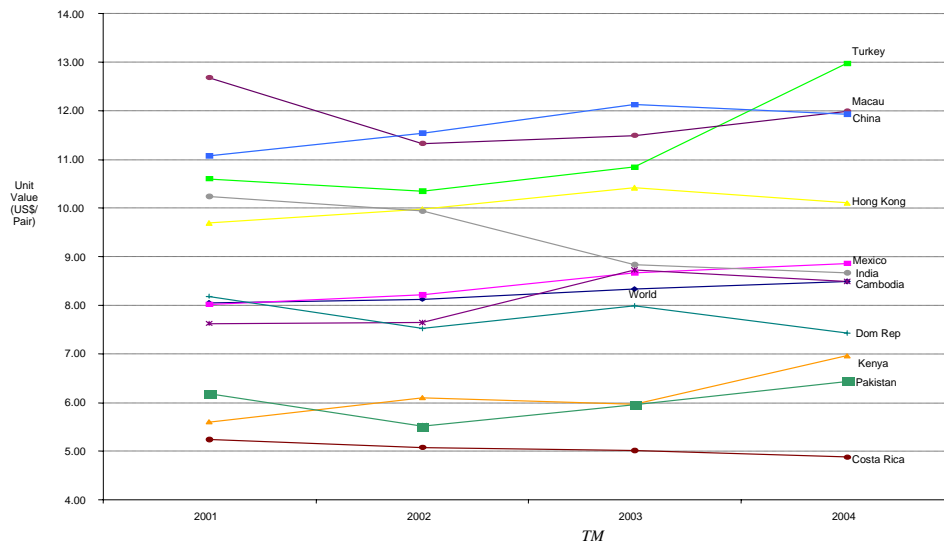
As shown in Figure 1 below, while other competitors such as China and India are already exporting higher value-added jeans (the result of investing more in special designs and increasing their capabilities for mass customization), Pakistan still exports in the lower end of the market. In contrast, Turkey's performance shows a steady move up-market following an intensive program of up-grading its technical abilities and expertise.

were initially heavily dependent on quotas, they appear to have successfully exited the MFA regime as their year-on-year growth in textiles and apparel exports to the EU and US in 2005 has been 14.1% and 12.1% respectively.

⁶Pakistani textile and garment producers have for a long time had access in the local market to chemical fibers coming mainly from Malaysia, South Korea, Indonesia, and Thailand. In November 2005, Pakistan's National Tariff Commission upheld a complaint by Filament Yarn Manufacturers Association that polyester yarn was dumped on the Pakistani market and has imposed duties of up to 37 percent on imports of filament yarns. Despite access to such yarns, textile and garment producers have not been able to develop a meaningful export strategy for such blended textiles and garments, and its main consumers of synthetic textiles and clothing remains concentrated in the domestic market.

⁷Mass customization in clothing means production of clothing in small batches customized for particular consumers and their preferences. Economies of scale are more difficult to reach in this setting compared to production in large batches with pre-determined sizes and colors.

Figure 1: Benchmarking Denim Jeans Export Prices, US Market, 2001 - 2004



Source: Compiled by Global Development Solutions LLC

Figure 1 above requires some care in interpretation. First since it represents average and not product-specific prices, changes in the composition of exports could be disguised in the average. Secondly, and equally important, since the prices are measured in the US, exchange rate effects can play an important role. For example in 2002, an international rise in the value of the US\$ corresponds to the dip experienced by almost all countries.

Facing heightened competition, suppliers of all sizes in Pakistan are developing value-added models to attract new customers and retain existing ones. Besides enhancing designs, suppliers in Pakistan are expanding their production capacity so that they can handle more orders. Approximately US\$5 billion of textile and garment machinery has been imported into Pakistan in 2002-2005, with growth of 66.29% in 2004-5.⁸

However, most Pakistani manufacturers of denim jeans continue to be confined to the lower end of the market due to a number of factors (discussed more fully in the rest of the chapter):⁹

- The lack of investments in skills development and limited availability of qualified textiles and garment technicians. To date, around 500 skilled textile and garments technicians have graduated from various

⁸ Figures presented at International Textile & Garment Machinery Show, March 19-21, 2005, Karachi, Pakistan.

⁹ As jeans, with a few exceptions such as stretch fabrics, are based on cotton, they are largely unaffected by the restrictions on the import of synthetic fibers, referred to earlier.

institutions of higher and vocational education, while the estimated demand in the entire textile value chain is at least 10 times the existing supply. This gap in a trained skill base results in:

- ◇ Absence of in-house design capability;
 - ◇ Slowness or inability to integrate new washing, dyeing, finishing, stitching and embroidery techniques; and
 - ◇ Low shop floor labor productivity, particularly among small and medium producers.
- The low quality of the denim fabric available severely limits the upward mobility and competitiveness of Pakistani manufacturers within the denim trouser market. The low quality is attributable to:
 - ◇ The absence of efficient market linkages across the entire cotton-to-garment supply chain, which prevents market signals (e.g., a demand for a particular type or quality of fabric) from being communicated up and down the entire chain, so hindering jeans manufacturers in responding effectively to the demands of their buyers and to competitive pressures,
 - ◇ The absence of an accepted cotton and lint grading system which would facilitate the manufacture of more closely specified and specialized fabrics needed for the more up-market products.

The above explain why Pakistani jean manufacturers are producing US\$6/pair jeans and not in the US\$10/pair price range. A move to prices higher than US\$10/pair (regarded as marking the boundary between low/medium and high priced jeans) would require significant additional investments in technical expertise as was the case in Turkey.

Denim Jeans Production

Most denim jeans produced are exported, with sales in the domestic market comprising principally rejects and seconds. Producers fall naturally into two categories. The most numerous are small-to-medium size producers who employ up to 200 people and purchase their inputs from local textile mills. Because of their small size, low capital intensity and relatively unskilled labor, they are not suited to meeting customization needs of foreign buyers and hence tend to concentrate on producing standard jeans. The other grouping is the small number of large garment producers that employ thousands of employees, are largely integrated either up to the spinning or weaving stage and dominate exports.¹⁰ These firms employ state-of-the-art technologies and business processes and are quite adept at meeting the mass customization needs of foreign buyers and reflect the best practice in Pakistan.

¹⁰ Contrary to many other industries, successful Jeans exporters tend to be integrated (including those in Turkey). The demanding standards in design, finishing etc. require tight control over all aspects of the manufacturing process and in many cases this is best achieved in an integrated framework.

The value chain analysis will thus focus on these two types of denim jean producers producing either a standard pair of 10/12 ounce jeans denim jeans, or up-market 10/12 ounce jeans with additional value-added, such as embroidery.¹¹ While large producers do make standard jeans in the face of a shortfall in orders for up-market jeans, their preference lies in producing up-market jeans.¹² Thus small producer/standard jeans and large producer/up-market jeans are the two representative cases used in the following analysis.

Large integrated jeans manufacturer of up market jeans

The integrated jeans manufacturer depicted in Figure 2 below, procures the denim fabric (45.4% of the total production cost) from its own integrated business unit at around \$2.45 per pair, and usually purchases the required pocketing cloth from local market suppliers at around \$0.20 per pair. This integrated structure allows the company to maintain a high degree of control over material quality, production and delivery time, and inventory. This diagram focuses only on the assembly of jeans; the upstream activities are discussed subsequently.

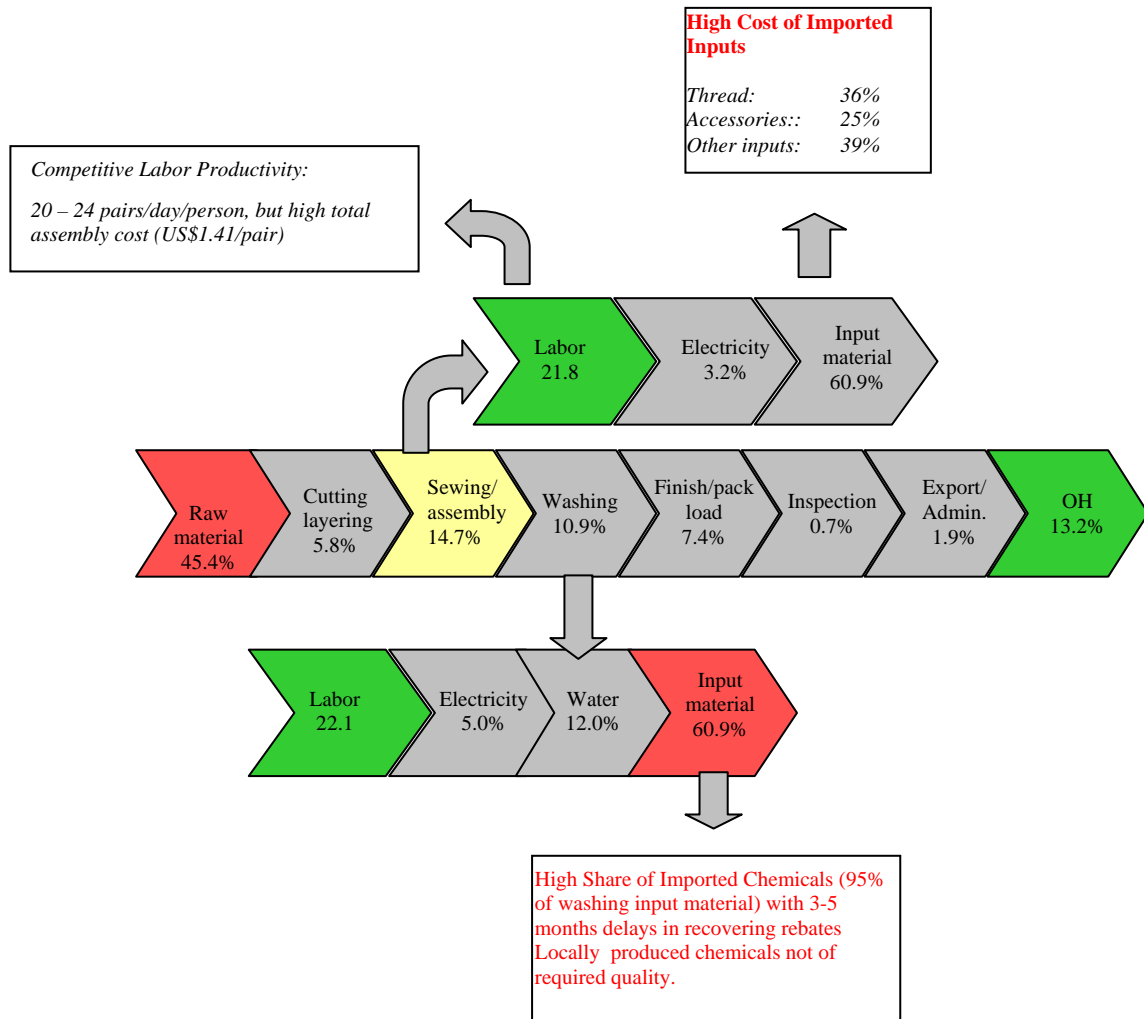
The value chain analysis suggests that the production cost (at the factory gate) price of a pair of jeans is in the range of US\$5.15 - \$5.25. This particular producer is selling a pair of jeans to some of the largest specialized brand name retailers in the range of US\$7.75, thus yielding a gross margin between 47.6% and 50.4%.

According to the breakdown above, sewing and assembly constitutes almost 15% of the overall cost along the value chain, followed by washing at approximately 11% of the entire value chain. Overheads (described in more detail in the Annex A) account for just over 13%.

¹¹ 10/12 reflects the weight of the cloth and so is a general measure of a type jean which includes many styles and qualities (for example the category “a family 4-door car” can include many types of cars with differing qualities and prices).

¹² This would include such factors as design, trimming, accessories, wash etc.

Figure 2: Value Chain for Up-Market Jeans



Source: Global Development Solutions, LLC™

The low labor share in sewing and assembly, a labor intensive process, is a result of efficiencies where on average 20 - 24 pairs of jeans are stitched and assembled per person per day, which is at par with the most competitive countries like China. The large producers invest substantial amounts of money in capital equipment, as well as on training and providing external benefits to the workforce in terms of lodging, food and other expenses.¹³ As such, these companies maintain high labor retention ratios (90% compared to less than 75% for smaller producers), which coupled with continuous training and investment in productivity improving machinery, allow them to remain at the cutting edge of global competitiveness and remain suppliers of choice to international clothing heavyweights like GAP, Levi's, and others.

¹³ More than US\$ 20million in total over past 5 years (to March 2005).

Washing, which accounts for 11% of production costs, is itself dominated by the cost of inputs. The specialized and evolving nature of the chemicals used in washing (e.g., indigo dyes and enzymes) require that they are imported – the changing technology and heavy investments required preclude domestic manufacture. While the import duty rates themselves are reasonable (between 5% and 10%) there are substantial delays (3 – 5 months) in recovering the rebates which place strain on the firm’s cash flow and so increase costs.

With this level of investment in automation and training and resulting internationally competitive labor productivity, such a company should be positioned to move farther up market. However, its ability to expand its product range with new design features continues to be constrained by limited in-house technical and design capability.¹⁴

Small-to-medium size jeans manufacturer

For a small-to-medium size enterprise (up to 200 employees), the factory gate production cost of a standard 12 ounce pair of jeans is \$4.17. While lower than the example for large scale advanced exporters, this type of jean cannot be sold to specialized clothing outlets but is rather sold to large retailers like Wal-Mart that attract price conscious consumers and cannot command the price premium of more customized jeans. In this particular example, the small-to-medium size jeans manufacturer is selling jeans from \$4.75 – \$4.95 with a resulting profit of between 13.9% - 18.7% (compared to appropriately 50% in the case of the large integrated manufacturer). The VCA for this producer is shown in Figure 3 below. As the structure is similar to that of the up-market manufacturer, the following paragraphs will focus on important differences.

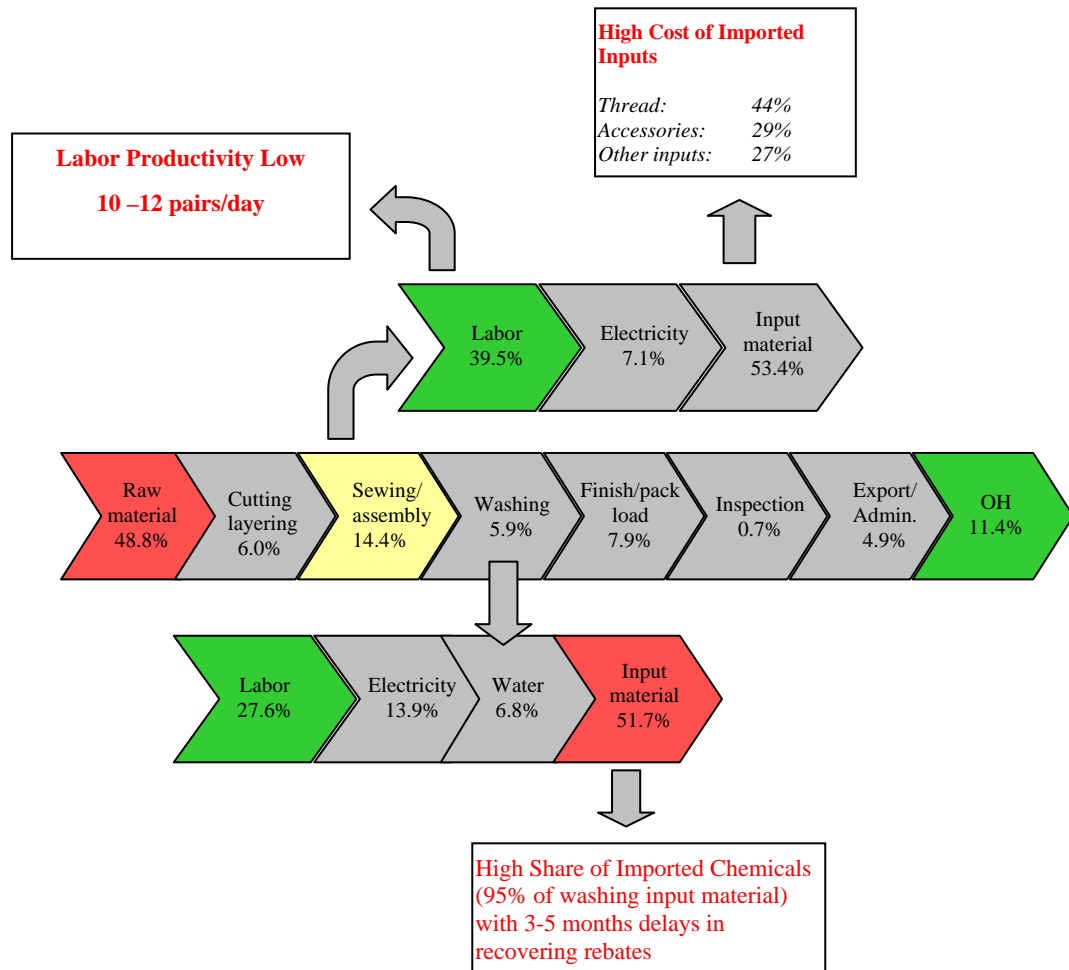
In contrast to large jeans producers, the small-to-medium size producers have a cost structure that is skewed towards higher share of labor in all the important processes such as sewing and assembly, as well as washing. While granting more flexibility, the higher share of labor in the total cost for smaller companies and lower technology levels results in lower labor productivity.¹⁵ Also, in contrast with bigger companies, small companies have lower technology levels and rely on higher labor input than bigger producers. Most notable differences are in the back end of the product pipeline where small companies do not have modern computer-aided modeling and cutting technology, but instead rely on manual labor for creating master copies of design and cutting. Also the smaller companies, sometimes managed by one person, do not have the sophisticated accounting practices of the larger firms

¹⁴ Technical/Design capabilities are the most closely guarded skills in garment industries around the world. Buyers and marketing agents globally do not pass technical/design know-how to suppliers/assemblers, thus keeping tight control over their ability to dictate fashion trends and designs.

¹⁵ It is easier to hire and fire relatively unskilled labor than an expensive machine. Still rigid labor regulations, which make it difficult to fire employees, lead to heavy dependence on contractual labor.

which would allow them to better identify potential efficiencies and cost savings.

Figure 3: Value Chain for Standard Jeans



Source: Global Development Solutions, LLC™

Field interviews revealed that small scale producers, unlike large scale producers, provide very little training to their staff. To make matters worse the capital intensity of small-scale producers is low and thus production of jeans is dependent on labor intensive rather than capital intensive production methods, resulting in the majority of Pakistani jeans manufacturers producing 10 - 12 pairs of jeans per sewing/assembly worker per day. As Table 2 below illustrates, Pakistani labor in the garment industry (measured in terms of the sewing/assembly process, the international norm) is cheaper, but also less productive than international competitors like China and India.

Table 2: Benchmarking Labor Productivity, Conversion Costs, and Wages, Pair of 10/12 Ounce Jeans

	Pakistan	China	India	Kenya	Pakistan Large Up-Market Producers
Wage Cost, US\$/month	82	135	83	90	82
Output, No, of pairs/day/person Sewing Assembly	10-12	24	21	18	20 – 24
Assembly Costs per Jeans, US\$	0.95 - 1.10	0.96	0.86	1.11	1.41
Price Range US\$/pair	4.50 - 5.00			8.00 – 10.00	

Source: Compiled by Global Development Solutions, LLCTM.

Note: Due to differences in the product, the comparisons in the above table are not exact.

As it stands now, not only is labor not trained, but it is very often paid on a per-pair basis with the hope that this system would serve as a good incentive for assembly workers (many of whom are short-term, contractual laborers, rather than permanent employees) to produce more and work harder. In fact, nothing can be further from the truth. Without appropriate training, tools and techniques, workers are limited in how much they can produce in a day simply due to lack of skills and a facilitating environment. In the overwhelming majority of companies, this limit seems to have been reached at between 10 - 12 pairs per man day, with rework rates as high as 10%.

Although some institutions for training and skills upgrading exist, most notably those run by the Pakistan Readymade Garment Manufacturers Association (PRGMEA), generally the country has a deficit of institutes and centers that specialize in extending support services to garment manufacturers. Unofficial estimates are that around 500 skilled textile and garments technicians have graduated from various institutions of higher and vocational education to date, while the demand in the entire textile value chain for 1,200 ginners, 450 spinners, and thousands of garment workers is at least 10 times the existing supply.

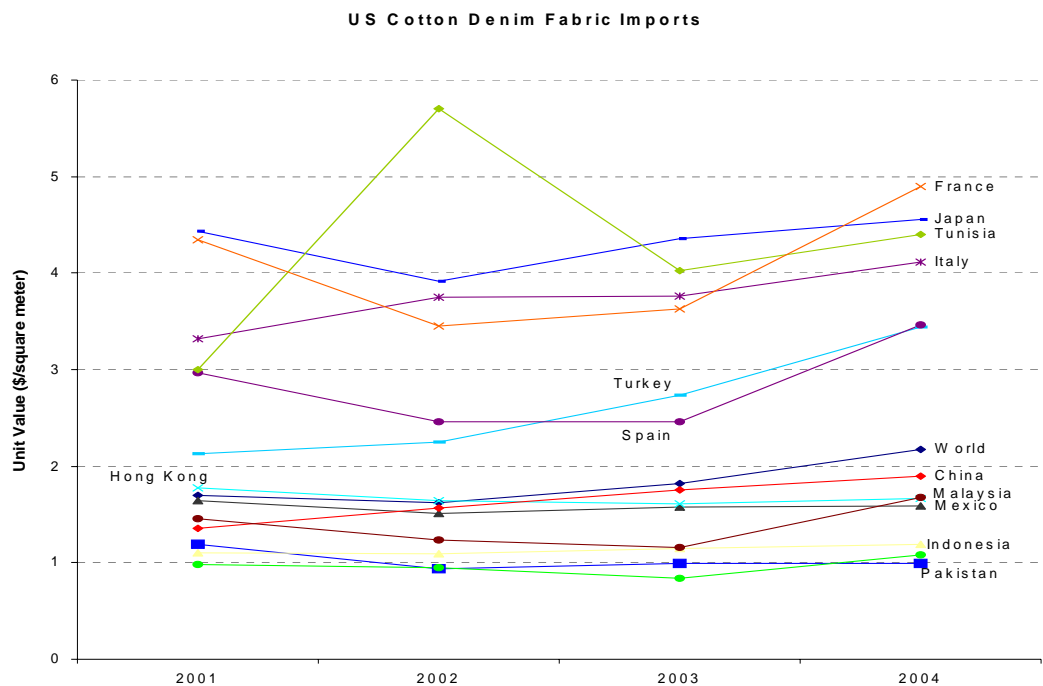
The Textile Sector

Following a brief summary and analysis of Pakistan’s position in the global market for yarn and fabric, the main focus of this section is the VCA of spinning and weaving, i.e., the conversion of cotton lint into woven denim fabric. The example chosen in this section is one where spinning and weaving are two business units operating as independent cost centers within a single company.

Pakistani textile producers are positioned in the low price end of the global market, and in many instances, in the lowest end. Despite inefficiencies in the value chain (described below), the cost level and structure of Pakistani textiles

is not hindering exports of textiles. The key problem, however, is that when compared to other global players, Pakistan is failing to move to the medium-to-high unit price segment in yarn and fabric, a segment that demands higher quality. In denim fabric, for example, Pakistan is operating at the lowest quality and price levels compared to all major competitors.¹⁶ Figure 4 below shows that the situation is most pronounced in the world's largest market, the United States, where Pakistan exports denim fabric at US\$1/m², the lowest level of any major exporter of denim fabric.

Figure 4: Benchmarking Export Unit Values, Denim Fabric



Source: Compiled by Global Development Solutions, LLCTM

Export-oriented denim fabric and garment manufacturers tend to rely exclusively on yarn from local lint or on local lint when garment manufacturers are integrated, since the quality potentially obtainable from the types of cotton cultivatable in Pakistan is sufficient for production of coarser yarn counts used for denim cloth where small inconsistencies are hidden by subsequent dyeing. However, failure to obtain the maximum quality potentially available from the types of cotton grown in Pakistan combined with the inability of the jeans manufacturers to produce or create more sophisticated products, including those using blended fabrics (e.g., stretch jeans) is confining both fabric and jeans exporters to the lower end of the market.

¹⁶ Since not all countries that produce fabric produce jeans (e.g., France and Japan) and vice-versa, the countries in Figure 4 differ from those in Figure 1

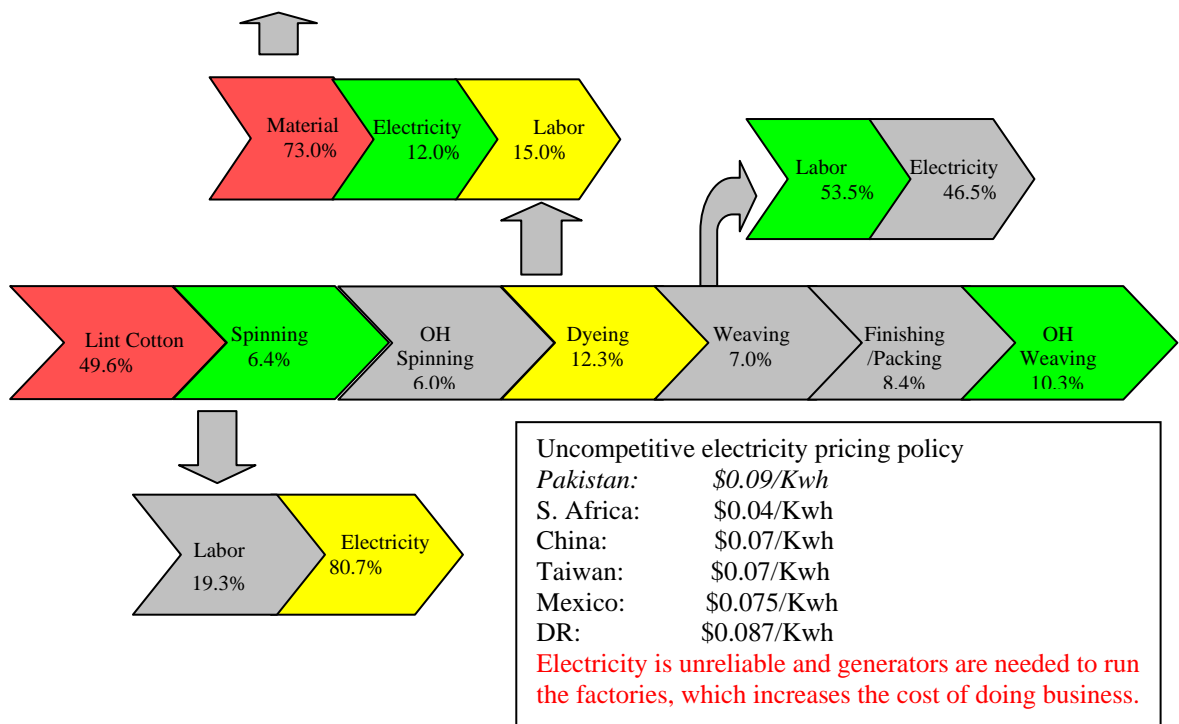
Value chain analysis for denim fabric production

The value chain analysis in this section, as shown in Figure 5 below, suggests that from lint cotton to denim fabric, the end factory gate price of one square meter of 12 ounce fabric is \$0.90 excluding profit margins, resulting in factory gate production cost for the amount of fabric that goes into a standard pair of 12 ounce unisex jeans of approximately \$1.84.¹⁷ This price includes the value addition steps of spinning the yarn, dyeing part of the yarn which is then combined with grey yarn before weaving it, and finally proceeding with finishing and packing the fabric. Prices and costs are quoted as of March 2005. If profits along the spinning and weaving value chains are accounted for (not accounted for in the Figure 5 below) then the delivered price of fabric to the denim manufacturer needed for a pair of jeans is US\$2.15.

Figure 5: Denim Fabric Value Chain, Non-integrated Mill

80% - 100% of chemicals imported

More than 95% of material cost in dyeing is in chemicals, the bulk of which are imported. Rebates take 3 - 5 months, same as for other intermediary inputs, most notably yarn



Source: Global Development Solutions, LLC™

The highest cost components in the production of fabric are lint (49.6%), dyeing (13.8%), and weaving (7%).

¹⁷ This producer gets a premium of about 5% above the average price on account of better quality and consistency.

Low lint-to-yarn conversion ratio

Lint of poor quality is characterized by mixed fiber length and inconsistent quality, high moisture content, contaminates, and other factors such as varied color, non-uniform fiber length and strength. Poor quality lint has a substantial impact on denim fabric production as evident from the fact that the lint-to-yarn conversion ratio of locally ginned lint is only 83% compared to that for imported lint, which is 90%. Ginners are able to sell lint to spinners only by selling at a large discount compared to the price of cleaner imported lint. As illustrated in Table 3 below, when inferiority of local lint is accounted for in terms of yield of yarn per unit of lint, the price of locally ginned lint is still 15.5% cheaper than the imported lint in terms of cost of lint per kg of yarn produced.

Table 3: Cotton Input Cost of Yarn, Domestic vs. Imported Lint, Pakistan

	Rs/kg Lint	kg Yarn/kg of Lint	Input Cost Per kg of Yarn (Rs)
Price of local lint (including cleaning *)	55.45	0.83	66.80
* Yarn producer's cost incurred for cleaning lint			
a. labor	0.22		
b. sorting machinery	0.03		
Price of imported lint	71.17	0.90	79.08
Price Differential (Rs/kg)			12.28 (15.5%)

Source: Global Development Solutions, LLC

* Based on turnover of 100,000 bales of lint, and purchase price of Belgian cotton sorting machinery. Data from period when lint purchased includes sales tax. Sales tax left out as it was rebated to spinner after exports.

NOTE: Lint to yarn efficiencies are estimates given by spinners.

This suggests that contamination of lint is depressing price levels of lint, thus hurting the ginners, and consequentially the farmers (through lower valuations of cotton), but it is also providing cheaper cotton to the domestic textile industry, and thus boosting their position in the low end denim market. It therefore appears that, ironically, the textile sector has an interest in perpetuation of lint contamination even though contaminated lint hurts their lint-to-yarn efficiencies, and is hindering their ability to move up-market.

Spinning

There was an over-investment in spinning in the late 1980s in response to generous tax incentives. Because the productivity of a spindle declines after about 10 years, the large share of old spindles will now be becoming a drag on

the sector.¹⁸ In the example used, the age of the spindles is between 10 to 15 years.

The value chain shows that electricity is the largest single cost component of spinning. This should come as no surprise since spinning lint into yarn is a capital intensive operation, with high dependence on electricity, both in terms of reliability and cost. As in other parts of value chain, the electricity cost of US\$ 0.9/Kwh is not competitive in an international context. Also, reported outages vary, but in general three outages a day are very common, something which makes the production process very difficult.

Weaving

The study did not cover the weaving sector in detail, but noted that in the case of weavers of denim fabrics, the looms were perfectly adequate. One issue did appear, however. Firms that export themselves (direct exporters) can use their past export performance as a basis for obtaining credit. On the other hand, firms (indirect exporters) that sell their product (e.g., denim fabric) to garment assemblers who in turn export cannot use their past sales performance as a basis for credit. Since collateral rates are reported in the range of 100% - 200%, financing is not easily accessible to small weavers in this sector.

The Ginning Sector

As discussed in previous sections, the constraints hindering the jeans manufacturers from moving up-market are: (i) the low quality of denim fabric and (ii) a lack of in-house design ability combined with the associated knowledge of more sophisticated manufacturing techniques. This section examines the first of these by extending the VCA analysis further upstream to the ginning sector. At least four factors contribute to the low quality of lint, and consequently the fabric, namely:

- Fragmented marketing system,
- The poor quality and lack of grading of cotton,
- Low ginning outturn, and
- High electricity costs.

Although discussed in more detail in the next section, it is worth noting at this stage, that the absence of an impartially administered grading system (e.g., length, micronaire, and fiber strength) reduces incentives to make high quality lint as the additional rewards are uncertain.

¹⁸ Field interviews revealed that new investment was occurring.

Cotton marketing system

The cotton marketing system is based on a complex set of inter-relationships among farmers, ginner, spinners, and textile producers governed by middlemen. Cotton growers generally receive their inputs and needed finance for crop farming from agents. In return, farmers deliver the harvest to the marketing agents who in turn sell to the ginner, who at that point acquires title to the cotton and assumes all the market risks that go with it.¹⁹

The spinners and textile mills know this, which is why another separate marketing system emerges with all characteristics of a buyer's market. Namely: there are approximately three times more ginner than there are spinners; spinners can and do purchase lint cotton from other than local ginner; ginner lack the necessary expertise to export (Pakistan imports ten times more cotton than it exports); and, since there is no impartially administered grading system, buyers have the power to unilaterally determine what grade the cotton is.

The above market asymmetries prevent the flow of market signals from the denim jean manufacturer all the way to the cotton grower. There is no evidence of the coordination within the cotton-to-garment chain that would make it possible for garment manufacturers to have a timely and effective response to the demands of the buyers and the strategic maneuvers of its competitors.²⁰ This lack of responsiveness is one of the reasons behind the high level of integration in the large scale jeans manufacturers.

Contamination and moisture content of lint cotton

Smallholder and large scale farmers have one thing in common – they both pick cotton by hand which is frequently contaminated with trash in the process. The irony of the situation is that hand picked cotton generally has limited amount of trash due to the fact that cotton bolls burst open upon maturity and when picked by hand unwanted trash such as leaves and twines are left uncollected. As a result hand picked cotton is universally usually considered the best cotton and commands the highest price.

In Pakistan today, it is widely accepted that trash is indeed collected and many stakeholders suggest that farmers should be trained not to collect leaves and twine during picking.²¹ While it is possible to target the issue of trash in cotton, such measures would address the symptoms rather than the causes of the problem, namely that of a cotton marketing system that does not provide

¹⁹ Only a few consolidated large farmers deal directly with ginner by acquiring their services on a contract basis (as in Australia or the US), keeping title to their crop in such instances.

²⁰ For example, garment producers would be able to fill up an order of type X,000 women's crosshedge denim jeans with rivets of type A, flyers type B color C, specialized thread of yarn D, leather straps of form E, wash F, and packaging G, by accessing an local established network of suppliers with established delivery times, established payment and credit terms.

²¹ Approximately 2kg of trash is present in each 40kg of seed cotton.

incentives for trash to be removed. From farm-to-ginner, cotton is priced on weight and variety of seed; other factors such as the length micronaire and strength of the fibers which play an important role in most other cotton markets are not taken into account.²² Thus in the whole chain, from farmer-to-agent and from agent-to-ginner, cotton has no other grading or valuation standard other than weight and cotton variety and in cases where the agents collect from a number of farms and blend the cottons, even the latter measure is suspect.

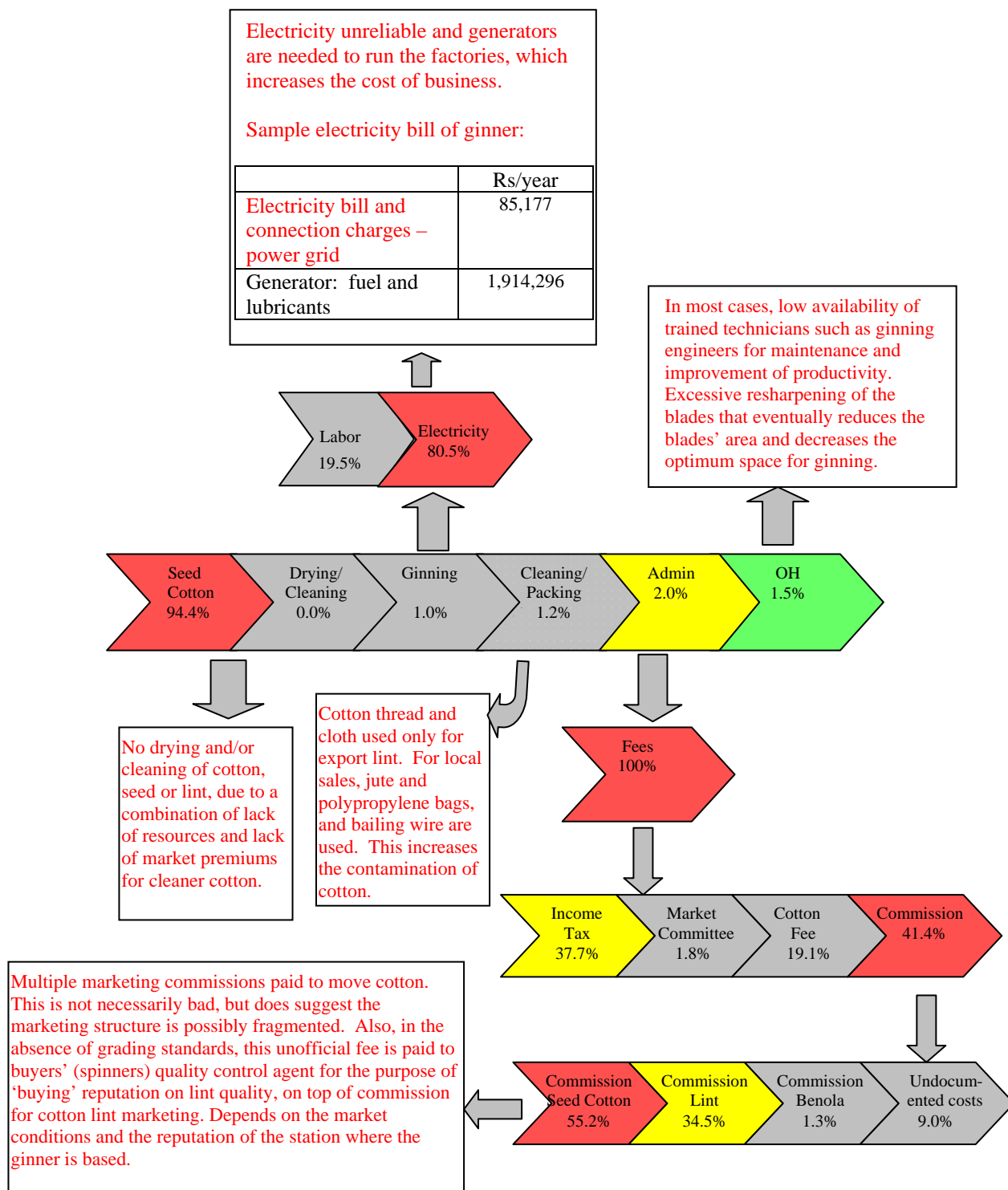
As a result, the incentive to add trash to cotton ripples down the value chain. In fact, when farm operators were asked why female pickers are not being trained to clean-pick cotton, a cotton farmer, and agent himself, responded “do you really think that these women, born in the cotton fields, do not know what clean picking is and what unclean picking is? That is impossible. We tell them whether we want clean or unclean picking, and they deliver. And that is it.”²³ This suggests that the amount of trash very much depends on the marketing decision of the farmer and his agent/financial backer and the agent’s marketing arrangements with the ginners. These are such that the ginner also has incentive to add weight to his bales, and does not clean the seed cotton, since his lint cotton sales are based on weight too.

In a market environment where the cotton market rewards weight rather than quality, there is no incentive for farmers to incur the extra costs of producing high quality cotton fiber – in fact it encourages them to add trash to their raw cotton bale. Consequently, there is very little choice but to price ginned cotton (lint) according to weight, particularly as raw cotton entering the ginning stage is already of mixed quality. Further, in the absence of impartially administered generally accepted grading standards (or a carefully specified contract with a spinner) the market cannot reward higher quality and thus the ginner has no means of ensuring that he could capture any premium associated with higher quality lint. The VCA analysis in Diagram 6 below shows that ginners are clearly conscious of this issue as they generally do not expend any resources on drying or cleaning raw cotton. In addition, given the upfront working capital already expended by the ginner to purchase the raw cotton, the ginner is generally in need of short term liquidity, and thus tends not to invest time and resources to dry and clean the lint, especially if he is uncertain about being able to receive a sufficient premium to fund these investments.

²² In the rare cases of established large farmers doing custom ginning, there is an incentive to control the quality and consistency of the cotton, but not for the majority of other farmers.

²³ Field interviews.

Figure 6: Ginning Value Chain



Source: Global Development Solutions, LLC™

This contributes not only to the contamination and high impurity content of lint cotton, but also to high moisture content, which impacts the Ginning Outturn (GOT), a measure of efficiency in the conversion of raw cotton into lint, and eventually the lint-to-yarn conversion ratio. Specifically, the moisture level of the ginned lint in Pakistan is estimated at between 10% - 11%, around 3 percentage points higher than the ideal moisture content of 8%. This effectively means that the spinner bears that cost by hiring labor and installing cleaning equipment in his facilities. This cost is then passed on to the ginner in terms of lower valuations of lint.

Ginning out-turn

Pakistani ginner achieve a GOT average of between 33% - 35% which is below the potential of 40% for the varieties most used in Pakistan. Although the 33% - 35% range is within a narrow margin from global averages, the failure of ginner is very pronounced in terms of lack of maximization of lint extracted as per varietal potential, with more than a 20% gap between realized rates of 33% than the 40% that the varieties of cotton used in Pakistan can achieve. The key factors behind the low GOT have been the poor quality of raw cotton, and the failure of the ginner to invest in replacing their machinery, much of which is more than 20 years old.²⁴

Electricity

The value chain in Figure 6 above shows that the process of ginning constitutes 1.7% of total cost of producing lint from cotton, of which 80% is in electricity expenses. A high share of electricity is to be expected as the entire ginning process is electricity-based. However, electricity in Pakistan is very unreliable and short outages range from 10 to as many as 20 per week, and this ginner has installed an in-house generator. In fact the ginning sector faces two major challenges. First, antiquated ginning lines contribute to high energy consumption, so having expensive electricity is an added burden to ginner. Secondly, proper drying, which is electricity-intensive, plays a critical role in defining the quality and GOT of lint cotton, something which is not done in Pakistan at all. The high cost of electricity was mentioned by half of the ginner interviewed as one of the factors that influence the lack of investment in drying equipment.

The Cotton Farming Sector

Cotton farmers in Pakistan are only able to achieve less than half the yield realized by their counterparts in China. And as Table 4 below shows, this disadvantage is not offset by lower labor costs and results in a higher unit cost of production.

²⁴ Saw tooth ginning is the appropriate technology for the varieties of cotton in Pakistan, the problem lies in the age and general dilapidation of the equipment and not the technology itself.

Table 4: Benchmarking Cotton Farming Cost and Yield

	Seed Cotton Yield/ha (tons)	Cost/ha (US\$)	Cost/kg seed cotton
Kyrgyzstan	2.45	393.63	\$ 0.16
China	3.50	752.00	\$ 0.21
India*	1.70	548.71	\$ 0.32
Pakistan	1.68	387.34	\$ 0.23
Kenya	0.57	184.00	\$ 0.32
Cambodia	1.20	415.00	\$ 0.35

* Irrigated production in Southern India

Source: Compiled by Global Development Solutions, LLC™

Guided by a VCA analysis of a typical small scale cotton farmer, there are four key factors affecting the performance of cotton farmers:²⁵

- Insufficient availability of improved seeds;
- High crop losses due to poor spraying regimes;
- Inefficient water utilization and high cost of irrigation; and
- Government cotton policies.

Seeds

The yield potential of the most common seed varieties used in Pakistan is estimated at 4,000kg/ha to 4,300kg/ha of cotton. With actual yield rates of 1,680 kg/ha, the gap between the yield potential of released varieties and the actual yields is significant. Pakistan cotton varieties are very susceptible to worms and viruses like Cotton Leaf Curl Virus (CLCV) that constantly develop new strains resistant to pesticides and thus new strains of seeds resistant (albeit for only a few years) to current worms and viruses are constantly needed.

Thus access to and availability of new and improved seeds is critically important to prevent crop losses. As Table 5 below shows, the distribution of improved seed covers only a part of the total requirements for seed. In the last five years to 2003, for example, between 35% - 53% of seed requirements were not met. Interviews reveal that smallholders compete with the large scale farmers for access to the limited availability of improved seeds, but the financial muscle of large scale farmers is considerably stronger leaving the

²⁵ While larger scale farms achieve higher yields than smaller scale farmers, they face the same broad range of problems.

smallholders' to resort to informal means of purchasing seeds or relying on seeds retained from the current harvest.²⁶

Table 5: Volume of Distributed vs. Required Quantities of Seed, Cotton, Pakistan 1996-2003 (million kg)

		1997-98	1998-99	1999-00	2000-01	2001-02	2002-03
Distribution of Improved Seed	26.63	23	27.02	33.4	29.46	39.87	31.12
Requirement*	62.23	58.49	57.76	58.96	57.86	61.57	55.21
% of Met Requirement	43%	40%	47%	57%	51%	65%	56%

Source: Compiled by Global Development Solution, LLCTM

*Based on estimated usage of seed at 19.8 kg/ha.

While private companies can and do produce, market and distribute seeds, all development of new varieties occurs in the Public Sector where recent developments leave great cause for concern. The virtual collapse of Sindh Seed Corporation (SSC), one of only two parastatal seed corporations besides Punjab Seed Corporation (PSC), is symptomatic of the inability of the parastatals to adjust to market mechanisms especially in maintaining R&D capabilities that would ensure a continuous supply of new and improved varieties. When its main variety (NIAB-78) fell prey to new strains of CLCV, SSC did not have a strong enough flow of improved seeds in its research and development pipeline to address the farmers' abandonment of the variety.

SSC suffers from chronic mismanagement which has led to virtual bankruptcy, with a loss of Rs.50 billion over the two year period from 2000 to 2002. The key reason behind the near collapse of SSC is that it consistently supplied seeds below the real cost of production, which in the short-to-medium term provided relief for farmers who could purchase seeds at lower than market prices, but in the long-term is unsustainable. SSC's justification for selling cotton seeds at below market prices appears to be that it felt it was mandated to supply low cost seeds to farmers. If true, its mandate addresses the wrong problem since, as the value chain shows, seed cost is not a key driver in cotton production, but seed availability is very much so. Therefore, while an increase in seed availability is warranted, this increase needs to be implemented in relation to market prices and not in opposition to them.

All imports of seeds must be accurately labeled and of a type approved by the National Register for Seed and Crop Production.²⁷ However, no imported

²⁶ Additional research is needed to establish the exact extent of market access displacement of the smallholder vis-à-vis the purchases of improved seed from large scale commercial farmers.

²⁷ Labeling requirements are outlined in "Truth in Labeling (Seeds) Rules, 1991"

varieties have proved more resistant to the Cotton Leaf Curl Virus than the types developed in Pakistan and since they tend to be more expensive, few imports occur.²⁸ In addition, due to lack of bio-safety laws in the country and necessary legal protection under WTO and TRIPS agreements, import of genetically modified (GM) seeds is not possible. This greatly reduces the interest of multinational corporations, such as Monsanto, to enter the market even though they engage in domestic seed distribution and marketing.

Spraying

As many smallholder farmers have to rely on retained hybrids rather than 'clean' seeds, their plants are highly susceptible to Cotton Leaf Curl Virus (CLCV), Bollworm, sucking pests, chewing pests, and other viral and pest-related diseases. Pakistani cotton faced substantial losses, estimated at 510,000 MT, in the period 1992 - 1995 when as a CLCV outbreak hit the country. To prevent yield losses and crop failure, a robust spraying regime is required in Pakistan, with 8 - 12 sprayings per season. However, field interviews showed that most smallholder farmers could only afford to pay for 5 sprays per year at most. Consequently, per hectare yield rate and fiber quality is often compromised.

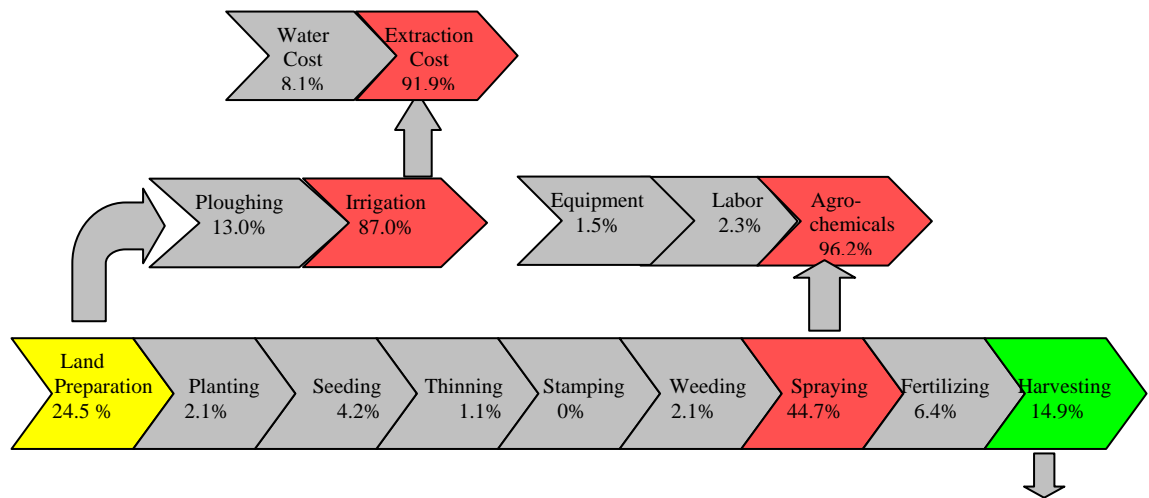
The value chain depicted in Figure 7 below shows that even with a compromised spraying regime of five sprays, over 44% of the costs associated with cotton farming are dictated by spraying costs. With a proper 8 - 12 sprays/season, cost of sprays can reach over 57% of the overall cost of farming a substantial expenditure for a relatively poor farmer.

What was also found to be significant is that the smallholder farmer is not properly informed on the proper dosage and types of chemicals required. His decision on how much and what to purchase is often based on the information from a retailer rather than a less biased party. The farmer's access to extension services on proper pest management and control is very poor. As such, the quantity and type of pesticides used is skewed towards the trade interests of the seller rather than the crop management and control knowledge of the smallholder buyer.²⁹ In this sense, it is very important that the availability of extension services be delivered to the farmer.

²⁸ The study was unable to determine whether the lack of a foreign developed seed resistant to the local CLCV was due to the limited size of the market (principally Pakistan) which would not justify development costs, or whether the virus *sui generis* adapts rapidly to new non-GM variants, no matter where developed.

²⁹ There are no accreditation requirements for pesticide dealers other than a requirement to be a registered trader.

Figure 7: Smallholder Cotton Value Chain



Source: Global Development Solutions, LLC™

Note: There was no overhead recorded in this case as the equipment was old and already depreciated – the running costs of pumps, spray cans, and other equipment included in VCA by process.

100% hand picked but one of the most contaminated cottons in the world

Another particularly worrying signal is that farmers do not use proper techniques and do not have the necessary knowledge to limit hazards stemming from spraying pesticides. Research by the Integrated Pest Management Program in 2003 found that 87% of female cotton pickers suffered from pesticide-related diseases, 63% of farmers fell sick while spraying chemicals and one person per 800 households died from it each year.³⁰

Irrigation

As the value chain in Figure 7 shows, the second highest cost of cotton farming for smallholders in Pakistan is land preparation, at 24.5% of total cost. Irrigation is the single largest cost component at 87% of total land preparation cost. A closer look at irrigation costs reveals two key issues:

- The cost of water is negligible at 8.1% of total irrigation costs; and
- The bulk of irrigation costs (92%) come from the energy costs of pumping water from tube wells (canal and groundwater) via electric and/or fuel pumps. For nearly 80% of farmers in Pakistan, water access from canals is inadequate, and thus must pump water from wells to meet the water requirement for cotton farming.

³⁰ Pakistan Agricultural Research Council, Vol.23.No.9

The resulting implications are significant. The effective subsidy on the water that runs through the vast canal network to reach the farmers in Pakistan at symbolic prices effectively serves as an engine for water wastage. It is estimated that out of 90 billion cubic meters of water that reaches the fields through canals, approximately 22 billion cubic meters, or 25%, is wasted.³¹ One of the main reasons is due to the fact that water for irrigation is virtually free. This combined with the lack of on-farm technical training on water usage, results in that when it is the farmer's turn to draw water from the canal, he basically directs as much water as he can towards his field rather than directing only what is needed.³²

This set-up of virtually free canal water for irrigation means that the true cost of producing cotton in Pakistan is higher than the current actual cost when the opportunity cost of water provision in the canals is taken into account, which is estimated at US\$148/ha or about \$0.24 per kg of cotton.³³ This would raise the cost of producing Pakistani cotton and bring the rest of the down stream cotton sector under increasing price pressure.

Taking into account that the share of canal irrigation in the total irrigated area of Pakistan has continuously fallen for almost a decade, water availability in canals has also gradually declined, from the averages of 130 billion m³ of canal head water supply during the 1990s to 90 billion m³ in 2001 - 2002.³⁴ This creates a need for a concentrated effort and strategy to minimize farm water inefficiencies, but as it will bring the cost of water closer to its true economic cost, it will result in an increase in the cost of producing cotton with consequential effects on down-stream costs.

Government cotton policies

The two elements of Government cotton policies discussed in this section are:

- The Cotton Price Support Policy, and (more importantly for the issues discussed in this chapter),
- The lack of any role in establishing and encouraging the adoption of cotton grading standards.

Price based policies

The support price computation through Trade Corporation of Pakistan (TCP) is primarily based on covering the average production cost per unit of area, and to compensate for the increase in the prices of inputs, particularly labor, fertilizers and pesticides. The mechanism envisages government's intervention only if the market prices tend to fall below the support level. As

³¹ Pakistan Water Gateway. Based on range of estimates in various articles on three efficiencies: head water, watercourse, and canal efficiency.

³² Cotton plants do not require intensive watering.

³³ As per ICAC estimates for 2001/2002.

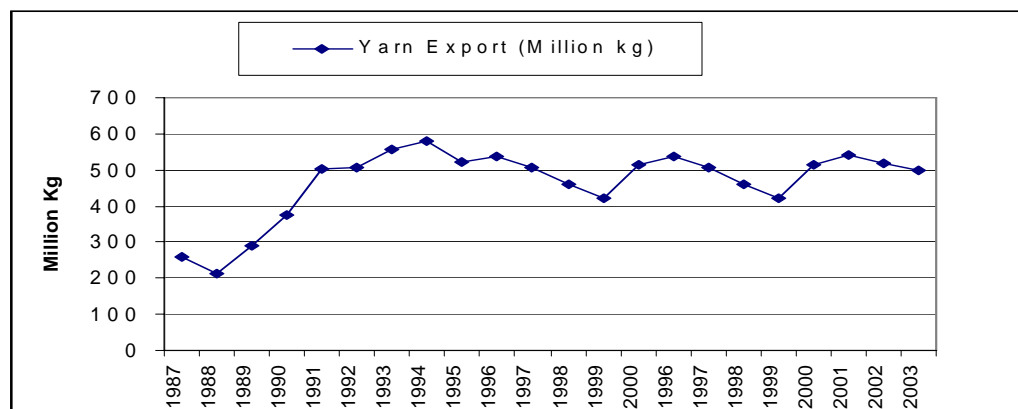
³⁴ *Pakistan Economist*, February 3 - 9, 2003.

domestic prices of both seed cotton and lint have, by and large, remained well above the support level, the policy has had no effect other than perhaps to provide a measure of comfort to farmers.

Apart from maintaining a stable price, government policy over the years has also generally been to maintain a relatively low domestic price of cotton principally, starting in 1986 – 1987, through the imposition of export duties to support the domestic textile industry. Export duties were removed in the late 1990's, much to the dismay of the spinning industry which demanded an outright ban on lint exports from the GOP.³⁵ In fact, one of the defining features of the cotton-to-textiles sector is the long-standing and constant struggle between the growers and ginners on one hand, and cotton mill owners on the other over the prices and policies of raw cotton.

As Figure 8 below shows, the spinning industry benefited from a subsidy on its cotton purchases in the late 1980s and early 1990s – when yarn exports tripled from a level of 200 million kilograms to 600 million kilograms. Despite the persistence of export duties on cotton throughout the 1990s, however, the spinning sector failed to move beyond the 500 million kilograms of annual yarn exports in any significant manner, suggesting the textile industry's inability to take advantage of government policies aimed at supporting the yarn and textile industry.

Figure 8: Yarn Export Volumes, Pakistan, 1987-2003



Source: Compiled by Global Development Solutions, LLCTM

One of factors underlying the continuous undervaluation of cotton and lint as shown in Figure 8 above is informational asymmetries. For most of the 1980s and early 1990s, the information available on the prevailing price of lint at

³⁵ The persistence of a discount between Pakistani cotton and world indices is partly attributable to the poor quality of Pakistani cotton, but the lint-to yarn efficiencies highlighted above show that the quality is not so poor as to justify lint undervaluation by about 20%. This strongly supports the hypothesis of informational asymmetries in the product's marketing channel and lack of standardization.

global levels was scarce, delayed, and difficult to access for cotton farmers and ginners in Pakistan. Yarn and other textile exporters on the other hand could more easily follow the price of lint through contacts with their clients in export markets. However, interviews revealed that the advent of information technologies, particularly the internet, has resulted in a fundamental change in this asymmetry for now farmers, ginners and traders of cotton in Pakistan have easier access to information such as the prevailing price of lint. As such, the continuous under valuation of lint has become increasingly untenable, much to the benefit of producers, ginners and traders of cotton in Pakistan. The key remaining factor responsible for the undervaluation of lint and difficulties in obtaining the maximum quality of lint from the varieties cultivable in Pakistan is the absence of an impartial grading system. This is the focus of the following section.

Cotton standards

There are official standards in Pakistan for grading cotton, including such key measures as micronaire (a measure of fineness and maturity), fiber length and fiber strength, which are “quoted” in cotton trading. However, since they are not impartially applied (e.g., instruments that measure the cotton qualities are not calibrated and rechecked by an independent agent) such measures are not accepted in the market place.

However, the asymmetries in the market discussed above (which depend on the absence of impartially applied standards), and the current lack of trust between participants, make it unlikely that the adoption of standards would result from the interplay of market forces. There is a clear need for an impartial agency to initiate and support such a change and in the current context of a lack of trust between market participants; the Government is a prime agent to act as the catalyst.

Critical Issues and Priorities for Improving the Competitiveness of the Textile and Garment Sectors in Pakistan

The value chain analysis suggests that Pakistan holds substantial potential for growth in the textile and garment sector, but faces a number of challenges. The potential gains in denim jeans manufacturing provides a useful case study of the various challenges facing the textile and garment sector, and more importantly, the potential growth opportunities for a number of strategic sector through improved market linkages and dynamics in the cotton-to-garment supply chain.

Table 6 below provides a summary of the key issues, their priority, and initiatives required by the public and/or the private sector, starting from jeans manufacturing and moving up-stream to cotton growing. They are discussed in more detail in subsequent paragraphs.

Table 6: Issues and Priorities for the Textile and Garments Sectors

	High	Medium	Low	Public Sector	Private Sector
Lack of investments in training in advanced jeans manufacturing techniques	X				X
Shortage of textile and garment technicians as a result of a lack of investments in training	X			X	X
Poor shop floor skills in smaller scale manufacturers		X			X
Old ginning and spinning equipment		X			X
Absence of market linkages across the entire cotton-to-garment supply chain	X			X	X
Absence of impartially administered cotton standards	X			X	X
Insufficient availability of improved seeds	X			X	X
Poor farming practices and absence of extension services		X		X	
Water access and wastage	?	X		X	X

The first group addresses the issue of skills in the jeans sector. As stressed repeatedly in the text, increasing technical abilities is the key to moving into the high-value (price in excess of \$10) jeans sector as in the example of Turkey. The large-scale manufacturers seem well aware of this and the investments of recent years add supporting evidence. However, it is a moving target requiring on-going attention.

The issue of a general shortage of trained garments and textile workers will prove an ongoing hindrance to the sector as a whole. A detailed solution to this problem is beyond the scope of this study, but a starting point would be an explicit recognition of the need, followed by a stock-taking of the effectiveness of current institutions and selective strengthening. This would have to involve both the Government and the private sector.

The lack of shop floor skills (as evidenced by low productivity rates in Table 1) will seriously constrain the current smaller-scale non-integrated lower-end jeans manufacturers from moving up-market. The first issue of a lack of trained workers to hire has been identified in the paragraph above. There is also a need to demonstrate to manufacturers the advantages of training (and trained) workers. This is clearly the job of the private sector.

As discussed in the text, the productivity of spindles decreases with age and it requires continuous investment to maintain high productivity levels. The industry is just emerging from the after-effects of a tax-induced investment boom and future policies should explicitly recognize the need for ongoing (as

opposed to large sudden) investment. The equipment currently in use in the ginning sector is antiquated. While replacement investment is occurring, it is constrained by a market where price is based on weight and quality is not rewarded. This is the issue under consideration in the next two headings in the table.

Market linkages of the type which would allow a jeans manufacturer to reliably and rapidly source specialized inputs from domestic suppliers are not functioning effectively. While the integration, characteristic of the larger manufacturers, allows them tighter control over manufacturing standards, this lack of market cohesion will affect lower-end jeans manufacturer's attempts to move up-market.

One of the key factors inhibiting market linkages is the absence of impartially admixture cotton grading standards. Recall that there are sufficient standards in place in Pakistan to allow the market to identify and reward differences in the quality of the lint – the problem is that they are not impartially applied or enforced. In view of suspicion between market participants, the Government is a prime candidate to act as a catalyst to initiate the change.

In the cotton sector, the on-going shortage of resistant seeds is affecting the yields. However, as noted in the text, it was not possible to determine whether the absence of foreign produced resistant variety is due to the limited market or whether the CLCV is in itself capable of mutating sufficiently rapidly to affect plants from newly developed seeds, no matter where they are developed. Additional information will be required before possible solutions can be identified.

As in the dairy sector (see Chapter 3), the poor quality of extension services is adversely affecting farm efficiencies. Also, the current method of irrigation using the public canal system and its subsidized price is encouraging inefficient (and excessive) use of water. While this may yield some short-term advantage, it will likely become a major issue in future years. Not only should water prices reflect their true economic cost, but farmers must learn efficient irrigation methods, another shortcoming of the extension services.

3 Constraints to Competitiveness in the Dairy Sector: A Powdered Milk Example

The dairy industry in Pakistan is based on a large number of farmers with small herds of both buffalo and cows. While the sector is internationally competitive in terms of the costs of producing milk, the collection system that has evolved to meet the challenge of collecting small amounts of milk from a large number of geographically dispersed farms results in significant wastage (as much as 20%) between the farm gate and the processing factories. Further, inefficient farming techniques result in less than potential yield from the existing stock of cattle and significant seasonal variability in supply of liquid milk. Strong local preferences for fresh (especially buffalo) versus processed milks (such as UHT or reconstituted powdered milk) further constrain the supply of liquid milk potentially available for processing and export. In view of likely difficulties in ensuring the necessary stability in liquid milk supplies to feed an export based dairy industry, the need to meet potentially stringent sanitary and phytosanitary requirements, and the difficulties in countering the significant dairy support subsidies provided by developed countries, near term-progress in Pakistan will likely depend on improving efficiencies in the current system, especially in view of the strong domestic preference for fresh milk. The longer-term export issues will await reductions in international market distortions and a full examination of the economics of moving towards less dispersed and larger scale dairy farms.

Introduction

While Pakistan is ranked fifth in the world in milk production, attributable largely to the sheer number of dairy animals, it has a very minor presence in the global market.³⁶ The subsidies provided by developed nations to their dairy industries are a substantial barrier to new entrants and thus it is unlikely that Pakistan will be able to crack the global market in any significant fashion in the next few years.

The purpose of this chapter is thus to examine what changes would be necessary for Pakistan to become an internationally competitive exporter, although the extent of its success would likely be dependent on the lowering

³⁶ Sheep and Goats which produce less than 0.1% of total milk have been ignored in this chapter.

or elimination of the current subsidies provided by the developed countries to their dairy industries. Also the strong local preference for fresh milk (especially buffalo which accounts for the bulk of fresh milk production) may well absorb any additional increases in raw milk output. This chapter analyzes and quantifies the required changes in the dairy sector, focusing principally on potentially exportable products such as powdered milk.

The chapter flows as follows. Following this section is an overview of the sector and the constraints it faces. Then a detailed value chain analysis of a powdered milk producer is presented, followed by that of a representative dairy farmer. The final section sums up the options and challenges facing the sector.

Sector Profile and Competitiveness

Fresh milk

Livestock (located principally in the Punjab) with a total output of \$5 billion (about 8.3% of GDP), is the major agricultural subsector in Pakistan and the major supplier of raw materials to the food processing industry.³⁷ Milk production has been increasing steadily from 1992 with growth averaging about 2.8% per annum. This increase, attributable more to growth in the number of dairy animals than improvements in technology or in yield per animal, has resulted in Pakistan being ranked fifth in milk production worldwide in 2004.³⁸ Milk is principally obtained from 9.5 million buffaloes (68% by volume) and 7.2 million cows (32% by volume).³⁹ Unfortunately, far less is known about buffalo (even in Asia, their habitat) than about cows. Thus although buffalo milk is 2/3 of total milk production, this lack of knowledge and available benchmarks to contextualize the analysis forces the discussion in this chapter to concentrate on cow milk.

Table 7: Herds Pattern (Cattle and Buffalo)

Herd Size (No. of animals)	%
1-2	43
2-4	28
5-6	13
Above 6	16
Small Holders Herd size 1-6	84% of Animals

Source: Pakistan Economic Survey 2003/2004

A feature that distinguishes Pakistani dairy farms from the larger more industrial units in milk exporting countries is the small size of the Pakistani herds. As Table 7 shows, 84% of the farms have fewer than 6 animals, with farms

with herd sizes of 1 to 2 animals accounting for nearly half the number of farms. Less than 0.1% of the herds have more than 55 animals.⁴⁰

³⁷ Milk accounts for 51% of livestock related raw materials.

³⁸ The most current figures available.

³⁹ The data are for 2002, the most current year for which the Pakistani national data and the FAO data are in close correspondence.

⁴⁰ Pakistan Agricultural Census 2000.

Further, most (about 75%) of the milk produced on small holder farms is retained and consumed by the producers, with the remainder being sold into the market. The small scale and dispersion of these herds creates a problem of collecting small amounts of milk from a large number of small suppliers. About 20% of the milk collected is rendered unusable during the collection as described in more detail in the next sections. Table 8 below shows that a conservative estimate of the loss during the period 2000 to 2003 is between 1.25 and 1.35 million tons, which in turn represents a financial loss of between 7.5 and 8.1 billion Rupees per year.⁴¹

Table 8: Cost of Underperformance of the Milk Collection System, 2000 - 2003

	Total Milk Produced* (‘000 Tons)	Estimated Non-Retained Milk For Trade** (‘000 Tons)	Estimated Loss*** (‘000 Tons)	Estimated Yearly Loss **** (Billion Rs)
2000	24,949	6,237	1,247	7.5
2001	25,646	6,412	1,282	7.7
2002	26,372	6,593	1,319	7.9
2003	27,128	6,782	1,356	8.1

*For human consumption

** Milk collected and delivered by the marketing chain for further formal and informal processing, mainly in urban centers (estimated at 25% of milk produced for human consumption)

*** At estimated losses a) 15% during collection/delivery stage, b) 5% reject rates, post-collection at the processing plant due to adulteration

**** Average farm gate cost price of Rs. 6 (US\$ 0.10). Estimated losses would be higher if milk is corrected for energy and its respective sales prices (value of cream (fat) + value of solid non fats) and or prices with middlemen’s mark-ups are included.

Pakistani milk yields per dairy animal per year are some of the lowest in the world with yields of between 1,300 to 2,400 kg of milk per annum, well below dual purpose cattle in the rest of the world where yields of up to 6,000 kg/animal/year are achieved (see last section of chapter for information).⁴² This is attributable to various reasons such as poor fodder, genetics, high calf mortality rates and long intervals between lactation.

The sterilization and pasteurization plants established in the 1960s have been replaced by UHT processing and powder milk.⁴³ However, Pakistani households have a strong preference for fresh (buffalo preferred to cattle)

⁴¹ While the calculations are based on industry supplied figures of 20%, other (informal) sources suggest the loss may be as high as 30%. In either case, a significant loss.

⁴² See IFCN Dairy Reports 2002,2003 and 2004 for details.

⁴³ The former products have a short-shelf life and plants were unable to produce effectively in the face of seasonal variations in fresh milk supply and the difficulties in operating an efficient collection system. Also the refrigeration system proved incapable of controlling spoilage before the product reached the final consumer.

versus UHT or reconstituted milk. Further domestic production of fresh milk has been unable to keep pace with domestic demand and as Table 9 below shows, this gap is expected to persist for some years.

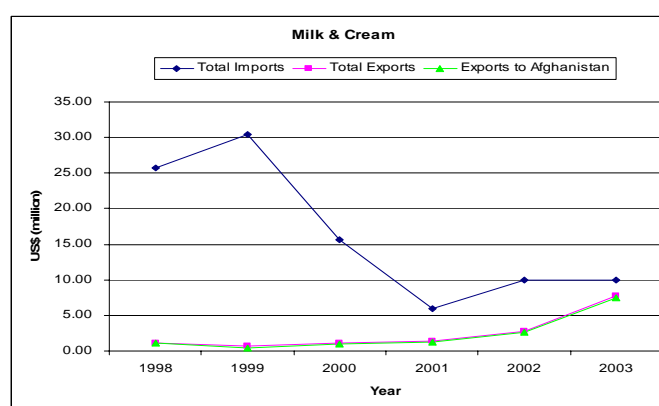
Table 9: Projections of Fresh Milk Production and Consumption to 2010 (Million Liters)

Years	Average Production	Average Consumption	Annual Deficit
Average 1971-2004	15,498.15	15,601.53	-103.38
2004-2005	29,882.92	31,194.59	-1,311.67
2005-2006	31,211.81	32,532.09	-1,320.28
2006-2007	32,504.91	33,785.13	-1,280.22
2007-2008	33,805.10	34,929.54	-1,124.43
2008-2009	35,495.25	36,361.25	-866.00
2009-2010	37,669.75	38,188.92	-519.17
Average 2005-2010	33,428.29	34,498.70	-1,170.41

Source: Econometric projections by Lahore University of Management Sciences, 2005

This gap has been filled by imports of processed dairy products as Figure 9 below shows. The limited exports shown in the chart are to Afghanistan and are driven by geographic proximity.

Figure 9: Pakistan Dairy Trade Structure, 1998-2003



Source: UN Comtrade

Thus the characteristics of the domestic fresh milk sector can be summarized as: (i) a large number of animals but low yields per animal, (ii) large number of small scale herds which hinder efficient collection, (iii) a consumer preference for fresh milk, and (iv) a long-term shortfall in domestic supply resulting in imports of processed dairy products.

Exportable dairy products

International trade in dairy products consists mainly of easily storable products like butter, milk powders as well as condensed and evaporated milk. Powdered milk was selected for further analysis for not only is it exportable

itself and can be used as an input for other exportable dairy products,⁴⁴ but the additional processing stages involved provide further areas for analysis of potential constraints. The installed production capacity of powdered milk is approximately 59,000 MT, but only six out of the ten plants are operating and these are all operating well below 50% of capacity.⁴⁵

International trade in dairy products is less than 5% of global production and the market is dominated by exporters from the developed world. The EU is the world leader in milk production and consumption followed by the US, while Australia and New Zealand are the leading exporters of dairy products with a combined market share of about 50%.

A significant element of the dominance of developed countries is the entrenched system of subsidies and domestic market protection schemes, which distort the global market and serve as major constraints on the competitiveness of other dairy producers in the rest of the world.⁴⁶ The EU's dairy regime, for example, affects developing countries in three main ways: by depressing world market prices, by pushing developing country exporters out of third markets, and by directly undermining domestic markets in developing countries.

Precise quantification on how high world market prices would rise in the absence of EU's dairy regime does not exist, but a number of studies suggest that EU subsidies have a substantially depressing effect.⁴⁷ A 2001 Australian government study showed that if the volume of subsidized EU and US dairy exports were halved, world dairy prices would be between 17% and 35% higher.⁴⁸ According to an OECD Producer Support Estimate, the EU supported its dairy sector to the tune of €16bn in 2001, which is 40% of total value of EU dairy production. In the whole milk powder segment, the EU is one of the largest players, with over 30% of total exports and just as important of a player in skimmed milk powder (SMP) market, with 28% of world market share.

The potential for export-led expansion of milk processing in Pakistan is thus constrained by the subsidized dairy production in the developed world which leaves Pakistan and many other dairy producers around the world undercut by price subsidies as well as tariff protection.

⁴⁴ Powdered milk is used in Pakistan to produce UHT milk when supplies of fresh milk are scarce.

⁴⁵ Field interviews suggested that this excess capacity results from investors both underestimating the preference for fresh milk and the strong seasonal variability in supplies of liquid milk.

⁴⁶ Australia and New Zealand, both heavily dependent on foreign markets and not heavy subsidizers of their domestic markets, are encouraging liberalization, while on the other hand the EU, US and Canada are reluctant to remove the subsidies.

⁴⁷ Dairy Australia's *Dairy Industry News*, various issues.

⁴⁸ ABARE Report, 'Trade Liberalization in World Dairy Markets', 2001.

Food safety is a key concern in most countries (especially in the EU) and an international system of Sanitary and Phytosanitary (SPS) controls has been developed under the auspices of the World Trade Organization (WTO) to allow importing countries to verify the safety of food imports. The agreement (discussed in more detail later in the chapter) stipulates that each country must establish a series of specific contact or enquiry points to facilitate communication regarding SPS measures in place. This is an absolute prerequisite for easy access to international markets. Pakistan lacks such a system of national authorities.

Thus the salient features of (potential) powdered milk exports from Pakistan can be summarized as the same issues facing the fresh milk sector outlined above (for fresh milk is their basic input), plus (i) an international market significantly distorted by subsidies, tariffs and other protective measures with the associated price undercutting of other producers, and (ii) the need to meet SPS requirements.

Powder Milk Production

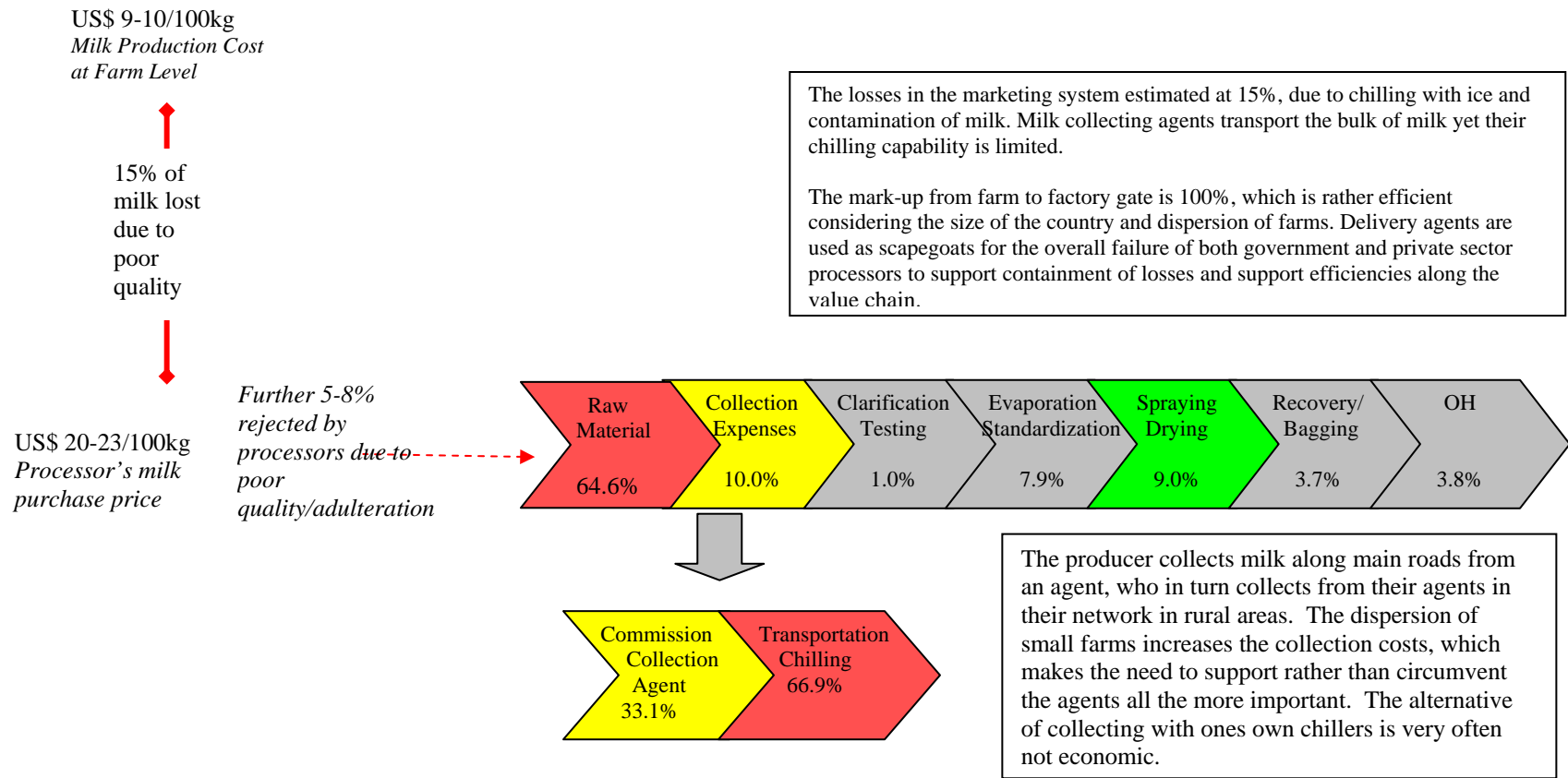
This section is based on a value chain analysis of a powdered milk producer located in Lahore. It costs this processor Rs. 127 to produce a kilogram (or US\$ 2,116/MT) of whole fat filled milk powder (FFMP). The VCA depicted in Figure 10 below, shows that raw materials (64.6%) and their collection expenses (10.0%) constitute 75.5% of the processor's value chain and thus will be one of the key factors (ignoring for the moment the current barriers to entry to global markets) underlying any potential exports.

Milk collection

A two tiered collection system has evolved in response to the challenge of collecting small amounts of milk from a number of geographically dispersed farms. The first level comprises milkmen (Gawallas) who purchase milk at the farm gate.⁴⁹ The majority of these ride motorcycles and transport the liquid milk in metal milk cans using ice as the primary means of chilling the milk. They in turn sell the milk they have collected either directly to consumers or packagers of liquid milk, or in the case of milk destined for processing to collection agents (Dhodis) commissioned by the powdered milk processors who then transport the milk to the processing plants. The absence of any milk chilling system (other than putting ice into the milk) results in significant losses during collection, for unless milk is "calm chilled" within 4 hours of milking, it starts to go bad. The best estimates are that about 15% of the milk sold at the farm gate is lost before it gets to the Dhodis and an additional 5% during transport to the processors.

⁴⁹ About 98% of the milk reaching the market has been collected by the Gawallas.

Figure 10: Powder Milk Value Chain



Powder milk processors largely unable to overcome the overall supply deficit of milk (combined weight of raw material and its collection at 75.5%). All other costs of processing constitute a fourth of total cost (at 24.5%) Absolute Rupee values for the main processing chain are shown in Table 7 in the Annex.

The cost of milk collection (for further processing into powder) ranges between \$0.022 and \$0.025/kg comprising transportation and chilling charges (if chilling was used) and the commission paid to the Dhodis by the processors. In India, a country which faces a similar collection challenge, collection expenses (for milk to be converted into powder) are in the range of \$0.029 to \$0.051/kg.⁵⁰ Thus the problem lies more in the collection losses than in the high cost of the collection system itself.

The value chain analysis shows no evidence of an abusive relationship between farmer and the Gawalla and the Gawalla and the Dhodis. Both the Gawalla's and the Dhodi's margins were found to be in the range of between 16 and 35% (not accounting for the proceeds from cream), and most probably are lower due to the losses and rejects they face as they move milk up the chain to the final consumer or processor.

Seasonality in milk supply

Another important aspect that is affecting the dairy processing industry and which largely has its genesis at the farm level is seasonality in milk production, which in turn leads to poor capacity utilization in milk processing plants.⁵¹ This is not unique to Pakistan. In Ireland, for example, capacity utilization (measured as annualized peak month production compared to total annual production) averages close to 60%. However, Denmark and the Netherlands have figures close to 93% (see accompanying text box). The corresponding measure for Pakistan is 25%, suggesting significant room for improvement. Addressing this issue will require cooperation between farmers, collection/delivery agents and processors and is likely to involve lowering losses in the milk marketing system as well as improving milk yields.

The higher utilization rates in Denmark and the Netherlands is partly attributable to the lower seasonal variation in milk supplies in temperate climates, but largely to the fact that the dairy farmer co-operatives own the processing plants so reducing uncertainty about the volume of milk supplies.

Potential export issues

As there are no examples of successful exporting countries that rely on an extensive network of small scale producers for their raw materials – they all rely principally on larger scale farms. However, there are examples, as the box on the right shows, where domestic

In the Mandalay Dairy Development Project (AusAID) a cooperative with a herd of about 100,000 specially bred cows (about 2 cows per owner) produced sweetened condensed milk that was sold in local tea houses and displaced imported condensed milk. However, they were aided by low cost energy supplies of urea treated paddy straw and grass cut from the sides of the roads. However, the strong preference for fresh milk in Pakistan makes close comparisons suspect.

⁵⁰ The Punjab State Co-Operative Milk Producer's Federation Limited (MILKFED), accessed via <http://punjabgovt.nic.in>.

⁵¹ Milk seasonality usually results from the natural cycle of a decrease in milk supplies in the summer (often called the "dead" season) with corresponding peaks in the spring and fall.

producers can displace imports. Thus the question of whether the existing structure can support an export industry warrants discussion. Reducing the loss rate during collection is the first issue. The standard solution is to use better chilling (or refrigeration) during collection and use a network of chilling stations for consolidating the individual collections of milk. However, the appropriate affordable small scale chilling technology, usable at the Gawalla level, has not been identified and may well not exist. Roadside chilling technology usable by Dhodis does exist, but is expensive and requires electricity (not always available in rural areas) or a substantial bank of batteries (also an added expense). On a larger scale only Nestle, drawing from its international experience and large corporate resources, has managed to establish and maintain such a system which suggests that such an approach is beyond the means of most smaller processors.

A second issue is the need to meet SPS requirements. The SPS Agreement under the WTO lays down requirements that aim to ensure transparency in the implementation of SPS measures in member countries. Members are required to establish specific contact points to facilitate communication regarding SPS measures – failure to notify and convince importing countries that SPS measures are up to date and implemented often results in time consuming inspections, quarantine measures or rejections.⁵² Apart from problems and gaps in the current SPS system, it is not clear how, in an environment where many small amounts of milk are consolidated before use, any authority would be able to certify sanitary measures in every one of the small farms. It would require a more professional approach to dairy farming, and likely less dispersed and larger farms, to permit a large scale certification of such issues as hygiene during milking, purity of feed etc.

Raw Milk Production

This section presents a value chain analysis of two milk producers, chosen as proxies for dairy farmers. The first focuses on a small holder with 11 buffaloes (which is still larger than an average farmer's herd size) while the second focuses on a larger farmer with 30 cows. Both are market oriented and sell the bulk of their output.

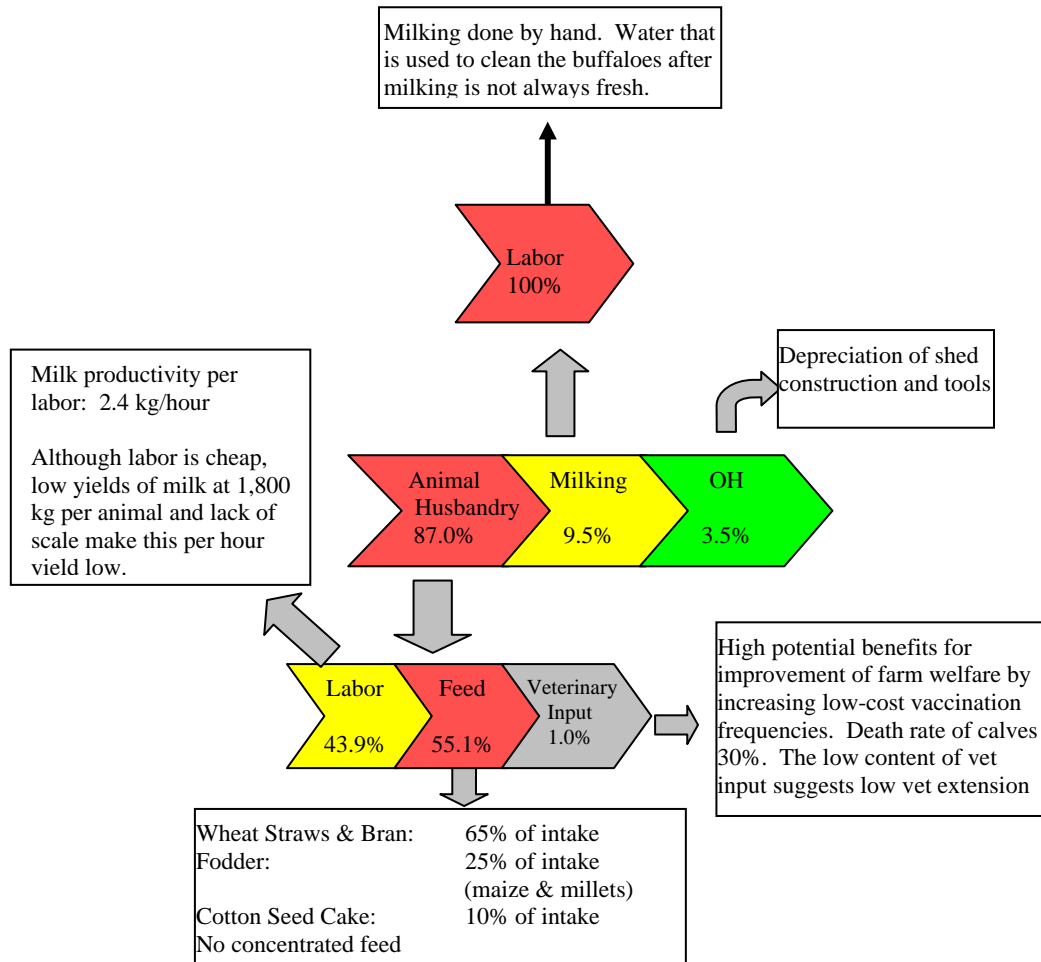
Smallholder dairy farmer

The value chain in Figure 11 below is a snapshot of a smallholder dairy farmer in Punjab with 11 milch buffaloes. The farmer is market-oriented and sells to milkmen at the farm gate. The farm gate production cost of this particular farmer is Rs.5.72/kg of milk (US\$ 0.095/kg), which combined with profits of Rs.3.56/kg makes a total of Rs. 9.28, the delivered/purchase price to/of the milkman. The milk yield is 1,800 kg per animal per year, typical of Pakistani yields of 1,200 to 2,400 kg. Field interviews suggest that this producer is

⁵² Mustafa, K. "Barriers Against Agricultural Exports from Pakistan: The Role of WTO Sanitary and Phytosanitary Agreement", pp.13-15.

within the same cost range of other small scale dairy animal farmers, including those with cows only or those with a combination of cows and buffaloes. By international standards small scale dairy farmers in Pakistan compare favorably with the lowest cost producers of the world like Argentina, Brazil, and New Zealand, which have per kg costs in the range of US\$0.07 - \$0.17 as shown in Table 10 below.

Figure 11: Value Chain for a Smallholder Dairy Farmer



Source: Global Development Solutions, LLC

Note: The Rupee values in the main chain corresponding to the percentages above are shown in Table 8 in the Annex

The figure above shows that animal husbandry constitutes 87% of the total value chain of this particular farmer. Feed (55.1%) and labor (43.9%) are the main value addition components of animal husbandry. The labor input is approximately 740 hours/animal/year (consisting of the farmer's own labor as well as hired labor). When considered that this is only about two hours per day, it shows the low level of care and attention given to the animals.

Table 10: Benchmarking International Milk Production Cost

Country	US\$/kg milk
Argentina	0.07-0.11
Pakistan	0.09-0.12
India	0.10-0.11
Australia	0.10-0.14
New Zealand	0.11-0.14
Brazil	0.15-0.17
Austria	0.57
Switzerland	0.79

Source: IFCN, 2003

listed above which have many larger scale dairy herds.

This type of farmer feeds the animals a low protein diet, and although the farmer understands the concept of a balanced diet, the farmer prefers to stick to feed rationing traditions passed down from generation-to-generation: mainly with wheat straws and bran (wheat being his own crop), maize and cotton seed cake (purchased in the market between Rs.7.5-8.7/kg). The farmer uses no concentrated feed. With this feed rationing, the yield of milk per lactation is lower than it otherwise would be.

Milking is done by hand and the water used for washing after milking is not always fresh and clean, increasing the likelihood of spreading disease. The farmer does not follow the weight changes of his animal before or after milking (reflected in the low hours per day spent on each animal), and neither does he measure the quality of his milk with anything other than a ‘finger test’. The veterinarian is usually called when there are problems, which sometimes can be too late, as the mortality rate of calves is high at 30%.

Taken together these factors suggest that while being one of the lowest cost producers in the world, this Pakistani dairy farmer is substantially behind modern farm management practices and thus has a very low milk yield. The milk yield per animal in Pakistan, depending on farm type (from 3 to 10 dairy animals) at between 1,300 - 2,400 kg of milk per dairy animal per year, is on the lowest end compared to other countries. Only India and Bangladesh have lower yields, at below 1,000 kg/animal/year in some cases.

As 68% of the milk produced in Pakistan comes from buffalo raised solely for the purpose of dairy production with the remaining 32% from (potentially dual purpose) cattle, it would be incorrect to characterize Pakistan as a country that relies extensively on the use of dual purpose cattle for milk production. As dual purpose cattle do have lower yields than single purpose cattle, comparing Pakistani milk yields with countries that rely on single purpose cattle may be overestimating the yield gap. However, data from dual purpose cattle in farms in Austria, Germany, and Czech Republic show that milk yield performed fairly well, at milk yields of up to 6,000 kg/animal/year, suggesting that yields

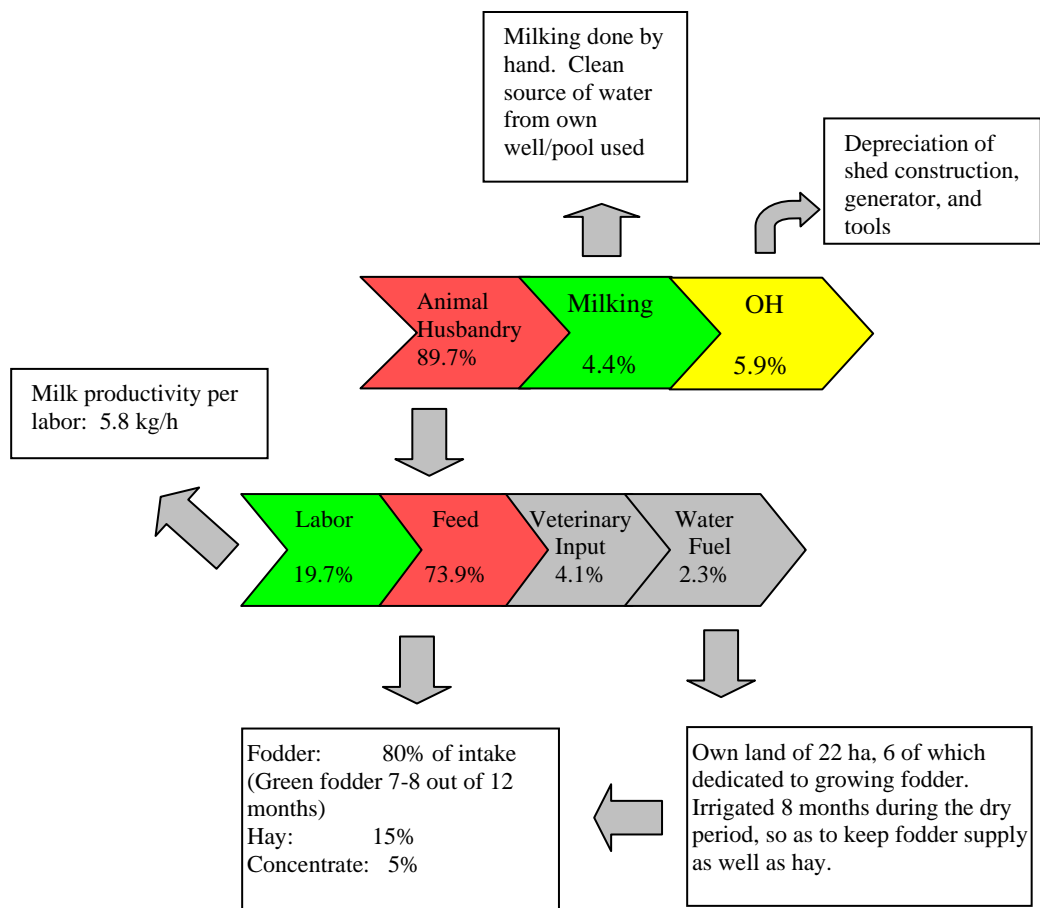
It would be incorrect to assume that this apparent competitiveness applies to the dairy sector as a whole, since the bulk of market-oriented farming in Pakistan is very small scale, with the majority of farms owning one to three animals. This is quite unlike the lowest cost countries

in Pakistan still undershoot the world performance levels, even in dual purpose cattle farms.⁵³

Medium-sized dairy farmer

The VCA shown in Figure 12 below for another type of farmer, with 30 wet cows (crossbreeds of Frisian and Sahiwal breeds), suggests that better farm management skills, both in terms of diet as well as animal health can produce substantial benefits in terms of yields within the same range of milk production cost of between Rs5.5-5.7/kg.

Figure 12: Value Chain for a Medium Size Dairy Farmer



Note: Rupee values corresponding to the percentages in the main chain are shown in Table 9 in the Annex.

For this farm, the farm gate production cost of milk is Rs.5.45/kg, and the delivered price of milk to local milkmen is Rs.8.5/kg (including the farmer's profit). The milk yields are exceptional for Pakistani averages, at 4,000

⁵³ See IFCN Dairy Reports 2002, 2003, and 2004 for more details.

kg/animal. The diagram shows that one of the main differences with the low-cost low-yield farmer is that this type of farmer has a higher feed component in animal husbandry cost at 73.9%, significantly higher than the previous example, where feeding constitutes 55.1%. Also this type of farmer has higher mechanized asset value in his farm, including generators and a well for irrigation of land. All in all, better feeding, constant supply of water for irrigation of pastures, farm hygiene, as well as an apparently successful genetic crossbreeding in this particular case, allows this farmer to produce better results.

Notwithstanding these characteristics, the farmer was beset by problems which are not unique to his farm, namely poor supply of irrigation water and poor reproductive performance which will be analyzed next.

Irrigation

This farmer incurs depreciation and fuel expenses for water pumping, unlike the typical farmer illustrated in the previous example, who does not use irrigation. The lack of constant supply of water in the canals (available for only 4 months out of the year) necessitated opening a well and purchasing a generator, which increases the cost of operating the farm by approximately Rs.0.13/kg of milk. This suggests that improvement in availability of canal water could bring in additional efficiencies, and may in fact spur investments in commercial cattle farming by giving the opportunity for farmers to have as much green fodder as possible all year round.⁵⁴ In fact, the inability to secure supplies of feed for animals all year round is one of the reasons why herds managed by smallholder dairy farmers do not grow in size.

Reproductive performance

In Pakistan, both smallholder and medium commercial farmers reported significant reproductive problems with low conception and pregnancy rates, and calving intervals of 15.5 to 16.5 months compared to international norms of about 12.8 months (see box on right for more details). As a result, these herds are faced with long number of days open (without pregnancy), which effectively means fewer calves per reproductive lifetime of an animal as well as fewer days in peak milk production. Pregnancy rates are low mainly due to the fact that feeding is poor. Without reasonable nutrition the animals

As a general rule, milk yield peaks about 2-3 months after calving and then starts to decline gradually over the next 7-8 months and ceases completely after 10 months. To have as many peak days in milk as possible during the reproductive life of a cow (3-3.5 years) the dairy animal must become pregnant during this 10 month period. The optimum period for conception is about 100 days after calving resulting in an interval of 12.8 months between calves. This will result not only in the maximum milk yield but also 3 additional calves.

⁵⁴ According to interviewees, to date there is no green fodder available all year round in Pakistan.

cannot reach puberty as early in life or reproduce as regularly as their physiology or genetic capabilities would normally allow.

Also, artificial insemination is used in only 6% of households raising dairy animals. In this particular example of a farmer with 30 animals in milk (with an additional 17 animals not yet calved), the estimated cost of not having close to optimal conception rates will result in approximately 18 fewer calves at the end of a three year reproductive lifetime of the cows, so resulting in a loss of potential income.

Even though many research and other institutions exist in the country, the performance of actually delivering extension services to farmers toward improving calving intervals has been lackluster. Artificial insemination (AI) has become the dominant insemination option among dairy producers worldwide because it reduces disease transmission, allows genetic selection, and ultimately increases longevity and milk yield of dairy cows.

Extension services

The value chain shows that veterinarian costs are low for the low-cost, low-yield type of farmer, at 1.0% of animal husbandry costs, while they are higher for the advanced type of farmer, at 4.1% who, in addition to regular vaccination, purchases AI services at Rs.500/semen dose (albeit only at success rates of 25%). This is mainly related to a combination of the small farmer not actively seeking calving interval reduction as well as poor offering of extension services on the part of largely government run veterinary and animal health services. While private sector vet services are available, their numbers are very small compared to almost 6,000 veterinary care institutions run by the government.

Table 11 below illustrates the fact that among countries with the largest livestock (cattle and buffalo) populations, Pakistan has the lowest availability of veterinarians per head of bovine animal, at 8.4.

Table 11: Veterinarians and Technical Personnel per Bovine Animal (2002)

	Per 100,000 Cow and Buffalo	
	Veterinarians	Technical Personnel
United States of America	56.68	53.84
China	40.31	88.85
Australia	28.40	10.70
Brazil	26.95	4.98
Argentina	25.03	15.25
India	13.30	24.57
Pakistan	8.42	20.35

Source: Compiled by Global Development Solutions, LLCTM from FAO and OIE data.

The table also illustrates that Pakistan’s reliance on technical personnel as compared to trained veterinarians is very high.⁵⁵ Even though technical personnel close the gap of low vet availability in the country, they lack the expertise and training of veterinarians.

Summary and Conclusions

In the face of strong consumer preferences for fresh milk and the deficit shown in Table 8, it is likely that domestic demand will absorb a significant portion of any increase in liquid milk – at least in the short run. When taken in conjunction with the problems of meeting the internationally subsidized prices for dairy products and meeting international sanitary and phytosanitary requirements, the focus of policy should be on increasing domestic supply.

The chapter identified a number of issues adversely affecting the potential yield obtainable from domestic herds. These fall naturally into two categories: those affecting the production of milk itself (i.e., on the farm) and those affecting the collection and delivery of the milk (reducing losses). For convenience, these are summarized in Table 12 below and then discussed in more detail.

Table 12: Issues and Priorities for the Dairy Sector

Issue Areas	Priorities			Action	
	High	Medium	Low	Public Sector	Private Sector
A. Low milk yields					
Poor on-farm management skills (partly a result of poor extension services)	X			X	X
Irrigation problems leading to lack of green fodder		X		X	
Low numbers of trained vets and poor provision of extension services, leading to poor reproductive performance (including insufficient availability of AI)	X			X	
B. Post milking losses					
Weak milk marketing system with high milk losses during collection and delivery	X			X	X

Low milk yields

Extension services are primarily provided by the Government. While there is a role for public-private partnerships, for example the extension services could use the close relations between the Gawallas and the farmers to deliver basic

⁵⁵ A fully trained veterinarian has undergone extensive formal training to receive his or her certification. A technician, on the other hand has only undertaken a few formal courses.

information pamphlets in advance of a visit by an extension officer, in the short to medium run the bulk of extension services will continue to be provided by the Government. This will involve an increase in resources devoted to extension services, provided an evaluation of the competing uses of these resources warrants their use.

As the training of veterinarians is a Government responsibility the issue would be similar to that discussed in the above paragraph, with the same caveat about competing uses of scarce resources.

The irrigation problem is part of a much wider issue of water management. This is an issue whose scope far exceeds that of this chapter and one (based on world-wide trends) will likely be of increasing importance over time. The effect of a lack of a year-round supply of green fodder on the milk yield of the herds, adds another argument for the Government of Pakistan to make water management a priority policy issue.

Collection losses

The small scale of the herds and their wide dispersion and the small amount of milk collected from each farmer suggests that the current two-stage system is the correct model. Further support to this is provided by the closed nature of rural society where the personal knowledge and trust of each farmer in the Gawalla plays an important role. Thus with the current herd structure, the solution lies more in making the current collection system more efficient and not in a total replacement of the system.

One of the key causes of problems is the lack of a small, easily portable (on a motorbike) non-contaminating refrigeration system, for milk needs to be chilled within 4 hours of milking to avoid going bad. The current system of adding (often contaminated) ice to the milk during collection is not optimal. Yet while small refrigeration units are available, they are not portable (at least not on a motor bike), they require electric power and they are expensive. The required technology does not exist, at least at a realistic price-point. But as there is a pressing need for it, and in view of the scientific expertise in Pakistan, the Government may want to consider offering a reward/ recognition for the development of a better system. The possibility of developing an affordable roadside chilling system for the Dhodis warrants similar examination.

A second area where improvements may yield results is in establishing a more cooperative relation between the Dhodi and the Gawallas. Even though the Gawalla has ties to the village, farmers do not always regularly sell to him, especially in the summer months when the retention of milk in the subsistence farms increases. Thus sometimes he does not return with a full load, and other times leaves milk uncollected because his cans are full. If the Dhodi was prepared to enter into a longer term contact with the Gawalla to collect a specified amount of milk per day over a period, then not only would be the

Gawalla be able to manage the distance traveled during collection and the farmers would have a more secure market for their milk and would likely to provide a more predictable amount of milk for collection.

While all of the above will contribute to the increase in the amount of liquid milk brought to market (especially any reductions in the wastage rate) the unsatisfied domestic demand for fresh milk will likely absorb additional increases. The development of an export oriented dairy industry will likely require both a reduction in international subsidies and a move towards larger scale farms, both of which are not on the immediate horizon.

4 Constraints to Competitiveness in the Mining and Quarrying Sectors: A Marble Tile Example

While Pakistan has extensive stone reserves including some rare and valuable varieties of marble, its exports fall well below its potential. Insecure and uncertain mineral extraction rights and a shortage of skilled workers are the causes of many of the problems. Uncertainty about on-going access to the resources encourages “quick and dirty” and inefficient extraction methods as well as inhibiting longer-term investment in modern and more efficient extraction techniques. This is compounded by a shortage of skilled workers. The processing sector faces similar constraints where antiquated machines and skill shortages result in additional waste and an inferior finished product. Inefficiencies in the transport system (mines are a distance from the processors) compound the waste. As there is no obvious short-term solution for the security of extraction rights, the focus lies in improving skills in both extraction and finishing, and reducing wastage.

Introduction

This chapter examines the current international competitiveness of the marble mining and processing sector in Pakistan with particular focus on identifying areas where improvements can be achieved. Pakistan has extensive marble reserves including some rare and valuable varieties such as Ziarut White and Burma Teak marbles. However, uncertain land tenure, inappropriate extraction techniques, skill shortages, substandard finishing and transport problems are constraining it from realizing its potential.

Almost all of the mines are in the North West Frontier Province (NWFP) with half being in the Federally Administered Tribal Areas (FATA). The finishing (dimensioning, polishing etc.) is done either in Peshawar or in Karachi, with the latter having most of the skilled workers and better machinery, and hence the higher quality product. However, significant wastage (about 85%) occurs as the stone is transported over bad roads from the mines to the processing factories, in processing and then in further transportation of the cut stones.

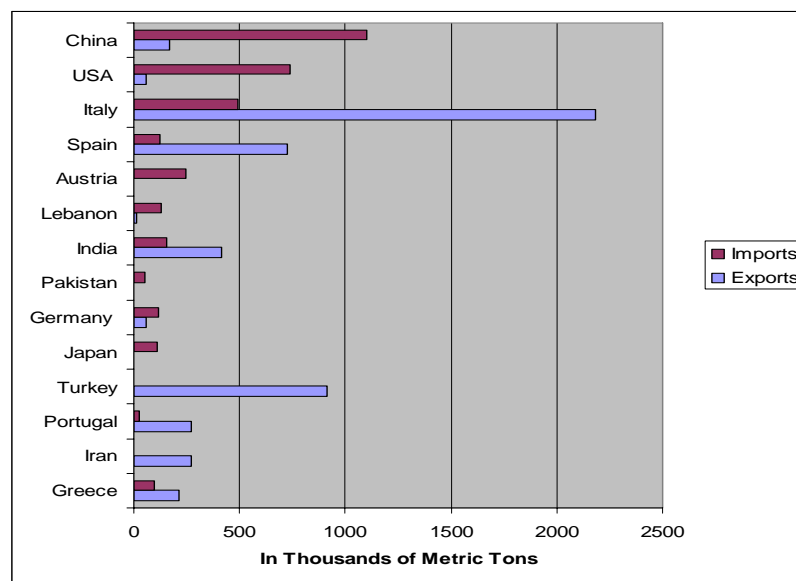
The chapter flows as follows. Following this section is an overview of the sector (both mining and processing), and the constraints facing potential export products. Then a detailed value chain analysis of the production of polished marble tiles is presented. The chapter concludes with a discussion of issues and options in the marble sector. Annex A contains a more detailed

discussion of some technical issues and a record of the Rupee values of the elements in the VCA diagrams.

Overview and Constraints

The net production of dimensional stones was nearly 70 million tons in 2004, representing an increase of 33% since 1999.⁵⁶ The global market for marble in particular was valued at US\$3.5 billion in 2003. The world trade leaders for marble are shown in Figure 13.

Figure 13: Marble Trade Industry Leaders, 2001 - 2002



Technical advancements have made the quarrying, cutting, polishing and finishing of dimensional stone less complicated, costly, and wasteful. These technological improvements of the past several decades will likely continue, with the production levels by 2025 estimated to reach as high as 175.7 million tons.⁵⁷

Dimensional stone exports, of which the bulk are in the form of roughly dimensioned blocks of partially finished stone, constitute 0.13% of Pakistan's US\$15 billion estimated exports for 2004.⁵⁸ For example, out of the total marble exports of US\$4.48 million in 2004, US\$3.95 million were exported in the form of marble merely cut by sawing into blocks/slabs of a rectangular

⁵⁶ All natural stones including Marble, Granite and slate, which can be cut to sizes, polished and used for construction purposes, are referred to as dimensional stones.

⁵⁷ GDM Stone Industries Handbook, Mineralzones.com 2005 and Dimension Stone Advocate News, April 2005.

⁵⁸ Pakistan's marble exports are too small to show in Table 1 and the figure for exports represents the midpoint of current preliminary data for Pakistani exports..

(including square) shape.⁵⁹ The extent to which this relatively low level (and quality) of processing has affected the price received by Pakistan for its exports is shown in Table 13 below.

Table 13: Pakistani Processed Marble Valuation Gap in International Markets

	Volume (MT)*	Price (\$/MT)**	Price Discount of Pakistani Processed Marble (\$/MT)
Pakistan	2,219	360	
Italy	328,019	780	420
Spain	59,494	880	520
Turkey	153,206	410	50

Source: UN Statistics
** 2003 to 2004 average annual export volume of monumental/building stone & arts of marble, travertine & alabaster, simply cut/sawn, with a flat/even surface*
*** Average price for 2003 and 2004 exports. For Italy, average for period 2002-2004*

Source: Jordan Ministry of Planning, The Stone Report, UN Comtrade.

Since 1990, mining and quarrying have contributed around 0.5% to Pakistan’s GDP and marble makes up a large part of this. Pakistan harbors vast reserves of marble, much of which is considered to be stone of the highest international standards. The vast majority of reserves are located in the Northwest Frontier Province. Known reserves amount to 160 million tons, but estimates by the Directorate General Mines and Minerals (DGMM), the body responsible for the policy and regulatory control of the mining and related sectors, range as high as 3 billion tons. At present extraction rates (approximately 900,000 tons in 2003) the known reserves will last for at least another 175 years.

The marble and granite industry in Pakistan, of which marble constitutes 92% of the production, provides as many as 25,000 direct and indirect jobs. Most, about 85%, mining operations are micro in size extracting 3 – 5 tons daily. Most of what is extracted from these mines is used for tiles with little being used for high value items such as slabs and furniture. Another 10% of the mines are small enterprises, extracting 5 – 20 tons daily, whose output can sometimes be used for higher value items. Very few mining operations have the capacity to produce up to 100 tons per day.⁶⁰ Likewise, the processing plants are predominately micro and small operations as well. However, in spite of the problems outlined in the rest of this chapter, most of the firms are profitable. This, perversely, reduces the incentive to embrace the riskier opportunities.

As shown in Figure 13 above, Pakistan is a very minor player on the global field (and is a net importer) and further lacks the necessary skilled labor,

⁵⁹ Similarly in 2003, where out of the total marble exports of US\$4.21 million, approximately US\$3.82 million were exported in raw blocks of sawn marble. Source: UN Trade Statistics.

⁶⁰ 100 tons per day is commonly used to delineate small/medium sized operations from large ones.

machinery and infrastructure necessary to command the highest prices for its exported marble. A key factor underlying this is the uncertainty and insecurity of mineral extraction rights. This is compounded by skill shortages, inappropriate extraction methods, low quality and antiquated finishing machinery, a high wastage rate throughout the chain from extraction to shipping the finished product, all of which to varying extents are linked to the uncertainty and insecurity of mineral extraction rights.

Over half of all mines in the NWFP are in the Federally Administered Tribal Areas (FATA) and over 50% of the mines in FATA are shut down due to security issues or ownership disputes. Thus, mines often become inoperable after significant investments have been made as a result of a “dispute” that arises between the mining company and local community leaders. Even though there are laws against instigating a shut down of a mine, those interviewed said that they knew of no actions ever taken against anyone under this law. However, most of the high value stones are in this region and sources confirm that none of the mines capable of extracting Ziarut White marble are currently in operation.

Further, even in areas where the rule of law is in effect, the legal rights to minerals are obscure. For example, a recent study noted:⁶¹

“There is no constitutional basis for private mineral rights in Pakistan. Mineral rights in Pakistan are purely creatures of Provincial Law. Investors in major projects are likely to want to satisfy themselves that the mineral rights they obtain are recognized by the Federal Government as property rights that cannot be taken without due process of law and prompt and adequate compensation. The National Mineral Policy (NMP) contemplates that such assurance could be obtained through the negotiation and execution of a mineral agreement that may be acceptable and desirable for major investors; but requires considerable resources on the part of the Federal Government and the Provinces to first negotiate and then administer the mineral agreements.

Although the mining rules of the three Provinces reviewed for this chapter (Balochistan, Sindh and NWFP) describe the rights and obligations of mineral licenses and leases, they do not explicitly clarify the nature of those rights. The licenses are presumably personal property rights; the exact legal nature of the rights may be determined by other laws. Both are subject to some restrictions on transfer. It would be desirable to clarify the legal nature of such rights in the Provincial Mining Laws, by specifying whether they are real or personal property, inheritable, mortgageable or pledgeable and transferable.”

⁶¹ “Mineral Sector Development Policy Note”, jointly prepared by the World Bank and the Ministry of Petroleum and Natural Resources, Government of Pakistan, November 30, 2003.

This uncertainty in mineral extraction rights (a) encourages a strategy of extracting as much as possible as fast as possible and as well as reducing the incentive and need for knowledge of better techniques, and (b) a problem in obtaining longer-term finance to upgrade technology. It is further compounded by a lack of awareness and necessary skills to efficiently quarry rock.

Extraction in Pakistan comprises boring holes in the bedrock which are then filled with explosives to blast the rock. This results in cracked, potato-shaped blocks of varying quality and sizes. Also the blasting creates not only cracks in the blocks, but also cracks throughout the area being mined, so leaving cracks in blocks that may be mined in the future. The potato-shaped blocks cannot be stacked on a truck the way rectangular blocks can and so are difficult to transport securely to the processors (to minimize additional breakage while in transit), and make inefficient use of available truck space. The processors themselves are forced to discard as much as 60% of the material arriving at their plants as being unsuitable for further processing. Further, the irregularly shaped blocks tend to move while being cut, resulting in variations of as much as 3 to 4mm in thickness. International buyers allow variations of only 0.5mm for tiles and 1.0mm for slabs. Also the smaller the size of the block the less value it has, as larger dimensioned stones command disproportionately higher prices.⁶² However, the biggest problem is that the processor cannot obtain as many tiles from an irregular shaped block as from a rectangular block. (This is discussed in more detail in Annex B.)

The uncertainty about extraction rights has its maximum impact in FATA. However, a general lack of knowledge of modern explosive based blasting techniques (there are currently no qualified quarry masters in Pakistan), tends to perpetuate these crude blasting procedures in areas where there is some *de facto* security of extraction rights.

The problem of inappropriate blasting has become so serious that all those interviewed for this report stated that there are such few good blocks on the market that many companies employ people to wait at the mines to see when a good block comes out. They then mark the block and prepare for the sale and delivery of the block to the factory so adding to overall costs.

In comparison, the modern method consists of drilling holes around the optimal block size and the use of hydraulic jacks and splitting equipment to loosen the rock and cranes or gantries to remove the rock. The block size and shape can thus be controlled and wastage minimized.

The uncertainty in mineral extraction rights also has an impact on the financing of firms in the sector. While lending rates are not exceptionally high in Pakistan, almost all marble processors are self-financed. Banks are

⁶² On a square foot basis, a slab can bring as much as 50% more in price and without all of the extra labor involved in cutting each individual tile.

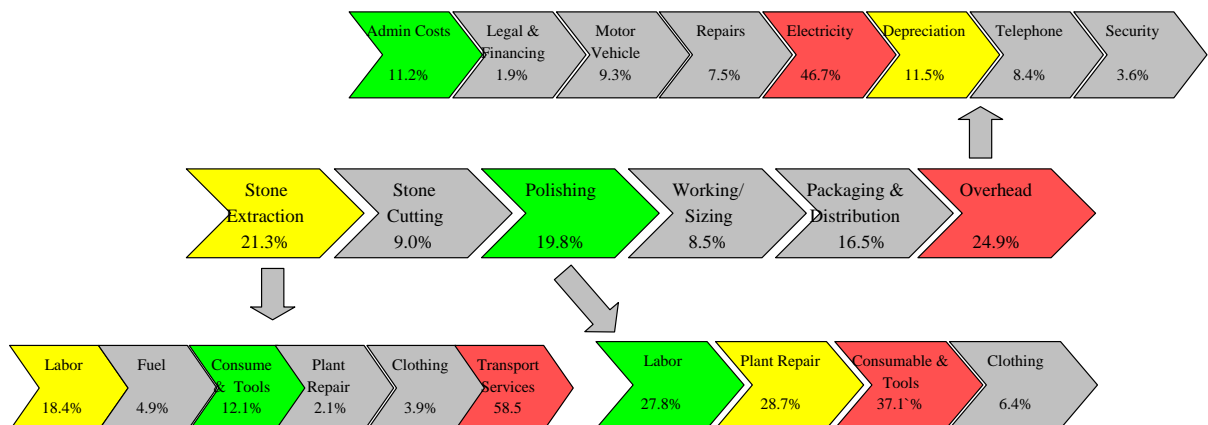
unwilling to invest in the industry because of the problems with security. With no external sources of finance, growth has to be financed internally, and with no ability to make quick use of market opportunities, large orders go unfilled due to the shortage of capital and labor.

According to mine operators and marble processors, one of the reasons why there is not more investment in mining technology is that most miners and processors are already making reasonable profits and they do not want to take on the added risk. The risks discussed involve not only issues with physical threats from tribes in FATA and other parts along the Afghanistan border, but also related to the insecure and arbitrary enforcement of property rights and lease arrangements more generally. Miners and processors interviewed for this report believed that the risks of making large investments in new mining equipment, for instance, are greater than the potential return, compared to the returns and profits currently being made.

Marble Tile Production

This section presents a value chain analysis of the production of a 12 inch square by 1/2 inch thick polished floor tile of white Badal Marble using current methods in Pakistan. This type of marble is very common in the NWFP and is popular for use in homes and offices. It is also exported to Afghanistan and to a lesser extent to Europe and parts of Asia. Although less than 20% of all tiles produced in Pakistan are polished, this analysis follows a polished tile through the value chain as most tiles exported throughout the world are polished. The tile is finished in Peshawar and then exported to Afghanistan. As exports to most other countries are finished in and shipped from Karachi (where the bulk of international standard finishing plants are) the analysis includes a discussion of the transport of rough-cut tiles to Karachi for finishing.

Figure 14: Value Chain for Polished Marble Tile 12X12 Inch Badal Marble Floor Tiles



In the above VCA (Figure 14) the total cost per square foot of polished marble tile (excluding profit but including FOB related costs) was estimated at Rs. 21.46, with typical profit margin of 12% to 22%. Of the total cost, the largest component is overhead at 24.9%, then stone extraction at 21.3%, polishing at 19.8%. Packing and distribution account for 16.5%. These are discussed in detail below. The values corresponding to the percentages in the diagram are recorded in Annex A.

Overhead

Overhead is the single largest element of the value chain and of these, electricity is by far the single largest component. The importance of electricity is partly due to polishing being an electricity intensive process and partly to the high costs of generating electricity in the remote areas where the mines are located. As it is unlikely that grid electricity will become available in these mining regions in the near future, the need to self-generate electricity, and the associated high cost, will remain a feature of the industry.

The machines used in the polishing industry are particularly heavy users of electricity. In addition, since the marble processing industry requires a lot of water, most processors cannot rely on the public water system to deliver water in the quantities and at the quality required.⁶³ Therefore, most processing plants' cost and competitiveness is hampered by them having to drill wells for their water supply which requires the use of a pumping system, another heavy user of electricity.⁶⁴

Stone Extraction

Stone extraction is the second highest cost component in the production of marble tiles. Within stone extraction, by far the largest component is transport services (principally bringing in supplies and transporting uncut rocks from the mine to the processors), followed by labor, and then consumables and tools (discussed in the next section).

There is almost no infrastructure such as electricity, water, roads, medical services etc. in the tribal areas. Thus mining companies need to build the roads, drill the wells, generate electricity and ship in all services and supplies. The remote locations and poor roads result in heavy wear and tear on motor vehicles. Transportation costs related to the transport of the marble blocks from the mines to the processing factories are particularly high. Part of the reason is that the roads are inadequate to handle the large, heavy trucks which can weigh well over 15 tons when fully loaded. Another reason is that the system of transport requires a variety of payments depending on location of

⁶³ It is not uncommon that distilled water is used in sophisticated polishing operations. This is generally done when high value pieces are polished. Otherwise water with least mineral content is used to process marbles.

⁶⁴ These costs are included in the case illustrated in the VCA.

the mine. Table 14 below lists some of the fees required before blocks can be transported out of the mine and/or areas surrounding the mine.

Table 14: Documented and Undocumented Fees Related to Transporting Raw Marble from the Mines in FATA or NWFP to the Processing Facility in Peshawar

Description of Tax/Fee	Amount Rs/ton
Cost of freight within 75 kilometers of Peshawar.	400
Fee that goes to the Directorate General of Mines and Minerals of the NWFP. A documented payment.	25
Gunda Tax, also known as the “Bully Tax” – this fee is paid at some mines to “protect” the mine and its workers from unwarranted security threats. This is an undocumented fee and is paid to tribal leaders who have claims to the land that the mine is on.	20
A tax paid to the political agents in FATA, also an undocumented payment.	20
The surface rent (also known as “the tribe tax”) paid by mine owners to prevent problems with the tribes in the areas.	30
Total	495
<i>Source: Field interviews.</i>	

Polishing

Most marble traded in the international market is polished before leaving the factory. In Pakistan, on the other hand, almost all of the marble tiles sold in the country are unpolished, but as the focus of the study is on exporting, polishing has been included in the value chain. It accounts for 19.8% of the cost of the marble tile and, in turn, consumables and tools (37.1%), plant repair (28.7%), and labor (27.8%) are the largest elements of costs of polishing.

Consumables

Consumables and tools are a relatively high cost item for a number of reasons, not least of which is because most marble processing companies import all of the blades, tips for blades, polishing crèmes and related substances. In addition, several of the items carry high duties. For instance, a processor who imports blades from China and South Korea has to pay import duties of 15% as well as the generally applicable 15% general sales tax, and 6% advanced income tax. Importers face goods valuation problems from Customs officials. For instance, it is not unusual for Customs to try and classify the artificial diamonds that are imported for blade tips as *real diamonds*, which of course dramatically increases their value and hence the amount of duties and taxes required before they can be imported. Often the only way around this problem, according to several sources, is to pay a bribe to make sure the goods are released in time to keep the factory operating.

Plant repair

The machines used in finishing are antiquated, almost dilapidated, and require frequent repairs. If the needed parts have to be imported, they can be expensive as in the case of consumables above. If parts are locally made, they are of inferior quality and need frequent replacement.

Labor

The productivity of labor is low in the mining and marble processing industries mainly due to a lack of skilled labor. For example, many operators of stone cutting machines are not well qualified so resulting in slow and uneven cutting.

Table 15: Benchmarking Labor Productivity, Marble Processing

Country	m ² /person/year
France	1,593
Italy	2,096
Spain	1,394
Pakistan	463
<i>Source: Global Development Solutions, LLC & CEPI Briefs, Tunisia.</i>	

When compared to major marble producers like Spain, for example, labor productivity of Pakistanis working in the marble processing sector, is three times lower (Table 15). When compared to the top productivity producers, like those in Italy, the gap is as big as fivefold in disfavor of Pakistani producers. Further skills are unevenly distributed. Although there is skilled labor in Karachi, where a large marble processing industry has developed, very few workers want to move from Karachi to Peshawar to work in the marble factories there.

Table 16: Labor Input Comparison (unit Based on 1 ft² tile)

Country	% of Unit Cost
Palestine	5.39%
Jordan	2.51%
Egypt	3.20%
Turkey	9.22%
Italy	14.19%
Pakistan	21.10%
<i>Source: Global Development Solutions, LLC</i>	

Another reason for the low productivity and relatively high per-tile unit cost of labor, as is shown in Table 16 (left), is that a number of activities, which in other countries are mechanized, are done manually in Pakistan. However, as pointed out previously, given the high cost of electricity, transitioning away from high labor input to mechanized process may not necessarily yield substantial cost savings,

though it would help in achieving export quality finishes.

Packaging and Distribution

Packaging and distribution, which includes all transport of both the finished and semi-finished tiles, is the fourth largest component of the VCA chain for marble tiles accounting for 16.5% of the production costs. These high transportation costs are a particular burden for exports requiring sea freight (i.e., to non-contiguous countries), for the mines and processors in the NWFP are 1,300 km from Karachi which is not only the nearest sea port but also the major location of processors capable of meeting international standards. Further the roads are poor along this route as are many of the trucks resulting in long trips, regular breakdowns and damaged cargo. Table 17 below gives a comparison of the costs of shipping a 20 foot container of tiles from Peshawar to the port of Karachi and onward to Dubai.

Table 17: Cost per Metric Ton of Transporting a 20-foot Container of Tiles

Route	Rs/MT
Peshawar – Karachi via truck	1,842
Peshawar – Karachi via rail	842
Dry port – Karachi port via rail	368
Karachi – Dubai via ocean vessel	916
<i>Source: Interviews conducted by Global Development Solutions, LLC in February and March 2005 and Pakistan Rail</i>	

Processors use very little packaging material when transporting or delivering the intermediate (e.g., unfinished) or final product, particularly to Afghanistan so resulting in cracked and chipped tiles.

Some processors, who ship their goods to Karachi for export, cut the tiles 20% - 25% larger than what the final product will eventually be. After the journey from the NWFP, these tiles that were originally sized and finished are then finished again in Karachi before being shipped.

Several companies that send their tiles to Karachi for finishing or direct export complained about the shortage of containers in the market. This results in the need for shippers to load small lots onto smaller trucks for shipment to the dry port or other central shipping point. The goods are then off loaded onto a waiting container. This procedure is repeated until the container is full and ready for movement to Karachi. Not only is this a labor intensive exercise, but it also leads to more damaged tiles and longer lead times for orders.

These factors, taken together, go a long way to explaining why exports from Karachi (i.e., of international quality) are so small. However, in spite of all these difficulties, Pakistan is still competitive as shown in Table 18 below.

Table 18: Wholesale Price of 12x12x3/8 Badal (or close substitute) Tile

Marble Name	Price	Country
Storm Cloud Grey	\$2.99	China
Badal	\$3.25	Pakistan
Venetian White	\$3.45	China
Galaxy White Standard	\$4.20	Greece
Volakas Spider	\$4.20	Greece
Volakas Standard	\$4.20	Greece
Olympic White Standard	\$4.35	Greece
Silver Cloud	\$4.45	Greece
<i>Price is wholesale FOB in the country, converted to US\$ Source: Inquiries made by GDS with wholesalers in Europe and the United States.</i>		

Issues and Options

The analysis above identified some key constraints in the production and exports of dimensioned stones from Pakistan. These are summarized in Table 19 below.

Table 19: Issues and Priorities for the Dimensioned Stone Industry

Issues	Priorities			Action	
	High	Medium	Low	Public Sector	Private Sector
Lack of security of mineral extraction rights	X*			X	
Lack of skills and training in both mining and finishing	X			X	X
Poor quality of products	X				X
Waste (including during transportation)					
Insufficient availability and access to market and technical information	X			X	X
<i>* While not amenable to a rapid solution, large scale expansion will depend on its solution</i>					

Some issues, such as the condition of public highways and electricity prices are best addressed in the context of the economy as a whole and, as such, are not discussed here. Other issues such as extraction rights, the lack of skills and training in both the extraction and finishing stages, and the high degree of wastage are sector concerns are discussed below.

Mineral rights

These, or more accurately the lack of them and security concerns, are the cause in varying degrees of many of the problems the sector faces. They encourage the use of rapid but wasteful extraction methods, make it all but impossible to obtain long-term financing to modernize capital equipment, limit

access to the most valuable stones, and severely discourage potential foreign investors and the associated transfer of knowledge. Yet there is no easy or quick solution. However, the first step would be for the responsible levels of Government to work on clarifying legal issues that cloud mineral rights.

Skills and training

While a lack of skills and knowledge are a factor in both extraction and finishing there are differences. There is an almost universal lack of skills in modern extraction methods, but there is a higher degree of finishing skills in Karachi than in Peshawar.

One approach currently being promoted is the establishment by the government, along with private industry, of a model mine at Buner for 50 million rupees. Ownership of the mine will be a 50/50 public/private partnership, with day-to-day management by the private partner. The purpose of the mine is to provide a high tech marble mining and processing facility that can be used as a platform for training quarry masters (of which there are currently none in Pakistan) and as a demonstration project for the mining and processing industries.

There are, however, a number of contentious issues that require resolution before the model mine can move ahead with full industry and government support. These include, *inter alia*:

- The private investors are only willing to invest 10% of the requisite capital yet want over 50% of the equity in the venture as well as full operational control.
- This public-private venture will sell its (potentially subsidized) product into the market, competing directly with other domestic producers; likely taking away some of their market shares.
- There is the risk that the model mine could exclude from its training programs workers from the best and most competitive operations, particularly if the mine becomes a major competitor in the market.

While potentially a good training vehicle the market distorting effects of the model mine as outlined above could well negate the advantages. The mine should not be so large as to be a noticeable player in the market, and while it should cover its costs, its primary purpose should be to train workers, not to make large profits. The structure of the mine and its objectives should reflect this and the private sector should reap its rewards in the form of a larger pool of skilled labor, rather than as profits to model mine shareholders. The model farms used in many countries to develop and disseminate improved agricultural techniques could serve as a model. At the same time the government should continue to support vocational training through institutions that are currently operating such as the Department of Mining, University of

Engineering and Technology, Peshawar, and the Department of Geology, at the University of Peshawar.

In terms of finishing, a key factor is that there are few gang saws in Pakistan and the ones that are operating are not very accurate and regularly break down.⁶⁵ Gang saws, which are a staple of the marble industry, are machines with multiple blades that make several parallel cuts at once. The development of a modern, competitive marble industry cannot take place without having sufficient gang saws operating. As is evident from Table 20 (below), Pakistan trails three of the largest producers of marble in the number of gang saws commissioned and in service.⁶⁶ The gap in terms of gang saws per quantity of quarried stone reveals that Pakistan would need to double the number of gang saws to match the level currently operating in India. Hydraulic gang saws would improve accuracy, however, there are only a few present in the NWFP and most are not of good construction or in good condition which results in irregular shaped blocks moving when they are being cut.

Table 20: Number of Gang Saws in Operation, Major Dimension Stone Producers

Country	Gang Saws in Operation	Gang Saws/Million Tons of Stone Quarry Produced (2000)*
Italy	1,880	229
Brazil	1,520	723
India	1,100	239
Pakistan	136	113

Source: Milanez & Milanese, and Global Development Solutions, LLC, Marble and Granite Strategy Working Group.

The process used in Pakistan to produce polished marble is labor intensive. Thus as producers do not employ much machinery and equipment the aggregate monetary expenditure of electricity per unit of tile is similar to processors in

other countries, despite high electricity costs. Further, the machinery employed is old and with low efficiencies that require high consumption of electricity so tilting preferences towards more manual techniques. As a result, due to low unit consumption of electricity in processing a tile, Pakistani processors remain within the cost range of international competition, but without the benefits that the competition enjoys through extensive use of machinery, such as higher control on final product precision and the ability to produce more and faster delivery times. The price of electricity will constrain any meaningful needed technological upgrading of the industry.

Such improvements would increase the returns to the industry. For example, floor tiles by themselves have little added value, while fireplaces, slabs for

⁶⁵ Although international buyers allow variations of 0.5mm for tiles and 1.0mm for slabs, prevailing industry average variations are too high and do not match the international standards. Many of the processors are cutting with variation in thickness within the same slabs of as much as 3 to 4 mm.

⁶⁶ Industry surveys revealed that only 8 of the processors in the NWFP had 2 gang saws and only 2 of them had 3.

tabletops, and decorative items have much more value-added according to the marketplace. In the international market, for instance, transactions involving slabs fetch a much higher price and profit than do a comparable number of tiles. On a square foot basis, a slab can bring as much as 50% more in price and without all of the extra labor involved in cutting each individual tile. However, the additional investments required in both training and capital equipment are currently not occurring, partly because of the uncertainty in extraction rights, partly because of a lack of knowledge and partly because the firms in the industry state they are obtaining returns they deem as satisfactory.

Waste

Although a large proportion of the wastage is attributable to current extraction methods and hence the mineral rights issue, there are areas where improvements can be made. Average quarry wastage in the world is 41% to 50% of the gross amount produced; however, in Pakistan quarry loss regularly approaches 70%. Taken together with the high amount of waste in the processing industry, total wastage of the marble stone from extraction to final consumer can be 85%. Table 21 below shows the percentages of waste from the mining extraction and processing activities in Pakistan compared with India, Egypt, Jordan and Italy.

Table 21: Benchmarking Waste from Marble Mining and Processing (2003-2004)

Country	Total waste
Pakistan	74%-85%
Egypt	45%-80%
Australia	45%-80%
India	45%-75%
Jordan	35%-75%
Italy	25%-50%

Source: *Global Development Solutions, LLC, Master Marble (Pvt) Ltd., American University of Cairo, Stone World.*

Although waste adds to the cost of the final product marketed by the industry, it also represents an environmental disaster and a missed opportunity to take advantage of secondary uses (and markets) for the waste. There is no organized system for

disposing of industrial waste in the quarry and processing areas. Processors recycle their water and then dump the resultant slurry outside of their facilities.

The following are just some of the examples of what could be done with the waste from the mines and processing plants:

- The chips can be used to create agglomerated tiles or used for landscaping purposes;
- Marble dust and jute fiber bound with resin can be used to manufacture floor tiles;
- Door panels can be made out of marble slurry, which can also be used as a wood substitute;

- Bricks have been developed using marble slurry;
- Marble dust can be mixed with certain types of soil for use in road embankments; and
- Marble dust can also be used as a replacement for lime in some applications.

In addition to the wastage in processing directly attributable to the inherent difficulties in efficiently utilizing irregular shaped slabs, additional losses were incurred by the inability to cut slabs to the required degree of precision and damage incurred in transporting finished and rough-cut stones.

Marketing

Marketing is a very weak point for the industry. According to interviews with processors, most of the export sales are either indirect through brokers in Karachi or because buyers from Europe and Asia “find” the processors in the NWFP. Very few Pakistani producers go to trade shows and those that do are facilitated by the government. Since exhibiting at trade shows is one of the most important forms of marketing products internationally, there are a number of opportunities to support the marble industry to expand their trade show presence.

5 Constraints to Competitiveness in the Fisheries Sector: A Processed Shrimp Example

All shrimp exported from Pakistan are wild shrimp caught in the waters off the coast – there is currently no aquaculture. But shrimp is only a small proportion (5%) of a typical fisherman’s catch. This low catch rate is partly attributable to inefficient fishing and handling techniques and partly to declining fish stocks. The absence of a current comprehensive survey of fish stocks makes it difficult to determine the relative importance of these two, but the analysis below shows that improvements in fishing and handling would not solve the current financial crisis facing fisherman. There is strong circumstantial evidence to support the argument of declining fish stocks, especially for shrimp where illegal fishing of juveniles, and use of small gauge nets, is hindering the replenishment of stocks. The main argument of this chapter is thus for better management of fish stocks and better balancing between the number of fishing boats and available fish. It also suggests that aquaculture is worthy of serious consideration if Pakistan is to expand its processed shrimp exports.

Introduction

This chapter is structured differently from the others since its underlying hypothesis is that the shrimp industry (exclusively fishing for “wild” shrimp) is in sufficiently serious difficulties to cast its longer term survival into question and to suggest aquaculture as a possible alternative. Thus while a value chain analysis for processed shrimp is presented and briefly discussed, the VCA is used principally to show that many identified improvements are too minor to reverse the fortunes of the industry, in the face of high diesel prices and very probably declining fish stocks.

While the VCA is based on processed shrimp, this part of the chapter focuses on the economics of fishing. Thus the focus is on the amount of shrimp actually caught. However, since raw shrimp loses about 48% of its weight during processing (i.e., it takes 1.92kg of raw shrimp to produce 1kg of processed shrimp) the yield of processed shrimp will be less than the amount of raw shrimp caught.⁶⁷ The analysis is based on a typical 15 day fishing trip for a 45’ diesel powered fishing boat, costing Rs. 388,380 (see Annex A for details). The catch can be divided into three main components: raw shrimp which accounts for 5% of the catch by weight and has the highest value, edible fish and trash fish. The study does not provide information on the breakdown

⁶⁷ 30% of the weight loss comes from deheading with the remainder (18%) from peeling.

between edible and trash fish, but in view of the low price received for trash fish (between Rs. 4 and Rs. 6 per kg), fisherman make most of their revenue from the non-shrimp component of the catch (even though it is a small amount of total catch).⁶⁸ Table 22 below provides an estimate of the total revenue from the trip under some plausible assumptions, which can be varied at will by the reader to gain a better understanding of the economics of fishing.⁶⁹

Table 22: Estimated Revenue from Trip

	Shrimp	Edible	Trash	Totals
% of catch by weight (raw shrimp)	5.0%	10.0%	85.0%	100%
Gross weight in kg	271	542	4,607	5,420
price (Rs per kg)	137.3	100	6	
Gross value (Rs)	37,208	54,200	27,642	119,050
Wastage rate	35%	20%	0%	
Net (of waste) Value (Rs)	24,185	43,220	27,642	95,047
<i>Note: The above represents raw shrimp. There is a weight loss of about 48% when shrimp are processed. Parameters and values in bold are based on field interviews and used in the study. All other entries are estimates and can be varied for sensitivity analysis.</i>				

While the estimates for the edible fish are imprecise, it is clear that these revenues cannot remotely cover the total cost of the trip - Rs. 388,330 (see Table 33 in the Annex for more details). As will be discussed below, profitability is hampered by the low shrimp catch rate and high diesel prices.

The 5% catch rate for shrimp presented above indicates that the fishermen are not exclusively targeting shrimp.⁷⁰ Further evidence for the general nature of fishing is provided by their extensive use of dredging, for shrimps are swimmers and not bottom dwellers. Taken together with the low shrimp catch rate, this suggests that these fisherman catch some shrimp as part of their overall catch – or that there are few shrimp to catch.⁷¹

Part of the explanation for the relatively low shrimp (and edible fish) catch rate in Pakistan may be the result of inefficient fishing techniques. The lack of echo-sounding fish finders makes setting the depth of the shrimp nets a matter of trial and error. The lack of Global Positioning Satellite (GPS) navigation hinders returning to proven fishing spots, and the prohibition of long-range Single Sideband Band (SSB) radios hinders inter-ship communications and co-operation. However, according to interviews with fisherman, the potential gains from all of these will be an increase of about 20% in the total catch, i.e.,

⁶⁸ Interviews with fisherman indicated that other edible fish accounted for about 8% - 10%.

⁶⁹ Fishing boat owners estimate that only 10% of their members covered their costs in the last 4-5 years.

⁷⁰ Even general fisherman (not targeting shrimp exclusively) in Colombia have a shrimp catch rate of 25%; in Iran, this figure is 17%; and in Indonesia it is 12.5%.

⁷¹ In the absence of a proper fish stock survey, international comparisons should be treated with care for it is difficult to determine whether catch rates are determined by the number of shrimp in the ocean or by fishing techniques. Shrimp catch rate data is drawn from “*Reducing the Impact of Tropical Shrimp Trawl Fisheries*”, FAO Fisheries Report No 627.

an additional 54.2 kg of raw shrimp. However, if there is a lack of shrimp to catch, these gains may be hypothetical.

Part of the explanation for the low shrimp catch rates may be a low and/or declining number of shrimp, although it is difficult to know for sure without a proper fish stock survey. However, there is circumstantial evidence to support this hypothesis. The number of fishing boats has been increasing steadily - for example, in 1966 there were only about 400 fishing boats in the Karachi Fish Harbor, and now there are in excess of 2,000. While there is a ban on the catching of juvenile shrimp, locally referred to as PATAS, estimates suggest that 50MT/day are caught during August to September (the peak breeding season), and 5MT/day are caught between October to July. Interviews suggest that PATAS are caught by small boats fishing in the mangrove swamps where the shrimp breed and by other fisherman using finer gauge nets than permitted by regulations.

A similar story emerges for the other forms of marine life. Dredging damages the sea bottom and hence the feeding grounds for juvenile fish. Extensive use of small gauge nets (as reported in interviews) further depletes the fish stock. Local fisherman also claim that excessive fishing by large foreign boats during the months of June and July in Pakistani waters further contributes to declines.⁷² Finally, anecdotal evidence from local fisherman indicates that both the quantity and quality of the catch (shrimp and edible fish) has been declining.⁷³

The issue of the state of the fish stock, and whether the low shrimp catch rates are due to inefficient fisherman or low stocks of shrimp, cannot be resolved without a comprehensive survey. However, no matter which of the above explanations dominates, the hard fact remains that on a typical 15 day fishing trip, the gross (i.e., before wastage) shrimp catch is only 271kg which, after losses, yields only Rs. 24,256 at auction. The total cost of the trip (with diesel at Rs. 28.14/liter) is Rs.388,330 of which diesel fuel alone accounts for Rs.240,000.⁷⁴

Frozen Shrimp Production

At this point the focus shifts to processed shrimp and, in keeping with the approach adopted in other VCA analyses, the price and weight of shrimp is measured in terms of the processed output, so as to account for the weight loss during processing. Thus, after adjusting the catch for the weight loss in processing, the 271kg of raw shrimp actually caught can only produce 141kg

⁷² This is disputed by the Marine Fisheries Department which claims their inspectors ensure that these deep sea vessels adhere to the conditions of their permits.

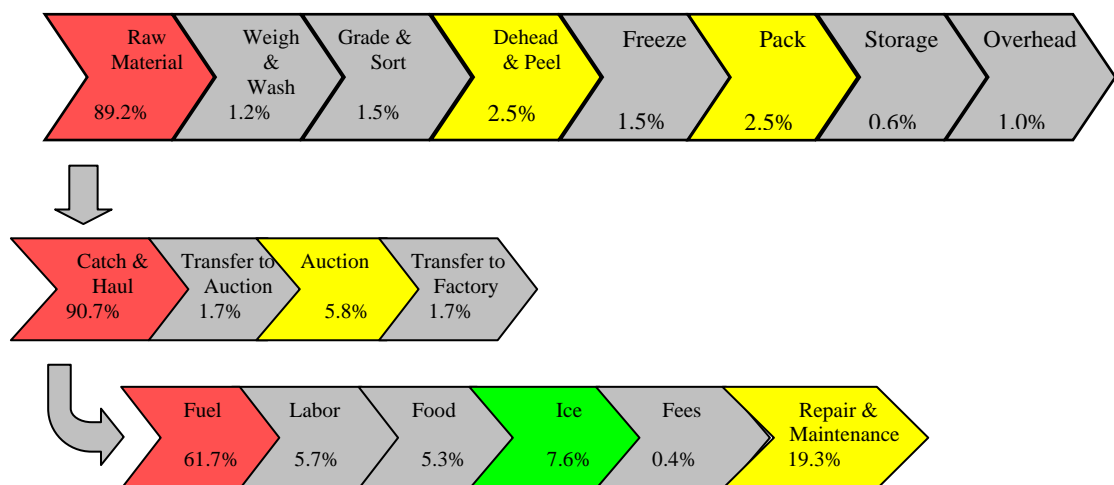
⁷³ Fisherman interviewed stressed that the size of the shrimp caught has been steadily declining over the past few years.

⁷⁴ Based on a March 2005 price of Rs 28.14/liter; more details in Annex A. At current prices (Rs 37.3/l) the fuel cost would rise to Rs 318,124.

of processed shrimp.⁷⁵ The following analysis is based on the above trip as summarized in Annex B. The costs of catch and haul for shrimp are the total costs for the trip pro-rated by the share of shrimp in the gross catch, in this case 5%. Further, since 99.6% of the shrimp catch is subsequently frozen, and only frozen shrimp is exported, the analysis of processing will focus on frozen shrimp.

In Figure 15 below, raw shrimp is sold at auction (the costs of the auction and transfer to the factory are included in the catch and haul costs) for Rs. 264/kg (US\$4.47).⁷⁶ The production cost at the factory gate (excluding profit) is Rs. 326/kg (US\$5.53) and adding in the F.O.B. costs bring this to Rs. 329/kg (US\$5.58). Full details of the costs in the VCA processing chain are provided tables 36-8 in Annex A. The nature of this analysis suggests that there only be a brief discussion of the below chain. Catching shrimp accounts for 90.7% of the cost of the raw materials (shrimp), and the three largest costs of catching the shrimps are diesel fuel (61.7%), repair and maintenance (19.3%), and ice (7.6%). Each of these is now discussed below.

Figure 15: Value Chain for Frozen Shrimp Production and Processing



Fuel

Diesel fuel used to cost about Rs. 23 per liter in 2004; It cost Rs. 28.14 in March 2005 when the data was collected and has risen to Rs. 37.3 per liter (February 2006), placing strong upward pressure on fisherman's costs. Fuel costs could be contained by ensuring better fuel economy per running hour, or by using the engine less (i.e., better navigation). However, the engines are old (or refurbished) and thus not very fuel efficient compared to modern engines,

⁷⁵ This includes loss in processing alone and not losses due to waste discussed in Table 22.

⁷⁶ This price accounts for the 48% processing weight loss. The Rs. 137.3 cited in Table 22 earlier is ex-ante processing stage.

maintenance is basic, the boat hulls are dirty, propellers are not matched to hulls or engines etc. As discussed earlier, there is some scope for reducing fuel use by better navigation and fishing techniques, but as the boats have to rely on other fish (dredging uses the engine more than shrimping) to make ends meet and also have to travel to the fishing grounds, it is unlikely that any combination of the above would be capable of significantly reducing fuel costs, say to the levels of the South Carolina fisherman whose fuel costs amount to only 12% of the total cost of catching shrimp.

Repairs and maintenance

Repairs and maintenance (to the boat, fishing equipment, engine etc.) account for approximately 19% of total shrimp fishing costs and are the second highest cost component of catch and haul. These costs include items such as engine parts, ropes, nets, etc. and (given the mechanical nature of fishing, the wear and tear from sea conditions, wind, water, weight bearing stress, etc.), these items need continuous replacement and maintenance and are often considered operational expenses. Repair and maintenance costs are a fact of life for fisherman and while there may be some scope for reducing these in the case of Pakistani fisherman, this will likely be limited.⁷⁷

Ice

The ice required for each trip represents the third highest cost of catch and haul. The average per trip cost of the necessary ice, purchased at the Karachi Fish Harbor is Rs.30,000, or 7.6% of catch and haul costs. However the ice is contaminated and of poor quality and hence about 5% of the shrimp catch is wasted before the boat reaches port. A further 10% is lost due to bad fish handling techniques, so resulting in 15% of the shrimp catch being lost at sea.⁷⁸

There are two main avenues for reducing this loss. One option would be to install on-board ice-making equipment. Not only is it expensive (approximately Rs. 500,000 or about \$8,300) and can require expensive, and specialized maintenance, but it also takes up space which in turn reduces the fish carrying ability of the boat.⁷⁹ Flash freezing fish immediately after they are caught is also an option, but would involve similar large expenditures, retraining the crew to process the fish on board and would also involve a more expensive registration fee since the boat would be reclassified as a trawler.

⁷⁷ For example, the most efficient operators in the US spend about 13.7% of fishing costs on repair and maintenance. "Costs and Returns Analysis for South Carolina Shrimp Trawler" Clemson University, Clemson, South Carolina, U.S.A.

⁷⁸ Bad fish handling comprises such factors as shrimp lying off the ice, shrimp being crushed by the weight of other fish on top of it, etc.

⁷⁹ The system consists of a reverse osmosis system feeding an ice-maker. The membrane in the reverse osmosis system is easily damaged (a trace of oil will damage it) and is expensive (approximately US\$ 1,200) and parts must be imported.

Simpler and less expensive avenues would involve renovating the fish holds of the boat by installing better insulation, creating a separate (shallow) compartment for shrimp (to minimize crushing) and dipping the shrimp in a sodium metabisulfite or Everfresh® solution to minimize contamination. However, limited knowledge and training, and the current cash-flow crisis, have inhibited the adoption of these approaches.

Vessel to factory and subsequent processing

Once a boat approaches the Karachi Fish Harbor, the captain contacts the owner and a commission agent (“mole holder”) to arrange for auction space and acquire necessary labor and the trolleys required to offload the catch. The catch is offloaded and weighed before the entering the auction hall.⁸⁰ Prior to the auction, the mole holder, using local workers, sorts and reweighs the catch. A further 2% loss occurs during this process.

Half of the auction hall is not roofed thus leaving part of the catch exposed to the direct sun for up to five hours. This, combined with poor handling and hygiene in the auction hall, results in a loss of 8% of the original catch.⁸¹ The use of contaminated ice results in an additional 10% loss (of original catch) at the auction hall. Thus as summarized in Table 23 below, the cumulative effect of all these losses is that 35% of the shrimp caught are rendered unsuitable for further processing. Thus, of a total raw shrimp catch of 271kg, only 176 kg are useable and this yields a total of 91.6 kg of frozen, headless peeled shrimp.

Table 23: Shrimp Loss Rates from Boat-to-Auction

Losses at sea	
Poor fish hold and handling on boat	10%
Contaminated ice used on boat	5%
Losses due to poor post-harvest handling	
Poor handling after unloading from boat	2%
Losses at auction	
Contamination on the auction floor	8%
Use of contaminated ice at the auction	10%
<i>Source: Global Development Solutions, LLC</i>	

Exports of shrimp must also meet international Sanitary and Phytosanitary standards (SPS). EU inspectors raised concerns about hygiene in both the fish

⁸⁰ Trash fish is sold directly to fish meal processors at the harbor area at a price which ranges between Rs 3 and Rs 6 per kilogram.

⁸¹ Observers comment that just prohibiting betel chewing (which causes chewers to spit on the floor where fish are kept) and smoking (where cigarette butts are left on the floor) would significantly reduce the problem.

holds of some boats and the auction hall. The Pakistan Government, instead of facing an externally-imposed ban decided on a voluntary ban on exports.

Options

The absence of a comprehensive current survey of fish stocks makes it difficult to provide a definitive answer to the question of the international competitiveness and further evolution of shrimp fishing in Pakistan. However, the following must be born in mind when making any assessment.

First, while the analysis in the previous section showed that there are areas where improvements to both fishing and fish handling techniques could be made, these improvements are not large in the context of the situation and will not reverse the financial decline of the fishing industry.

Second, while the evidence is not definitive, viz, an historical increase in the number of boats, the ongoing catching of juvenile shrimps, the reliance on bottom fishing techniques (dredging) and fine gauge nets, and the low shrimp catch rate, the declining size of shrimp caught, it does support the hypothesis of a declining fish stock, an increasingly common phenomenon around the world.

Third, Pakistan with a factory gate price of US\$5.53 is not a low cost producer compared to countries like Thailand and Indonesia which rely on aquaculture and can undercut this price by more than 20%.⁸² The high Pakistani cost is principally due to the high cost of catching shrimp (raw materials).⁸³

While the solution to declining fish stocks, is simple to outline, viz, reduce the allowable catch rate to sustainable levels, usually by a combination of limits or bans on the catching of juveniles or during the breeding season, and reductions in fish caught, often by reducing the number of fishing boats, it has proven difficult to implement.

In the case of Pakistan, the first obvious step would be to enforce the ban on PATAS fishing. The Sindh Fisheries Ordinance, 1980 and the Conservation of Fisheries Resources S.R.O. 329(1)/79 address the issue of PATAS fishing. (The latter also includes regulations on permitted net gauge outside coastal waters, i.e., 12 nautical miles.) This could be supplemented by a ban on the trading of PATAS (although this would be difficult since it is mainly done by subsistence fishermen using small boats in creeks). The negative impact on breeding of other species could be partly addressed by enforcing the regulations on the gauge of the fishing nets used.

⁸² GDS studies.

⁸³ These are average costs and thus do not permit exact comparisons, but the difference in cost of raw material is so large as to be significant.

Controlling the amount of fish caught is a different issue and is usually addressed by setting an annual limit on the number or weight of a particular species caught, and by limiting the fishing season. However, this requires efficient monitoring and credible enforcement and penalties and if the PATAS situation is typical this will be difficult to enforce. Another approach is to control the number of fishing boats by restricting the number of fishing licenses issued. If, as in some countries, a fishing license is like a property right (i.e., can be sold and resold) there is a market solution to the problem as the issuing authority can buy back the licenses. When licenses are issued on an annual basis, or only an annual registration fee is levied, some other less market oriented method of reducing them has to be used with the resulting political implications. In any case, this is a moot point if there are no effective means of enforcement.

The technical details of how to design and implement such ideas as raised in the above two paragraphs are beyond the scope of this study, but clearly must be addressed in the longer term interests of the fishing industry. Such measures will need to be accompanied by a comprehensive fish stock survey to determine sustainable catch levels.

If Pakistan wants to become an important shrimp exporter, aquaculture (farmed shrimp) is the option worth exploring. While some potential sites in Sindh (Zero Point Badin, Kharo Chan, Keti Bandar) and Balochistan (Daam, Lasbella, Jewani, Gwadar, Pasni) have been identified by SMEDA, the issue of what type of farming is best suited to each locale still needs to be completely resolved. For example should it be extensive (basically shrimp pens in the water) with yields of up to 500 kg/hectare, semi-intensive (above the tide line and using formulated feed) with yields of 500 – 5000 kg/hectare, intensive with yields of 5,000 – 20,000 kg/hectare (but needing carefully formulated feed and with an increased risk of disease), even super-intensive with yields in excess of 20,00 kg/hectare but requiring significant capital expenditures. The economic and ecological issues involved in choosing between these alternatives are beyond the scope of this study.

This does not bode well for “wild catch” shrimp exports. Indeed, in the current environment, it would be a good strategy not to count on any major expansion in “wild catch” shrimp exports in the near future, or at least until sustainable fishing rates are identified. In fact, in the near future, it is more likely that the sustainable catch rate will be below current levels and since, if Pakistan moves to aquaculture and achieves a cost structure similar to that of Bangladesh or Indonesia, then “wild catch” shrimp will not be price competitive unless significant cost reductions (along the lines discussed in the previous section) are put into place. It is too early to judge whether these will prove economically viable in the face of aquaculture shrimps, but if the fish stock problem is severe, and aquaculture costs are lower, “wild catch” shrimping may well end up being a marginal activity.

6 Constraints to Competitiveness in the Automotive Component Sector: A Radiator Example

The manufacture of automobile radiators was chosen to serve as a proxy for analysis of the competitiveness of the light engineering sector in Pakistan. However, it proved an unsuitable choice as the technology employed is obsolete in modern automobiles and even a small scale plant employing current technology is too large for the domestic market. In essence, this situation is attributable to the confluence of two factors – a protectionist policy in Pakistan with strong incentives for automobile assemblers to increase their use of domestically produced parts, and a shift in technology away from a more labor intensive production process to a more capital intensive one with an associated change in the scale of the plant. These two are summarized in the following paragraphs.

The key policy is the deletion program which is product specific (i.e., one program for each make and model) and is designed by a combination of incentives and penalties to force the Pakistani auto assemblers to purchase domestically produced parts even if they were of higher cost or otherwise inferior to imported parts.⁸⁴ At the time of introduction in the late 1980s, most automobiles were using radiators made from soldered brass and copper. Such radiators are suited to relatively small scale labor intensive production, and there are four companies in Pakistan that either produce radiators now or have produced them in the past. One company exported aftermarket radiators for Ford F150 trucks but is now finishing up its last export production run and is unlikely to get further orders as not only is it being undercut in price by India and China, but many aftermarket retailers are transitioning themselves to supply only mass produced all aluminum radiators. The miniscule size of exports from this sector is shown by exports of all auto parts being less than 1% of production.

Starting in the 1980s the automobile industry in most developed countries began to move away from traditional brass/copper radiators towards all aluminum radiators. Table 24 below shows the extent and rapidity of this move.

⁸⁴ The relevant policies are (i) “Indigenisation Policy of the Government of Pakistan”, as outlined in 1987 by Presidential Directive, and (ii) “Industry Specific Deletion Program” as recommended by the Deletion Committee of the Engineering Development Board of the Government of Pakistan.

Table 24: Automobile Manufacturers Transition from Copper/Brass to Aluminum Radiators

Manufacturer	<i>% of all Autos Manufactured with all Aluminum Radiators</i>			
	1980	1984	1988	2000
Ford	0	20	54	95
General Motors	0	17	45	93
Toyota	0	10	40	80
Nissan	0	8	32	84

Compiled by Global Development Solutions, LLC from various sources

The advantages of aluminum radiators over brass/copper radiators, viz. weight reduction and resulting increase in fuel efficiency, economies of scale in production, and reduced environmental concerns will ensure (in the view of most analysts) the demise of brass/copper radiators. However, the manufacture of these aluminum radiators involves a different process involving larger scale and more capital intensive plants. All of the parts, including the top and bottom tanks, pipes, core, connections and fasteners are assembled and put into a brazing furnace. The radiator is then brazed and completed in a single process, so eliminating the labor intensive elements of soldering, bolting or crimping the parts of the brass/copper radiator.

Such radiator plants are capital intensive and expensive compared to those assembling brass/copper radiators. For example, the relatively small scale but fully automated aluminum radiator plant build by Cyromax in Taiwan which commenced operations in 2001 cost US\$10 million and can produce in excess of 300,000 radiators per year, greater than the forecast assembly of all types of automobiles in Pakistan in 2010. Further, these plants are an intensive user of electricity which places Pakistan with its frequent power outages at a further disadvantage.

Thus Pakistan has to face the choice between the lesser of these two evils: continue to use traditional brass/copper radiators in its domestically assembled cars and fall behind the rest of world in the quality of its automobiles, or adopt the same technology as the rest of the world and face the closure of many or if not all its brass/copper radiator plants. It is likely that the only remaining market for brass/copper radiators will be the shrinking market for small production runs of radiators for “elderly” cars, and even this market could be contested by numerous other manufacturers around the world.

The lesson is clear: while protectionist policies are often seductive in the short-run, in the longer-run they are always disastrous.

Annex A: Absolute Values Behind VCA Diagrams

This Annex records the Rupee values of the items presented in the Value Chain Diagrams presented in the report. The Rupee total in the rightmost column represents the factory (farm) gate cost. The three biggest cost elements in each chain are shown immediately following the table.

Denim Jeans

Table 25 below presents the values corresponding to the components of the main value chain for the Value Chain for Up-Market Jeans in Figure 2 in Chapter 2.

Table 25: Up-market Jeans Value Chain (Rs/pair)

	Raw Material	Cutting Layering	Sewing Assembly	Washing	Finishing Packing Loading	Inspection	Export/Admin	OH	Total
Unit Cost	139.65	17.67	45.13	33.49	22.80	2.28	5.70	40.50	307.22
% of Total	45.5%	5.8%	14.7%	10.9%	7.4%	0.7%	1.9%	13.2%	100.0%

OH			Rs/Pair
Maintenance/Sewing & Assembly			3.96
Other Charges /Sewing and Assembly			11.89
Maintenance/Washing			3.95
Other Charges /Washing			20.69

The three biggest cross-cutting cost items in the chain are: Input Material (thread, trims, labels, and finishing patch) at Rs. 53.01, Labor at Rs. 22.23, and Chemicals at Rs. 20.52.

Table 26 below presents the values corresponding to the components of the main value chain for the Value Chain for Standard Jeans in Figure 3 in the main text.

The three biggest cross-cutting cost items in the chain are: Input Material (thread, trims, labels, and finishing patch) at Rs. 43.64, Labor at Rs. 28.38, and Chemicals at Rs. 7.21.

Table 26: Standard, Low-End Market Jeans Value Chain (Rs/pair)

	Raw material	Cutting Layering	Sewing Assembly	Washing	Finishing Packing Loading	Inspection	Export/ Admin	OH	Total
Unit Cost	122.50	15.08	36.17	14.69	19.79	1.65	12.29	28.54	250.71
% of Total	48.9%	6.0%	14.4%	5.9%	7.9%	0.7%	4.9%	11.4%	100.0%

OH	Rs/Pair
Maintenance/Sewing & Assembly	3.4
Other Charges /Sewing and Assembly	19.6
Maintenance/Washing	2.5
Other Charges/Washing	3.04

Table 27 below presents the values corresponding to the components of the main value chain for the Denim Fabric Value Chain for a non-integrated mill shown in Figure 5 in the main text.

Table 27: Denim Fabric Value Chain (Rs/meter)

	Raw Material	Spinning	OH Spinning	Dyeing	Weaving	Finishing Packing	OH Dyeing and Weaving	Total
Unit Cost	40.10	5.20	4.88	9.91	5.63	6.83	8.30	80.85
% of Total	49.6%	6.4%	6.0%	12.3%	7.0%	8.4%	10.3%	100.0%

		Rs/Meter	
		Low	High
Sales prices		94.5	100.5

From material (yarn and woven fabric) sales of 1 m:			
Spinner gets	4.5	4.9	
Weaver gets	8.5	9.05	

OH	Rs/Meter
Maintenance/Spinning	0.704
Other Charges /Spinning	4.179
Maintenance/Dyeing	0.497
Other Charges /Dyeing	2.668
Maintenance/Weaving	0.495
Other charges/Weaving	4.635

The three biggest cost items across all components in the chain are: Electricity at Rs. 8.01, Dyeing chemicals at Rs. 7.01, and Labor at Rs. 6.18.

Table 28 below presents the values corresponding to the components of the main value chain for the Ginning Value Chain shown in Figure 6 in the main text.

Table 28: Ginning Value Chain (Rs/kg of lint)

	Seed Cotton	Drying Cleaning	Ginning	Cleaning Packing	Transport	Admin	OH	Total
Unit Cost	63.14	0.00	0.67	0.78	0.01	1.35	0.99	66.94
% of Total	94.3%	0.0%	1.0%	1.2%	0.0%	2.0%	1.5%	100.0%

OH	Rs/Kg Lint
Maintenance Ginning	0.485
Other charges	0.504

The three biggest cost items across all components in the chain are: Electricity at Rs. 0.62, Labor at Rs. 0.45, and Iron Hoop and Hessian Cloth at Rs. 0.38.

Table 29 below presents the values corresponding to the components of the main value chain for the Smallholder Cotton Value Chain shown in Figure 7 in the main text.

Table 29: Smallholder Cotton Value Chain (Rs/kg)

	Land Preparation	Planting	Seeding	Thinning	Weeding	Spraying	Fertilizing	Harvesting	Total
Unit Cost	3.38	0.29	0.59	0.15	0.29	6.18	0.88	2.06	13.83
% of Total	24.5%	2.1%	4.2%	1.1%	2.1%	44.7%	6.4%	14.9%	100.0%

	Rs/kg
Sales price of seed cotton as of March 2005	22.5

No OH - Old equipment with no discernible value

The three biggest cost items across all components in the chain are: Spray Chemicals at Rs. 5.95, Fuel/Electricity (water extraction) at Rs. 2.65, and Labor at Rs. 2.34.

Powdered Milk

Table 30 below gives the Rupee values for each of the major components in the main value chain in the analysis of powdered milk presented in Figure 10.

Table 30: Powder Milk Value Chain (Rs/kg)

	Raw Material	Collection	Clarification Testing	Evaporation Standardization	Spraying Drying	Recovery Bagging	OH	Total
Unit Cost	81.95	12.64	1.30	10.08	11.45	4.67	4.82	126.91
% of Total	64.6%	10.0%	1.0%	7.9%	9.0%	3.7%	3.8%	100.0%

Note Factory gate price is Rs 126.91/kg
The profit margins are unknown.

OH (all stages)	RS/kg
Maintenance	0.44
Insurance	0.06
Admin	1.16
General Stores	0.78
Depreciation	1.59
Other	0.79
	4.82

The three largest cost elements across all components in the chain are: Additives at Rs. 12.72, Energy (Furnace Oil and Gas 2.84 & Electricity 2.64) at Rs. 5.48, and Bagging Material at Rs. 3.06.

Table 31 below gives the Rupee values for each of the major components in the main chain in the example of the small scale farmer depicted in Figure 11.

The largest cost elements across all components in the chain are: Labor Rs. 2.73. Veterinarian services Rs. 0.05.

Table 31: Small Holder Dairy Farming Value Chain (Rs/kg)

	Animal Husbandry	Milking	OH	Total
Unit Cost	4.97	0.55	0.20	5.72
% of Total	87.0%	9.5%	3.5%	100.0%

	Rs/Kg
Farm gate cost is Rs. 5.72	
Sales Prices	
Farmer to Gawalla	9.28
Gawalla to Dodhi/ Mkt Agent	10.5-11
Mkt agent to Processor	12-12.5

OH: comprises of depreciation of constructed shed and tools

The largest cost elements across all components in the chain are: Labor at Rs. 2.73 and veterinarian services at Rs. 0.05.

Table 32 below gives the Rupee values for each of the major components for the medium sized dairy farmer used as an example in Figure 12.

Table 32: Medium Sized Dairy Farmer (Rs/kg)

	Animal Husbandry	Milking	OH	Total
Unit Cost	4.89	0.24	0.32	5.45
% of Total	89.7%	4.4%	5.9%	100.0%

Farm gate cost is Rs 5.45	Rs/Kg
Sales Prices	
Farmer to Gawalla	8.5
Gawalla to Dodhi/ Mkt Agent	9.5-10
Mkt agent to Processor	11.5-12

OH: comprises of depreciation of constructed shed, generator, tools

The three largest cost elements across all components in the chain are: Labor at Rs. 1.20, veterinarian services at Rs.0.20, and Energy at (pump fuel) Rs. 0.11.

Marble Tile

Table 33 below summarizes the Rupee values behind the VCA diagram in chapter 4 (Figure 14). The three largest cost items across all elements in the chain are shown immediately below the table.

Table 33: Polished Marble Tile Value Chain (Rs/ft²)

Main VC			Extraction	Polishing	Overhead	
Extraction	4.56	Labor	0.84	1.18	Electricity	2.51
Cutting	1.92	Fuel	0.23	-	Legal & Financing	0.11
Polishing	4.25	Tools	0.55	1.58	Motor vehicle	0.49
Working/Sizing	1.83	Plant Repair	0.10	1.21	Repair	0.41
Package/Distribute	3.54	Clothing	0.18	0.28	Security	0.19
Overhead	5.35	OH Cost	-	-	Admin	0.58
Total	21.45	Transport Services	2.67	-	Telephone	0.45
		Total	4.56	4.25	Depreciation	0.61
					Total	5.35

The three highest input costs totaled across all elements of the Marble value chain are: overhead at Rs5.35/ft² (electricity accounts for Rs 2.51/ ft²) followed by transport at Rs4.85/ft² and labor at Rs4.80/ft².

Processed Shrimp

This section summarizes the costs of a typical fishing trip (catch and haul in Figure 15).

The boat under consideration is a diesel powered 45' wooden fishing boat, with a crew of 21 men: a captain, a driver, a cook, two men filling the fish hold and 16 general laborers. The trip lasts a total of 15 days. Note that the figures do not coincide exactly with those in the value chain as they were drawn from a different set of interviews. However, the differences are of the order of 0.1%.

Table 34: Summary of Trip Costs

Item	Cost (Rs)	Share	Pro-Rated @ 5% (Rs)
Diesel Fuel	240,000	61.8%	12,000
Labor	21,000	5.4%	1,050
Food	20,000	5.2%	1,000
Ice	30,000	7.7%	1,500
Fees etc	2,330	0.6%	116.5
Repairs and Maintenance	75,000	19.3%	3,750
Total	388,330		19,417
Direct Costs	282,080	72.5%	14,104
<i>Direct costs = fuel, lubricants and other essential operating inputs, but does not include maintenance and repair costs</i>			

The major cost is fuel. The engine runs 24 hours per day and consumes 568 liters in a 24 hour period. As of March 2005 (when the data was collected) diesel fuel cost Rs. 28.14/l so resulting in a daily fuel cost of Rs. 16,000 and a cost of Rs. 240,000 for the whole trip. The engine (either old or refurbished) consumed 60 liters of oil at Rs. 110/l for a total cost of Rs. 6,600. Other elements such as oil filters, spare parts, etc cost Rs. 10,000 per trip.

Table 35: Revenue from Raw Shrimp

% of catch by weight	5.0%
Weight of catch in kg	271
Price Rs per kg	Rs 137.7
Price US\$ per kg	\$2.33
Gross value Rs	Rs 37,317
Gross value US\$	\$632.49
Wastage rate	35%
Net value Rs	Rs 24,256
Net Value US\$	\$411.12

Recall that the boat caught 271 kg of raw shrimp. Ten percent of the shrimp caught is lost due to poor fish handling on the boat and an additional 5% due to contaminated ice. A further 2% is lost after unloading from the boat. Eight percent is lost from contamination on the auction floor and 10% from the use of contaminated ice at the auction. Thus 35% of the gross catch of 271kg of raw shrimp is wasted. The financial implications are summarized in Table 35.

Rupee costs in the VCA diagram

The following tables present the Rupee costs per kg of processed shrimp used in Figure 15 in the main text.

Table 36: Catch and Haul (Rs/kg of processed shrimp)

Fuel	Labor	Food	Ice	Fees etc	R&M	Total
163	15	14	20	1	51	264
61.7%	5.7%	5.3%	7.6%	0.4%	19.3%	

Table 37: Raw Material (Rs/kg of processed shrimp)

Catch and Haul	Trans to Auction	Auction Commission	Transfer to Factory	Total
264	5	17	5	291
90.7%	1.7%	5.8%	1.7%	

Table 38: Main Processing Chain (Rs/kg of processed shrimp)

Raw Materials	Weigh & Wash	Grade & Sort	Dehead & Peel	Freeze	Pack	Storage	Overhead
291	4	5	8	5	8	2	3.1
89.2%	1.2%	1.5%	2.5%	1.5%	2.5%	0.6%	1.0%

The total cost of processing the shrimp is Rs. 326 or US\$5.53.

Annex B: Cutting Irregular Marble Blocks

As mentioned in the Overview section and subsequently in the main text, the biggest problem with the irregular shape of the blocks is that the processor cannot obtain the optimal amount of tiles from an irregular shaped block as it can from a rectangular block. Below is an illustration showing how much less an irregular, potato shaped block yields versus a rectangular block. The slab on the left is from an irregular shaped block of Badal marble generally found in the NWFP, while slab on the right is from a rectangular block typically being mined in India, China, Italy and elsewhere. It is laid out in a way to show how it might be cut into 12x12 tiles compared with a rectangular block of Badal marble, and how the cutters would lay it out and cut 12x12 tiles from it.

Both blocks are about the same height and width, yet the irregular shaped block yields less than 55% of the total than that of a square block would yield. In this case, the square block can be cut into 35 12x12 tiles, while the irregular shaped block can only be cut into 18 12x12 blocks. These numbers assume that none of the tiles in the irregular shaped block are cracked and therefore not saleable, which is often the case. In addition, most cutters in the NWFP do not make full use of the excess marble that results from cutting the irregular shaped block into tiles, thereby increasing the wastage and adding to the environmental problems.

Figure 16: Lost Tiles from an Irregular Shaped Block

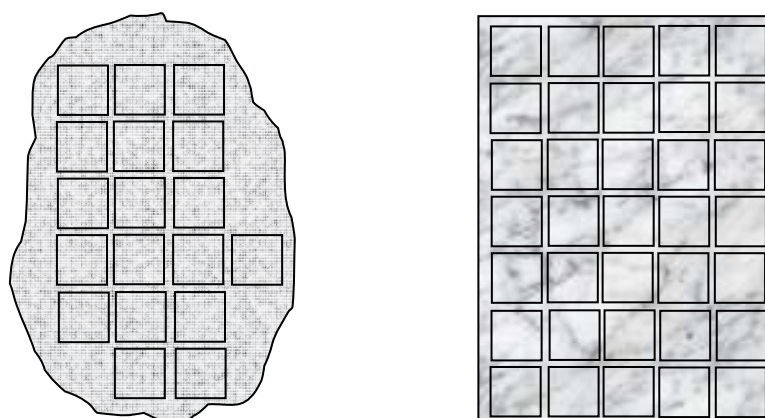


Table 39 below shows the different profit scenarios using irregular shaped slabs versus rectangular or square shaped slabs. Under this scenario, a company producing 30,000 ft² per month would make Rs.215,918/month using rectangular blocks versus Rs.81,818/month using irregular shaped blocks. It is worth noting here that most of the major exporting countries, including India and China produce square or rectangular shaped blocks.

Table 39: Profit Comparison Using Two Different Shaped Slabs

	Irregular potato shaped block from a mine in NWFP	Square/ rectangular shaped block typical of an Indian mine
Number of tiles from slab	18	35
Revenue/tile (based on an international market price)	27	27
Total revenue from slab/tiles	486	945
Cost of slab and processing tiles	426	786.66
Profit	60	158.34
Profit per Tile	2.73	7.20
Margin	12.35%	16.76%
Profit based on production of 30,000 ft ² per month	81,818	215,918
Annual profit based on production of 30,000 ft ² per month	981,818	2,591,018

Assumptions:

1. *Square slab costs 20% more than the irregular shaped block*
2. *All tiles cut from the slabs are not damaged and sell for full price*
3. *Waste is not sold into a secondary but instead dumped for no cost or gain*

Source: Global Development Solutions, LLC