

Geotextile prospects in Pakistan

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ABSTRACT: South Asia is being viewed by the world as a promising market for geotextiles in near future. Whilst markets in India and China are frequently discussed, it is rather surprising that the neighboring Pakistan has by far, done virtually nothing to come up in this potentially lucrative market. This paper discusses the indispensable need of Pakistan's textile industry to expand their product portfolio to include hi-tech products like geotextiles. Also included is a SWOT analysis of the situation and the reasons why the author thinks Pakistan can, with the right strategy, make its niche in the emergent geotextile market of South Asia.

1 INTRODUCTION

The introductory part will cover the general literature available on geotextiles, the existing market in South Asia and the need of Pakistan textile industry to join the hub of geotextile market of South Asia.

1.1 *Geotextiles*

Geotextiles are defined as permeable textile materials used with foundation, soil, rock, earth etc that is an integral part of a constructed project, structure or system; they may be made of natural or synthetic fibers.

On the basis of manufacturing techniques, geotextiles can be broadly classified into three basic categories, namely, woven, knitted and non-woven.

At present knitted fabrics are rarely used as geotextiles, woven fabrics have an excellent tensile strength but provide poor abrasion resistance and dimensional stability and, except for uncalendared monofilaments, it has low coefficient of permeability.

Non-woven, fabrics, particularly needle punched, have the unique ability to elongate locally to resist damage though their tensile strength is much lower than that of woven fabrics.

Geotextiles perform four primary functions:

- Separation: Geotextiles act to separate two layers of soils that have different particle size distributions. For example, geotextiles are used

to prevent road base materials from penetrating into soft underlying soft subgrade soils, thus maintaining design thickness and roadway integrity.

- Drainage: Water is allowed to pass either downward through the geotextile into the sub-soil, or laterally within the geotextile which functions as a drain. Geotextiles act as a drain to carry fluid flows through less permeable soils.
- Filtration: Geotextiles act similar to a sand filter by allowing water to move through the soil while retaining all upstream soil particles. For example, geotextiles are used to prevent soils from migrating into drainage aggregate or pipes while maintaining flow through the system.
- Reinforcement: Geotextiles act as a reinforcement element within a soil mass or in combination with the soil to produce a composite that has improved strength and deformation properties over the unreinforced soil.
- Erosion Control: Geotextiles are used to prevent soil or other particle movements at the surface of, for example, a slope.
- Protection: Geotextiles act to prevent or limit local damage to a given element or material.

The point to be noted from the technological aspect of geotextiles is that this particular hi-tech product lies in the domain of various different industries: textile, civil, hydraulic, environmental, geotechnical and coastal to name a few. In order to derive maximum benefits from geotextile technology, all the related industries need to work together and provide their expertise for a geotextile solution that benefits all, both in terms of cost effectiveness and good engineering design.

1.2 *Market in South Asia*

South Asia is being viewed by the world as a very promising new market for geotextiles, with India taking the lead and China not very far behind. Though there is a difference in market perception and niche of the two countries, with India focusing on quality and expertise development and China going for cheaper non-standardized range, both the countries are well into geotextile market according to their own strategies.

In India, the growth of technical textiles is being patronized by the government itself. The country's eleventh five year plan (2007-2012) spearheaded the formation of National Mission for Technical Textiles in 2007, and a national budget totaling USD 170 million was allocated for the development of technical textiles.

There are various industries in India that are already involved in the production of geotextiles.

Different research institutes are playing their part as well for instance the Central Road Research Institute in New Delhi has taken up studies in the rural areas of Gujarat and Maharashtra with highly fertile soil; strips of indigenous bitumen-coated nonwoven geotextiles have been successfully used in Madurai, Ahmedabad and Chandigarh airports to control cracks in the runways and nonwoven polypropylene geotextiles have been used in the parallel taxi track at Delhi airport.

There is also awareness about the importance of standardization of geotextiles and Bombay Textile Research Association (BTRA) has done a great deal of work in not only adopting International Standards for geotextile products but also developing India's own standards where it deemed necessary.

Standardization of geotech products is a just one of the task that BTRA is responsible for as a "Centre of Excellence for Geotech" in India. BTRA, whose ultimate aim is to boost the geotextile market in India, is recognized and funded as such by the Ministry of Textiles, Government of India.

According to statistics, the Indian market growth in geotextiles is the largest of the technical textiles segments at 68.90% a year, was predicted to reach

US\$636 million by 2007-2008, from US\$ 132 million in 2004-2005.

As far as the geotextile market in China is concerned, according to statistics, the fastest growing consumer of geotextiles today is China, which is using a lot in its infrastructure development. In recent years, China has invested as much as US\$86.70 billion in infrastructure construction, including improving road-rail networks, building new airports and water conservation projects. In 2001-02, China's actual consumption of geosynthetics stood at US\$250 million, compared with India's market potential of US\$22 million during the same year.

However, there are issues with Chinese geotextile market showing non-compliance with international rules and standards regarding patents, quotas, product piracy and proper chemical use. These matters may adversely affect China's geotextile market in the long run.

The bottom line of this overview of South Asian market is to emphasize the fact that while the world views India and China as promising emergent markets of geotextiles and while these countries are investing in the development of their indigenous markets, the potential of other South Asian countries like Pakistan, Sri-Lanka and Bangladesh remains largely unexplored.

1.3 *Need of the hour: Pakistan's geotextile industry*

Textiles accounts for about 70 per cent of Pakistan's exports and the sector contributed 8.5 per cent to gross domestic product in the first eight months of the 2007/08 fiscal year to February. The textile sector employs nearly 40 per cent of the country's total manufacturing workforce, or about 15 million people. Thus, the statement that textile Industry is the backbone of Pakistan's economy is no exaggeration.

Amidst the backdrop of these statistics, it is unfortunate to note that virtually no research and development has taken place in Pakistan in the textile sector; with the result that the range of textile products that Pakistan manufactures for foreign and domestic use, is quite limited. Major portion of the yarn produced is exported to Japan, Hong Kong and South Korea, where it is converted into high value added product and is used to fetch much higher prices from International Markets.

Compared to China that offers full range products in the textile value chain, and India where there is continuous product development, Pakistan is perceived in the world as low quality manufacturer of semi finished goods.

Since Pakistan's textile industry has been dominated by spinning sector for long, it has been difficult for it to focus on other areas of product development, val-

ue addition and innovation. However, post quota scenario demands that countries whose economies rely mainly on textiles, and whose exports are targeted towards American and European markets should make a concrete effort in diversifying their export range and markets. It is the need of the hour that Pakistan actively identifies market niches higher up the scale.

Geotextiles is one such opportunity. With its developed textile industry base and raw material availability, Pakistan has the potential to enter and make its space in geotextile market; provided that she is ready to take bold decisions and invest in technological and expertise development in the textile sector.

2 NASCENT GEOTEXTILE MARKET IN PAKISTAN

Though the use of geotextiles in Pakistan is not a practice widely employed, there are cases, though few and far between, that deserve documentation because these would serve as a foundation stone for further acceptance of geotextiles in Pakistan's civil, hydraulic, landfill and environmental engineering practices.

Though the author anticipates that there may be much more small scale traders in Pakistan that are supplying geotextile products to market on need specific bases, there are only few vendors that are known country-wide as dealers of geotextile products. Local manufacturers' include only one Karachi based industry and two Lahore based ones. There is also a presence of foreign geotextile industries that outsource their products to Pakistani customers through their consultants.

It is author's observation that industries that deal traditionally with carpets, rugs and other non woven products can easily expand their product portfolio to include non-woven geotextile material.

Local geotextile manufacturers have in the past few years provided quite a few cost effective solutions to civil engineering sector of Pakistan. For instance, non woven geotextiles provided protection to pipelines in certain projects in Quetta. This innovative method is much more convenient than the conventional method which involves the transportation and installation of huge volume of protection soil to the site. Also, non wovens are easy to handle, quick to install, resistant to chemical and mechanical damage and provide sufficient cushioning effect for force absorption.

Geotextiles are now finding acceptance by such prestigious national companies such as Sui Southern Gas Company Limited and Pakistan Petroleum Limited for pipeline construction, maintenance and protection.

Other civil and hydraulic sectors that have employed geotextiles for varied purposes include De-

fense Housing Authority for construction of golf courses, Pakistan Navy for reclamation works at Ormara Naval Harbor, Irrigation Department Government of Baluchistan for coastal protection at Sur Bandar (Gwader), Karachi Port Authority for flyover construction and Hub-Pak Salt Refinery for infrastructure development.

3 SWOT ANALYSIS OF THE GROWTH OF GEOTEXTILE MARKET IN PAKISTAN

The market of geotextiles in Pakistan is at its infancy stage. In order to make sure that this market grows with confidence and market competitiveness, it is very important at this stage, to do a comprehensive SWOT analysis of the situation and then tap into the market accordingly.

3.1 Strength

The strength of Pakistan lies in its developed textile industry, which means that many companies in Pakistan can expand their product portfolio to include geotextiles. Whist producing non woven geotextiles from non woven machinery maybe comparatively easy, production of woven geofabric from conventional textile machinery may require some detail analysis.

The following table gives the general physical properties (as available in the UK market) and can be used for comparative analysis of how the conventional textile material can be modified to produce material with geotextile properties.

Table 1: Physical properties of geotextiles for different applications.

Function	Strength range (kilo Newton per meter)	Mass per unit area (gram/sq meter)	Roll width (meter)	Roll length (meter)
Separation	0.5-5	70-500	3.8 -5.5	50-100
Filtration	0.3-2	70-250	2.5-4.5	50-100
Drainage	1-5	500-2000	1.5-5.5	25-50
Reinforcement	30-1000	N/A	3.8-5.5 or strips	50-100 (Or definned)
Cushion	5-50	300-2000	4.5-5.5	50-100

In the case of woven geotextiles, Pakistan can enter markets of both synthetic and biodegradable geotextiles. The potential of product development of both the types are discussed below:

3.1.1 Synthetic geotextile fabric

Two stages of product development require particular attention:

- Production of geotextile yarn

The following table compares PET yarn for apparels with PET yarns for geotextiles:

Table 2: PET yarns for apparels and geotextiles

	Apparels	Geotextiles	Requirement for geotextile
Raw Material	PET	PET	PET
PET Chip	Green chip	SSP Chip with greenchip	For high tenacity and CEG
MW of PET Chip	N/A	>25,000	For high tenacity and CEG
CEG (mol/kg)	N/A	<30	To prevent hydrolysis
Tenacity (g/d)	Around 4	>9	In market
Elongation (%)	Around 30	<12	For dimensional stability (creep rupture)
Shrinkage (%)	< 8 for dyeing	N/A	<15 % For geogrid

The opportunity for Pakistan lies in the fact that there are many polyester and polypropylene manufacturers in Pakistan that are already into high-tenacity yarn production. According to the latest update (2005) given at the All Pakistan Textile Mills Association's (APTMA) website, there are 07 polyester fiber units with production capacity of 625,000 tons per annum. Also there are 21 units for the production of yarn with the annual production of approximately 78000 tons per annum.

These manufacturers can easily tailor their production parameters to produce yarns suitable for geotextile fabric production.

That is not to say that the industry will not need to invest for machinery upgradation. In fact, as geotextile market and demand grows, it would be advisable for spinning industries to modify their plants and shift towards modular production style.

Modular plants facilitate relatively swift changing from one type of yarn to another one. Each module incorporates its own extrusion, dosing and winding system. Polymer feed, rate of color addition, spin-finish, take-up and winding setting can be specified on individual modules for simultaneous production of different POY and FDY filament yarns in a line consisting of several modules.

- Production of geotextile woven fabric

The hypothesis is that existing machinery for conventional textile production, sometimes with only

change of parameters can be used for the production of geotextiles. Though wide widths of five meter and above are preferable, production of narrower geotextile fabrics should not be ruled out altogether.

A major difference in the production plan of conventional textiles and geotextiles in that construction of geo fabrics depend upon functional properties of fabrics, e.g. breaking strength, secant modulus, water permeability and apparent opening size etc. This technique is referred to as "Customized Weaving Technology" and is more suitable for small scale weaving plants.

3.1.2 Natural geotextile fabric

It is encouraging to note that Pakistan's jute industry is already aware of the potential benefits of jute geotextiles (JGT) in various civil and agricultural applications. It has been trying on its own to create awareness in Pakistan about JGT, but according to Pakistan Jute Mills Association (PJMA), a lot remains to be done in this regard. In fact, large portion of Pakistan's JGT have found its market in the neighboring countries instead of being consumed locally.

A lot of research and development has been going on in India to encourage the use of JGT in various civil and agricultural applications. "Indian Jute Industries Research and Association" (IJIRA) and "Jute Manufacturers and Development Council" (JMDC), for example, have been working for the past few years to encourage the use of Indian JGT.

As such, various jute industries in Pakistan have maintained their contact with JMDC and are working for technology transfer and market development of their geotextile products

3.2 Weakness

There are two major weaknesses that Pakistan will have to overcome in order to develop a viable geotextile industry and market. These are lack of technical expertise and absence of legislative encouragement on part of the government.

Textile education in Pakistan at university and technical training institutes have unfortunately been centered on conventional textile technology. Little or no research has been done on the technical textiles aspect. This means that Pakistan needs to do long term sustained investments for expertise development. The country's textile industry is in need of educated personnel who could bring together the potential end users and manufacturers of geotextiles. Also, expertise is required to help the conventional textile industries en-

ter geotextile market. Indigenous studies need to be done to assess local environmental and geological conditions so that suitably engineered geotextile products can be used for ground improvement or environmental protection.

The government should play its due role and start by giving incentives to potential geotextile industry; and eventually as the industry progresses there is also a possibility of making the use of geosynthetics mandatory, for example in the construction of roads where the subsoil is below a certain level-where the California Bearing Ratio (CBR) is less than 3. This will enhance the performance of roads and reduce maintenance cost. This pattern of gradual progress was followed by European countries, with the introduction of CE Mark for geotextiles, in October of 2004. It now applies virtually to all public projects.

Another point to be noted is that infrastructure development is totally controlled by government agencies that follow the tender system for awarding contracts: tenders are still decided on the basis of price with the lowest bidder normally winning. With all the big contracting companies fighting on price, the inclusion of geotextiles in the tenders does not happen as it would certainly push up costs. Hence use of geotextiles, at least in projects where it would result in life cycle cost savings, should be made compulsory by laws and legislations.

3.3 *Opportunities*

Though Pakistan can start by building up market of geotextiles for small scale indigenous projects, in the long run, the industry can also benefit by export of products to neighboring countries, Far East Asia and Middle East region.

3.3.1 *Opportunity in national market*

Some of the areas where geotextile can help provide superior engineering designs in national civil and environmental sectors are discussed below:

Roads, railways and airports

In pavement construction and ground modification, geotextiles can be put into variety of use: it reduce or avoid reflective cracking, work as a barrier to avoid pumping of soil fines, reduce asphalt cap thickness, reduce pavement thickness and increase the lifetime of the pavement.

In the context of Pakistan, the use of geotextiles is indispensable for the construction of highways over soft soils in waterlogged areas of Sindh. In fact in many areas like Sukkar, Lakhi, Madeji, Shekhupura

and Dadu etc, soft soils present a serious challenge to highway building authorities, where they have tried conventional road building methods in some of these areas with little or no success.

Civil aviation authorities in Pakistan responsible for runway construction have only recently opened themselves up for the use of geotextiles and geogrids for pavement reinforcement.

Hydraulic works

Geotextiles protect the coast line, river banks and canals as their flexibility and permeability ensure withstanding of the impact of waves and currents, preventing erosion and washing out of fines. Geotextiles are also used in harbor construction in which they are placed behind the retaining wall that keep the drainage layer clean which relieves the hydraulic pressure on the wall. When placed in front of the retaining wall, geotextiles prevent washing out of the sea bed.

In fact, some of the projects for coastal protection in Gwader and reclamation in Ormara Naval Harbor Port have already been successfully completed. These successful case studies should serve to build up confidence of Pakistani users in the use of the relatively new geotextile technology.

Construction

Among other things, geotextiles are very suitable for construction of buildings and architecture. For instance, below concrete floors, geotextile protects the drainage layer from contamination from the concrete and the subsoil.

After the unfortunate earthquake of 2005 that wrecked havoc in many northern areas of Pakistan, there has been an impetus on research to incorporate mechanical reinforcement elements in building design and construction. Geotextiles can play an important role in seismic-proof building designs. Research can also be done to investigate the applicability of geotextiles in slope stability and landslide protection: a factor that accentuated human and capital loss in 2005 earthquake.

3.3.2 *Opportunities in International Market*

Pakistan can target both the Indian and the Chinese market for export of her geotextile products. However success in this regard can only be achieved if a proper strategy is devised to make sure that the products from Pakistan have a competitive edge that the other countries do not offer.

Another very important aspect in this context is that of standardization. Pakistan will have to standardize her geotextile products from the very beginning, and also comply with international legislations of envi-

ronmental and ecological concerns to win the confidence of Western and European markets.

In the context of quality, organizations like Pakistan Standards and Quality Control Authority have a part to play. Though by virtue of their membership of International Standards Organization (ISO) PSQCA adopted ISO standards for geotextiles as the country's national standards about six years ago, there needs to be more awareness amongst local geotextile manufacturers about these standards and how to comply with them. Certification of PSQCA for geotextile vendors needs to be encouraged. Also, local Pakistani Standards for geotextiles also needs to be established. PSQCA should realize that though index testing for products can be borrowed from ISO, the in-situ testing should be developed according to local geological and environmental conditions.

Though there are testing facilities for geotextiles available at SGS labs, Quality Control Centre and Pakistan Centre for Scientific and Industrial Research (PCSIR), these facilities are limited and little equipment there has been specifically engineered for quality control testing of geotextiles. There is a need that a comprehensive laboratory for geotextiles should be established where equipments for both index and in situ testing should be available for geotextile manufacturers and researchers.

3.4 Threats

The threats that Pakistan might encounter in the production and application of geotextiles is the same that is associated with these products all over the world. For example production runs can be erratic since geotextile is a durable product, and is not demanded by a user regularly. Furthermore, a geotextile cannot be inspected until it is in use.

Industrialists in Pakistan might resist the change from conventional products to this innovative market. There is an initial risk involved, but the idea is to create awareness that opportunity cost is still very high.

Long term plan to deal with these threats is to gradually transit the potential industry to a stage where they can profitably produce geotextile. This can be done through modular production plants where production parameters can be easily varied to cater to a variety of product demand.

Furthermore, there is also a need to see to the fact that the production cost of the local market is cheaper as compared to the alternatives from outside. This can be done either by government intervention, or the producers can enter into contracts with the end users. The government can take appropriate measures like increasing import duties on products that might flood an

aware Pakistani consumer market from neighboring countries like India and China.

Protectionist measures at governmental level are essential; and it can be seen from the fact that almost all the major projects of geotextile applications in Pakistan has been done by foreign companies. Local manufacturers have little or no confidence to compete with the well established foreign competitors. It is important therefore that the quality and confidence of indigenous vendors has to increase and where appropriate items that can be manufactured locally should be placed on Customs General Order (CGO) - CGO is a list of locally manufactured goods issued by Customs Office of Pakistan that is prepared and issued with the objective to encourage the local industry and protect their products from exemptions/concessions extended on their imports.

4 CONCLUSION

The scope of Pakistan's entry and establishment in the field of geotextile appears to be very promising. However, much more concrete work needs to be done to attain the figures of the profits that this new market has the potential to accrue.

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