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TEXTILE AND APPAREL

Introduction

The export-apparel manufacturing industry is the leading manufacturing industry in Sri Lanka and has emerged as the country's main export earner (38% of the total exports and over 50% of industrial products exports) and the largest employment provider in the industrial sector. The industry export revenue has grown from $ 3.2 billion in 2009 to $ 4.5 billion in 2013. The industry provides over 300,000 direct employment and 600,000 indirect employment opportunities. USA and UK have been the top markets for Sri Lankan apparel throughout the decades. It is no surprise that Sri Lanka's top three apparel companies are already amongst the world's 50 most important suppliers. The industry has an ambitious target of $ 6 billion in exports by 2020, making Sri Lanka one of the world's top 10 apparel exporting countries. Handloom industry was well established in Sri Lanka in 1970's and around 110,000 handlooms centers creating job opportunities at least 200,000 people in rural areas.

The growth witnessed by the Textile and Apparel (T&A) industry can be attributed to two major factors. First, the market-oriented liberal economic policies introduced in 1977. Second, the Multi-Fibre Agreement (MFA), the worldwide system of managed trade in textiles and apparel that came into existence in 1974. Under the quota regime, Sri Lanka, like other apparel export developing countries, had enjoyed a relatively assured export market through bilateral agreements with countries in the developed world. However, changes occurred when this system of managed trade introduced by the MFA came to an end. The export apparel manufacturing industry in Sri Lanka faced this imminent phase-out of the MFA quota system for the EU by late 1990s and for the USA in 2005. The Sri Lankan garment industry is now progressively moving towards the 'fashion' industry from a purely manufacturing industry.

Sri Lanka having established itself as a reliable supplier of quality garments at competitive prices, also upholds ethical practices, thus being identified as a producer of "Garments Without Guilt", making the "Made in Sri Lanka" label synonymous with quality, reliability, social and environmental accountability. With an impressive partnership portfolio, Sri Lanka also showcases the best of technology in the garment industry, including the world's first eco-friendly "Green Garment Factory". There are a great number of challenging conditions that the Sri Lankan industry currently faces. These include increasing labour cost, trade barriers in certain important export markets such as EU and USA, strict environmental and safety legislation and growing shortage of skilled labour. The change of comparative advantage has influenced thinking about new strategies to be adopted in this sector. Since the mid-2000s, export-apparel manufacturers in Sri Lanka identified possibilities for them to turn to lean manufacturing for improving the efficiency of apparel production. The attributes of lean production, and close integration from raw material to customer through partnership fit with high-volume repetitive export-apparel manufacturing environment practiced in Sri Lanka. Further, most of the leading apparel firms have been adopting continuous improvement and value addition through research and innovation as the new strategy to face the global competition. This whole exercise is a collective effort to grow the sector by investing on Research and Development (R&D).

Sub Areas, Issues & Relevant Interventions

Table 1: Sub Areas and Justifications

Sub Areas	Justifications
1) Institutional collaboration	National level R&D institutes, universities, etc. work in scattered way and no proper link among them. No proper procedure to nurture ideas / innovations Lack of research partnerships with international institutions Therefore there is a need to establish R&D technology platform to improve competitive position of the industry
2) Marketing and Branding	Due to lack of raw material base, low cost strategy is not viable for T&A industry in Sri Lanka Branding will help to differentiate products, and secure premium margin. Sri Lankan manufacturers are yet to reach branding status. R&D on branding of Sri Lankan apparel will increase their market value. Sri Lanka concentrate mainly on two markets. Competitive position is diminishing.
3) Fashion design **4) Product innovation** **5) Process innovation**	Design and product innovation in textile and apparel industry lead to differentiated products, earning consumer loyalty that can secure premium prices. Sri Lanka is no longer a low cost labor apparel destination and has lost its competitive advantage. There is a need to be competitive by lowering production cost and value addition. In apparel business, design, fabric and colour changes take place more frequently. Sri Lanka can develop the competitiveness if manufacturers can meet short lead time, short runs, quick response and flexible manufacturing.
6) Textile material innovation (fibre, yarn, Accessories)	Need to add value through backward integration of the processes Sri Lanka needs R&D on developing flexible supply of fabric, dyeing and finishing techniques. Country does not have a fibre industry for textile yarn manufacturing. It needs research on developing fibres based on locally available raw materials such as agricultural waste. Spend significant cost component for imported accessories such as threads, buttons, linings, zippers, bra cups etc. Needs promotion of accessory development
7) Weaving /Handloom	Sri Lanka weaving industry seems to be not competitive due to high investment, high energy cost and outdated technologies. R&D will enable them to innovate through developments of new products, new processing techniques, new materials and new technologies Socio economic impact / empowering village women High demand for craft based environment friendly product from western countries Need to develop handloom industry to be a competitive and innovative industry

Sub Areas	Justifications
8) Knitting and Seamless "complete garment" knitting	Knitting sector is more vertical than weaving and apparel. Knitting sector is yarn forward where they buy yarn and knit it directly to final product such as socks, stockings, complete garment active wear etc. Flexible fabric manufacturing method could be developed to technical textile production
9) Colouration, finishing & surface treatments	Strong and efficient colouration and finishing sector is necessary to help and ensure that the changes in fashion can be responded to quickly by apparel supply chain thereby maximizing opportunities Opportunity for novel, fast response and environmentally sustainable products such as natural dyes since interest of "sustainability" is growing
10) Technical textiles	Technical textile is defined as textiles used for their performance rather than aesthetic or decorative characteristics. This is the Fastest growing sector in the industry. Success in this market is dependent on providing specific solutions to the customer's specific problems. Sustainability of the technical textile industry will depend on the continuous research and development and product innovation. Technical textile sector will give opportunities for companies to diversify and to move away from traditional textiles.
11) Textile Supply Chain	High lead time cause lack of competitiveness. Need speedy delivery to meet changing consumer requirements. Good supply chain management is important for Sri Lanka apparel industry to be competitive in an environment where quick and flexible responses to changing customer demand is needed.
12) Energy, Environment & Sustainability	High energy cost – higher production cost lose the competitiveness. No investment for backward integration due to high energy in textile. Need R&D on reducing environmental impact and enhance the sustainability of the industry.

Table 2: Issues/Problems, R&D Needs and Relevant Interventions

Sub Areas	Issues/Problems	Research & Development Needs	Relevant Interventions
1) Institutional collaborations	I) National level R&D institutes, universities, etc. work in scattered way and no proper link among themselves. II) No proper procedure to nurture ideas / innovations. III) Lack of research partnerships with international institutions	i) Promote coordination of R&D activities and innovations	**Capacity Building** a) Establish a R&D and innovation coordination center
		ii) Create opportunities for training in key strategic R&D focus areas	**Capacity Building** a) Introduce subjects on key strategic R&D fields in undergraduate and post graduate studies and research related to textile and apparel industry
		iii) Set up IP policy & strategy	**Policy Studies** a) Develop a IP policy & strategy
		iv) Setting up of funding mechanism for research	**Policy Studies** a) Develop a policy document to support funding for research
		v) Establish partnership with foreign universities / R&D centers to facilitates knowledge sharing	**Capacity Building** a) Develop partnerships with foreign universities
2) Apparel Marketing / Branding	I) Sri Lanka loosing competitiveness in traditional markets II) Lack of branding and consumer awareness	i) Market research on new business models.	**Information and Communication Technologies** a) Develop a new business models using ICT
		ii) Research on emerging markets and branding	**Pure and Applied Research** a) Research on emerging markets and branding **Popularization** a) Exploration of new markets

Sub Areas	Issues/Problems	Research & Development Needs	Relevant Interventions
		iii) Development of a data portal to provide information to the stakeholders	**Information and Communication Technologies** a) Setting up data portal to provide information to the stakeholders
		iv) Research on suitable branding strategy of Sri Lankan identity using core strengths	**Pure and Applied Research** a) Market research on suitable branding strategy based on Sri Lankan identity and its core strengths **Popularization** a) Find new Sri Lankan brands for the identified international markets
3) Fashion Design	I) Lack of commercialization in fashion developments II) High lead time for design realization III) Lack of value addition using textile and surface design IV) Lack of emerging design entrepreneurs V) Opportunity for new embellishment techniques.	i) Scientific study of fashion trends & forecasting	**Pure and Applied research** a) Research on fashion trends and forecasting
		ii) Personalized product design using CAD / virtual prototyping	**Information and Communication Technologies** a) Develop personalized product using CAD / virtual prototyping
		iii) Development of textile & surface design techniques	**Nanotechnology** a) Develop textile and surface design techniques
		iv) Development of design- incubators	**Popularization** a) Develop design- incubators and promote new Sri Lankan brands

Sub Areas	Issues/Problems	Research & Development Needs	Relevant Interventions
		v) R&D on embellishment techniques and capability	**Information and Communication Technologies** a) Develop design software to enhance embellishment techniques and capability
4) Apparel Product Innovation	I) Low efficiency and low material utilization in traditional cut and sewing II) Consumers demand individual fit or customized garments III) Increase functionality of wearing apparel. IV) Research on consumer trends towards wellbeing and increase energy levels V) Less usage due to wearing / tearing some of the apparel parts VI) Longer product development process VII) Delay in sampling process	i) Development of alternative manufacturing techniques to traditional cut and sew method	**Innovations** a) Develop efficient alternative methods to traditional cut and sew method
		ii) Design and modeling 3D movement in a virtual environment	**Information and Communication Technologies** a) Develop software for 3D modeling
		iii) Nano-technology research on apparel product development	**Nanotechnology** a) Develop new mechanisms to the textile development
		iv) Product development to meet specific muscle and dynamic bio mechanical movement needs for active ware	**Innovations** a) Utilize biomechanical knowledge when developing active wear
		v) Development of detachable/dis-assembly techniques for apparel	**Innovations** a) Develop efficient detachable methods
		vi) Quick product development processes	**Innovations** a) Develop efficient product development methods
		vii) Development of faster sampling processes	**Innovations** a) Develop efficient sampling processes
5) Apparel Process Innovation	I) Difficulty in attracting manpower for production II) Higher labour cost	i) Automate production and material handling	**Information and Communication Technologies** a) Adapt/ Develop automated production and material handling mechanisms

Sub Areas	Issues/Problems	Research & Development Needs	Relevant Interventions
Apparel Process Innovation (contd.)		ii) Automation of sewing machines and sewing operations to reduce dependency on skilled labour	**Information and Communication Technologies** a) Develop automated sewing mechanisms
		iii) Use of Radio frequency identification (RFID) systems for cost effective inventory tracking and defect identification	**Innovations** a) Develop radio frequency identification systems for cost effective inventory tracking and defect identification
		iv) Simulation and modeling of the garment manufacturing process and seam engineering	**Information and Communication Technologies** a) Develop models to simulate the garment manufacturing process and seam engineering
		v) Research on variations in anthropometric requirements	**Pure and Applied Research** **a)** Enhance anthropometric knowledge to identify variations in anthropometric dimensions in designing apparels
		vi) Research on implementation of lean and advanced manufacturing systems	**Indigenous knowledge & Intellectual Property Rights** a) Promote usage of lean technologies based on indigenous knowledge and such other knowledge streams
6) Textile material innovation (fiber, Yarn & accessories)	I) Non availability of natural and man-made fiber base. II) Customer concern on	i) Research on value added materials, such as Cosmeto Textiles, using local raw materials: Fibers that can release sustained chemicals/ medication.	**Pure and Applied Research** a) Conduct research on value added materials such as Cosmeto Textiles using local raw materials

Sub Areas	Issues/Problems	Research & Development Needs	Relevant Interventions
Textile material innovation (fiber, Yarn & accessories (contd.)	environmentally friendly textiles and apparel III) Demand for sustainable fibers in the high end markets IV) Demand for innovative textile materials	ii) Eco-friendly and bio-based fiber/yarn production that does not require intensive utility or processing	**Indigenous knowledge & Intellectual Property Rights** a) Promote Indigenous knowledge in production of eco-friendly and bio-based fiber
		iii) Research into sustainable/renewable fibers/materials	**Pure and Applied research** a) Conduct research into sustainable/renewable fibers/materials
		iv) New methods of recycling and regenerating textile materials.	**Innovations** a) Develop new methods of recycling and regenerating textile materials
		v) Method of re-cycling polyester fiber / fabric waste and blended materials.	**Innovations** a) Develop new methods of re-cycling polyester fiber / fabric waste & blended materials
		vi) Sustainable natural fibers and regenerated fibers based on agricultural waste such as banana, pineapple, plant materials	**Innovations** a) Develop new methods of production Sustainable natural fibers and regenerated fibers based on agricultural waste such as banana, pineapple, plant materials
		vii) Research on emerging fibers such as bamboo, banana etc.	**Pure and Applied Research** a) Conduct research on emerging fibers such as bamboo, banana etc.
		viii) Nano materials & processing technologies	**Nanotechnology** a) Promote Nano technological knowledge in production of Nano materials and in processing technologies.

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		ix) Functional Fibers and Polymers	**Nanotechnology** **a)** Promote Nano technological knowledge in production of Functional Fibers and Polymers
7) Weaving/ handloom	I) High investment requirement with regards to textile machinery II) High energy cost III) Increased set up time and labor cost and skill IV) Weaving not supporting technical textiles V) Higher production cost and low productivity in handloom sector Weaving not supporting technical textiles	i) Modernization of existing machinery to suit varied & diverse needs.	**Indigenous knowledge & Intellectual Property Rights** a) Initiation of modifying existed machinery to suit varied & diverse needs
		ii) Develop attachments or computerized programmable rigs to assist machine set up.	**Pure and Applied Research** a) Conduct research on attachments or computerized programmable rigs to assist machine set up
		iii) Redesign of equipment to produce value added materials.	**Pure and Applied Research** a) Conduct research on redesign of equipment to produce value added materials
		iv) Mechanization of handlooms	**Information and Communication Technologies** a) Develop a database for the handloom industry
		v) Methods for improving machine efficiency and productivity	**Pure and Applied Research** a) Conduct research on methods for improving machine efficiency and productivity

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		vi) Development of 3D weaving to achieve conformable shapes for technical textiles.	**Capacity Building** a) Conduct training programs on 3D weaving to achieve conformable shapes for technical textiles
		vii) Machine modifications specifically aiming energy cost reduction	**Pure and Applied Research** a) Conduct research on Machine modifications specifically aiming energy cost reduction
		viii) Development of alternative natural and sustainable raw materials, dyes & finishes specially for handloom use	**Innovations** a) Find out solutions for development of alternative natural and sustainable raw materials, dyes & finishes specially for handloom use
		ix) Development of alternative energy sources to operate looms	**Pure and Applied Research** a) Use alternative energy sources to operate looms
8) Knitting /seamless garments	I) Not explored the compression possibilities with seamless garments. II) Not fully explored the value addition through vertical Integration	i) Develop machinery and structures with ability to pre-stress for compression characteristics	**Pure and Applied Research** a) Develop machinery and structures with ability to pre-stress for compression characteristics
		ii) Development of knitting technology and 3D shapes for technical textile applications such as medical and smart textiles	**Innovations** **a)** Initiation of knitting technology and 3D shapes for technical textile applications such as medical and smart textiles
		iii) Computer controlled knitting, designing and shaping	**Information and Communication Technologies** a) Develop computerized systems for controlled knitting, designing and shaping

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		iv) Combined fabric and garment formation through seamless knitting	**Innovations** a) Develop information portal to cater fabric and garment formation through seamless knitting
		v) Development of cost effective complete garment with seamless knitting using pre-dyed and finished yarn	**Pure and Applied Research** a) Conduct research on cost effective complete garment with seamless knitting using pre-dyed and finished yarn
9) Colouration, finishing & surface treatments	I) High water and energy usage II) Environment issues & sustainability III) Unable to access high efficient new dyeing techniques due to high investment IV) Longer time for colour matching and dyeing V) High shade variation due to dependence of human skills for colour matching.	i) Reduce water consumption in pre-treatment and dyeing and finishing	**Capacity Building** a) Conduct training programs on reducing water consumption in pre-treatment and dyeing and finishing
		ii) Continuous pre-treatment and dyeing techniques aiming low water and energy consumption.	**Capacity Building** a) Conduct training programs on pre-treatment and dyeing techniques aiming low water and energy consumption
			Innovations a) Develop water-less Dyeing techniques
		iii) Development of finishes using locally available indigenous/herbal materials	**Indigenous knowledge & Intellectual Property Rights** a) Develop finishes using locally available indigenous/herbal materials
		iv) New fast dyeing techniques to reduce dyeing cycle time	**Pure and Applied research** a) Conduct research on new fast dyeing techniques to reduce dyeing cycle time
		v) Development of computer aided techniques for colour matching and	**Information and Communication Technologies**

Sub Areas	Issues/Problems	Research & Development Needs	Relevant Interventions
		dyeing	a) Develop computer aided techniques for colour matching and dyeing
		vi) Development of techniques to reduce colour variation and methods of detecting and correcting variation on-line	**Information and Communication Technologies** a) Develop computerized systems to reduce colour variations and methods to detect and rectify such variations on-line
		vii) On-line fabric quality inspection	**Information and Communication Technologies** a) Develop information system or portal for on-line inspection of fabric quality
		viii) Development of natural dyeing and finishing	**Pure and Applied Research** a) Development of natural dyeing and finishing
10) Technical Textiles	I) Technical textiles are expected to continue to grow at a higher rate than any other segment of the textile market.	i) The different applications of technical textile including structural composites, thermal and acoustical isolation, filtration and separation, liquid management, biological applications and non-structural mechanical properties	**Pure and Applied Research** a) Conduct research on different applications of textile structures
		ii) Research on protective textile and apparel	**Pure and Applied Research** a) Conduct research on protective textile and apparel

Sub Areas	Issues/Problems	Research & Development Needs	Relevant Interventions
Technical Textiles (contd.)			
		iii) Functionalization of textile structures which will be in contact with a living environment (bacteria, proteins, etc.), either for antibacterial purposes or for the delivery of drugs and medicines.	**Pure and Applied Research** a) Conduct research on functionalization of textile structures
		iv) 'Clothing assistants' that have a memory to store information and carry out complex calculations	**Information and Communication Technologies** a) Develop information system as 'assistant' for clothing that have a memory to store information and carry out complex calculations
		v) Clothing monitors that record the behaviour or the health of the person	**Information and Communication Technology** a) Develop information system to monitor clothing that record the behaviour or the health of the person
		vi) Regulative clothing that adjusts certain parameters, such as temperature or ventilation	**Testing, Standardization & Accreditation** a) Testing standards of regulative clothing that adjusts certain parameters, such as temperature or ventilation
		vii) Development of electronic components that are washable and durable and safe for on-body application	**Information and Communication Technologies** a) Develop electronic components that are washable and durable and safe for on-

Sub Areas	Issues/Problems	Research & Development Needs	Relevant Interventions
Technical Textiles **(c0ntd.)**			body application
		viii) Integration of the electronic components into apparel	**Innovations** a) Integrate the existing electronic components into apparel
		ix) Smart fibre based monitoring systems	**Information and Communication Technologies** a) Develop smart fibre based monitoring systems
		x) Development of cost effective production methods of nano fibres for technical textile applications	**Nanotechnology** a) Develop cost effective production methods of nano fibres for technical textile applications
		xi) Development of nano coating for fibrus surface	**Nanotechnology** a) Develop nano coating for fibrus surfaces
		xii) Nano conductive materials for medical & smart textiles	**Nanotechnology** a) Develop nano conductive materials for medical & smart textiles
11) Supply Chain	I) Longer lead-times	i) Efficient supply chain models ii) Near shore production / speed models iii) Research on **Business to Consumer models** using IT infrastructure iv) Model with reduced lead time from consumer need to delivery, RM	**Information and Communication Technologies** a) Develop information portal to cater to seamless fabric and garment making

Sub Areas	Issues/Problems	Research & Development Needs	Relevant Interventions
		production, sampling, manufacturing, logistic.	
12) Energy	I) High energy cost II) lack of sustainable energy sources	i) Research on low cost / sustainable energy sources optimised for T&A.	**Pure and Applied Research** a) Conduct research on low cost / sustainable energy sources optimised for T&A
		ii) Machine improvements to reduce energy consumptions	**Pure and Applied Research** a) Conduct research on machine improvements to reduce energy consumptions
		iii) Development of low energy manufacturing models.	**Pure and Applied Research** a) Conduct research on low energy manufacturing models
		iv) Green technology for textile & apparel	**Popularization** a) Adapt green technology for textile & apparel industry