

Focus Area 7 : 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 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 the 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 added 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 R&D.

Sub Areas, Issues & Relevant Interventions

Table 1: Sub Areas and Justifications

Sub Areas	Justifications
1) Institutional policy	<ul style="list-style-type: none"> • National level R&D institutes, universities, etc. work in scattered way and no proper link between them. • No proper procedure to explore 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	<ul style="list-style-type: none"> • Due to lack of raw material base, low cost strategy is not viable for SL T&A industry • Branding will help to differentiate products, and secure premium margin. SL manufacturers have not developed to brands. R&D on branding SL apparel will increase value addition. • Concentrate mainly on two markets. Competitive position is diminishing.
3) Fashion design 4) Product innovation 5) Process innovation	<ul style="list-style-type: none"> • About 300,000 employment and 38% of the industrial export contributed by T&A industry. • Design and product innovation in both textile and apparel differentiate product, earn consumer loyalty and able to get premium price. • Sri Lanka is no longer low cost labor apparel destination and losing its competitive advantage. • Need to be competitive by lowering production cost and adding value to apparel. • In apparel business, design, fabric and colour changes are being made 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)	<ul style="list-style-type: none"> • Need to add value through backward integration of the processes • SL needs R&D on developing flexible supply of fabric, dyeing and finishing techniques. • Country does not have a fibre industry for textile yarn manufacturing. Need 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. Need R&D interventions to accessory development
7) Weaving /Handloom	<ul style="list-style-type: none"> • SL 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

Sub Areas	Justifications
	<ul style="list-style-type: none"> • 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 & innovative industry
8) Knitting & Seamless “complete garment” knitting	<ul style="list-style-type: none"> • 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. • Hybrid of textile and apparel very much suit to SL strengths. • Flexible fabric manufacturing method which could be developed to technical textile production
9) Colouration, finishing & surface treatments	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Technical textile is defined as textiles used for their performance rather than aesthetic or decorative characteristics. • Fastest growing sector • 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	<ul style="list-style-type: none"> • High lead time cause lack of competitiveness. Need speedy delivery to meet changing consumer requirements. • Good supply chain management is important for SL apparel industry to be competitive. • Critical where quick and flexible responses to changing customer demand is needed. • E-commerce
12) Energy, Environment & Sustainability	<ul style="list-style-type: none"> • 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 Policy	I) National level R&D institutes, universities, etc. work in scattered way and no proper link between them. II) No proper procedure to explore nurture ideas / innovations. III) Lack of research partnerships with international institutions	i) Create a single point of contact for all R&D /innovation requirement of the industry: Setting-up of a R&D technology platform/forum	Policy studies Develop a policy document to support single point of R&D center
		ii) Research centers for key strategic R&D focus areas	Capacity Building Include subjects on key strategic R&D focus areas for undergraduate and post graduate studies and their researches
		iii) Set up IP policy & strategy	Policy studies Develop a IP policy & strategy
		iv) Setting up of funding mechanism for research	Policy studies Develop a policy document to support funding for research
		v) Establish partnership with foreign universities / R&D centers to facilitates knowledge sharing	Capacity Building Develop the partnership with foreign universities and sign MOUs
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 Technology Develop a new business models using ICT
		ii) Research on emerging markets & branding	Pure and Applied Research Design a market research on branding Popularization 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 Technology Setting up data portal for to provide information to the stakeholders
		iv) Research on suitable branding strategy of Sri Lankan identity using core strengths	Pure and Applied research Implement a market research on suitable branding strategy of Sri Lankan identity using core strengths Popularization Find new SL 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 & 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 Research on fashion trends & forecasting
		ii) Personalized product design using CAD /virtual prototyping	Information and Communication Technology Develop personalized product using CAD / virtual prototyping
		iii) Development of textile & surface design techniques	Nanotechnology Develop textile & surface design techniques
		iv) Development of design incubators.	Popularization Promote New SL brands
		v) R&D on embellishment techniques and capability	Information and Communication Technology Develop design software to enhance embellishment techniques and capability

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

Sub Areas	Issues/Problems	Research & Development Needs	Relevant Interventions
		ii) Automation of sewing machines and sewing operations to reduce dependency on skilled labour	Information and Communication Technology Develop automated sewing mechanisms
		iii) Use of Radio frequency identification (RFID) systems for cost effective inventory tracking and defect identification	Innovation 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 Technology Develop models and do simulations of the garment manufacturing process and seam engineering
		v) Research on variations in anthropometric requirements	Biotechnology Promote biotechnological knowledge to identify variations in anthropometric requirements
		vi) Research on implementation of lean and advanced manufacturing systems	Indigenous knowledge & Intellectual Property Rights Promote Indigenous knowledge based lean manufacturing systems
6) Textile material innovation (fiber, Yarn & accessories)	I) Non availability of natural and man-made fiber base. II) Customer concern on environmentally friendly textiles and apparel III) Demand for sustainable fibers in the high end markets IV) Demand for innovative textile materials	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 Conduct research on value added materials such as Cosmeto Textiles using local raw materials

Sub Areas	Issues/Problems	Research & Development Needs	Relevant Interventions
		ii) Eco-friendly and bio-based fiber/yarn production that does not require intensive utility or processing	Indigenous knowledge & Intellectual Property Rights Promote Indigenous knowledge in production of eco-friendly and bio-based fiber
		iii) Research into sustainable/renewable fibers/materials	Pure and Applied research Conduct research into sustainable/renewable fibers/materials
		iv) New methods of recycling & regenerating textile materials.	Innovation Develop new methods of recycling & regenerating textile materials.
		v) Method of re-cycling polyester fiber / fabric waste & blended materials.	Innovation 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	Innovation 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 Conduct research on emerging fibers such as bamboo, banana etc.
		viii) Nano materials & processing technologies	Nanotechnology Promote Nano technological knowledge in production of Nano materials & in processing technologies.

Sub Areas	Issues/Problems	Research & Development Needs	Relevant Interventions
		ix) Functional Fibers and Polymers	Nanotechnology 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	i) Modernization of existing machinery to suit varied & diverse needs.	Indigenous knowledge & Intellectual Property Rights Initiation of modifying existed machinery to suit varied & diverse needs
	IV) Weaving not supporting technical textiles V) Higher production cost and low productivity in handloom sector Weaving not supporting technical textiles	ii) Develop attachments or computerized programmable rigs to assist machine set up.	Pure and Applied research 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 Conduct research on redesign of equipment to produce value added materials
		iv) Mechanization of handlooms	Information and Communication Technology Develop computerized systems to record handloom industry
		v) Methods for improving machine efficiency and productivity	Pure and Applied research Conduct research on methods for improving machine efficiency and productivity
		vi) Development of 3D weaving to achieve conformable shapes for technical textiles.	Capacity Building Conduct training programs on 3D weaving to achieve conformable shapes for technical textiles

Sub Areas	Issues/Problems	Research & Development Needs	Relevant Interventions
		vii) Machine modifications specifically aiming energy cost reduction	Pure and Applied research 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	Innovation 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	Indigenous knowledge & Intellectual Property Rights Initiation of 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	Indigenous knowledge & Intellectual Property Rights Initiation of 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	Innovation 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 Technology Develop computerized systems to controlled knitting, designing and shaping

Sub Areas	Issues/Problems	Research & Development Needs	Relevant Interventions
		iv) Combined fabric and garment formation through seamless knitting	Innovation Develop information portal to cater fabric and garment formation through seamless knitting
		v) Development of cost effective complete garment in seamless knitting using pre-dyed and finished yarn	Pure and Applied research Conduct research on cost effective complete garment in 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 Conduct training programs on how to Reduce water consumption in pre-treatment and dyeing and finishing
		ii) Continuous pre-treatment and dyeing techniques aiming low water and energy consumption.	Capacity Building Conduct training programs on how pre-treatment and dyeing techniques aiming low water and energy consumption
		iii) Development of water-less Dyeing techniques	Innovation Develop water-less Dyeing techniques
		iv) Development of finishes using locally available indigenous/herbal materials	Indigenous knowledge & Intellectual Property Rights Develop finishes using locally available indigenous/herbal materials
		v) New fast dyeing techniques to reduce dyeing cycle time	Pure and Applied research Conduct research on new fast dyeing techniques to reduce dyeing cycle time

Sub Areas	Issues/Problems	Research & Development Needs	Relevant Interventions
		vi) Development of computer aided techniques for colour matching and dyeing	Information and Communication Technology Develop computer aided techniques for colour matching and dyeing
		vii) Development of techniques to reduce colour variation and methods of detecting and correcting variation on-line	Information and Communication Technology Develop information system to reduce colour variation and methods of detecting and correcting variation on-line
		viii) On-line fabric quality inspection	Information and Communication Technology Develop information system or portal to inspect on-line fabric quality
		ix) Development of natural dyeing and finishing	Pure and Applied research Conduct research on how to develop 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 textile structures including structural composites, thermal and acoustical isolation, filtration and separation, liquid management, biological applications and non-structural mechanical properties	Pure and Applied research Conduct research on different applications of textile structures
		ii) Research on protective textile and apparel	Pure and Applied research Conduct research on protective textile and apparel

Sub Areas	Issues/Problems	Research & Development Needs	Relevant Interventions
		iii) Functionalization of textile structures which will be in contact with a living environment (bacteria, proteins,...), either for antibacterial purposes or for the delivery of drugs and medicines.	Pure and Applied research Conduct research on functionalization of textile structures
		iv) Clothing assistants that have a memory, store information and carry out complex calculations	Information and Communication Technology Develop information system as assistant for clothing that have a memory, store information and carry out complex calculations
		v) Clothing monitors that record the behaviour or the health of the person	Information and Communication Technology 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 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 Technology Develop electronic components that are washable and durable and safe for on-body application
		viii) Integration of the electronic components into apparel	Innovation Implement the existing electronic components into apparel

Sub Areas	Issues/Problems	Research & Development Needs	Relevant Interventions
		ix) Smart fibre based monitoring systems	Information and Communication Technology Develop smart fibre based monitoring systems
		x) Development of cost effective production methods of nano fibres for technical textile applications	Nanotechnology Develop cost effective production methods of nano fibres for technical textile applications
		xi) Development of nano coating for fibrus surface	Nanotechnology Develop nano coating for fibrus surface
		xii) Nano conductive materials for medical & smart textiles	Nanotechnology Develop nano conductive materials for medical & smart textiles
1) Supply Chain	l) Longer lead-times	i) Efficient supply chain models	Information and Communication Technology Develop information portal to cater fabric and garment formation through seamless knitting
		ii) Near shore production / speed models	Information and Communication Technology Develop information portal to cater fabric and garment formation through seamless knitting
		iii) Research on B to C models using IT infrastructure	Information and Communication Technology Develop information portal to cater fabric and garment formation through seamless knitting

Sub Areas	Issues/Problems	Research & Development Needs	Relevant Interventions
		iv) Model with reduced lead time from consumer need to delivery, RM production, sampling, manufacturing, logistic.	Information and Communication Technology Develop information portal to cater fabric and garment formation through seamless knitting
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 Conduct research on low cost / sustainable energy sources optimised for T&A
		ii) Machine improvements to reduce energy consumptions	Pure and Applied research Conduct research on machine improvements to reduce energy consumptions
		iii) Development of low energy manufacturing models.	Pure and Applied research Conduct research on low energy manufacturing models
		iv) Green technology for textile & apparel	Popularization Adapt green technology for textile & apparel

***Table 3: Interventions and Key Performance Indicators**

Sub Areas and Issues/Problems	Interventions/ Activities									
	Policy Studies	Pure and Applied Research	Innovation	Information and Communication Technologies	Nanotechnology	Biotechnology	Indigenous knowledge & Intellectual Property Rights(IPR)	Testing, Standardization & Accreditation	Capacity Building	Popularization
1) Institutional Policy										
i) Create a single point of contact for all R&D /innovation requirement of the industry: Setting-up of a R&D technology platform/forum										
Time Frame (TF)	S								L	L
KPI	Policy document								No. of PhD, Researchers	Invest. growth in R&D
Lead Institute(LI)	NESTEC, MIC								UOM, OUSL, SLITA, JAAF	MIC, JAAF, NSF

**Please note that this is only a sample page*