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## Multidisciplinary and synergetic research in apparel sector can increase the scope of integrating sustainability

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### **Abstract**

This paper discusses how Multidisciplinary and Synergetic Research in Apparel sector can increase the scope of Integrating Sustainability. It is a Conceptual Research paper discussing with relevant examples how research inspired by other industry and learning from other sectors has worked to advantage of Apparel Sector specially with reference to integrating sustainability.

We learnt the ways of mass production from Toyota- Toyota Production System which completely revolutionized the way garments were bulk manufactured. Sweat shops of the 1960s were converted to today's automated manufacturing system. Automated manufacturing is after all one of the facets of Sustainability as it means "minimize resources"- one of the key focus areas of Sustainability. This research paper shall discuss many other relevant examples as to how broad based research in the industry has shaped it for betterment.

**Methodology:** This Conceptual Research paper discusses multidisciplinary learning of Apparel sector from other industries which has led to swift evolution of the Apparel. In addition this research paper also discusses how sustainability can be better integrated through synergetic research. The multidisciplinary learning and research has led to implementation of innovative ideas inspired from various fields.

**Keywords:** Synergetic sustainable research, eco-innovation, sustainable technology, sustainable practices

### **1. Introduction**

#### **1.1 Outline of paper**

This paper sketches how Sustainability is key driver to innovation across various industries. Aptly named as "Eco-innovation". Taking examples from across various industries it has been discussed how multidisciplinary research can be used in a synergetic way towards achieving the common goal of sustainability.

#### **1.2 Definition of Eco-innovation**

Peter <sup>[1]</sup> James defined eco-innovation as "new products and processes which provide customer and business value but significantly decrease environmental impacts" <sup>[2]</sup>. Klaus Rennings <sup>[3]</sup> introduced the term eco-innovation addressing explicitly three kinds of changes towards sustainable development: technological, social and institutional innovation.

### **2 Methods of Eco-innovation**

#### **2.1 Synergy of Information Technology to facilitate Sustainability of Apparels**

These are a beautiful examples where the need of apparel industry teamed up with Information technology research has led to creation of "sustainable Product". It all begins with creating the product right and sustainably. Nike, one of the pioneering Apparel brands took a giant leap to creating the products sustainably in the year 2013 by introducing the MAKING App to help designers create better with impetus on sustainability. As Lee Holman, Nike VP of Apparel Design mentions: "We've created the MAKING App to empower any designer around the world to make better materials choices in the initial stages of the innovation process to ultimately create products that are better for consumers and better for the planet <sup>[4]</sup>."

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Continuing with making it right, Scalable Garment Technologies Inc. (SGTI) introduced a robotic knitting machine connected to 3D modeling software [5] to make custom seamless knit garments. It facilitates advanced knitting technology integrating information technology in the entire production process and use in customized apparel products. This helps in overcoming overproduction and the product is made only when needed by the customer. It shall lead to zero pattern waste/ cut waste/ scrap- made to fit clothing. Indeed a very sustainable idea formulated by synergy of Knitting technology and Information technology.

In addition there are end number of software available which facilitate optimized pattern efficiency. After all one of the basic tenets of Sustainability is reduced usage of resources. In other words eliminating wastes. They do help in minimizing the wastes and scarp bringing the corporate closer to the goal of sustainability.

One of the classic examples is how FedEx [6] in the year 2008 came up with a novel business model by integrating the Kinko's chain of print shops that it had acquired. Instead of shipping copies of a document they asked their customers preference for electronic transfer. At the delivery location, the file would be printed and bind and deliver copies anywhere in the city. This helped them in cost cutting, being agile and prompt and also Sustainable.

Reusing is a wonderful idea but would it not be better if the garments are ever lasting and are never torn. Self healing garments are a major step towards sustainability erasing the need of recycling altogether. Today with advent of technology and using biomimicry self-healing materials including self healing fabric has been created which are capable of "healing" themselves when cut, torn or cracked [7]. This increases the longevity of Apparels in turn reducing the demand as well and need to recycle. It indeed is a giant step towards sustainability. Classic fashion cycles may add on the finishing touch to it.

The list continues. What can be measured can also be managed. This lays emphasis to the need of Quantifying Sustainability in the Apparel Industry. None other than the IT tools facilitate this. With softwares like Higg2.0 module and Gabi 6.0 modules companies can foresee the environmental impact of what they create and take prompt decisions in favors of integrating Sustainability. With better visibility of Supply chain, things automatically fall in place.

## 2.2 Synergy of Chemical Engineering and Biotechnology to facilitate Sustainability of Apparels

Chemical Engineering and Biotechnology comes to the rescue of Apparel industry whenever we think of creating synthetic leather. Innovations in Raw material is nothing new.

Being ethical is next to being sustainable. Looking for alternative materials which help overcome the cruelty towards animals as well as putting at bay the polluting processes if leather is indeed a remarkable thing. Modern Meadow came up with an alternative of growing leather. This innovative company through collagen growth, has been able to create leather and modify it for different purposes and quality bases. Their product is completely controlled, from DNA to clothing.

Self cleaning garment, stain repellent fabrics, anti microbial finishes etc are a few examples in continuation. There are myriad such examples in this domain. Few have been discussed in the section of packaging materials as well.

Microbial fuel cells, MFCs can be used to treat textile waste water one of the major grey areas in Textile and Apparel

Sector. The technology invented by JSP Enviro<sup>(12)</sup> in collaboration with IIT, Madras shall make the idea more feasible.

## 2.3 Synergy of Research in Energy sector and Apparel sector facilitating Sustainability

Energy conservation being one of the simplest answer to the bigger problem, there have been many innovations in this domain. One of the prominent ways of eco innovation is energy conservation methods and techniques. After all reduced usage of resources is a synonymous to sustainability. To define it, energy conservation is the utilization of devices that require smaller amounts of energy in order to reduce the consumption of electricity. A few are being discussed here One of the simplest instances in the apparel industry can be using energy efficient machines especially for processes which are automated and energy intensive like spinning, weaving (both through mills) and garment stitching etc. Innovations done by machine making companies play a vital role here.

Small distance transportation on the production floor can be done by Gravitational Chutes/ Overhead hangers running on gravitational pull - if the isle for transportation is slanting. Every Joule saved brings the factories closer to Sustainability. Most of the production floors use small simple hacks for the motive of Cost cutting even if Sustainability is not in their minds.



Fig 1: Gravitational Chute used for transportation in an Apparel Factory

## 2.4 Synergy of Research in Building and Architecture and Apparel sector facilitating Sustainability

Sustainable buildings are inevitable as there is need of 360 degree sustainability. In one way it helps reduce the energy consumption of the organization parallely making the people within and outside the industrial system happy and satisfied having long term gains. Research from field of Architecture and Eco-innovation in this domain can help achieve the goal.

Nanosolar [8] is one of the leaders in producing printing thin films for solar energy. Through its industrial printing process that coats CIGS (Copper, Indium, Gallium, Selenium) and nanoparticle inks on low-cost aluminum foil. It not only reduces the need for expensive high-vacuum manufacturing equipment commonly used in the mills and production floors but also makes the work environment better. Usage of such innovations in Buildings of Apparel sector is not uncommon. There are companies which strive to get platinum rating of their factories. Working for and in such organizations becomes an experience.

Honggerberg Campus in Switzerland <sup>[9]</sup> aims to create such a heating and cooling system on its Science City Campus. The Eco-innovations is that it shall harness natural heat generated by systems in summer, pump it underground, and store it during the summer to be pushed back up into buildings where it will act as a heating system. The scheme is the first of its kind, and futuristic but can be of great use to Apparel sector as factories struggle to maintain the temperature and humidity affecting the comfort and hence productivity of the operators as well as minimize the carbon emissions.



**Fig 2:** Science City Stores Warm Air from summer to Heat Buildings in Winter

Using Solar panels for heating systems is nothing new. One of the more accessible ways is usage of artificial leaf that can feasibly convert sunlight and water to energy in an affordable and accessible way. This has been developed by a group of MIT chemists led by Dr. Dan Nocera <sup>[9]</sup>. After all any eco-innovation cannot be successful till it becomes accessible and can be practically implemented.

### 2.5 Research in System reengineering with collaborative efforts to have better recycling methods and waste management methods

Disusing a case study from Harvard Business Review <sup>[6]</sup>. In 2002 HP learned that Europe's Waste Electrical and Electronic Equipment regulations would require hardware manufacturers to pay for the cost of recycling products in proportion to their sales. HP teamed up with three electronics makers—Sony, Braun, and Electrolux—to create the private European Recycling Platform. In 2007 the platform worked with 1,000 companies in 30 countries and recycled about 20% of the equipment covered by the WEEE Directive. Not only did HP save more than \$100 million from 2003 to 2007, but it enhanced its reputation with consumers, policy makers, and the electronics industry by coming up with the idea. In UK alone, Apparels constitute one third of the landfill. This case study can be an inspiration to various apparel brands which have already worked in this direction now as more than a decade has elapsed. if such ban is imposed on landfill, the recycling percentage will definitely increase.

Robotic Sorting could be one of the efficient futures in recycling. In Colorado, a recycling robot uses artificial intelligence to sort through discarded cartons more efficiently <sup>[10]</sup>. At places it is also used for automated sorting of municipal solid waste and hazardous waste.

### 2.6 Synergy of Research in Automobile Sector

The Apparel industry learnt the Art of Lean manufacturing from Automobile industry. Lean manufacturing or lean

production, often simply "lean", is a systematic method for the elimination of waste ("Muda") within a manufacturing system. It also takes into account waste created through overburden ("Muri") and waste created through unevenness in work loads ("Mura"). This helped us reduce the usage of resources and optimize it as well. Both leading to a common path of sustainability.

The learning of Six Sigma might have probably come from Motorola. Six Sigma ( $6\sigma$ ) is a set of techniques and tools for process improvement. It was introduced by engineer Bill Smith while working at Motorola in 1980 <sup>[1, 2]</sup>. Jack Welch made it central to his business strategy at General Electric in 1995. A six sigma process is one in which 99.99966% of all opportunities to produce some feature of a part are statistically expected to be free of defects. Having minimal defects means not generating waste which is another name for being sustainable.

### 2.7 Synergy of Research in Packaging

Packaging industry has been one of the biggest culprits of unsustainable practices. Since the advent of Polyester by DuPont, there has no thought towards making packaging sustainable till the time it became inevitable to integrate sustainable eco-innovation in this field. Since then, there has been tremendous leap an conscious choice of packaging material by companies.

There cannot be a better example of sustainable packaging than Ooho edible water ball. There have been learning from researches done by myriad companies towards making packaging wasteful, only as much as required, biodegradable, reusable and recyclable etc. Many Apparel companies are already practicing ways to address the concern

### 2.8 Synergy of Research in agriculture

There can be learning for agro industry to help reduce the usage of Insecticides and herbicides as Apparel industry in its cultivation phase happens to be the largest consumers of both (Australian model of cotton cultivation). Also water footprint in this area can be reduced with collaborative researches.

### 3. Findings and Conclusion

There is no end to learning from other industries. Having synergetic approach and cross-industry learning of "eco-innovation" and usage of sustainable technology can be a very powerful and effective methodology for integrating sustainable practices across industries. The apparel industry has learnt a lot and can learn a lot from other industries and in turn teach other industries in the pathway of sustainability. There shall always be scope for betterment. by promoting research in all the arenas with special impetus to sustainability. It is only through collaborative researches that we can have a win-win situation for all.

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