



SUSTAINABILITY IN TEXTILE INDUSTRY- THE HISTORY OF RECYCLING

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Abstract : Any kind of production is directly related to consumption of natural resources and generating waste. From the beginning of civilization human being started consuming natural resources including forest, water, land and animal. But the world was sparsely populated then which, has become 7.9 billion today and estimated to be 11.2 billion by the end of this century, according to United Nation report. Mankind is still using resources from environment with little restraint and few concerns which leads to environmental crisis including biodiversity loss, scarcity of fresh drinking water, depletion of fossil fuel, deforestation, air pollution, climate change etc. These environmental issues emerge from increasing rate of global production and over consumption and associates with high volume of waste generation. Textile industry is one of the biggest industries in the world and also considered as one of the most pollutant industries in the global environmental scenario.

This paper explains the limitation of textile production in the past and the impact of Industrialization on textile industry which made it one of the biggest and earliest established industries and gradually became the top of the polluting industry too.

IndexTerms – Sustainability, consumption, environmental impact, waste generation, recycling.

I. INTRODUCTION

History of textiles is as ancient as human civilization and it has become technologically advanced and enriched with times. A piece of textile was used as clothing in ancient time when primitive people used simple tools and basic weaving principles like interlacing and knotting. It is difficult to believe that the oldest indispensable crafts have reached to a point where garment has become disposable. Textile industry plays most important role in accelerating country's economy by generating maximum employments but the process of making fabric has adverse affect on the environment also. There are many other manufacturing industries which are damaging planet's wellbeing but textile industry often blamed much more than it deserves. Firstly, the chemicals are involved in manufacturing textiles and textile products contaminate the land, water and air. Then the ever changing fashion trends and low labour cost significantly making clothing inexpensive for that people are purchasing more frequently than in the past. This trend of buying cheap fashion items and discarding after wearing just a few times is referred as "fast fashion" which goes to the landfill eventually. Many conscious consumers are aware about the effect of fast fashion on the environment and the concept of "slow fashion emerges from this point. Because thousands of people earn their livelihood from this constant change of fashion so there is an urgent need of altering the way where fashion may not have that much negative amplification.

Understanding Sustainability through textile waste recycling in the past

Sustainability is not a new concept in the history of textile and fashion. It has come and gone throughout the time of evolution of textile in the world. Recovering old material and reuse or recycle them is an old practice throughout the human history. Textile is one of the common materials which is discarded and considered to be valuable raw materials for recycling. In ancient time, picking fibres from plant and making them suitable thread to weave was not only laborious but also very time consuming process. People from ancient civilization used to wear robe like garments with minimal stitching. A rectangular piece of cloth used to be worn as a wrapper with a help of belt, sometimes it was stitched from the side and hemmed also¹. Before Industrial revolution the process of making fabric was not only time taking but also very laborious task. There were hardly few manufactories to supply the royal families and well-off can only afford the luxurious textiles². Thus even a wealthy also used to save and repair clothes until the end-of-life of textiles or textile products and consequently sold them in second hand market³. Though wearing second hand clothing as vintage clothes began in 1980s but the existence of second hand clothing trade originated at Guild's market place in several European cities since 1280s⁴. Options are not that plenty like today's contemporary era simply because the cost of skilled labour and time consuming process but also because of the limited technical application and equipments, fibre and other raw

¹ Houston, Mary G. Ancient Egyptian, Mesopotamian, and Persian Costume. New York: Dover Publications, Inc., 2002.

² Raizman, D., Raizman, D., & Raizman, D. (2011). *History of modern design*. Upper Saddle River, N.J: Pearson Prentice Hall.

³ Frick, C.C. (2005). The Florentine 'Rigattieri': Second Hand Clothing Dealers and the Circulation of Goods in the Renaissance. In A. Palmer & H. Clark (Eds.). *Old Clothes, New Looks: Second Hand Fashion* (pp. 13–28). Oxford: Berg Publishers.

⁴ Hansen, K. T. (2000a). Other people's clothes? The international second-hand clothing trade and dress practices in Zambia. *Fashion Theory*, 4(3), 245- 274.

materials like dyes and fixing agents came only from nature and processed into textiles through a laborious but in eco-friendly process.

For example flax which is known as one of the oldest textile fibres and which has been domesticated far back as 3000 BC in Mesopotamia and ancient Egypt⁵. Wearing a white linen toga was a sign of aristocracy and purity too. It required a labour intensive process to extract fibre from the stalk. The process starts with rippling where the upper part of the flax bundle drawn by coarser combing to remove the seeds then it goes under water retting where fibres get looser by from the stalk. Then a sequential process of drying, scutching and hackling was followed to remove all unwanted shorter length fibre and finally get a long light grey fibre which is spun and then it followed by another laborious process to make linen fabric⁶. And the shorter fibres were not went unused; they were consumed to make a coarser fabric for making sac, upholstery fabric or fabric for work wear for the labour.

In 1st century AD Chinese were able to torn the used silk waste and textiles into fibre and re-used them in paper making⁷. Hence, textile waste was a valuable source raw material since centuries.

Cultivation and nurturing of various plants of textile fibres depends on varied favourable weather condition. This is why production of textile fibres was not evenly distributed in the world.

For example the weather condition of Northern Europe was idle for cultivation of flax fibre whether in the same time growing period of cotton was too short in there as cotton needs hot and humid weather condition during that active growth of the plant. As a result cotton was not a popular option in Europe until it was imported from India around the year 1600⁸.

From then until Mughal Empire cotton was indigenous fibre to India. Textile industry was one of the biggest manufactories during 16th and 18th century Mughal period, India, particularly calico, muslin and cotton including unbleached and variety of colours in cotton. Bengal only was responsible for 50% of cotton and 80% of silk to be exported by the Dutch to the world through Indian Ocean in 18th century⁹.

As a result higher class in the society in Western country wearing clothes using such a high quality fabric marked as a status symbol than fashion. Anyhow, this time consuming process of making textiles due to lack of mechanization, weather condition and limited availability of fabrics made people have control on consumption.

People used to repair their clothes till end-of-lifecycle of the product. Worn out but still usable clothes were sold to the second hand market via rag pickers. Even rags had value and it's proven by the existence of rag peckers from 19th century literature. Though second hand clothing trades were recorded in 16th and 17th century in Venice under guild's regulation and surveillance but some illegal activities was found in the trade. Some records indicate non registered dealers or street peddler used to resell garments and fabrics illegally before clothes are produced in mass and became less expensive¹⁰.

Early Industrialisation

During the second half of 18th century few progressive-minded people were working on mechanised devices to make the process of fibre to fabric fast. Even it is believed that textile clothing industry took leading role in Industrial Revolution. Before industrialisation the process of making fabric was done in small scale which was often called as "cottage industry". Because of the lack of communication and transportation the production of textiles became very slow to fulfil the demand of increasing population. In contrast industrialisation allows to produce goods in mass and could reach out to people in every corner because of transportation.

First the invention of flying shuttle in 1733 for using in handheld weaving which sped up the production. Then finally 1764 the invention of spinning machine which allowed many spindles of threads to be spun at once multiplied the capacity of a single worker. Then gradually the invention of power loom in 1785 and cotton ginning machine in 1793 which sped up the separation of cotton seeds from cotton fibre. In 1812 steam-powered railways revolutionised the long distance shipping and transporting of goods¹¹. All these inventions and mechanisation in textile turned that small scale "cottage industry" one of the oldest and biggest established industry of the world.

Initially textile mills used to run the power coming from waterwheel and for this reason cotton mills were situated near river banks but after invention of steam powered engine mills were no longer needed to be on the river side.

Early industrial revolution gave a big boost of advancement in Britain and America. After agricultural revolution there was a massive growth in food production. Farms were able to run without much man power. So the people from villages started moving to the city to join the mills which were mainly textile manufacturers. According to Sukoo Kim¹², "In the transition period between the early to late industrialisation, the rate of immigration rose dramatically and a great majority of immigrants were unskilled farmers, labourers and servants."

⁵ Barber, E. J. W. Prehistoric Textiles. Princeton, N.J.: Princeton University Press, 1991.

⁶ Prehistoric Textiles: The Development of Cloth in the Neolithic and Bronze Ages by E.J.W. Barber

⁷ Wilkinson, Endymion (2012), *Chinese History: A New Manual*, Harvard University Asia Center for the Harvard-Yenching Institute

⁸ Riello, G., & Roy, T. (n.d.). Introduction: The world of south asian textiles, 1500â€“1850. *How India Clothed the World: The World of South Asian Textiles, 1500-1850*, 1-28. doi:10.1163/ej.9789004176539.i-490.9

⁹ Vajani, D. R. (2019). Textile dyeing and waste water treatment. In *Textile dyeing and waste water treatment* (p. 107). New Delhi, India: Cyber Tech Publications.

¹⁰ Allerston, P. (1999). Reconstructing the second-hand clothes trade in sixteenth- and seventeenth-century Venice. *Costume*, 33, 46-56.

¹¹Harley, C. K. (1998). Cotton Textile Prices and the Industrial Revolution. *Economic History Review*, 51

¹² Kim, S. (2007). Immigration, industrial revolution and urban growth in the United STATES, 1820-1920: Factor endowments, technology and geography. 6. doi:10.3386/w12900

Traits of unsustainability in textile industry

The environment has been a source for human civilisation from the beginning, where the general definition of sustainability refers to maintain the balance of ecological system. And the traits of unsustainability starts from industrial revolution, as B.W. Clapp wrote, "Every economic process leaves behind a waste product. A coal fire, whether in a poor man's cottage or an industrial boiler, leaves behind ash, soot, and carbon particles, which either escape into the air if they are finely divided, or remains as solids if they are not¹³." He also outlined that atmospheric pollution in Britain became worst in the end of 19th century.

Early textile manufacturers exploited those immigrants in most possible ways; they were not concerned about fair wages of labours or the over-timed shifts. Manufacturers were taking advantage and employing children, women worker and exploiting them in terms of unfair labour ethics as people in great number were moving to the city to find employment in the factories.¹⁴

And these manufacturers did not even consider pollution much which resulted the chemical residuals of dyes and wet finishes were discarded into nearby river or waterbodies. Pollution became a major issue in America also; progressive reformers of that time took issue with air pollution for burning coals in the factories, and burning fossil fuel for transportation, water pollution for discarding chemical discharges through the gutters which used to emit fearsome smell.

Expansion of Apparel Industry

Garment industry more specifically, readymade clothing industry was one of the most important industry in the economic history of western worlds, which generated second largest source of non-agricultural employment for women after domestic service¹⁵. People Prior to the industrial revolution until the invention of sewing machine common people used to make their garment stitched by hands and mend their clothes if they are torn. People owned just a few outfits because it used to take a long period of time to produce.

After the revolution in textile industry in the latter half of 19th century lifestyle of people started to change and as a result clothing industry has not be the same since.

The Aesthetic Movement of 19th century was the emergence of high fashion or haute couture in Paris by Charles Fredrick Worth. Worth created an ideal image of a fashionable aristocrat woman. He used his sharp business mind, vast textile knowledge and evolving technology to transform a cottage based craft into a major industry. His success expanded in Paris through newly invented sewing machine, using best fabrics and employing many dressmakers and seamstresses of Paris.

Because of this rising demand of increasing population departmental store appeared in 1870. There was a significant commercial expansion after opening departmental store in Paris, Britain and America soon followed. The social system changed with ready-to-wear industry.

The invention of synthetic fibre is another revolutionary step in textile industry. Many attempts had been taken in early 1800's as its original goal was to invent a cheaper fibre which can mimic the natural fibre. Cotton, silk, wool, linen were the only few options in fibres but they have their own limitations. For example, silk was very labour intensive commodity. Only finest quality of these fibres were able to produce a good quality of fabric and maximum downgraded or low quality fibres were used to produce stiff and coarser quality of fabrics which were consumed in making workwear for labour or sac for goods. Production of these fibres were also depended on so many factors like weather, bugs attack, transportation to the factory etc. so the man who had applied science and technology for making the laborious process smooth he had tried to apply technology to bypass the lengthy process of growing natural commodities.

As a result in 1855, in Britain, Auderman a Swiss scientist attempted making an "artificial silk" by chemically modified the cellulose part of the inner bark mulberry silk to produce cellulose. The first commercial production was made by Chardonnet in 1891 which was renamed rayon in 1924, acetate soon followed. Nylon was made in 1939 just before World War II¹⁶. This manmade fibre research continued after the war to produce military needs and other consumer products. It had a significant contribution in both couture and retail fashion also by producing woman hosiery and other silk like dresses¹⁷. Rayon and acetate fibres came from Renewable resource like wood pulp and synthetic fibres like nylon, polyester made from non renewable resources like fossils fuel, coal, gas.

History of Commercial Recycling

There is an old British phrase "rags and bone man" which was used for junk dealers. It referred to a person who travelled city to city, door to door looking for old rags (for making new fabric or paper mould) and bone (for making glue)¹⁸.

Industrialisation escalated the Demand for all kind of used materials. Other than rags there is evidence of scrap metals as they were cheaper virgin ore. Many pedlars used to go by door to door in the city looking for old goods including clothes, discarded machineries, kitchen utensils and other source of metals.

¹³ Clapp, B. W. (2017). An environmental history of Britain since the industrial revolution. In *An environmental history of Britain since the Industrial Revolution*(pp. 13-14). London: Routledge.

¹⁴ STEARNS, P. N. (2021). Industrial revolution in world history. In *INDUSTRIAL REVOLUTION IN WORLD HISTORY*(pp. 5-6). S.I.: ROUTLEDGE.

¹⁵ Godley, A. (1995). The development of the uk clothing Industry, 1850-1950: Output and productivity growth. *Business History*,37(4), 46-63. doi:10.1080/00076799500000127

¹⁶ Shaikh, T., Chaudhari, S., & Varma, A. (2012). Viscose Rayon: A Legendary Development in the Manmade Textile. *International Journal of Engineering Research and Applications*, (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 2(Issue 5), September- October 2012, pp.675-680.

¹⁷ Srivastava, S. (2012). The Non-Thermoplastic Man-Made Fibres - Rayon. In *Natural and Man-Made Fibres*(ISBN-13: 978-81-904737-2-9, pp. 79-81). Allahabad: Pushpa Publishing House.

¹⁸ London labour and the London poor [Introduction]. (1968). In 1383764407 1010683269 H. Mayhew & 1383764408 1010683269 J. D. Rosenberg (Authors), *A London labour and the London poor*. New York: Dover Publications.

There are several posters available from WWII where we can see manufacturers from Britain and America encouraging people to sell bottles, aluminium can, papers, rags, bones etc. Recycling is a process where used, unused or abandoned materials are treated to make a new product which not only reduces the consumption of virgin raw materials from environment but also conserves energy and also brings down pollutions¹⁹. It also reduces the amount of waste dumping in the landfills and the amount of harmful Green House Gas emitted by the dumping ground.

Textile recycling is as old as textile industry. Yorkshire faced an insufficient wool supply in early 19th century during Napoleonic War (1803-1815) due to import restriction of raw wool²⁰. Back in 1813, the time of early industrialisation, Benjamin Law, a local man in Batley, Yorkshire, developed a process where he grind finely shredded old woollen rags into fibres and mixed with virgin wool and blend into a new fibre and which was woven into a cloth known as shoddy²¹. Though it was inferior in quality but It had a revolutionary effect in the industry. After few years another process was developed by shredding tailor's scraps, coats, hats, trousers and including second hand cloths into finer ground fibres and which made a finer quality woven cloth, called mungo. Mungo sometimes might contain, linen and cotton rags along with wool and sometimes it might include both old and new fabrics which made the mungo price fluctuate from shoddy²². By 1855 the shoddy industry in Yorkshire grew and it produced very best quality woollen products included some percentage of shoddy and mungo. It was not at all inferior in quality even it produced some high quality woven cloths for suiting, over coat fabrics.

Bately was major centre for recycling yarn. Rags or textile wastes were sourced in 2 ways.

1) Old rags that are used domestic rags or post-consumer waste are collected by paddlers or ragmen in return of money. Peddler used to sell those rags to rag merchant.

2) New rags or fabric scraps or pre-consumer waste are bought by rags merchant from manufacturer or local tailor.

The increasing demand of clothing needed more raw materials, and to meet this demand shoddy was born. This shoddy industry in Batley lasted till 1914 from early 19th century.

Conclusion

It is clear that technological advancement and production practices in textile industry has a great positive impact on employments thus economic growth of the country but at the same time it has a negative impact on overconsumption and environmental issues.

In the past people used to practice sustainability without even knowing it as textile was scarce and the process of making textile was also laborious, people used to mend and repair clothes till the end of its lifecycle. Textile and clothing were valued and passed down to the successors.

After industrialization society and economy started to grow through unfair labour practices and using natural resources as a result production reached its peak and environmental issues like waste and pollution began to rise. Textile and clothing started becoming cheap and people started buying without giving it a thought which led to overconsumption. Over the past few decades efforts are being made to make people understand the effects of fast fashion on the environment and to encourage people to consume less and recycle more. The solution not only lies with the consumer but also with the industry, researcher and designer who vouch for ethical, environmental safe choices over inexpensive fashion.

¹⁹ Morris, J. (1996). Recycling versus incineration: An energy conservation analysis. *Journal of Hazardous Materials*, 47(1-3), 277-293. doi:10.1016/0304-3894(95)00116-6

²⁰ Dickenson, M. J. (1979). Fulling in the West RIDING woollen cloth industry 1689-1770. *Textile History*, 10(1), 127-141. doi:10.1179/004049679793691312

²¹ Haigh, M. H. (1978). *History of Batley, 1800-1974*. (n.p.): (n.p.).

²² Malin, J. C., "The West Riding Recovered Wool Textile Industry (1813-1939)", (Ph.D. Thesis, University of York, 1979), p.