



# ECO-PRINTING

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**Abstract:** Globalization has entirely changed the fashion industry and its approach toward sustainability. Synthetic dyes and fabrics are prioritized in this fast-changing industry and fashion trends. And these products have failed building the bridge between sustainability and environment-friendly designs. Therefore, this section is aimed at the approach toward design development and development of sustainable eco-friendly approach for eco-printing by using natural dyes on fabrics like silk and cotton. The chapter is based on sustainable design approach which gives much provision for using natural dyes for everyday change in fashion. It also focuses on color fastness properties of the used dyes. These results were evaluated by carrying out color fastness tests for light, wash, rubbing, and perspiration using standard testing methods. Design methodology used in the study also has the potential for skill development programs for entrepreneurs and contributes to rural development programs by creating sustainable growth. Data was gathered from both primary and secondary sources to fulfill the aim of the research. Secondary sources were from books, journals, and other published articles including the internet. Company documentation and other published reports and archival records were also used. The environmental sustainability of printing companies is measured using different key environmental indicators. These indicators may vary between companies. Performance of the different indicators is noticed to be different over different periods. Sometimes the company does well in some indicators while other times, it performs ailing. Though eco-printing enables companies to strive towards improving their environmental sustainability, these companies should strive to communicate their sustainability situation to stakeholders based on a majority or all the indicators and not just focus on one or a few indicators on which the environmental performance is high to avoid “green washing” of the public.

**Index Terms – Eco-printing, Eco-friendly, Environment, Sustainability, Dyeing.**

## I. INTRODUCTION

### **Eco-Printing, botanical printing, eco-dyeing, or leaf printing.**

Known in several terms is a technique where plants, leaves, flowers, and other floral leaves their shapes, colors and marks on fabric. Eco-dyed or print cloth is made by the bundling plant material with cloth then binding it and applying heat by steaming which transfers the color from plants to the fabric. The process of dyeing the fabric is fun and gives a magical effect on the fabric. These causes one to wonder what secrets are held inside the plants that surround us which we so often hardly take notice of. The following direction are deliberated to give a starting point to your own exploration. Plants will give some color, but only certain plants or flowers combined with various adjuncts will render long lasting colors. Eco printing is an opportunity to work with these plants in their last whoopee, to walk the woods or your garden and see things differently. Pick up a few leaves from the ground, arrange them on fabric, roll into a bundle, then steam. The heat transfers the pigments and images onto the fabric, creating an ethereal design, an explosion of color and pattern. The advantage of vegetable-based ink is that it does not require additional equipment or training to be used instead of the regular ink. It is supported by regular offset presses and has become increasingly available. Vegetable based inks replace a certain amount of the petroleum base with bio-derived oil that can greatly diminish the Volatile Organic Compounds emissions. This bio-derived oil can be canola, sunflower, linseed, tall or soy oil. However, vegetable-based inks take more time to dry and may require longer heat setting, therefore increasing the energy consumption of a printer. Also, ink labels are not always what they seem. The —Soy Inkl label that was promoted in the 1990’s by the American Soybean Association means that an ink contains a designated minimum percentage of soybean oil, as little as 7%. So, an ink could be more than 90% petroleum oil and still qualify for the —soy inkl label.

### 1.1 TERMINOLOGY

The term “eco-printing”, “eco-dyeing” and “contact printing” each describes the same result. Eco-printing” tends to describe a method of transferring a design; “eco-dyeing” focuses on the chemical bonding that results in a dye-printed surface, “contact printing” refers to a method of printing.

## 1.2 HISTORY OF ECO-PRINTING

Before the mid-1800s, natural dyes were the only source of color on fabric. Most typically, a “tea” was brewed with the plant materials and then strained into a huge pot made with copper or iron. The material reacted with the tea, and left color in the fiber. Dyers would stir constantly to keep the dye even. Not all plants make good dyes, but over the centuries the process of natural dyeing has been refined and shared so that dyers know which the good plants are. Eco-Print effects may be familiar to reads from several sources.

### **Inventor of Eco-printing**

Flint, India (1958), Textile artist, dye developer.

India Flint was born in Melbourne, Australia, but celebrated her first three birthdays in Montreal, Canada. This not only set a nomadic pattern, but it also meant that when starting her formal education on the family’s eventual return to Australia, learning to speak English was the initial hurdle. Her first attempts at stitching were guided by her maternal grandmother, an infinitely patient re-threader of needles, who overdyed faded garments in various combinations of tea leaves, calendulas, and onion skins. As a child, she discovered felt by accident, whilst vigorously scrubbing wool gathered from barbed wire fences near Werribee. Her fascination for textiles was greatly encouraged by her mother, who always seemed to have a piece of embroidery or knitting in progress and took her through seemingly endless museums during the family’s wanderings around the world!

**The distinctive Eco-print, developed during research for a Master of Visual Arts at the University of South Australia, has become a defining feature of India’s textile practice. While she has made details of the technique available to assist dye practitioners with colour assessment of eucalypts, it is on the understanding the process will not be used on a commercial basis.**

## 1.3 THE VALUE BEHIND SUSTAINABILITY

The cost of waste Now that the seriousness of the environmental crisis is a well-known reality, businesses including print design companies, have been thinking about ways to implement sustainable practices into their work ethics. The process is long, and actions seems to be taken only when issues get bad enough but yesterday’s belief that environmentally friendly practices and the competitiveness and profitability of a business are like oil and water, is slowly fading away. The conflict between the —green side and —business side has reached a dead end. The anger from the green side and the defensiveness from the business side have probably been convenient for a certain time to avoid real action. Transparency and creativity Sustainable businesses need to differentiate themselves both from conventional competitors and their fellow green-businesses to succeed. The sole goal of making profit does not suffice anymore to satisfy the green ideals of the modern, informed customers. Even the whole principle of consumption and our economic model would need to be questioned but this is another topic. Along with expert knowledge in the field of sustainability, a —green print business must be creative and bold—from the office management to communication strategies and frameworks.

## 1.4 STEPS FOR MAKING ECO-PRINTING:

**Scouring** is preparatory treatment of certain textile materials. Scouring removes soluble and insoluble impurities, for example oils, waxes, fats, as well as dirt. Scouring is the textile term for cleaning fibers prior to mordanting and dyeing, and does not refer to washing fabrics in a washing machine. If the fiber is not clean, the mordant and dyes will not adhere well to the fiber

**Mordants** are needed to set the color when using natural dyes. Different mordants will give different hue color with the same dye. A mordant is a chemical agent which allows a reaction to occur between the dye and the fabric. In textiles, mordants are used to fix the color in dyeing or fabric printing, especially for fabrics of plant origin (cotton). Cotton has very low affinity for natural dyes. The tannins play an important role in cotton dyeing and are largely used for preparing cotton to enable it to retain coloring matter permanently.

**Dyeing** When you place plant materials onto fabric, roll or fold it up tightly, tie it with string, and steam it to release the colors from the botanicals into the fabric.

## II. LITERATURE REVIEW

2.1 Eco printing as a process doesn’t look as easy as it seems. Gupta stresses that it requires finesse. Explaining the technique, she says, “This process is a one-of-a-kind art where no two pieces can be similar. With change in season, certain flora creates impressions, while others don’t.” The conditions in which the fabrics are dried, play a major role in deciding the outcome. The designer while explaining the process, says, ample factors play a major role in deciding what eventually happens of the fabric. “First, the fabric is washed very carefully and thoroughly with soap. Then it is mordanted which means that the fabric is dyed in different colours. In this process, it is soaked in different solutions such as tea, indigo and so on. It is then spread out and is allowed to dry in the sun. Sun rays also play a major part in deciding the eventual outcome. A cloudy day may ruin the impression. Once dried, the fabric gets ready for dyeing and eco printing.” For defined leaves, the designer does not colour the fabrics. She instead rolls them very tightly to ensure that the leaves encounter the fibre and make sure that it is properly imprinted. She either steams or boils them for three to four hours, depending on the leaf. “Boiling, results in diffused prints. The prints are more shadowy,” she says. However, unlike other processes, eco printing is only possible on certain fabrics. “Eco printing is mostly done on protein fibres and less on cellulose. On cellulose fibres, the colours appear muted. The best absorption of colours is on silk and then on wool. So I normally use pashmina or pure silk. It’s only a very few times that I use cellulose or cellulose mixed fibre.” Currently operating out of her studio at home in Delhi, Renu prints on fabrics as a hobby. However, if the number of pieces being printed go up in the future, she will sell them.

Sherry Haar, Ph.D. Apparel, Textiles & Interior Design; (2013)

2.2 Khadi fabric is handspun and hand-woven cloth primarily made out of cotton, but now khadi wool and khadi silk is also available. Khadi fabric has become fashion statement on account of its popularity among youth, adults and designers as well. The use of non-toxic and eco-friendly natural dyes on textiles has become a matter of significant importance because of the increased awareness about environmental pollution and harmful effect of hazardous synthetic dyes. The present paper discusses the standardization process of dyeing and printing with selected three natural dyes and five natural mordants for developing eco-friendly prints on cotton khadi fabric. Effect of dyes and mordants on preliminary properties of khadi fabric and also the varied shades obtained on printed fabric has been analyzed by subjective evaluation

**Adya Tiwari\* and Meenu Srivastava (2020)**

2.3 Yogyakarta is one of the centers of Batik that has already well known in the world. Tourist can buy batik in several places in Yogyakarta, such as the Beringharjo Market on Malioboro Street or the center of batik in the Imogiri sub-district, Bantul Regency. According to Irwan Tirta, batik is a technique of decorating fabrics or textiles by using wax in a color dyeing process, where all this process is done by hand. Batik is made either by drawing dots and lines of the resist with a spouted tool called a tjanting or by printing the resist with a copper stamp called a cap. In general, people only know three types of batik, namely handmade batik, copper stamped batik and printed batik. However, along with the development of textile world there emerged new form of batik technique called the ecoprint batik. Batik ecoprint is an environmentally friendly textile activity because it uses provided materials among the community. Basically, this batik ecoprint is slightly different from handmade batik because batik ecoprint produces motifs from nature, such as leaves with their arrangement of motifs which are free and do not contain symbolic meaning, so that they are included in modern motifs. The purpose of this research is to develop an entrepreneurial business to improve and develop local batik businesses in the area of Puri Mojo Asri, Sleman, Yogyakarta. Present development, batik ecoprint crafters are returning to increase their production capacity. To develop more ecoprint fabric products, both for fashion and home decoration such as pillowcases, bolsters, curtains and more. The research method used is a qualitative method.

**Noto Pamungkas et. Al (2020)**

### III. OBJECTIVE

The study is focused on the contributions of eco-printing to environmental sustainability.

- ♣ To study about eco-printing.
- ♣ To make people aware of the magic of Nature.
- ♣ Preventing Nature.
- ♣ To make fabric eco-friendly.
- ♣ To stop skin infection.
- ♣ Creating something new in the textile, creative variety and delivering to the people.
- ♣ Promote small scale business.

### IV. RESEARCH METHODOLOGY

Up to this point, the text has given a theoretical overview of the phenomenon of sustainability in the print design industry. My aim was to show how sustainability came about and what conceptual, technical, and economical innovations it brings to the print industry. This background research highlighted the hypothesis that all these changes could play a pivotal role for the need to redefine print design in the future. For this practical part, qualitative research has been conducted in the form of individual focused interviews of experts in the field of sustainable print design. There are couple of reasons behind this choice.

Firstly, the qualitative research was made to gain a deeper understanding of what sustainable print design is, to eventually get data confirming my above-mentioned hypothesis. Secondly, while having the intention to carry my thesis question further by approaching my thesis subject from a more concrete angle. After taking the opportunity to collect empirical data to understand the factors and approach that lead to developing a successful sustainable business. In this regard, qualitative research is the only way to create new theories that can be regarded as understanding a phenomenon. Furthermore, the qualitative method was the adequate way to conduct my research because of the flexibility and open responses it allows.

**Have spent months learning and reading and testing and testing some more. But just like a degree in chemistry it is still nowhere near knowing it all. But that is also the beauty of this Eco printing; it keeps you yearning to learn more and trying new variations.**



Figure 1

**Objective** – Eco printing with Ajwain leaf & Marigold leaf on cotton fabric.

**Process** – The steps for eco printing process are as follows-

**Step 1** – Collect all the supplies-

- Cotton fabric
- Vinegar
- Iron water solution (ferrous sulphate + water)
- Ajwain & Marigold leaf.
- Polythene or plastic sheet
- Some PVC pipe or wooden sticks or rods
- Threads
- A utensil for boiling
- Stove or gas

**Step 2** – Detergent wash: Soak the fabric in detergent and warm water solution for 30 minutes. Wash the fabric with detergent properly to remove the starch, so that the dye can be fixed properly on the fabric.

**Step 3** – Then soak it in vinegar + water solution for about 30 minutes again. Meanwhile, soak the leaves in iron water solution (Ferrous sulphate + Water solution).

**Step 4** – Lay out the leaves on the cotton fabric in whatever pattern you want.

**Step 5** – A plastic is placed over the leaves and the whole thing is rolled tightly onto a piece of PVC to make bundles. (Make sure there is good contact between the fabric and the leaves for printing)

**Step 6** – Dye Bath Preparation-

Take a steamer or roaster pan in which add iron water solution, vinegar, and put some leaves and barks. Let it boil for 10 minutes.

**Step 7** – Take your bundle and arrange them in a pot to be steamed.

Use an extra dowel rod to lift the fabric bundles out of the water. Place a lid on top to keep in the steam.

**Step 8** – Continue boiling for 45 mins to 1 hour.

**Step 9** – Check it periodically to make sure the water doesn't boil off entirely; add more water as needed.

**Step 10** – Let them dry completely and steam iron them and then wash it with detergent.

**Conclusion** – The natural dyes from the rose leaves are fixed on to cotton fabric beautifully.

**Personal Statement** – The Way, I understand it, Eco printing is a form of natural dyeing where the colors from plant material are transferred to paper or fabric via steaming or boiling. The results are unpredictable and beautiful on every trial.

#### 4.1 UPSHOTS OF ECO-PRINTING

The increased awareness in printing has brought forth the following contributions or benefits towards a more sustainable environment. Reduction in energy consumption -The print process involves a significant amount of energy at all stages of the print process and throughout the factory. This involves the use of energy from heating and lighting to powering equipment and final delivery of the print material. Environmental printing methods have resulted in energy efficient lighting to heat recovery systems and fuel-efficient vans while enhancing more potential for action and innovation. Reduction in waste – High levels of waste are generated in the print process. This usually include material waste (sometimes separated into printed and unprinted), hazard waste (such as ink tins) usually collected by licensed companies for safe disposal and finally general waste which is collected and sent to landfill subject to landfill tax. Reduction in water consumption -As a result of increasing water costs, printing companies are charged for water use and disposal (ppe.uk.net). This financial incentive also helps to reduce the amount of water in the print process thus helping to preserve this essential natural resource. Safer working environment for workers -Low alcohol printing together with the elimination and reduction of other hazardous VOCs in the printing process has gone a long way to enhance workers safety and health in the workplace. Based on my review of literature, the object of my study which includes the environmental sustainability of UNT Distribution AB can be measured using the following indicators.



- The environmental policy of the company. This simply implies the company's policy towards environmental issues such as energy use, emissions, waste management, and recycling e.t.c.
- Company's objectives. Objectives are defined as the strategic plans of a company. Therefore, by this I intend to verify if achieving environmental sustainability is regarded as part of the strategic objective of UNT Distribution AB.
- Environmental Management System (EMS) This seeks to verify if the company has an external environmental certification program to certify that the activities of the company are environmentally appropriate. This usually includes a certification such as ISO14001 and ISO9001 for quality assurance.
- Eco-printing This simply involves an approach to printing that aims at reducing the environmental hazards of the entire printing process.

#### 4.2 ACHIEVING SUSTAINABILITY

The following five strategies supported by the pioneers' experiences can be used by companies in reinventing one's business to meet the challenges of sustainable development.

- **Set Outrageous Goals.**

These are goals that sound virtually impossible to achieve. Such goals, when presented hypothetically for brainstorming purposes represent an excellent way of by-passing incremental thinking quickly in favour of 'out-of-the-box' thinking (ibid). An example of two companies that understand the meaning of setting outrageous goals is DuPont and Xerox. DuPont has an environmental goal of 'zero waste' while Xerox's environmental goal is 'waste free products from waste free facilities. When such goals are set, the company strives to enhance its environmental performance thereby ensuring a sustainable environment.

- **Think like a system.**

Instead of making adjustments to specific features of an existing product in and of itself, the environmental performance of products can be more significantly improved through modifications to the system in which the product operates (ibid). The system in this case is defined as the product value chain beginning with extraction of raw materials, processing and distribution through to the in-use phase and the product's eventual recovery or disposal which consist the various stages in the product life-cycle. Many products refinements to date have often involved or focused primarily on reducing impact within specific stages. An example includes reducing the amount of recyclable materials, reducing energy or water consumption during the in-use phase, or by designing the product to be recyclable. However, other ways exist to further reduce the impact by attempting to collapse two or more life-cycle stages. An example might include the case of Xerox who refurbishes its used copies and sells them as remanufactured machines combining the recover/disposal and manufacturing stages of its own product life cycle. A second tool employed in 'thinking like a system' is industrial ecology. It studies material and energy flows in the economy and ecosystems and aims at enabling companies redesign industrial processes whereby "waste" from one process becomes "food" for another.)

- **Dematerialise**

The basic notion of dematerialization is to be able to meet consumers needs with as few materials and as little energy as possible. It describes a technology shift away from economies based on enormous and increasing consumption of raw materials This could further be viewed or defined from an environmental perspective as change in the amount of waste generated per unit of industrial product It assumes that we can use services based on technology or know-how in place of material products so as to reduce global material flows and energy significantly One important question to be asked in order to be able to "dematerialize" one's business is: Can our consumers' needs be met equally or better by providing them with a service as adjunct to or replacement for a material product? Some excellent examples of dematerialization are electronic voice mail as a replacement for answering machines, e-mail virtual libraries including electronic alternatives to direct-mail catalogues, yellow pages directories and encyclopedias and telecommuting.

- **Make it fit**

From a sustainability standpoint, this can be translated into the notion of maximizing the utility of resources by designing products to fit the real needs of consumers as closely as possible. It assumes that product design, materials and technology are appropriate to the scope and difficulty of the task as well as the locality (climate, resources, available solid waste infrastructure for example). One questions often asked when uncovering ways of using existing products and technologies more efficiently is: How does our technology best fit within the entire range of alternatives that meet a particular need of consumers?

- **Restore rather than take**

It is generally accepted that all products must use up resources and create waste. Therefore, the current goal in eco-related design projects is to minimize the impact of this waste on the environment. To use this strategy to generate out-of-the-box thinking regarding 16 environmentally preferable product development, businesses can ponder the following questions. What will it take for our products to benefit the environment or society? Can our marketing efforts help to educate consumers about key environmental and sustainability issues? Can our manufacturing be a source of jobs for the handicapped?

From the above, it is evident that sustainable development strategies can make businesses more competitive and result in better products with enhanced level of customer satisfaction over conventional products. Therefore, developing sustainable products requires that companies operate under a new paradigm that includes:

- Products do not have to be disposed of. They can be more useful to the society and more profitable for businesses if they can be re-used or recycled into new products.
  - Products do not have to be designed for obsolescence to be profitable. They can be more productive to society and the bottom line if they are durable.
  - Consumers' needs can be profitably met with services rather than products, or at least an optimum combination of both.
- Consumers will reward businesses that help restore the environment while creating the products consumers want.

### 4.3 THE FUTURE OF THE ECO-PRINT DESIGN INDUSTRY

The final part of my interview aimed at asking for the professionals' opinion on the connection between sustainability and the future of print design, regarding my thesis question. I wanted to know if they would share my views and agree on my hypothesis that sustainability is and will continue to play a pivotal role in redefining print design. To my question —to what extent do you think sustainability will influence the future of print design? all respondents unanimously answered —to a large extent, which is a first conclusive point. Green technologies have the power to remedy to the general and ongoing decrease in printed materials. As I have shown in the theory part of my thesis, sustainability is the current center point of innovations in the print design industry. From creative design frameworks to technical advances in greener production systems, sustainability is redefining the way to print and communicate through physical materials. A new set of expertise is making its way into creative studios, from chemistry, biology, ecology to material engineering which will give a higher value to the print design profession and to the printed materials. If printing becomes more expensive and more of a luxury product—I think each printed product will become more exclusive in its production. The sustainable design of a product can be one of those exclusivity elements that customers will be looking for.

### V. CONCLUSION

Undeniably, the print design industry is in a transitive state. As a natural-resources dependent industry, print must face complex issues to develop cleaner production processes in a time of environmental struggle. Moreover, the advent of digital technologies has challenged print's position as a relevant and contemporary communication tool. More than ever, digital media has taken over as a primary means of communication. It is true that print is on a slow and steady decline but by no means has it implied that print is disappearing. It is and will remain as an important part of our lifestyle, culture, and communication habits. Because of the oversaturated flows of information in the digital world, print is gaining back some appreciation to stand out among the crowd. Credibility, reliability, authenticity, and physicality are among the values that print design has been conveying and that the digital supports have failed to outdo. This is the strength of print, its niche on which to focus to stay relevant among virtual communication means. From the results of my research and focused interviews, sustainability is going to play a crucial role in print design's transition and future. The sustainable movement fits perfectly in this context of print's necessary revamping. At first, the rise of sustainability significantly threatened the industry. Print had been the main target of early efforts towards environmental protection. Nowadays, though, it is no longer true. Digital is not anymore, the greenest option and, in the meantime, paper has become one of the few fully sustainable and renewable products. With time, awareness about environmental issues has spread. We are just starting to question the assumption that nature had to be tamed for humanity to prosper, that came up during the Industrial Revolution. Little by little, we are realizing that we are part of nature and that we do benefit living in balance with it. Deliberately looking away did not make environmental issues disappear. Scapegoating, blaming and cynicism have not brought up any solution. It behaves our industry to show that printing can be a sustainable alternative to online communications. Through education, open dialogue and transparent relations to clients and audience, graphic designers need to learn the faculty to integrate sustainable practices as an elementary part of their work ethics and creative problem-solving abilities. It is also important that the shift to sustainable practices takes its roots from a personal conviction, to change the status quo and build a cleaner and more efficient alternative system. It is obvious that the problems arising from environmental concerns are very complex and all-encompassing. It questions our values and lifestyles, particularly our unbridled consuming habits. Instead of focusing on the problems—which can seem hopeless at times—we need to see the opportunity in creating alternatives. We need to overcome any obstacles and focus on solutions and actions that will benefit the whole humankind.

### VI. RECOMMENDATION

Consumers of products from this industry should develop positive attitude towards the environment and put pressure on producers to be able to meet up to basic environmental requirements. That is, they should strive that producers use papers only from forest sources that are certified and make sure that they use environmentally friendly printers in their production processes. Simply put, consumers should think twice the environmental effect before the give a print command and read thrice the source of paper before they purchase a product.

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