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INTRODUCING NOVEL PRINTING TECHNIQUES TO ANTLER FABRIC PRINTERS PVT.LTD, SRI LANKA: A CASE STUDY

P.V.M Karunarathne[1] and B.M.L.S. Senevirathne
Department of Textile & Clothing Technology, Faculty of Engineering, University of Moratuwa, Sri Lanka
Email: virajinik@uom.lk

ABSTRACT
Screen printing and embellishments are used as an aesthetic improvement and value addition in the global apparel industry. Value adding in Apparel Industry plays a pivotal role in bringing foreign exchange to the country's economy. In the global fashion industry, new aspects of value additions are emerging as trends among the consumers. The objectives of the study are focused on three major areas. First is to investigate the existing portfolio of garment printing and value addition in Antler Fabric Printers Pvt. Ltd, which is one of the leading garment value addition firms in Sri Lanka. Second is to find out the orientation of the mentioned printing firm with global customer garment value addition and printing trends for Spring-summer 2020 and Autumn-Winter 2019 seasons and finally to apply existing capabilities to match with trends focusing on main areas of value addition (batik effect, sequins, and embellishments). The study was carried out at Antler Fabric Printers. A questionnaire based on the methods, on site observations and experimental studies were carried out. Primary data were collected through questionnaires and set interviews of Antler sample processing unit staff. Secondary data were gathered through books, papers, journal articles, patents, websites and news articles. The data analysis reveals that there is an opportunity to use a combination of existing facilities in modified and strategic ways together with years of knowledge on printing at Antler Fabric Printers to orient to global printing trends. Sequin effects, batik and multi-color embellishments to serve needs of customer clothing brands are available in Antler Fabric Printers customer profile. The experimental data proves capabilities of increasing production capacities of printing through increased efficiency of printing and quality improvements.

Key words*:* Garment Value Addition, Antler Fabric Printers, Global trends, printing

1. Introduction

The garment and textile industry plays an important role in the world economy. It occupies 3 trillion dollars, which is about 2% of the gross domestic product (GDP) in world economy. In the global apparel retail market, the Asia- Pacific

region holds 36.8% together with Europe accounting for 27.4% followed by the United States (24.0%) (Lu, 2017).

Export oriented garment industry in Sri Lanka originated in 1970 and expanded rapidly after 1977 with the introduction of the trade liberalized economy. More than 60% of income in Sri Lanka is gained through the apparel industry. According to Sri Lanka Export Development Board, it is expected to reach export income of US$ 8.5 billion from the apparel industry by 2020 (Harshana, 2018). Ready-made garments (RMG) which cover about 95% of total textile and apparel exports in Sri Lanka serve for a wide range of international customer brands. In 2007, out of total RMG exports, 50% was to the USA and 47% was to the European Union (Kelegama, 2009). The apparel industry of Sri Lanka is aiming to be the best supplier of clothing with regard to quality, price, speed, design, innovation, execution, logistics and compliance with ethical standards. Industry leaders believe that specializing production of specific product categories will make Sri Lankan manufacturers enhance their production processes and development skills to be world-wide experts in their chosen product category (Kelegama, 2009). Being a part of this national income, Antler Fabric Printers Pvt. Ltd. has marked every milestone to be one of Sri Lanka's pioneers in textile printing. It contributes to the screen printing and embellishment value addition requirements with accumulated experiences over years of practice by adapting their strengths in order to satisfy customer needs of garment prints.

According to Lowson, King and Hunter (1999) the rapidly changing culture, politics and economics of modern life deeply affect the industrial environment, especially consumer industries such as textile and clothing (Bae, 2005). At present, consumers demand for high quality customized products with low cost and fast delivery (Bae, 2005). In order to meet with customer preferences, the textile industry gets advice from trend forecasters on meeting seasonal customer preferences. WGSN Group, Design Options Inc, Style Fyles, and Trend Council are a few such fashion trend forecasters.

2. Literature Review

History of Garment Printing and Techniques of Printing

Garment printing is used in the apparel industry to improve quality, appearance and value of the garment. Printing is a way of coating colors into a design on a localized area of a textile or a fabric (Karunaratne, & Bhagya, 2018). Textile printing demonstrates a co-relation between creativity, chemistry and engineering to give an outcome of an aesthetically appealing, designed fabric (Moser, 2003). Printing on textiles has a history that runs deep into civilizations. According to the literature, printing on a Garment, Textile Swatch using a wooden seal runs past the Egyptian era which belongs to the time of 400 to

600AD. In Asia, records on textile block printing in the period of the 13th-15th centuries are found from India. In Europe, the evidence of block printing runs to the 15th century, with the oldest evidence on textile printing lying far beyond about 1650 (Dawson & Hawkyard, 2000).

From the earliest practices of block printing on textiles into the direct digital printing on finished garment, textile printing has evolved over the years to the state in which it is today. Screen printing is a standard method of garment printing where creating a picture or a pattern by forcing ink through a screen made of fine material blocked with a stenciling agent. It makes a significant spot among the many techniques of printing having many variations itself. Mostly, these are achieved through different recipes of making the ink paste used to push through the silk screen on to the fabric surface (Russell & Goode, 2011). Transfer printing means the design is printed on a paper initially, followed by transferring the design onto the fabric surface to get the printed garment. The most successful methods of transfer printing use sublimating disperse dyes. It is only successful for fabrics made from sublimated disperse dye readily accepting fibers such as polyester, triacetate and nylon (Moser, 2003). In addition, special methods such as discharge printing, flocking and foiling are also available (Russell & Goode, 2011).

Garment Surface Value Addition

A commercial value-added textile lies within a frame defined by the technical capabilities of manufacturing and the customer requirements. The textile designer is responsible for balancing technical requirements of the designs and the style requirements satisfying the customer. In other words, this includes a process of direction, design and conversion. The design they produce will be affected by awareness of trend and market (Russell & Goode, 2011). Different methods were used in garment value addition such as screen printing, sequin attachments, embellishment decorations, heat transfers, digital printing, and embroidery, applique and fabric manipulation to enhance the value of the final product. The main objectives of the garment surface value addition are increasing aesthetic and price value of garment and attract the customer.

Garment Surface Decorations effect on the Consumer

"…it is an endless cycle of designer/manufacturer/consumer that ensures survival… the consumer like the designer requires change; monotony must be avoided. Fashion is synonymous with change… What makes a best seller? It seems to be an intangible balance between color, design and availability, but the quest for change remains dominant" (Campbell, 1984). Developments in the textile printing field over past years were mainly focused on re-adjustments and developments of the existing techniques rather than introduction of new techniques to achieve large-scale printing. The continuous changes need to be

focused on providing quality, cost effectiveness and novelty to satisfy customer needs (Dawson &Hawkyard, 2000). According to Chen & Lee, today's consumers are demanding high quality personalized products at a low cost (Bae, 2005). Under the management strategy, Quick Response (QR), the production should be aligned with demand and customer behavior. It is important to identify these demand patterns consequently. Aside from the forecast errors, this makes it easy to satisfy consumer demand (Forza and Vineli, 1997- as cited by (Bae, 2005).

Garment Surface Value Addition and Upcoming Trends 2020

According to Blumer (1969) fashion trends are time dependent and volatile. They are collective selections by consumers and handled by consumer needs. Consumers often get fed up of available designs and often seek new designs. With respect to the changing market trends, the design with the correct fashion trend is needed to win the consumer demand (Yu, Hui, & Choi, 2012).

According to fashion seasonal trend forecasters FW20 & SS20 season garment value additions can be identified as sequin embellishments, multicolor rhinestone embellishments, batik effect, animal skin effects, luminous, lunar light, metallic effects and extreme glitters, embroidery and foil print effects. Accordingly garment value addition companies need to be focused on providing garments designed with the above techniques to satisfy the customer in 2020.

Figure 1: Ice dye effect trend (Chander, What Next Priya Chander Trend Research, 2018)

Figure 2: Batik effect trend (Chander, What Next Priya Chander Trend Research, 2018)

Figure 3: ss20 Print trend: floral (Bruno, Fashion Vignette, 2018)

By analyzing the global picture about customers responding to different styles and areas of garment purchasing, these fashion trend forecasting agencies provide a clue about the interests of the customer depending on the fashion

Figure 4: Extreme glitters (WGSN-Active Textile A/W 19/20, n.d.)

Figure 5: Iridescent Sheen (WGSN-Print Trends,Code create SS20, n.d.)

seasons (Spring Summer- SS, Autumn Winter- AW and fall). So, the garment manufacturers and companies need to align their seasonal production strategies by taking the trends into consideration. The product which does not cater to seasonal needs has a high tendency for merchandizing failures among customers.

3. Methodology

The study focuses on identifying the garment printing profile (techniques, capabilities) of Antler Fabric Printers Pvt. Ltd, identification of consumer preferences on ready-made garment decoration techniques for year 2020 and innovative approaches to garment printing techniques (Batik, Sequin, Multicolor embellishments) with the use of existing knowledge to satisfy consumer preferences. Through the study, the focused garment printing firm, Antler Fabric Printers, will be able to gain a summarized portfolio of their printing technical knowledge and SWOT analysis, to get knowledge on consumer expectations in ready-made garment decoration field for 2020 and develop novel techniques of garment printing which can be applied to face consumer needs for year 2020.

The specific area and research problem were identified by observing a broad area of interest in the garment printing industry. Then the research was planned, and data were gathered through primary and secondary resources. For identification of the research area (garment printing), gathering of background data and validation of research data, secondary resources like research articles, theses, books, company websites, blogs and patent articles were used. Garment printing technique trends for SS19/SS20 seasons were identified. A questionnaire survey was carried out to identify Antler Fabric Printer's portfolio. A random sample of 20 people from Antler Fabric Printers sample processing unit staff were targeted to collect data by distributing the questionnaire. Through on-site observations and questionnaires, the printing techniques practiced at Antler and printing strengths were identified. From

SS19, SS20 seasonal trends; batik, sequin effect and multicolor embellishment designs were selected within Antler capabilities. Present technical process, weaknesses and areas to be developed on the above techniques were identified through observations and interviewing. Gathered information was recorded. Experimentations were carried out with the support of Antler PDC unit for development of an innovative process of printing for the above-mentioned techniques. Degree of success of printing, technical limitations, applicability and areas to be developed further in batik, sequin and multi-color embellishments were tested using lab experiments and the conclusions were recorded.

4. Results, Analysis and Discussion

Antler Fabric Printers is one arm of the Antler group of companies. Originating in 1978, it grew strategically, diversifying and providing services as the Antler group of companies where it remarks its footprint as an internationally recognised manufacturer for screen printing inks and cleaning products in addition to fabric printing. Antler Fabric Printers cater to fabric printing in the Sri Lankan apparel export segment for world renowned fashion brands. With services like cutting–edge fabric printing and embelishment technologies, maintaining high quality standards, delivery and compliance, Antler has made its name as a pioneer in screen printing in the Sri Lankan apparel industry. Creative innovation with changing demand is one of Antler Fabric Printer's straegic management in order to remain as a pioneer in screen printing. The vision of Antler Fabric Printers is "Creative branding solutions. To experience the sheer joy of printing and providing value added embellishments for the benefit of the apparel industry." Today, the Antler group of companies consists of a workforce of over 1500 and remark its footprints in its achievements by providing standards and satisfactory service to its clients with the strength behind, harmonious culture and humanistic values (Antler Fabric Printers).

Customer relationship

At present Antler Fabric Printers is completing sampling on 2500-3000 customer jobs per year. This includes the process of new technical and graphic designing, wash testing and other testing as requested by customers and size sampling. But only about 75-80% of the total jobs will be picked by the customers for the bulk printing (usually around 1000-1500 jobs) per year. In bulk production, Antler Fabric Printers has an accuracy of 98% of printed pieces per order, which results in 2% of damaged printed pieces. Antler serves customers in new design developments also, which runs at a capacity of 400-450 jobs (design-wise it is around 1000 per year). The PDC (print development center) is handling this section. Antler Fabric Printers exceed 15 brands which include PINK, NIKE, CALVINKLEIN, TOMMY HILFIGER, VS, A&F and ADIDAS. In addition, brands like LULULEMON, ATHLETA, SPEEDO, LAND'S END, DKNY,

DIESEL, ASICS, SOMA, PUMA, HUGO BOSS, NEW BALANCE, and HURLEY are served occasionally based on seasonal trending.

Techniques of printing practicing and Printing Capabilities

The machinery prints and manual prints are performed at sample and bulk production stages. Machine prints include mainly water-based prints (in an area of 22" x 28" with color limitation up to 8), soft hand feel plastisol prints, flock prints (heat transfer and direct), heat transfer prints, litho prints and sublimation. Manual prints include any technique of prints within an area of less than 22" x 28", all silicon-based techniques (gel, spike), embellishments, glitter, flock and so on. The main techniques of bulk production include water-based prints, silicon prints, soft hand feel plastisol (SHP) and Heat Transfers. Experimentas were carried out based on obtaining batik effect, multicolor embellishments and sequin effect. To achieve novel techniques existing printing techniques were combined, and results were practically experimented to get the quality identification.

Experimental Data Analysis

Experiments were carried out based on obtaining batik effect, multicolor embellishments and sequin effect. To achieve novel techniques; existing printing techniques were combined, and results were practically experimented to get the quality identification. 3 major types of strengths and 5 weaknesses were identified. Further, identified 3 types of opportunities and understood threats too.

Batik Effect

Batik is one of the major surface value addition trends in the textile and apparel industry predicted to shine in Fall/Winter (FW20) and Spring/Summer (SS20) season among the consumers. It is carried out with traditional methods of using melted wax and dyes on natural fiber made fabrics. At present, batik effect is applied as a print for time saving. In Antler Fabric Printers, batik effect has been practiced in early seasons through a sublimation technique based on customer demand. Here the design is first drawn using graphic designing software and wax crack effects are added and then it is sublimated into the fabric. In the novel method, the screenprinting technique is suggested for batik effect designs.

Experiments: Sublimated batik VS screen printed batik (new) feature comparison

The sublimated batik technique is practiced as a heat transfer technique and Batik effect added into graphic before printing on fabric. It can be done on synthetic fiber made fabrics such as nylon, acrylic and polyester successfully but cannot be practiced for natural fiber made fabrics due to dull effect of colors and sometimes design doesn't transfer at all (Cotton, viscose, silk). The color

intensity of design lowers when fabric is made by blending with natural fibers. Design accuracy is affected by fabric structure (e.g. rib knitted fabrics because of the stripping of design on stretching).

In the new method of batik printing, screen printing techniques were used. The batik effect is added into the graphic used for printing, colors are separately printed using silk screen and a squeegee. For this technique, possible ink types are pigment print inks, water-based inks, soft hand-feel Plastisol (SHP), foils and water-based metallic ink. When the foils are used for obtaining batik effect (tie dye foil technique), the design becomes unique from piece to piece which is identical for batik effect practiced with traditional wax and dyes. Screen printed technique of batik can be used for both woven and knitted structured fabrics and both synthetic and natural fabrics. The color intensity is not affected by the fabric composition and it is also applicable for bulk production using machine printing and manual printing when water-based and pigment techniques are used. Defects of this screen-printed technique can be identified as foil method being less bulk feasible than water-based and pigment methods. When batik is using foil, due to use of crushed foil for pressing, the design cannot be taken fixed. When more than 02 foils (colors) are used, it may be subjected to a matte effect in design. But most of the defects of the sublimation method are minimized and quality and aesthetic value are improved in the screen-printed batik effect in to bulk feasible level.

Figure 6
Batik effects by foil Print

Figure 7
Batik effect by metallic + tie dye foil

Figure 8
Batik effect by pigment print

Batik effect- tie dye foils (02 foils)
Mesh count for screen: 43W, Materials: foil adhesive (1418), foils, prepared screens

Procedure: Lay the fabric print board. Print adhesive 1418 on fabric 3strokes using prepared screen and dry. Then crush and press 1st foil on to adhesive printed fabric (120^0C, 2 Barr, 0.2N, 10 Sec.) in heat press machine. Keep it to

cool and remove foil film. Finally crush and press 2nd foil (160^{0}C, 4 Barr, 2N, 15 Sec.)

Batik effect- metallic + tie dye foil (02 foils)
Mesh count for screen: 43W, Materials: water-based metallic ink paste, foil adhesive (1418), Foils, prepared screens

Procedure: Lay the fabric print board. Print metallic water-based (here being one color) 3strokes and dry at 160^{0}C for 1.5 minutes. Then print adhesive 1418 on fabric 3strokes using prepared screen and dry. Then crush and press 1st foil on to adhesive printed fabric (120^{0}C, 2 Barr, 0.2N, 10 Sec.) in heat press machine. Keep it to cool and remove foil film. Finally crush and press 2nd foil (160^{0}C, 4 Barr, 2N, 15 Sec.)

Batik effect- pigment print (03 colors)
Mesh count for screen: 43W, materials: water-based pigment ink paste, prepared screens

Procedure: Lay the fabric print board. Print colour 01(here Yellow) 3 strokes and dry. Print color 02, dry. Print color 03 (here Black), dry. Finally cure at 160^{0}C for 1.5 minutes.

Sequin effect
Sequins are another trend predicted for customer demand in apparel value addition for Fall Winter (FW20) and Spring Summer (SS20). Mainly it is practiced as hand or machine attachment or a heat transfer embellishment sequin design. In Antler, sequin designs were done in the past as hand attachment and today it is practiced as a foil heat transfer which only gives a sequin appearance. In the new method, sequin techniques practiced at present are further improved by silicon coating and metallic prints and defects are minimized for improving customer satisfaction.

Comparison: Foil sequin print and attachment sequins VS sequin effect print feature
Hand attachment of sequins into designs is practiced at Antler Fabric Printers. Sequin hand attachment is time consuming and low bulk feasible. Foil heat transfer method practiced there gives flat sequin look and foil can get a matte effect with heat press. It has high transferring error percentage and low wash test resistance. Printing possible sequin width is at a minimum of 2mm. Skin irritations are caused by conventional embellishing sequins. In the new method of sequin printing into designs, metallic print and silicon print can replace foil method. High build effect of conventional sequins is achieved into print by increasing the number of ink coatings. Foil heat transfer sequin is coated with a

silicone gel layer in order to improve wash fastness. With silicon and metallic ink, minimum width of sequins for the design can be lowered up to 0.6mm. In the new printing technique, a comfortable hand-feel can be taken, and skin irritations caused by conventional embellishing sequins can be overcome. Silicon printed sequins are needed to be done manually which is time consuming compared to the metallic method. Metallic printing technique is applicable for machine printing which provides high advantage in bulk production.

Figure 9
Sequin effect- silicon gel high build print

Figure 10
Silicone gel+ foil HT

Figure 11
Sequin effect-Water-base-metallic

Sequin effect- silicone gel high build print
Mesh count for screen: 39W, materials: silicon ink paste, prepared screens

Procedure: Lay the fabric print board. Print silicon color 3 strokes and dry. Then print silicone gel base 6 coatings and dry. Cure at 160 ^{0}C for 1.5 minutes.

Sequin effect- silicone gel + foil HT
Mesh count for screen: 39W (silicon), materials: silicone gel paste, foil adhesive (1418), Foils, prepared screens.

Procedure: Lay the fabric print board. Print adhesive 1418 on fabric 3strokes using prepared screen and dry. Then press foil (150 ^{0}C, 3 Barr, 1.3N, 15 Sec) in heat press machine. Keep it to cool and remove foil film. Then print silicone gel base 6 coatings and dry. Cure at 160 ^{0}C for 1.5 minutes.

Sequin effect- water-based metallic
Mesh count for screen: 43W, materials: water-base metallic ink paste, foil adhesive (1418), Foils, prepared screens.

Procedure: Lay the fabric print board. Print metallic water-base (here one color) 3strokes and dry at 160^{0}C for 1.5 minutes. Then print adhesive 1418 on fabric 3strokes using prepared screen and dry. Then press foil (150 0C, 3 Barr, 1.3N, 15 Sec) in heat press machine. Keep it to cool and remove foil film. Finally

crush and press 2nd foil (160^{0}C, 4 Barr, 2N, 15 Sec.) jn heat press machine on fabric. If need to have high build, increase metallic ink coatings.

Multi-color Embellishments

Different types of embellishments are used in the garment value addition field as hand attachments or heat transfers. When it comes to designs with multi-colors and different stone sizes (e.g. 1-10mm) the steps needed to follow in designing are higher. If the design has 4 stone colors, the design is made as 4 parts and assembled before heat transferring into a Mylar tape (hot fix tape). Then it is heat transferred into the garment. Efficiency of designing is very low and time consumption for one design is very high compared to other value addition techniques. Here in the experiment multi-color stone embellishment design is obtained with minimum steps of design assembly.

Comparison: Multi-color embellishment heat transfer old VS new method features

In the present practice of heat transfer embellishment technique, the design is heat transferred onto fabric at 150^{0}C, 3Bar, 1.5N, 15 seconds. It can be used for natural and synthetic, mixed fabrics (both woven and knitted). Here, different colored stones and different sized stones, different shaped stones are used. Rhinestones, dome-studs, nail-heads, pearls, rhine-studs and epoxy are used. Different stone colors with same stone size needed to be assembled into hot fix tape using separately laser-cut blocks and different stone sizes and shapes are assembled onto hot fix tape separately. In the new multi-color embellishment heat transfer technique, the multi-color effect is obtained through sublimation. Here, the design with colors is heat transferred onto fabric (sublimation) at 150^{0}C, 3Bar, 1.5N, 15 seconds using a heat transfer machine. This method can be used for natural and synthetic, mixed fabrics (both woven and knitted). In multi-color design, Different stone colors with same size are assembled using one laser-cut block following one step on to hot fix tape. Different sizes and shapes of nude-stones are used. For embellishments, nude dome-studs and nude-rhine stones are used. But sublimated colors get a dull effect when done on natural (cotton, silk, rayon) fabrics so colors cannot be achieved accurately. Different stone sizes and shapes are assembled onto hot fix tape separately.

Multi-color stone effect with sublimation + heat transfer nude stones

Procedure: Arrange design with colors and sizes of stones. Laser cut stone assembly boards according to stone sizes and makes design using nude stones on to Mylar tape. Sublimate design with colors onto fabric. Align stones in Mylar tape with sublimated design and heat transfer. 150^{0}C, 3Bar, 1.5N, 15 seconds.

Figure 12
Multi-color stone effect
with nude stone

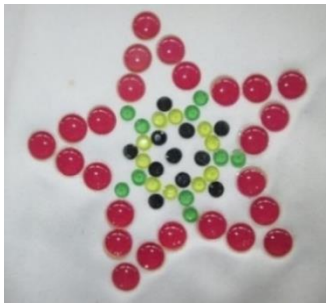

Figure 13
Multi-color stone effect
with nude stone

Figure 14
Multi-color stone effect with
nude stone embellishment,
polyester single jersey

Figure 15
Multi-color stone effect with
nude stone embellishment,
cotton woven fabric

5. Conclusion and Implication

Batik is one of the traditional methods of textile value addition done with melted wax and different classes of dyes. Due to high consumer demand, cost factors and low production rate of the traditional method, batik is done as a printed effect at present using batik elements (Lawrence, 2002)(Li & Yang, 2011). Novel methods of batik effect printed using pigment print and tie dye foils show new strengths of batik printing on a wide range of materials including synthetic and natural fiber made textiles. This supports for mass production being applicable with machine printing (pigment print method). Being able to use a high amount of colors (up to 8 colors in machine printing), this pigment method is highly effective with time and cost factors than the traditional waxing method of batik. Technique passes colorfastness with wash testing. This technique is applicable with designs made for brands which demands low cost, trendy and metallic effect designs like Calvin Klein, TOMMY HILFIGER, PINK, VS and Patagonia who are served by Antler Fabric Printers.

Embroidery machines with sequin roll feeders are used in industrial garment sequin value addition (US Patent No. 5562057, 1996) or sometimes hand attachment and hot-melt sequin applications were done (US Patent No. US 2018 / 0195235 A1, 2018). In the novel method, sequin effects are applied into the design through screen printing by using foil+silicone gel, silicone gel or water-based metallic+clear foil. Hand feel and wash fastness are improved compared to embroidered sequins. This method of sequin printing can be used in garment print designs made for trendy, luxurious feeling and fancy factor demanding brands like VS, VSX and PINK which are included in the customer profile of Antler Fabric Printers.

Multi-color embellishment designs are a highly demanding type of garment value addition. At present, these are done by hand attachment or heat transfers. In Antler Fabric Printers, the heat transferring technique is followed by stone embellishments. Steps of design assembling of multi-color stone embellishments can be reduced with the novel method. In here, sublimation of design colors and nude stone heat transferring is done. Embellishment efficiency can be increased through less man hour consumption for one design which increases production strength for a day. Also, this method reduces error occurrence percentage when doing a typical multicolor stone design. This technique is highly applicable with brands such as Victoria's Secret, PINK and VSX which are a few of the main customer brands of Antler Fabric Printers.

The new screen-printed batik effect is applicable for bulk production with water-base and pigment printing techniques using machinery and table printing. This reduces production time from the traditional batik process. Foil batik technique has limitations with colors which are obtained by increasing number of foils pressed due to matte effect appearing, adhesive power and heat liability. Further experimentation is suggested to overcome defects of foil batik effect for increasing colors. Technical developments are limited to foils, pigments, SHP and water-base. Sequin effect prints can be done on both woven and knitted fabrics and on natural and synthetic fabrics. Wash test defects of the foil only sequin print practiced at present in Antler can be overcome with silicone gel coated new technique. Sequin hand feel can be improved by increasing the number of print coatings. Skin irritations caused by conventional attachment of sequins are avoided here. Here the minimum width of a sequin ring is limited to 0.6mm. The new embellishment technique can be used in achieving multi-colored design with same stone sizes successfully. Currently stone shapes are limited to rhinestone and dome-studs. For designing on natural-fiber fabrics (cotton, silk and so on) further experimentation needs to be done in order to obtain accurate colors. Instead of using the sublimation technique, experimentations with digital printed colors and nude stone heat transferring need to be conducted for further developments.

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