SET 10

JANUARY 2018

EXPERT TECHNICAL GUIDE

TEXTILE PRINTING

GUIDE 1

FESPA
profit for purpose

TEXTILE PRINTING

Printing on fabric has been around for centuries, starting with the use of woodblocks to transfer colours and patterns to substrates, and not just for textiles and apparel. Over the centuries different models evolved based on the printing methods and materials constraints for producing different types of printed goods. In that time, the gap between printing processes for communications print, such as newspapers, and other forms of print, such as textiles, has grown to be huge. But times are changing. New technologies break the bond between print product and printing method. This is most obvious in the commercial print and sign and display markets, where digital technologies are upending traditional business models. The textile market, for both printed textiles and apparel, is being similarly changed.

The disruption is creating new markets for textiles and decor. Print service providers already engaged in digital printing, screen printing or both, have a readily accessible market for textiles. Most companies can identify customers who might be interested in textiles for their offices and factories, but there are new prospective buyers such as organisations responsible for retail and public spaces, for hospitality venues as well as consumer spaces. Digital textile printing is a natural extension of existing print businesses already producing print such as posters and signage from digital artwork. The move into printing fabrics, clothing (for instance uniforms), carpets and fabric tiles, fabric wallcoverings, rugs, curtains and other household paraphernalia is not that hard and there is a ready market for such prints.

Richard Quinn Design

Richard Quinn is one of a growing cohort of young designers using digital printing technologies to produce fabrics for their designs.

IT'S IN THE NUMBERS

This is why research organisations around the world are confident in their predictions of an exploding textile printing market. According to FESPA and Infotrends this market is worth $165 billion, creating an opportunity for printing companies around the world. Digital printing makes this market accessible to end users and to entrepreneurial service providers, so it also should be of interest to print service providers.

It's not just an opportunity for technology providers and printing companies. Digital technologies and applications growth also benefit the wider market, creating opportunities for new business ideas and new products for customers. According to Provost Inkjet Consulting, an international technology and market information consultancy, in 2014 the textile printing industry generated around 31 billion square metres of printed textiles worldwide.

As for the future, pundits vary in their positive projections from over 33 billion square metres in 2017 to nearly 40 billion square meters by 2024 for apparel, interiors, sign and display work and industrial applications, such as car seats and flooring. These huge numbers reflect rising affluence, printing system advances, new approaches to design, process efficiency and the rapid uptake of digital printing technologies. We are also seeing innovations in ink recipes and dyeing techniques, all of which helps to drive new textile printing applications.

Traditional printing methods still account for most textile production, both garments and fabrics. Rotary screen printing still dominates with roughly a 65% market share worldwide and flat screen printing accounting for 25%. Digital printing systems produce much of the balance of work along with hand screen printing and transfer printing and is generally seen as an eventual replacement for rotary screen. According to Infotrends, in 2014 digital printing accounted for 600 million square metres of textile print. Infotrends expects this number to rise to 3.2 billion square metres by 2019. A market that in 2014 was worth $7.5 billion will rise to be worth $33 billion in 2019. This is why print service providers and manufacturers are paying attention to digital textile printing.

	29.3%
	17.6%
	[illegible]
Americas	17.4%

Table 1 Te[illegible] volumes by ge[illegible]ical spread.

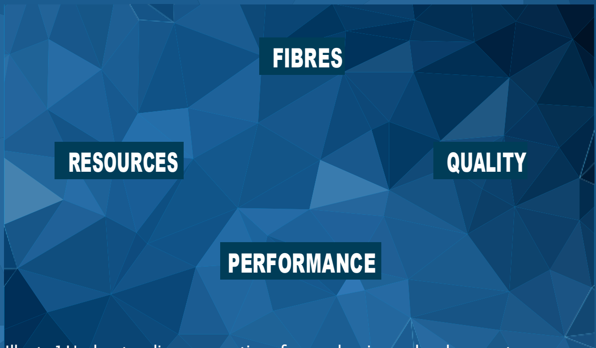
DIGITAL ADOPTION

The commercial uptake of the World Wide Web in 1996 and the march of digital technologies across the graphics industry landscape have together profoundly affected the graphics industry's business models. They have created a business environment that affects manufacturers, service providers, associated supply chains and end users. Digital adoption is moving most rapidly in developed markets and economies, however legacy technologies and processes in these markets mean that adoption has been splintered and complicated, and this has acted as a brake on uptake. Other rapidly growing markets such as Turkey, Brazil, India and China have an opportunity to bypass legacy technologies, practices and business models, to leapfrog straight into direct digital production.

Digitally printed sportswear is one of the most common applications of digital printing technologies for textile printing. It is especially popular for team outfits, produced in very short runs.

PRECEDENCE

The adoption of digital printing technologies for different printing applications has been underway for many years. Digital printing of fabrics started in 1990s, with sampling and trials produced at lower costs than were possible using conventional methods. Thus, digital processes have been changing the textile industry more widely for last 15 years or so as companies worked out how to use the technology to best meet customer needs. Successful business models depend on a profitable balance between the cost of technology, the fibres for which ink and imaging technologies are suitable, the performance, the final output quality and of course local markets.



Illustr. 1 Understanding your options for new business development means getting the balance right.

For many years the technology has been improving and although digital output cannot match like for like the output quality and productivity of volume screen printing, other considerations drive investment. The most important of these is the substantial reduction in prepress times due to process collapse. As with other forms of print, digital prepress in textile production has cut the stages needed to print textiles. Workflows are more efficient due to digital prepress which has reduced multiple prodcuction stages to a few. Depending on the substrate, ink and imaging technology, digital production can still require pre- and post-treatment for the substrate, but numerous other steps such as separations, engraving, colour checks, screen washing and storage, are no longer necessary.

The market is also getting greedier and more impatient for innovative designs delivered at a higher frequency than has previously been the case. Fast fashion is driving market expectations from seasonal changes, occuring every three months, to monthly and even weekly shifts. There is less and less talk of Summer, Autumn, Winter and Spring collections, and more of collections based on lifestyle and highly perishable microtrends, such as for chokers or lowline trainers, whose lifespan was a mere few months. According to a report by the Ellen MacArthur Foundation half of high street fashion is disposed of within a year and the amount of clothing purchased in some markets has doubled in 15 years. However people are wearing their clothes 20% less than they used to.

This is the model companies such as Inditex with its Zara brand and H&M are exploiting, along with initiatives to recycle clothes. These organisations turn stock every six weeks or so, constantly refreshing their lines. In some cases it can be as little as every three weeks, so market success depends as much on effective logistics and recycling as it does on desirable fashion.

Digital on demand production means the near elimination of warehouse stock and a move to Purchase Activated Manufacturing (PAM) so that logistics is increasingly the differentiator for service providers and fulfillment. Under this model all processes are initiated at the point of ordering, and when the money for goods is paid. The model is fully automated from ordering, printing, cutting and sewing through to delivery, and applies for all forms of textile production.

Fashion designers and labels are increasingly keen on small and medium sized batches, which are price competitive because of the technological efficiencies used to produced them. Increasingly, although not yet entirely, the production cost for small to medium sized runs is competitive with costs used in advanced production technologies used to produce long runs and large batches. Over time the use of digital tools for such a model will be increasingly viable.

Also clear for print service providers and manufacturers is the powerful dynamic that is coming to exist between market demands and production methods. Technological enablers such as e-commerce, the internet and on demand production tools are taking print applications out of their niches and creating new applications, for instance for accessories and objects.

The market can expect progressively better quality and output speeds and support for a growing range of fabric options. The speed of production cycles may even encourage reshoring of jobs in the textile business, so that production takes place close to target markets. Digital printing advances such as new inkjet printheads, innovative inks and textile treatments, plus improved fabric transport systems, are driving market adoption. All of this supports new business models that provide printed textiles on demand, whether it's for fabrics, direct to garment prints or apparel.

ENVIRONMENTAL IMPACTS

The textile industry is considered to be one of the world's most polluting. The nature of textile production processes means that at every one of the steps needed to make an item of clothing the environment takes a hit, mostly through water waste. But fibre spinning and weaving affect air quality, and dyeing and printing by conventional methods use lots of water and chemicals, releasing Volatile Organic Compounds (VOCs) into the air. This has encouraged growth in the use of digital processes, particularly if goods can be produced close to end users, which also cuts the emissions associated with long distance transportation. Digital production requires less water and energy for production and less waste.

In addition there is the link between environmental sustainability and the economic optimisation of supply and demand for textiles and apparel, which can help to improve the industry's environmental footprint. Because it collapses many processes, digital printing can yield water savings of around 60-70%. ICEA, an Italian producer of textiles based on re-generated cotton fibers, has certified a 50% water saving with digital printing compared to rotary screen and 30-40% reductions in energy consumptions and CO^2 emissions.

Digital production also requires around half the volumes of colorants and auxiliary chemicals compared to traditional printing methods. To these benefits add the fact that it can be cheaper and more convenient to produce textiles digitally, and it's clear why the industry has embraced digital production.

BY DESIGN

Collapsing supply chains and processes are the primary commercial drivers for print service providers who want to go digital, but there are also design and production convenience considerations. It's very easy for instance to propagate single or multiple patterns in software for designs with complex pattern repeats. Base pattern designs can be easily rendered in multiple colours using digital design tools without the time or cost penalty, and it is straightforward to create variable data designs using dedicated software tools.

This enhanced creative process also makes it simpler to render designs on different rag types, so that colours are accurate and consistent across different fabrics. Adapting the colour data so that it works on linens, cotton and silk for instance, can be managed as the data is processed ready for output. Designers have more flexibility for how work can be rendered. In addition to being able to use photographic images in designs, designs can be enlarged or reduced as needed, for example to fit a garment without worrying about the constraints imposed by the size of the printing cylinders.

Digital production software also overcomes limits in the screen printing process to pattern complexity and colours, making halftone printing easy and creating all sorts of interesting new creative and commercial possibilities for designers as well as brand owners.

The market is noticing that since all textiles start with design, designs for digital printing, with its dramatically shorter production times, can make more immediate emotional connections. Fulfillment cycles for digital production are driving new design demand to support instant gratification, design diversity and demand for identity fashion. This includes accessories such as hats, scarves, bags, gloves and shoes, as well as objects, so digital is as much about new opportunities as it is about process replacement. Digital printing can support both on demand fulfilment and prototyping for high end fashion, but it has huge potential to serve fast fashion where brands such as Zara, H&M and Primark are making fashion disposable and resaleable or available to secondary markets. Creativity, artisanal skills and digital printing also combine to create unique luxury pieces with the sensation of handcrafting, at lower cost and much more quickly.

WHERE TO BEGIN

Many printing companies have entered this market starting with relatively low risk investments. They have moved beyond soft signage and into fabrics and garments, starting with wide format roll-to-roll devices printing polyester using dye sublimation. This natural extension of an existing business model is low risk and relatively low cost. And although the quality may not suit the expectations of luxury garment providers, it is acceptable for many sectors of the market.

Illustr. 2

Somewhere in this mix is the perfect business model for your company.

However the convenience and flexibility of digital printing also raise concerns relating to copyright protection across formats, training in digital production processes and managing market expectations. Falling short in any one of these areas could be the source of serious headaches for a business. Digital printing methods are not a straight swap for conventional methods and there are still plenty of areas where screen printing has the edge, most obviously in the cost and productivity for large volumes which justify complex and time consuming prepress.

Traditional production models still have a commercial edge over digital priniting, particularly for designs that use special effects and enrichments, such as devoré. This process creates surface patterns on the fabric, most commonly on velvets, for a sheer, drapey effect. Devoré paste contains selectively corrosive chemicals and when applied to mixed fabrics, these chemicals eat away viscose and cellulose fibres to leave protein based materials, such as a silk or wool backing, in place. The technique can also be used to created lacey patterns in linens, cottons and other cellulose based fibres. This type of special effect is not yet possible in an automated production line with digital printing. Nor are some other enhancements such as adding 3D components, foils and glitter, but it is just a matter of time before that is no longer the case.

CONSIDERING THE OPTIONS

Print service providers who want to expand into this field have first to decide which area of the business is most attractive for their organisation and investment capacity. To some extent this depends on the existing customer base, printing systems and digital expertise, especially for prepress workflow management, website design and management and e-commerce. Do you want to produce clothing and printed textiles for interiors using roll to roll printing technologies? Is DtG printing of t-shirts, and hoodies your thing, or do you want to get into the fast fashion business? Which market is the most accessible to you in terms of products and production models?

UNDERSTANDING SUBSTRATES AND INKS

Whichever sector attracts you most, your preferred substrates and the inks that work with those materials will determine your investment options.

Textiles are produced with natural fibres such as those based on proteins including silk and wool, and those based on cellulose which includes linen, cotton and hemp. In addition are the man-made fibres including synthetics like polyamide and polyester which are made from petrochemicals. Rayon, often referred to as viscose, is a semi-synthetic commonly used as a substitute for silk. It is made from a spun cellulose mixture, a pulp of plant and wood mixed with chemicals, which is turned into a liquid and then spun into fibres.

Protein and cellulose based materials make different demands on the ink, and whether there is the need for pre- and post-treatment. Pre- and post-treatments of the fabric may be required for ink adhesion, colour depth and accuracy, uniformity and output consistency, as well as the feel or hand of the fabric.

Ink types requiring pre- and post-treatment of the fabric include the acid dye inks used for silk, wool and polyamide. Reactive dye inks are required for cotton, linen, hemp, silk, wool and viscose. Disperse dye inks for polyester and pigment inks for cotton, linen, hemp, viscose, some silk, wool, polyamide and polyester generally do not require pre- and post-treatment. Polyester may require post treatment with special resins and heat, for instance to make it flame retardant or antimicrobial. Digital printing devices are optimised for a specific ink and substrate combination, so manufacturers offer technologies to fit specific applications. However hybrid digital textile printers that support both acid and reactive inks are slowly coming onto the market.

Post-treatments for fabrics include cutting and sewing of garments, plus treatments for fabric quality and feel, as well as performance for a given application. Silicones, chemicals and resins can be added to enhance softness, or make the fabric more water repellent and to make the material more resistant to staining and abrasion. This can also improve wrinkle resistance, propensity to shrinking and stretch and tear strength.

Richard Quinn Design

This Richard Quinn design was created from digitally printed Mylar. Mylar is a brand of stretched polyester film.

TECHNOLOGY OPTIONS

In the mobile, on demand, instant gratification space that digital technology has created, a business's most important consideration is its IT platform, workflow muscle, capacity and support for mobile computing. We live in an age where there is huge scope for vertical platforms to sell, for instance, interior design print, fashion and DtG clothing. In such an environment the importance of the IT underlying that platform cannot be understated.

Output system investment decisions will depend on your target application and the nature of the service you want to offer. Technological innovation in this field is a combination of advances in inkjet printing systems and materials science. However new approaches to textile treatment and inks, fabric transport and drying systems mean that the technology is continuously moving and improving. There is every expectation that it will continue to get better and better, so consider first your quality, productivity and margin requirements and then look at what's available on the market. Set targets for quality in terms of output colour accuracy, performance (uptime, running costs, service scheduling), throughput (how many square metres or garments per hour), ease of use, training support and above all, what you can sell to end users and how much it will cost you to do so.

PRACTICAL CONSIDERATIONS

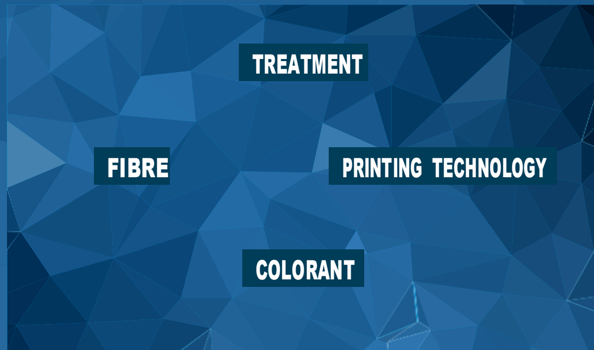
Your IT foundation is vital to success in digital textile printing, whether you are going for an ondemand fast fashion model or doing prototyping for haut couture. Accurate, reliable and consistent data management will influence productivity, colour and error rates: don't forget that the cost of errors rises the closer you get to output. But in addition to the IT, the materials you choose to work with will determine your technology choices and be driving factors in your success.

Dye sub roll-to-roll (transfer printing) is a common starting point and supports a range of applications using polyesters and polyester blends to produce such garments as personalised sports clothing, soft signage and uniforms. Designs are first printed on paper and transferred to the fabric with a heat press.

Illustr. 3

Dye sub printing is widespread and inexpensive. It is attractive for its simplicity for different textile applications, especially for polyesters and polyester blends.

Roll-to-roll technologies print onto a variety of static and stretchy textiles using a variety of ink tyes including pigment and sublimation dyes. Digital Direct to Garment (DtG) printing relies on inkjet flatbed printing with bidirectional printheads to print water-based specialty inks onto garments. DtG has grown considerably in the last fifteen years, boosted by web-to-print and peoples' desire for personalised and short run customised clothing. It currently accounts for 200 million garments annually and this number is rising as manufacturers introduce new machines and the range of fibres and textiles suitable for digital printing grows.



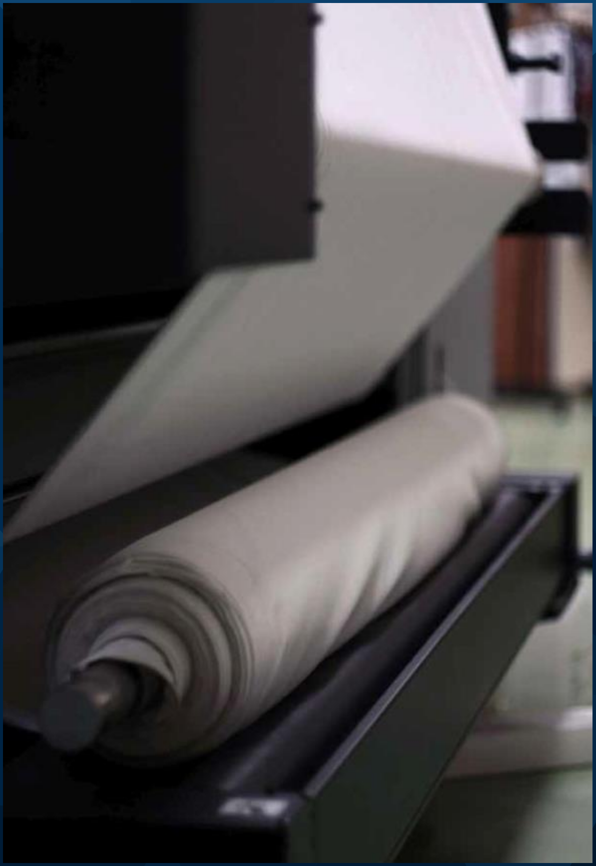
Illustr. 4

Your investment in this dynamic new market will be based on the type of work you want to produce and local market demand.

STRATEGY FOR SUCCESS

As with any new venture, you must start with a plan and be prepared to adapt the plan as you research the market, technologies and the investment impact on your existing business activities. Work with customers and try to research technologies, inks and materials with them. Don't forget to consider your existing process management and quality assurance procedures and be clear about the market you want to serve, for instance should you go for the very high end or commodity market? There is a premium on bespoke products but can you find enough business to keep your capital equipment running at capacity? Don't forget workflow management, associated production software and variable data tools. Variable data software allows you to both optimise a device's capabilities by ganging lots of smaller jobs for printing on the same fabric and to offer bespoke customisation to your customers.

The technology is changing fast and you should be prepared to put in the time for thorough research. Understand the nature of your own production processes and the commercial drivers of your customers. When you come to investing in new kit, know the answers before you ask the question so that you can be ready for a deeper dive into the offer, and can develop a cohesive and realistic strategy for success.



WWW.FESPA.COM

FESPA
profit for purpose