

# **Analysing the New Zealand Fashion Market: New Opportunities for Printed Knitwear Design**

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## **Abstract**

This paper presents the outcomes and findings of an investigation into design innovation through digitally printed merino knitwear within the New Zealand fashion sector. The project involved a review of current uses of digital print on knitwear both internationally and in New Zealand; the development of a range of digitally printed knitwear which utilised and demonstrated a range of print on knitwear approaches to be shown to industry as a promotional kit; and consultation with NZ designers and design companies to ascertain levels of understanding, interest and opportunities for the use of these technologies to add value to New Zealand apparel production. The project was carried out between December 2009 and June 2010. The research identified and consolidated a body of contextual material that has informed ongoing research and teaching at the AUT's Textile and Design Lab (T&DL) and the researchers own inquiry and practice. The design development process that was used in this project has led to the production of some innovative and sophisticated design applications which were used as the basis of information and promotional material for industry. Additional research into industry approaches, understandings and future opportunities for these technologies has provided valuable information to inform new initiatives at the T&DL to support NZ industry.

## **Introduction**

The aim of this project was to collect information, gain feedback and analyse the state and potential use of digitally printed textiles in the NZ fashion industry. In particular, the study was focussed on digital printing onto knitwear. This project firstly involved an investigation into the use of digital printing in the knitwear field. The next stage was the design and production of a capsule knitwear collection to fit into the high end knitwear sector of the fashion market. After releasing the collection at an exhibition evening, attended by academic staff and post graduate students from AUT along with industry representatives, a general survey of New Zealand knit wear manufacturers, knit design companies and designers was conducted to gain insight into broader industry perspectives on knitwear design and manufacture in New Zealand. A series of interviews was then held with a selected group of eight designers and two knitwear companies, who were presented with some of the collection pieces along with an Autumn/Winter 2010-11 look book and asked a short list of questions, to gather their feedback on the response to digital printing in these garments and their potential within the New Zealand fashion market.

This information was collated and the project concluded with an analysis and identification of factors that limit or affect uptake and application, and a consideration of current and potential uses for digital printing in the New Zealand fashion knitwear industry.

The overall response indicated that *designers* were more open to the adoption of digital printing compared to *knitwear makers* and *producers*, who tended to hold more traditional views on production methods and applications. It was concluded that the main barriers to uptake are cost and a lack of knowledge in the industry about this form of digital textile application.

Overall, response by the industry to this research project was extremely positive in relation to the uptake of new technology. However, technology uptake in the NZ fashion and textile industry has been slow due to the current economic situation and a lack of information about the value and potential of these technologies. More education and information being made available to industry and a more favourable economic climate would support greater demand for this point of difference in knitwear collections.

## **Part One: Design Review**

### ***The new craft of machine knitting***

The uptake of new knitting technologies in New Zealand reflects a shift in fashion toward a digital industry where methods of production, assembly and supply chains are becoming more integrated. The technological shift has not only changed production systems but has also supported design innovation. This inquiry first investigates international and local examples of knitwear design supported by new technologies.

A display of such innovation was seen in an exciting knit-focused exhibition held at the RMIT Gallery in Melbourne in February 2010. *The Endless Garment: The new*

*craft of machine knitting* (Healy & Bigolin 2010) assembled the work of twelve International and Australian designers who use knitting technologies to create innovative modern garments. The exhibition focus was on showcasing the bright future of machine knitting, and included high profile designer garments by internationally renowned designers such as Issey Miyake, Sandra Backlund, and Walter Van Beirendonck. Their work showcased creativity through the use of the new craft of machine knitting, demonstrating a consciously artisanal approach that these designers have developed through high-tech processes. Reviews of the exhibition discussed public perception towards 'machine' knitting, recognising that mass production processes are often viewed negatively (Turcu 2010). In comparison, notions of 'craft', and 'workmanship' that are associated with traditional hand knitting tend to be more warmly recognised as creative and meaningful. One of the main aims of the exhibition was to enlighten people about the changing forms of knitting due to technological development and to show that machine knitting can also be creative and innovative.

Experimental, yet highly wearable knitwear was also seen on the catwalks of Tokyo Fashion Week Autumn/Winter 2010-2011. Renowned for its conceptual clothing, the event presented Japanese viewers with a wide range of knitwear as accent pieces in collections, adding texture and body to other garments. For example in 'Quesorvel', designer Yoshiyuki Iwagishi used warm colours with chunky cabled cardigans to compliment his outfits. Nozomi Ishiuro's 'Haute couture' show displayed colourful abstract digital textile prints, with chunky crochet-like knitted Eskimo jackets. Akira Naka showed delicate knitted structures juxtaposed with a sculptural silhouette. Mihara Yasuhiro's designs referenced deconstructed knit but in an elegant, lace-like manner. The stitch structure let the skin peek through the garment, referencing laddered or ripped stockings. The underlying themes of deconstruction, sculptural knitting, and androgyny were seen in many knitwear pieces at Tokyo Fashion week, which mirrored the directions shown in the trend forecasting magazine 'View' and directional fashion websites.

Italian knitwear designer Saverio Palatella, who displayed pieces at the RMIT's gallery exhibition in Australia, also created a capsule collection titled 'Bianco' in collaboration with leading knitwear specialists *Shima Seiki*. This showcased the potential of seamless or WholeGarment® designs in the high fashion market. This technology uses CAD / Cam knit technology to produce whole garments direct from the machine, which do not require garment assembly by machinists, a process which adds a significant labour cost to the production of knitted garments. Shown in New York in 2008, Palatella created stunning white whole garment pieces void of any colour to display the technical mastery achieved in knitting an integral garment. 'Bianco' was created to show designers, technologists and consumers the endless creative possibilities of WholeGarment® knitwear. Recognising the potential of this new technology the designer noted:

*WHOLE GARMENT® knitting is not only a novel alternative to existing production methods. Its technological breakthroughs have also led to the development of previously unknown knitting techniques that expand the range of knitwear as fashion. New shapes, new patterns and new textures can now*

*be knitted using a wider range of new materials. (Showcase and more... 2009)*

German based knitwear equipment manufacturer *Stoll* also produces seamless garment machines. *Stoll* recently paired up with Australian Wool Institute (AWI) to create a technically-focused knitted collection featuring their version of integrally knitted garments, called 'Knit and Wear®'.

Focusing on using a merino fibre, the collection was a themed sportswear range which used specialised stitch structure and yarn integration. The technicality of the knitting structures allows breathability of the body, combined with the excellent wicking capabilities of merino wool, making this collection notable in terms of technique marrying machine knitting skills with a sustainable natural fibre. The design consultant for the range commented on this combination:

*The concept of building 'smart' garments, using truly innovative knitwear techniques, and capitalising on the benefits of the Merino natural fibre have been brought to fruition with the Modern Nomad collection, specifically for the outdoor active-wear market. (Stoll-AWI collaboration... 2009).*

By creating specially designed knitted panels to address body needs such as moisture retention, heat retention and odour control, these garments have a functional edge as well as a novel aesthetic that appeals to current trend driven markets.

### ***Digital textile printing***

Another significant technology development in the fashion and textile industry has been that of digital textile printing. The development of an inkjet printing process for textile applications allows for a greater variety of print approaches than traditional screen printing methods. While there are specialised machines for the roll to roll digital printing of fabric lengths, there are two methods of print application that are most relevant to digitally printed knitwear: placement printing and engineered printing. These print technologies are well supported by AUT's Textile and Design Lab (T&DL).

The placement print is the simplest method and has a high success rate when running a large quantity of prints for commercial output. This is due to the print generally being placed in the centre of the garment, which has no effect on any seams, or prints wrapping around the body. As it is generally a simple print, it can be used on a variety of different shaped or size graded garments with the motif being scaled accordingly, and printed either front or back.

Engineered printing, where the print design is adapted to fit the shape of the garment, requires a lot more precision and also requires allowances to be made for the garment shape, size and seam interference. Due to the high amount of accuracy involved, this type of printing significantly affects the price of the garment so it is generally used in high end products where price is not an issue.

The technique of engineered prints allows designers to create patterns to the exact shape of their garments which flow over the seams, or join a design at the seams for

a focus of the design. The pattern is made on Adobe Photoshop or Illustrator and exported in TIFF file format. As this method requires moving or flipping the garment for printing, some seam overlap in printing can occur. With this in mind it is better to create a 'forgiving' print, so the design will not be compromised if there is any slight inaccuracy. In this form of printing, 'formers' are placed inside the garment to ensure it is held flat and that minimal movement of the garment takes place.

In 2009, researcher and textile artist J R Campbell from Glasgow School of Arts visited as a guest of the T&DL. Campbell is a leading researcher and artist in the field of digital textile printing, exploring the possibilities of two dimensional and three dimensional prints. This new textile technology has extended print design possibilities beyond the confines of traditional screen or rotary printing. Using bright colours and 'planetarium-like' space age prints, Campbell's work showcases the potential to distort garment silhouettes and display interesting shapes on the body. In an interview with journalist Melanie Cooper from AUT, Campbell compared the differences in printing techniques from those used only a few years ago:

*We have come from reduced colours, large scale production in which a few designs get produced in multiple millions, to a stage where any colour is almost possible and it is just as easy to produce multiple millions of design ideas as it is to make multiples of one idea. (Cooper 2009)*

This use of technology in the area of textiles has encouraged the collaboration of other digital areas of design, moving from a fashion context to product and furniture focused areas of design as well. Digital print doesn't abolish the use of traditional screen printing methods; rather it extends the use and aesthetics of applications through technology. J R Campbell commented that the context of New Zealand is a good environment for digital printing technology to flourish and become a commercial possibility, and also an experimental area full of potential:

*Like Scotland, New Zealand will not be able to sustainably manage mass production of textile products. We are no longer 'manufacturing' countries. Instead, we need to use approaches like the one I described above (digital textile printing) to circumnavigate the mass production supply chain. This will allow for more meaningful design to occur and will result in more valued products, which people will retain for longer. None of these products will have to be produced in advance; instead they will be created on-demand. As a result, as smaller countries, we will be able to take advantage of a more responsive, more appropriate, more creative and more sustainable means for textile product consumption. (Cooper 2009)*

The inquiry also identified a number of designers making innovative use of digital textile printing. For example, Cathy Pill, a designer from Brussels, uses colour gradients, and large scale images to highlight the point of difference digital printing can give textile design. Her garments sit in the high fashion price point and are currently being sold in the UK in Brown's department store. Blue Area is a company established in Germany in 1996 that produces digitally printed knitwear. It is sold exclusively to Browns Department store in the UK. The cashmere knitwear is printed reproducing artist's artwork as placement prints over and around the garment. The world renowned designer Chalayan has also included digitally printed garments in his

collection. These prints boast photo generated images which can be duplicated onto fabric due to the technology of digital printing. In one case, the texture of concrete can be seen coming through in the print, which would be very difficult to achieve using the traditional screen printing methods.

The most expensive digitally printed garment identified during research in the overseas fashion market was by designer Cathy Pill, at £5,890 (\$12,696.70 NZD) for a digitally printed garment. The cheapest garment, internationally, was £60 (\$120.30 NZD), from a company called Kaliko. Within a New Zealand context, digital printing is being used by designers such as Lonely Hearts, on mohair sweaters, socks and gloves with a vintage floral print. The price point in the New Zealand 'high fashion' market would allow the expansion of digital printing to offer exciting new cutting edge prints in this market. As J R Campbell noted, we have the ability to offer 'on demand' printing in NZ to cater for small production runs, and Lonely Hearts is a perfect example of this application.

A number of innovative international designers and companies using digital knit or digital print technologies were identified. However, it was recognised that currently the use of print on knitwear was still at an experimental stage. While some outstanding international examples were identified, in general, digital print is still often being used in a similar way to screen printing, even though the new technology has significant potential for innovation in print design. Innovative combinations of print on knit are more limited. The technologies within the TD&L offer significant opportunities for New Zealand designers and knitwear companies, however greater industry awareness of these opportunities must be developed.

## **Part Two: A Collection**

In the next phase of the research, a collection using digital printing and knitwear technology was developed to explore and show some of the possibilities of the successful combination digital print and digital knit technologies. This stage of the project involved several steps:

1. Consideration of fashion and textile trend forecasts to ensure stylistic relevance to the high end fashion market
2. The development of print design concepts
3. The development of garment shape concepts
4. Tests of knitting and printing experiments
5. Virtual prototypes of garments
6. Collection cohesion for sample range

Due to the use of high quality merino wool and digital printing within the collection, it was imperative that it was developed for the high fashion bracket of the NZ apparel market so that the price point would fit into this demographic of fashion retail. A review of trend guides on line and directional forecasting magazines was made, to inform the development of a fashionable, high end collection.

A sub theme of print directions in forecasting magazines was identified as the print 'slipping out of control'. This design approach appealed as it would support the aesthetic range enabled by digital print technology. The work of designer Talbot

Runhof follows this approach. His hounds tooth prints are digitally manipulated to make them flow around the wearer's body, giving the prints a 'slipping' notion as if they were falling off the fabric. Another influence was the work of the Dutch graphic artist M. C Escher (1898-1972) who based his work around symmetry and geometry. Such concepts are relevant to textile design in terms of repeating patterns.

A number of garment shapes were explored and some were selected for further development. The silhouette developed was a relaxed fit, with drop shoulders and lowered armholes. It was a slimming silhouette following the body. Most of these garments incorporated drape into the body and sleeves. I chose to do a six-piece collection, five women's garments and one menswear piece.

Textile print designs were based on the theme of flight. A graphic hand sketched illustration style was adopted using a contrast of bold and thin lines, referencing the notion of 'slipping out of control' from something structured to an organic image which flowed over the garment. This aesthetic works well in digital textile printing as lines can be fluid and free flowing, using varied thicknesses of pen. The use of colour gradation is an additional distinction between digital printing and traditional screen printing technique. Another design factor to consider was hue in relation to the application of colour onto already dyed merino. The base wool colours selected were a 2/28 count bone grey merino wool yarn because it would have minimal affect on the brightness of the dyes applied through printing.

Initial designs were made on computer and then, once sample prints were ready to be made, a colour swatch was produced. This showed how the colours would appear on the fabric. Consequently, the screen colour was adjusted to more accurately represent the physical printed colour. This usually resulted in changing the saturation of the colour on screen to one or two shades brighter, to show up more vibrantly on the fabric.

The final colour palette was selected to give further cohesion within the collection. Although digital printing is not limited to a set number of colours (unlike screen printing, where each colour requires one screen), it is still important to consider the range and number of colours for maximum visual impact and consumer appeal.

The selection of final garment shapes and prints was not an individual decision, but was made in consultation with a team of my supervisors and technicians who advised and gave feedback on the design and production decisions. A computer aided visualisation was produced before the knitting process was started. This utilised the 'virtual' design and prototyping capability of the *Shima SDS One* design programme.

The technical specification of the garments was developed with the T&DL's knitwear technologist, Gordon Fraser. The collection used two approaches to garment construction: Firstly, WholeGarment® designs which eliminate side seams, and secondly, fully fashioned garments, which require a post knitting construction process. These construction choices were made to showcase different design approaches that can be used with a digitally printed, knitted garment, as the construction of the garment is a factor influencing the placement of the print onto the garment. Specification sheets are used in industry to communicate between the

designer and machinist, or designer and knit technologist. They are important tools of communication between departments, and hold key 'physical' information, such as size, shape, yarn type etc.

Using the Shima interface, the garments were created as programming packages and exported to the design CAD interface to virtually simulate the knitted garment view. This is an area of knitwear technologist specialisation, involving the programming of the machines to create the desired garments. Because some of the shapes weren't traditional garment shapes already existing in the CAD garment shape library, the technologist had to create these manually by building 'packages' for the knitting machine to understand.

After the garment is processed by the computer the designer can use the same software (Design CAD) to produce a virtual view of the garment. The programmed designs can be virtually simulated with the correct yarn colour, gauge and yarn count, to show a finished knitted image of the garment before it has gone to the machine to be physically knitted. The textile print can then be 'virtually' applied to the garment through a technique called 'mesh mapping'. This places the print onto the garment by taking the shape, gauge and texture of the knit into consideration.

A number of designs were produced using the design interface of the Shima Seiki software to help visualise the end product. This process helped determine how the garment would look, allowing design modifications to be made before knitting a stitch. This process had some drawbacks when it came to simulating fuller, draped garments, due to limitations of the software. However, for print placement it was an effective tool to use as this work was being designed and created in a digital medium. This virtual simulation of the garment on a mannequin is also a useful technique which CAD offers. It is used through a 'template mapping' technique, which allows the garment to be fitted to the mannequin. With this version of the software I was unable to see a 'draped' version of this garment, though the new Shima Seiki 'Apex' Design CAD interface will support this sort of virtual view.

Visualisation techniques are helpful for designers to get a more comprehensive idea of the completed design. Being able to apply the print and texture of the garment is a lot more accurate than the two dimensional sketches traditionally used in this process.

These methods are also important tools in communicating designs to other people involved in the garment development process. Ideas can be abstract and hard to explain in words so these visual representations give a clear indication of the shape, colour and scale of the print the intended garment is to have.

The next step was the physical production of the garments. They were knitted, then pre-treated ready for print to allow binder chemicals to adhere to the yarns. Once dry, they were placed on the print bed in a cardboard former to keep the garment flat for the digitally printed design to be accurately applied. This particular garment used panel printing and was printed all over front and back. The print was designed so that the background image was forgiving across join lines in the garment. Due to the stretch and tension of knitwear, it can be difficult to get exact matches over seam intersections.



The garment was then taken through a heat setting process in a tunnel dryer to set the dye and the reverse side of the garment can be printed. This technique of printing is similar to an engineered print, as the print comes together at the seams. The other garments were either printed as placement prints, on front or back, or they were printed over seam lines. This happened on the fully fashioned garments, which were linked together on the shoulder seam and around the arm hole, then laid flat for printing.

### ***Post-printing treatment***

Due to the yarn being a natural protein fibre the post printing treatment for wool is different to that of a synthetic yarn. Wool is most commonly printed using a reactive dye which needs a more thorough post treating process. This is in contrast to pigment dye, which bonds better to synthetic fibres. The post-printing process for pigment inks is usually tunnel drying so no washing needs to take place. This difference in fixing processes affects the production costs of printed garments, due to extra time and processing acquired for reactive dyes. However, the 'handle' of reactive dyes is usually softer and fabrics feel more luxurious.

### ***Garment construction***

The two fully fashioned garments were first linked over the shoulder seams and the crown of the armhole, to get a more accurate print placement on the garment. They were then taped down onto cardboard and printed as usual, then afterwards sewn up down the side seams, also using a linker.

The other garments were whole garment designs, which came off the machine with no post-knitting construction required.

### ***Final garments completed***

The final collection was then styled with other winter merino garments and accessories to create six outfits, and a photo shoot was conducted to produce professional photos for research and promotional end uses. The next stage in the research process was an exhibition evening to which industry professionals and education staff was invited to.

### ***Exhibition of collection***

The final part of the project utilised the printed knitwear collection as a promotional tool to inform and to prompt industry feedback about digital print on knitwear in a New Zealand context. After the collection was produced it was set up in the display area of the T&DL at AUT University with fashion industry, post graduate students, and academic teaching staff invited to view the collection and give feedback on the results. The garments on show successfully displayed the innovative and practical application of this technology. However due to the limited numbers of attendees at the viewing, there was not enough feedback from which to draw conclusions and so another, more individual assessment was conducted. The collection pieces, a professional look book, and a questionnaire was taken out to selected knitting companies and designers to gather fuller, more comprehensive feedback.



*Figures 1-4.* Images are taken from the A/W 2010-11 Defining Flight lookbook, used to promote this collection. Model: Sarah Davidson, Photographer: Amy Yang, Stylist/Designer: Alysha Gover.

### ***Industry Survey***

As part of the research conducted throughout this project a survey was electronically sent out to thirty businesses around New Zealand to gain feedback from the industry about their perception and knowledge of print on knit. This survey was sent out whilst the collection was being completed, then afterwards the companies which replied to the survey were invited to view the collection and answer additional questions in a face to face interview with the researcher/designer.

### ***Survey Summary***

There were nine responses received out of the thirty companies or designers contacted. Of these, six companies were based in Auckland and one each from

Rotorua, Christchurch and Dunedin. Of these respondents three represented companies of five or less staff, one was from a company with more than ten staff and five were from companies with more than twenty staff.

Eight companies used some printing in their products. Of these, six companies had used screen printing in NZ, and three had used screen printing off-shore. Three companies had used digital printing in NZ and two had used digital printing off-shore.

When asked why they didn't develop their own original print designs for garments, three companies said it was too expensive, two said that it was not part of their style. One said they did not have the expertise and two added that they did not have ease of access to facilities. Seven companies were interested in learning more about digital printing, and two were not interested. Four companies were interested in learning more about placement prints on garments. Two were interested in engineering prints, three in pre-production sampling and two in digital textile design.

Eight companies used knitwear in their ranges. Five companies have knitwear manufactured in NZ, and four have it manufactured internationally. In relation to garment construction techniques, eight companies used cut and sew, five used fully-fashioned and three were also using whole or seamless garment technology. One company did not include knitwear in their range because available scales of production are too large.

Six companies had previously used print on knitwear in their collections; two had not tried to do this. Four of these companies were very satisfied with the results of print on knit, two were satisfied. Two companies had not used print on knit because of the additional cost involved.

Seven companies answered that they were aware of the whole garment knitwear development capability at the TDL at AUT University. Four companies were interested in finding out more about digital print on knit at the TDL, three companies were not interested. Three respondents were interested in design approaches for digitally printed knitwear. Two were interested to know more about whole garment knitting. One was interested in learning more about knitwear design using Shima Seiki CAD system. One was interested in learning about knitted accessories.

Five companies were interested in viewing the range of digitally printed knitwear specially developed for this research project to showcase innovative applications of print on knitwear.

The initial feedback gained from this survey helped gauge the level of usage in print on knit in the industry and how the promotional collection could be effectively used for industry visits. After the questionnaire was processed a further set of questions were developed to gain further feedback and opinions on the collection and a look book that was produced to provide images of the garments worn by a model.

### ***Feedback from Industry***

Visiting New Zealand based fashion companies and presenting the T&DL promotional range was an exciting and beneficial aspect of this project. As well as being an academically based project which informed my ongoing design

development, it was a valuable marriage between post graduate research and industry application. This was a practical 'bridging' of knowledge which allowed postgraduate research to be shown, speculated on and evaluated by people from industry.

Many businesses were not aware this technology was available in New Zealand and though many had heard of 'digital printing' some had no idea of the process or application involved in producing digital textile prints. This indicates a gap between the potential inherent in the new technology and the knowledge and confidence that NZ designers have in using it as a viable textile printing option. In spite of the T&DL's efforts over three years to publicise and involve industry in training sessions for both print and knit design and production this remains an issue. Several companies and designers were unsure of the way to go about designing prints let alone producing them. In such cases out-sourcing to a designer would be necessary which would increase costs even before the actual printing.

Cost was what most businesses brought up as the initial reason why they wouldn't use digital printing at the moment. This issue goes hand in hand with the lack of education about this product. Many place it in the realm of 'speciality applications' which means less people use it, leading consequently to affect the cost of production. Greater awareness and use of digital printing in the future would lead to more demand for the machinery and scales of production, and lower costs.

This is a different response, compared to the use of digital printing in an educational and research context. As students aren't so limited by cost or time efficiency, digital printing has taken on a highly experimental form of printing by university students. The limitless possibilities have appealed to fashion and textile students, who have produced many inspiring products to show the industry the commercial application of digital printing in the years to come. These technologically informed and capable students going out into industry is one of the best ways of challenging this lack of industry awareness and many projects have been brought to the T&DL by these graduates working in industry. There has also been interest in digital print technology for spatial design students, graphic design, visual arts, and product designers. Local artists and costume designers have also employed the facilities at the T&DL for print replication onto fabric for further extension of their work to a digital medium.

The contextual review of digital printing technology used overseas, detailed earlier in this report, shows that the market is picking up on these new technologies. In terms of the use of printing, interest is building in this area. In a few years it is likely there will be wider use of this textile application, which would mean production prices would be lowered due to higher customer demand. As universities like AUT are producing more students capable of using this technology, the change of traditional textile applications will start to shift into technology based applications. This will aid the integration of technology as future graduates are employed in the industry.

## **Conclusions**

This project was undertaken to promote digital print on knit design and to identify why New Zealand companies were slow to adopt digital print on knitwear. The project was located in the context of the relative strength of the NZ knitwear sector in relation to

other NZ apparel sectors, the exciting work that is beginning to be produced internationally using these technologies, and the opportunities offered at the Textile and Design Laboratory at AUT for industry learning and product innovation support. This research has been valuable in beginning to identifying levels of interest and specific issues affecting use and understanding of digital print and knit technologies in the NZ apparel industry. While the level of industry response to the general survey was not high enough to do any meaningful statistical analysis, this was only one aspect of a multi-stranded project that also involved an international and national review of current uses of digital print and knit, the design and development of a demonstration collection of printed knitwear with follow up viewing and interviews with selected designers and companies, and a conference paper presentation at a symposium with industry feedback.

The enthusiasm that the NZ fashion industry has towards new technologies was evident in the research. Eighty percent of companies interviewed clearly indicated that they could see the value of uptake in this technology. However cost factors inhibit use – production costs are always a factor in the NZ apparel industry where smaller scales of production mean that overheads have to be tightly controlled. This would seem to be exacerbated by the current economic downturn which is making companies reluctant to pursue commercial applications of new production methods.

As the questionnaires indicated, the majority of companies contacted would be interested to learn more about these areas of digital textiles in relation to their work. The T&DL offers educational facilities and expertise to industry through short courses about these technologies and introductions to the process of digital textile design. While knowledge of the T&DL was widespread, understanding of what was available regarding training and support for product development was not as high, indicating that despite considerable publicity and profile there is still work to do in making industry aware of how the T&DL can support fashion and apparel design companies, and the opportunities offered by these new technologies. The T&DL also functions as an experimental laboratory in running initial print samples, or trying innovative ideas. Through this medium of 'on demand' printing at the T&DL, businesses can try out ideas and print development, without large expenditure of time or money to see how these applications may fit into their company aesthetic.

Producing tangible examples of how these new technologies can be innovatively used to provide distinctive knitwear design – as developed in this project- allowed designers to see and feel the potential of these new approaches. It also helped educate designers about the different ways print can work with a range of construction techniques, and how these different approaches affect production time and cost, as well as the distinctive aesthetic effects that can be achieved. It is anticipated that the information provided to designers through the specially designed knit and print collection, and the knowledge gained about the concerns and understanding by industry towards these technologies will lead to an uptake of interest, in the coming years, in these textile applications.

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**The Journal of Creative Technologies (JCT)**  
**Issue 1: Transmedia / Transmodality, 2011**

ISSN: 2230-2115

Colab, Auckland University of Technology, New Zealand  
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