

„SIMULATE, PRINT AND GO - DIGITAL ASSISTANCE FOR DESIGN, DEVELOPMENT AND PRINTING FOR CUSTOMIZED PRODUCTION“

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ABSTRACT

Development of virtual tools for applications within a collaborative framework of partner companies is quickly leading to smarter, hands-free production systems. These virtual tools offer the level of precision necessary to help the fashion and textile industries meet new demands for flexible production and profit from new business opportunities. Ongoing improvements will significantly boost value-added products and services in the areas of mass customization and industrial collaboration, with benefits for both consumers and producers.

Customers increasingly expect access to cutting-edge production options and these color management and print workflow modules build on the strengths of the Digital Textile Printing industry to deliver fast and flexible printed products. Accurate proofs and true-color prototypes combined with stable production results are signs of a maturing industry, and will build customer confidence. In addition, the features described in this document, show promise in terms of reduced ecological impact through increasingly stable, accurate and efficiently produced end products.

From the beginning to the end of the production cycle, new software features increase transparency and oversight, through virtual 2-D and 3-D simulations. Internal and external access to virtual samples and proofs streamlines production procedures. The one-stop-shop methodology for print-and-go processes, with comprehensive output files, ensures that all industrial partners have access to the same original data, reducing errors and repetition in the workflow.

Paired with web access, these tools can simultaneously give the industry access to smaller local markets, while supporting an efficient, streamed workflow and practical inter-factory production planning. The global current of supply and demand is shifting, but implementation of these innovative practices and technologies will ensure that the European fashion and textile industries remain essential.

1. Customer-interactive Design of Clothing and Fabrics

1.1. Objective

Design, production and distribution of small series fashionable goods for specific target groups require innovative consumer-driven environments for product design. The goal is to create a novel concept that supports the vision of an “empowered-to-design” consumer. A key building block of this concept is the availability of methods and systems for customer-interactive design of clothing and fabrics, which include a.o. colour management, and web-based data repository (=data management). Additionally, the integration of 3D scans into the development process chain for designing clothing is performed.

Clothing design is technically centered up to textile design and pattern CAD systems for garments. The introduction of 3D CAD and virtual garment modeling enables the designer to visualize the fit, physical and visual textile properties without a physical mock-up, as well as checking positioning, seam matching details or adding other design features (step 1-3 of the workflow in Figure 1 below).

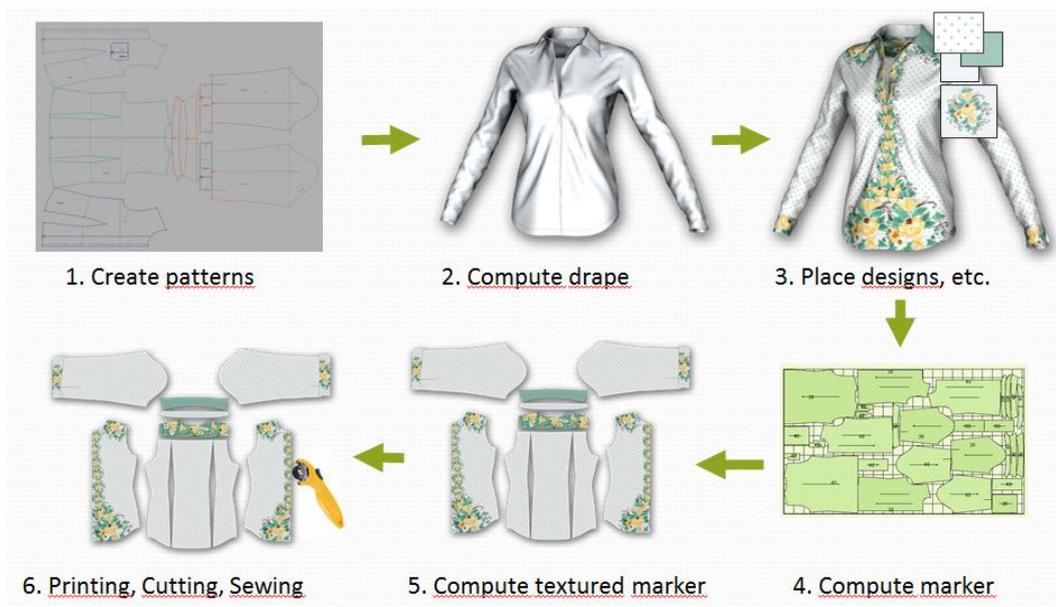


Figure 1: Basic workflow of customer-interactive design of clothing

After the final release of the product design the subsequent automated process steps of marker generation, creation of the print file and finally of digital textile printing are described (step 4-6 of the workflow).

2. CAD System, Automated Marker Making and Interfacing 3-D Development and Digital Textile Printing (DTP) Environment

The figure below illustrates the workflow and specific input and output details, which will be described in the following chapters.

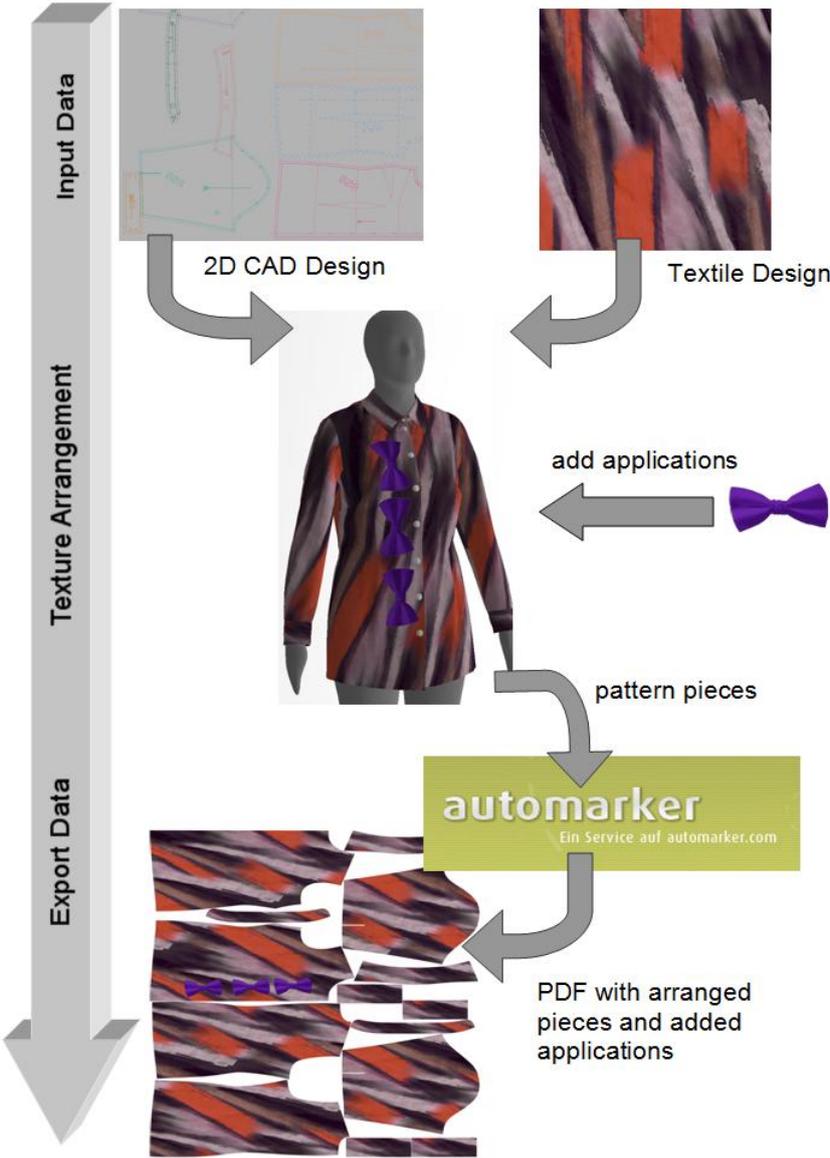


Figure 2: Overall workflow

2.1. Cad System and Interfacing Vidya

2.1.1. Input Data

Figure 3 shows the input data from two different CAD systems; the image on the left shows pattern pieces from a pattern development system while the image on the right shows a CAD system to develop decorative surface designs for textile printing.



Figure 3: Input data from different CAD sources

The process of combining a 2D CAD pattern with a textile surface design in a 3D cloth simulator program is simple. However, for accurate color simulation, the textile design file must be saved as a .tif or other file type, which uses the LAB color space. This guarantees best results when combined with the simulated textile texture. The user can then easily import the textile design using a two-click import, choosing between different image options like repeat, offset or rotation of the texture.

During importation, a smaller Jpeg image is made from the source data for easier use within 3 D simulation. The Jpeg file includes enough information for an accurate rendering but is much smaller than the full-sized image and therefore easier to work with. The original design file remains unchanged and will be accessed again at the end of the process when it's time to create the output data for printing.

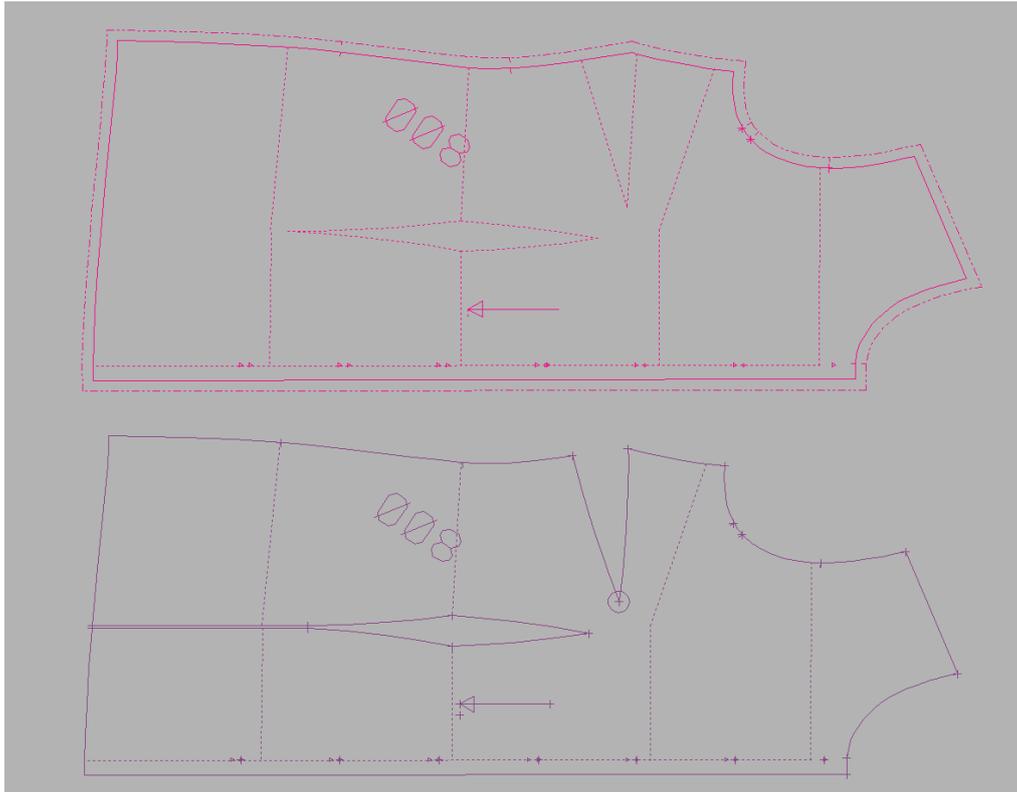


Figure 4: Pattern contour with and without seam allowance

The 2D CAD file includes all the necessary data about the pattern contours and sewing information, which are defined by 3D pre-position points in the simulation, called 3D Styles. In addition to the production pattern a simulation pattern is also needed to visualise the textile in the virtual 3D cloth simulation model. These simulation patterns are a slightly simplified version of the production pattern (See Figure 2). For example, the 3D simulation needs a pattern contour without the seam allowance and some special handlings to represent tuck elements shown in Figure 4.

At the top of figure 4 the production contour of a cloth piece with seam allowance is shown (dotted lines around the piece) and below, a slightly simplified simulation pattern contour. Both will be stored; the below contour for simulation, the above contour for the production-ready export.

The result of the 3D Style and the 2D CAD design is one XML file. With these two input data, the 3D cloth simulation can combine the textile surface design with 2D CAD design information into one production-ready layout.

2.1.2. Texture arrangement

After loading the 2D CAD design and the textile design information in the 3D simulation tool, the simulator will display all pattern pieces in the 3D scene.

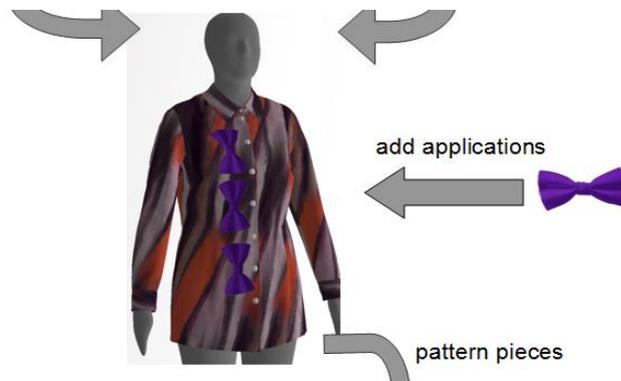


Figure 5: Texture and application arrangement

For a better visualization in the figure we use a strange colour and application in the example. Designers are not likely to do it in this way.

The pieces which can be simulated will be positioned around the body of the avatar and are “sewn” together. For these pieces, the user can also change texture elements like the repeat of the surface pattern, or add and remove applications on top of the textile design, such as this purple bow (see Figure 5).

After all elements are correctly laid out and ready to go into production, the virtual garment can be sent to an automatic marker layout tool (here: automarker.com) for correct layout of the pattern pieces.



Figure 6: Example of pieces which were not simulated

Figure 6 shows the strategy for non-simulated pieces. These pieces are added next to the avatar for changing the texture arrangement and adding applications and at the end all pieces will be included in the printed marker for production.

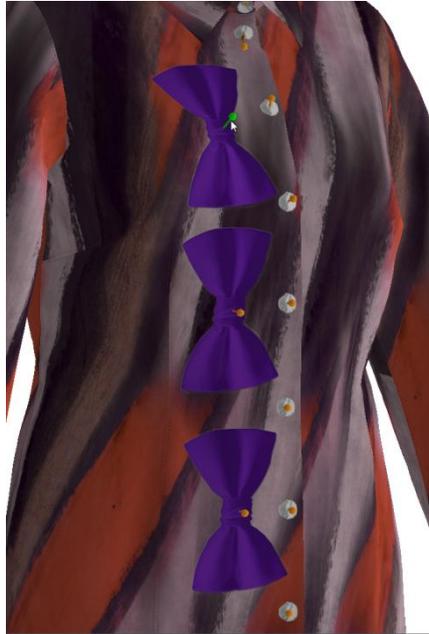


Figure 7: Simulation with added application

Figure 7 shows added applications to the virtual garment which will be combined with the textile surface design for the garment when exported.

2.2. Automated marker making for print-and-go simulation

The incorporation of an automatic marker system e.g. AccuNest from Gerber, Optiplan, Lectra or automarker.com from Assyst, into the virtual workflow leads to an automated marking setup. Using this tool, CAD files and cutting markers can be combined to:

- Reduce manual tasks and the risk of operator error
- Optimize fabric consumption
- Manage settings to simulate the print-and-go process
- Set limit options for each piece or for the whole pattern
- Eliminate information and tags of the marker
- Calculate and report fabric usage

The subsequent workflow describes the seamless process integration between Vidya and automarker.com.

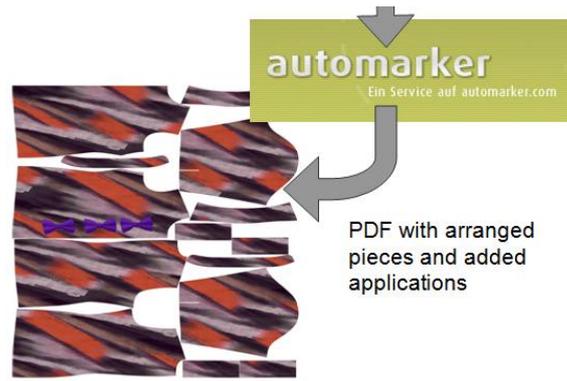


Figure 8: Process integration between Vidy and automarker.com

After optimization the marker making service sends the arranged pattern back to the user, including a transformation vector and a rotation matrix which has been calculated for the given garment. The 3D simulation tool uses this information to merge the simulation and the production pattern into a print-ready PDF file.

This transformation must consider the movement of the surface design repeat point within the Vidya texture. The same must be done for any additional decorative applications (such as the purple bow) which are added onto the garment.

The next figure shows the whole procedure.

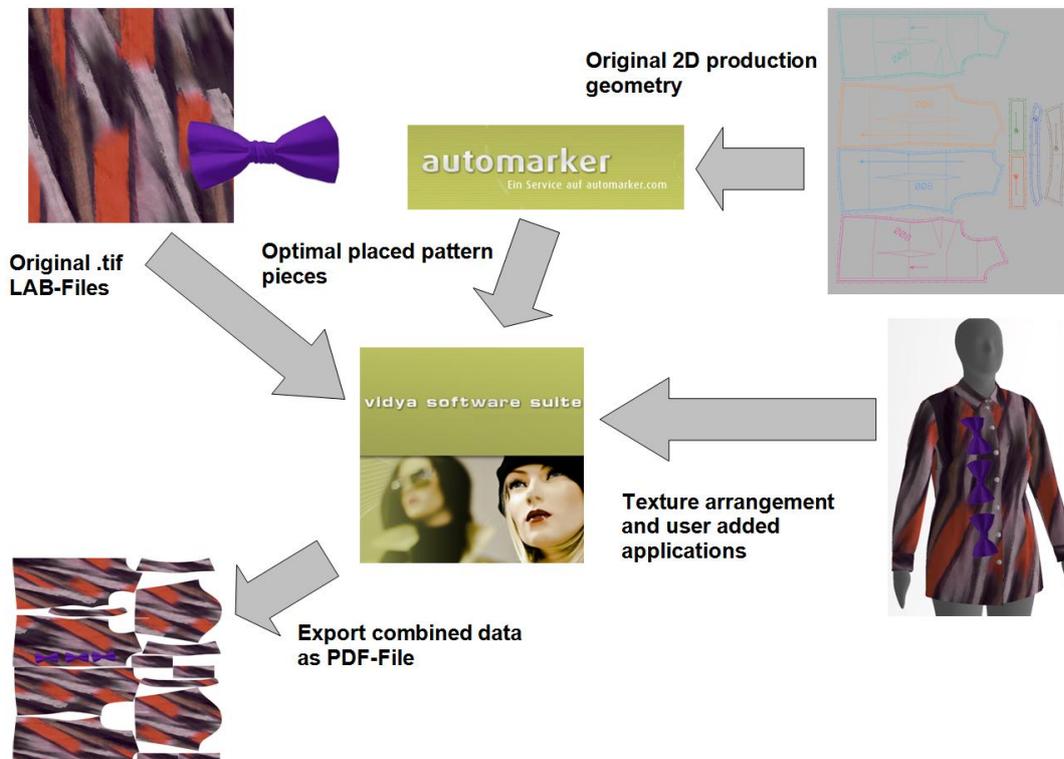


Figure 9: Generation of the PDF file for digital textile printing

The 3D simulation tool combines the original textile design data with the arranged production pattern pieces, the user texture arrangement and added applications into one PDF-File.

This guarantees that the pdf output contains the original LAB design file from the import and represents a correct visual and colorimetric representation of the textile design into the original 2D CAD production geometry.

2.3. Single Ply Cut for Print and Go Process Simulation

Within the print-and-go workflow, automated material spreading, cut part identification, and single-ply cutting are key technologies. To be able to apply these tools to mass production of individualized garments, compensations must be made for the dimensional instability of the printed textile. While dimensional shrink rates are included in the print environments of the digital printing facility, some additional movement must be anticipated during post-treatment.

Therefore, one requirement within the cutting process is to match and cut pieces while taking the shrinkage of a fabric into account. A projection and algorithms which help to optically control thread-to-thread accuracy reduce manual effort and miss-cuts. Also automated is the action of establishing pattern piece locations on a textile based on their relation to a set pattern point. Using a combination of optical devices and algorithms cut-part quality is optimized with reduced manual effort. Solutions on the market to match and cut files are offered e.g. from Topcut Bullmer, Zünd and Gerber.

Adaption of this functionality will be used to demonstrate automatic single ply cutting.

2.4. Generate Production Pattern and Output Files for different devices

With the automatic marker making service it is possible to simultaneously create any number of markers regardless of their complexity. The output data, which includes production markers as a part of print-and-cut files, can be converted for different printer or cutter devices. These files can also be exported and communicated to remote production sites.

Following figure shows the complete development and production (inkjet printing) workflow for the “Simulate, Print and Go” prototype dealing with the topic “color”.

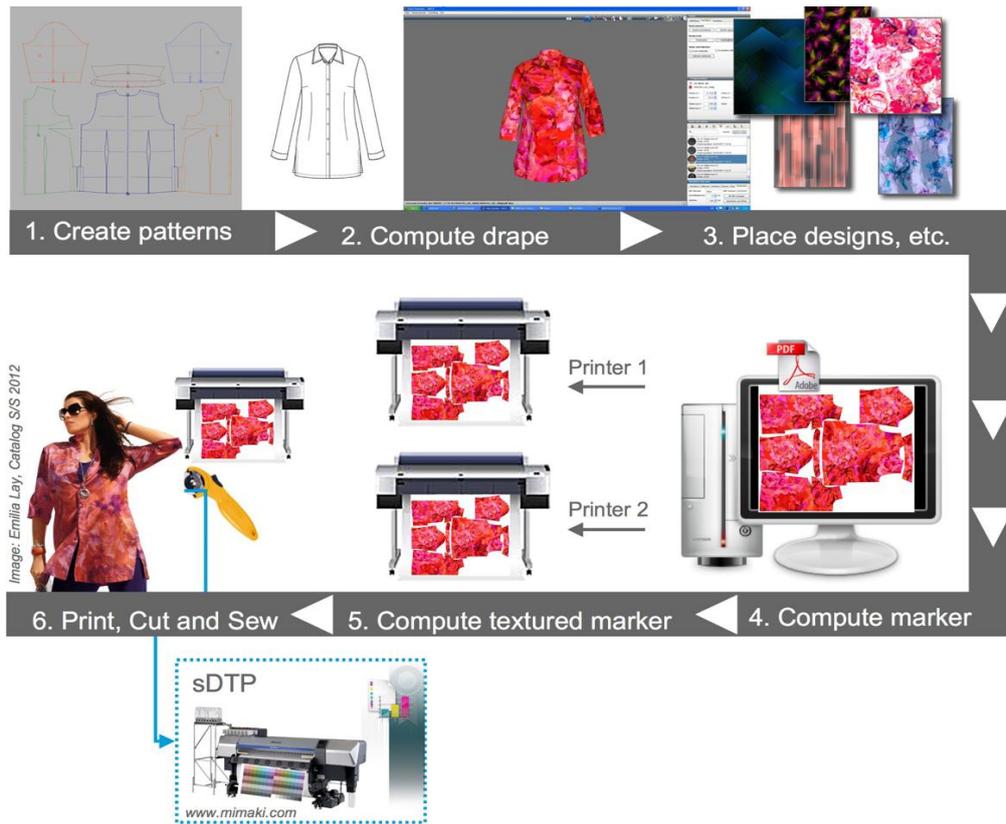
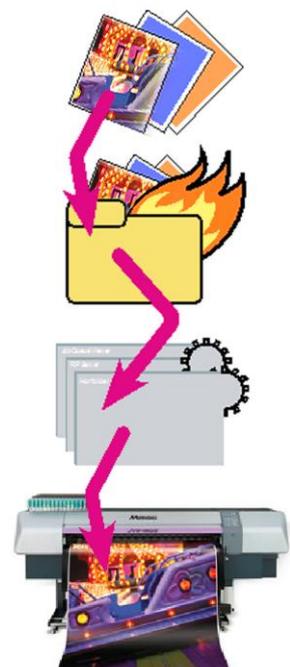


Figure 10: Overall workflow CMM visualization and inkjet printing

The result of the positioned textile designs on the pattern pieces of the 3D simulation is a print file embedded in the PDF.

The output file for DTP (picture and meta information) allows an image and xml file to circumvent many of the manual steps shown above through automation. The Job Composer from Ergosoft runs as a background program, scaling and placing single or multiple images, defining repeats and production length, choosing rendering intents and setting cut markers within a common print/cut environment; all without manual interference.

The textile composition and post treatment process has an influence on the dimensions of the final result. To combat this, the dimensional shrink and expansion rates for a given textile must be measured during testing and the result included in the print environment. The transformation will then be automatically counteracted in the print dimensions.



3. CONCLUSION

Development of virtual tools for applications within the textile and fashion industry is leading to smarter, more streamlined production systems. These virtual tools offer the level of precision necessary to help the fashion and textile industries meet new demands for flexible production and profit from new business opportunities while engaging with new market sectors. Ongoing improvements will significantly boost value-added products and services in the areas of mass customization and industrial collaboration, with benefits for both consumers and producers.

In addition to revolutionizing the workflow for small production runs, the Simulate, Print and Go process incorporates custom design more fluidly into the production process, giving customers the benefit of cutting-edge production methods while keeping quality high. Reliable virtual proofs and stable production results bolster customer and designer confidence while the reduced ecological impact of virtual prototyping and digital printing appeals to many sectors.

The digital SPC workflow increases transparency and oversight throughout production and simplifies the development process through use of integrated 2D and 3D virtual models. Paired with web access, these tools can simultaneously give the industry access to smaller local markets, while supporting an efficient, streamed workflow and practical inter-factory production planning. These new technologies offer pertinent solutions for an evolving global textile and fashion market and help to ensure that the European fashion and textile industries remain essential.

DITF-MR Denkendorf:

The Centre for Management Research (MR) is part of the German Institutes for Textile and Fibre Research Denkendorf. On current issues such as innovation management, knowledge management, production management and logistics, our approach consists in transferring best practices to individual companies and to value-added networks within the textile and clothing industries and their partners.

Assyst GmbH, Munich

Assyst is a leading provider of expert, value-add IT systems for innovation monitoring and process control in the fashion and interior industries.

ErgoSoft AG, Altnau (Switzerland)

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