Committee of Management

Proceedings

Nairobi, Kenya
September 8, 2018
Committee of Management

Committee of Management members from the following countries attended the meeting:

Austria
Brazil
China
Chinese Taipei
Egypt
Germany
Hong Kong, China
India
Indonesia
Italy
Kenya
Korea Rep.
Netherlands
Pakistan
Portugal
Spain
Switzerland
Turkey

ITMF Officials:
Director General
Economist

In the Chair:
Jaswinder Bedi (Kenya)
President of ITMF
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Attachments

document no. 1 Spinners Committee Meeting: Report by Mr. Wolfram Daubek-Puza on the ITMF Spinners Committee Visit to Lenzing/Austria in March 2018

document no. 2 Spinners Committee Meeting: YESS Survey

document no. 3 F&A Meeting: Presentation on Filament Cotton Yarn from Recycled Cotton Gerrit Bouwhuis, Saxion - University of Applied Sciences, Netherlands

document no. 4 F&A Meeting: Presentation on Digital Printing & Finishing Marc van Parys, UNITEX – TexZeppelin, Belgium
Opening Remarks by the President

The President of ITMF, Mr. Jaswinder Bedi (Kenya) welcomed the participants of the meeting and thanked everybody for attending the Federation’s Annual Conference 2017 in Bali/Indonesia. He thanked especially the Indonesian Textile Association (API) for successfully hosting the conference for the first time in Indonesia.

Proceedings of the Last Meeting

The Proceedings of the last meeting of the Committee of Management of ITMF, held in Jaipur, India, on November 18, 2016, were duly circulated on February 24, 2017 and were approved by way of correspondence.

Matters Arising of the Previous Meetings

There were no matters arising from the minutes other than those included in the agenda.

Appointment of Auditors, Solicitors and Bankers

The following appointments were confirmed:

Auditors: Universe (AG für Unternehmensberatung und Revision), Zürich
Solicitors: Dres. Pestalozzi Lachenal & Patry, Zürich
Bankers: Credit Suisse, Zürich

Financial Report by the Honorary Treasurer

The report on the financial position of the Federation at the end of 2017 was presented by Mr. Peter Gnägi (Switzerland), Honorary Treasurer of the Federation.

The Balance Sheet and the Income Statement as authorized by Universe, Zürich, were circulated to the Members of the Committee on April 29, 2018 and approved by way of correspondence.
**Balance Sheet 2017**

The Federation's **Assets** stood at CHF 1,061,209 (+145,546).

The balance sheet is sound: **Provisions and Funds** stood at CHF 1,034,646 (+150,606).

**Income Statement 2017**

The **Total income** (without the conference gain) was CHF 775,855 (+45,819). The main reason was the Net Investment and interest income of 117,817 (+90,727), which over-compensated the change in total membership fees of CHF -39,260.

The **Total expenditures** were CHF 671,718 (-22,708).

The Federation’s **Total gain** amounted to CHF 150,607 (+114'417). The conference gain contributed by CHF 46,470 (+45'889).

It is proposed that for 2019 the basis of calculation of **Member Associations’** subscriptions remains unchanged:

- The minimum levy shall therefore remain CHF 4,000.
- The maximum levy shall therefore remain CHF 57,000.
- Subscription which fall between the upper and lower limits shall continue to be calculated according to the subscription formula based on an unaltered unit rate of CH 0.065064.
- No Member Association shall pay a subscription representing less than 60% of total national yarn production by the spinners, and consumption by the weavers, in the cotton-system sector.

It is also proposed that **Associate Members’** levies shall for 2019 to be unchanged as follows:

**Textile Associations**

CHF 15,000  
Taiwan Textile Federation

**Cotton Associations**

CHF 7,000 each  
American Cotton Shippers Association (USA)  
Cotton Incorporated (USA)  
International Cotton Association (UK)  
National Cotton Council of America  
Texprocil (India)

CHF 5,000 each  
Australian Cotton Shippers Association  
Bremen Cotton Exchange (Germany)  
Supima (USA)  
XPCC Cotton Association (China)  
Cotton Association of India
Textile Machinery Associations

CHF 15,000  German Textile Machinery Manufacturers Assoc. (VDMA)
CHF 13,000  Italian Textile Machinery Association (ACIMIT)
CHF 12,000  Swiss Textile Machinery Manufacturers Assoc. (Swissmem)

Corporate Members shall pay an annual levy based on turnover, the minimum amounting to CHF 3,000 for companies with a turnover not exceeding USD 50 million. For a turnover between USD 50 and 200 million, the annual levy will be CHF 5,000 and for a turnover in excess of USD 200 million it will be CHF 7,000 (maximum).

The report by the Honorary Treasurer was unanimously approved by the Committee.

Report by the Spinners Committee

Opening Remarks by the Chairman

The Chairman of the Committee Mr. Andrew Macdonald (Brazil), opened the meeting with a few introductory remarks.

Report from the Visit to Lenzing AG in Lenzing/Austria

Mr. Wolfram Daubek, Lenzing AG, Austria, presented a report about the visit of the ITMF Spinners Committee on March 17, 2018, when three members visited Lenzing AG, a producer of cellulosic fibres from wood pulp, in Austria (see attached document no. 1).

ICA’s Cotton Consumers Committee

The meeting was informed by the Chairman, Mr. Andrew Macdonald, about the activities of the “Cotton Consumer Committee” of the ICA which is also chaired by Mr. Macdonald. He reported that the Cotton Consumers Committee had the objective of strengthening the Spinners’ voice within the ICA. Over the past few years it was able to achieve some positive results like

Additional discounts for delivery of qualities below the contracted quality

Removal of the tolerance on results of micronaire testing

but there was still much to be done

To this end, as progress was so slow, due to the involvement of non-members, the Committee was being disbanded and new one being formed with a slightly changed mandate, and only Members of ICA would be eligible to sit on the committee.

Mr. Macdonald encouraged the members of the ITMF Spinners Committee to endeavour to join ICA as a member, so that they would be able to participate in these discussions about problematic trade rules which should be reviewed and possibly altered. Furthermore, he
invited everyone to assist in identifying spinners who might join and contribute to the work of this new Cotton Consumers Committee.

Traceability

The meeting was called upon to discuss the need for traceability of cotton upland varieties.

The meeting believed that traceability on paper is already a reality in some countries like Australia, Brazil, China or the USA. However, true physical traceability will grow in importance as it will provide relevant information about the origin of the cotton, to ensure the industry and consumers, that the product purchased is actually manufactured from a specific region or produced under specific conditions, like Organic Cotton or BCI as examples. The use of these systems to protect the long staple industry with false claims about products declared to contain or be manufactured with a specific type or origin of the cotton, are already active.

The meeting agreed that traceability will grow in importance, but it needs to be seen which traceability technologies can be successfully implemented. However, the meeting acknowledged that for small holder farmers traceability at this stage might not be affordable.

The meeting also discussed the alternative to costly traceability for Identity Programs such as BCI or Made in Africa which is based on Mass Balance. While the mass-balance system provides the cotton textile value chain, especially spinners, with more flexibility, the full traceability systems guarantees that consumers buy and wear the type of cotton they prefer for whatever reason.

The point was raised that in some countries spinners have to pay an additional 0.75-1.00 US cents per pound for BCI cotton, as retailers/brands are demanding product produced with BCI-cotton, without a premium, whilst the farmer or producer does not receive such a premium. It was suggested that ITMF might take up this complaint with BCI.

Stickiness

The Chairman pointed out that stickiness is an enormous problem for cotton spinners as there is no compensation for sticky cotton delivered under the current cotton contract rules. He therefore advised that the various testing methods are being verified by the ITMF International Committee on Cotton Testing Methods (ICCTM) together with ICA-Bremen (Germany) and CIRAD (France). While there are currently more than 10 different methods to identify sticky cotton, there is not a method that is accepted as a reference method, to allow identification in a uniform manner.

The meeting agreed that testing cotton for stickiness is a must, and that the need for a reference method as well as affordable testing instruments is a given. The Committee agreed to support the efforts of the ITMF International Committee of Cotton Testing Methods (ICCTM) to identify a reference method.

In this context, the spinners were encouraged to participate in the round trials conducted by CSITC and on the round trials on stickiness, currently being undertaken. For more information about the round trial results 2017, see the ITMF-Website: https://www.itmf.org/committees/international-committee-on-cotton-testing-methods.
International Committee of Cotton Testing Methods (ICCTM)

The Chairman emphasized the importance of the ITMF-ICCTM. As could be seen in the discussion about stickiness, there is the constant need to improve testing methods and to develop testing instruments which allow the spinners to make best use of the cotton.

Yarn Prices Differences between Countries

The meeting was called upon to discuss the reasons for significant yarn price differences for 20s and 30s as published by Cotlook. As can be seen in below table the prices for yarns can differ significantly:

<table>
<thead>
<tr>
<th>Source</th>
<th>Cotlook</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quarterly average export prices</strong></td>
<td>(in USD dollars per kg FOB)</td>
</tr>
<tr>
<td>20's yarn</td>
<td></td>
</tr>
<tr>
<td>Q2/17</td>
<td>Q3/17</td>
</tr>
<tr>
<td>China</td>
<td>3.17</td>
</tr>
<tr>
<td>India</td>
<td>2.50</td>
</tr>
<tr>
<td>Indonesia</td>
<td>2.56</td>
</tr>
<tr>
<td>Pakistan</td>
<td>2.40</td>
</tr>
<tr>
<td>Turkey</td>
<td>2.92</td>
</tr>
<tr>
<td>Index Group</td>
<td>2.73</td>
</tr>
</tbody>
</table>

In the discussions it was argued that the differences between yarn prices are the result of numerous factors like import tariffs/duties for yarns or different supply and demand situations.

The ITMF Secretariat was asked to make inquiries about possible reasons for such differences.

YESS-Survey Results

The Chairman informed the Committee about a survey (see document no. 1) published by YESS: Yarn Ethically & Sustainably Sourced. YESS is a spin-off of the Responsible Sourcing Network (RSN).

The survey’s questions covered the following areas:

- Sourcing sources
- Transaction documentation
- Speciality cottons
- Mixing of cotton
- Spinning technologies
- Recycling
While the results of the survey are quite informative, they are not really representative with only 15 respondents.

**Next Activity**

The Members of the Committee discussed possible activities in 2019. It was suggested that in the coming months the Chairman together with the ITMF Secretariat make a suggestion for a country visit.

**Any Other Business**

Mr. Kai Hughes, Executive Director of the ICAC, informed the Committee about an agreement between the ICAC Task force, CSITC (Chaired by Mr. Macdonald) and Uster Technologies regarding the promotion of CSITC. For every new instrument sold, Uster Technologies will pay a 2-year’s subscription to take part in the CSITC round trials, and in India one year for existing instruments.

**Next Meeting**

It was proposed that the next annual meeting of the Committee will be held in conjunction with the ITMF Annual Conference 2019 (October 20-22, 2019).

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**Report by the Joint Cotton Committee (JCC)**

**Panellists:**
- **Moderator:** Nick Earlam, JCC-Chairman, Plexus (UK)
- **Grower:** Jeff Elder, J. G. Boswell Company (USA)
- **Ginner:** Suresh Kotak, Kotak Ginning & Pressing Industries (India)
- **Cotton Expert:** Wolfgang Bertenbreiter, GIZ (Germany)
- **Trader:** Henning Hammer, Otto Stadtlander GmbH (Germany)
- **Spinner:** Suresk Kumar Khandelia, Sutlej Textiles and Industries (India)
- **Spinning Machine Producer:** Pia Terasa, Saurer (Switzerland)
- **Retailer:** Aysegul Postoglu Gumus, IKEA (Turkey) *

* Ms. Aysegul Postoglu Gumus replied to the questions in writing as she did not arrive on time in Nairobi to participate in the panel discussion.
Opening Remarks by the Chairman

The meeting has been opened with a few introductory remarks by the Chairman of the Committee, Mr. Nick Earlam (UK).

Panel Discussion: “Transparency, Traceability, Sustainability – What is the Future of Cotton?”

Q1: At an estimated cotton consumption this coming year of nearly 27 million tons which will finally surpass the best figure achieved before the Financial crisis do you think that this continued uptrend is here to stay and if so why? And if not why?

Mr. Elder talks about a contradiction in the future of the cotton industry. He explains that cotton farming is not profitable enough to meet the future demand (which he expects to grow).

Mr. Kotak is optimistic about the future of cotton for two reasons. First, the sustainability trend pushes people toward cotton. Second, the cotton industry is evolving toward more responsible production.

Mr. Hammer explains that the global demand for fibres will increase, such as cotton consumption. He sees a chance for cotton to regain market shares despite that competition with other crops is challenging.

Ms. Gumus: Of course, we do not hold the crystal ball of the future, but we don’t expect, this trend to last. The reason is that in coming years there will not be enough cotton available to meet the growing demand. In the past few years, Chinese inventory have filled in the gap in demand and the gap in supply.

Further, with a general low global level of “carry forward” stock from previous year, the price of cotton will go up. As a consequence, the consumption might move towards man-made fibre. Unless, we manage to use recycled pre and post-consumer cotton textile, the gap between supply and demand could continue to grow.

Q2: The sustainability and environmental issues currently surrounding man-made fibres have had a profound effect on the price of man-made fibres and perhaps some usage. In view of the fact that these environmental issues seem here to stay, that man-made fibre represents about 70 percent of the fibre market and that it is virtually impossible for cotton to regain its percentage market share of earlier years, how do you see the man-made fibre market performing in having to address these issues in the coming years?

Mr. Khandelia explains that less than 1% of all trees is used in the cellulosic fibre industry. He states that about 1% of oil is used in the synthetic fibre industry. At the same time, there is not enough land to grow cotton. Man-made fibres (MMF) has a future because its production has not special constraint, requests less water than cotton, and requests less energy due to shorter production processes and a shorter product cycle. He also mentions two more advantages of MMF over cotton: price of MMF is lower than that of clean cotton and synthetic fibres can be produced from...
recycled PET. He concludes by saying that he does not see both fibre categories and substitutes but complement. 

Ms. Terasa reminds that at the ITMF Annual Conference 2016 in India, a major retailer mentioned that polyester is not sustainable, especially because of concerns about microfibres. Hence, the future orientation of the market toward one category or another is not clear. For machinery producers, the flexibility of the equipment in treating different fibres is important to follow the future demand of the market. She also mentions that cotton needs to reinvent itself to better fit the market requirements.

Mr. Bertenbreiter explains that cotton grows in many places where other crops don’t. Worth to mention is also that sustainability should account for cotton by-products too. And finally, a growing trend in the market (especially in Germany) is integration of cotton farming by companies in the downstream cotton industry with the aim to increase control over sustainability along the value chain.

Q3: It would be of great interest to hear from our machinery manufacturers how they see the future of cotton. Is Spinning cotton here to stay forever or are there other technologies which can materially alter the process? Indeed, is cotton the fibre that would be used? We see today digital printing straight onto greige almost impossible to imagine a few decades ago – how will the whole process develop further in the coming decades?

Mr. Khandelia says that machinery manufacturer need to create machines that are flexible enough to access various fibres.

Ms. Terasa answers that machinery manufacturers are putting effort on cotton and spinning preparation, so cotton is still a focus. However, new technologies are coming. 3D printing has made its proofs lately, but the adoption of new technologies depends on customer needs (i.e. 3D printing vs. mass production), sustainability, and traceability of yarn within the whole production process.

Ms. Gumus: At IKEA we believe that we, together with other brands, have an important role to play. As mentioned above, man-made fibres will continue to play an important role. At IKEA we are committed to work towards sourcing of more sustainable man-made alternatives. IKEA wants to source made cellulose fibres coming from well managed feedstock that are produced under more sustainable conditions. We are also moving from virgin fossil-based polyester towards rPET and, in the future, bio-based polymers.

Q4: Cotton has battled negative press since I became involved in the Industry over 40 years ago and has made enormous strides in reversing that image, but it still battles it. We have BCI, CmiA and numerous other smaller sustainability programs but they are mostly based on the mass balance system, which many people would argue is a good beginning for sustainability but very broad-based and lacking in comparison to something such as the Supima program.
which was started in 1954 and where everybody along the whole supply chain is traceable.

Ms. Gumus: Since 1st September 2015, all the cotton used for IKEA products comes from more sustainable sources. This means that the sustainable cotton we use, compared to conventional cotton farming, is grown with less water, chemical fertilisers and pesticides, while increasing profit margins for farmers. Today we have 77% BCI cotton in our sustainable cotton portfolio and has adopted a different approach than Mass Balance. Our requirement is that sustainable cotton, used in our production, is segregated and traceable all the way from IKEA product to fibre. IKEA went for physical traceability to be able to offer our customer a product with 100% sustainable cotton.

We have large retailers saying that they will be 100 percent organic by 2020 – Retailers that consume between them 750,000 tons of raw cotton - yet the world production of organic (and some of that is dubious) is only 130,000 tons.

Ms. Gumus: We don’t comment on ‘organic cotton’ and ‘goals’ of fellow retailers regarding ‘organic cotton’. On our side we are following the development of organic cotton and continuously evaluate the benefits and challenges compared to for instance BCI.

We have buying departments of major brands whose Buyers are totally incentivised to profitability rather than to impact, who pay lip service to sustainability but do nothing to further it. Of course, there are famous brands such as Patagonia and others who are serious about it – but is it mainstream?

Ms. Gumus: We are totally committed to ‘sustainable cotton’ and within our portfolio, BCI is by far the biggest. Our engagement is all the way up to farm. In recent years, apart from supporting Better cotton farm projects, we have extended the scope and engaged with water stewardship, agro-forestry and bio-diversity. This would create the right pre-conditions to be able to produce ‘sustainable cotton’. As we reach further back and influence the value chains we believe that we are part of influencing the supply chains towards more responsible sourcing. At IKEA we make our decisions based on five parameters: cost, quality, sustainability, form and function.

Is it possible to move beyond this to something the world can be truly proud of or is it something that will be continually fudged?

Ms. Gumus: We are perennial optimists, we can and should work together to reach further. To succeed we need to join forces in the whole value chain with everybody taking responsibility.

Mr. Bertenbreiter tells about a need for recent studies on water consumption and use of pesticides to rehabilitate cotton as a sustainable crop. He also mentions that standards are sometimes confusing due to competition amongst standard holders. Actors of the industry need to work together to solve that. Furthermore, traceability is important and there is a real demand for hard identity. But are industry players ready to comply? Finally, sustainability is a matter that touched the whole value chain. Retailer also must invest upstream if they want, for example, organic cotton to be a tangible product.
Mr. Earlam says he uses traceability back to the farm. He is ready to pay for it (decrease own margin) because he cannot push down its cost to his customers. Supima, for example, has also invested in this technology.

Mr. Hammer also says that the demand for sustainable cotton growing. In his view, however, cotton is mostly sustainable. What is missing is certifications.

Mr. Kotak concludes that cotton is a mass fibre with great economics. Being Bi-component fibre with tremendous backward integrations possibilities on cotton seeds and its derivatives.

Ms. Gumus: Since 1st September 2015, all the cotton used for IKEA products comes from more sustainable sources. This means that the sustainable cotton we use, compared to conventional cotton farming, is grown with less water, chemical fertilisers and pesticides, while increasing profit margins for farmers. Today we have 77% BCI cotton in our sustainable cotton portfolio and has adopted a different approach than Mass Balance. Our requirement is that sustainable cotton, used in our production, is segregated and traceable all the way from IKEA product to fibre. IKEA went for physical traceability to be able to offer our customer a product with 100% sustainable cotton.

Additional questions from the floor:

Q: What is the point of organic cotton?

Mr. Bertenbreiter says that the cotton fibre is part of a farming system. Hence, the farming system must be organic for the fibre to be organic. Organic cotton alone actually makes no sense, as organic cotton is not grown as monoculture.

Q: To what extent is cotton recycling a threat to cotton growing?

Mr. Bertenbreiter says that recycled cotton is used for specific applications like blanket and shouldn’t therefore be considered a threat.

Mr. Simeoni adds that the use of cotton in the non-woven industry is endless because it does not imply spinning.

Ms. Terasa adds that major developments are going on to allow an increased use of shorter fibres in spinning.

Q: What is the cost of per pound of soil-based system?

Mr. Elder says about USD 0.50 a ball, or about 10 points.
Presentation about and Demonstration of “The COTTONHAND App”

Mr. Walter Simeoni (The COTTONHAND, South Africa) has presented a new app that provides smallholder farmers with relevant information on their fingertips. More information can be found here: http://www.thecottonhand.com/

Any other business
None

Report by the Fibres & Applications (F&A) Committee

Opening Remarks
The Chairman, Mr. Loek de Vries (Netherlands), opened the meeting with a few introductory remarks.

Presentation on Filament Cotton Yarn from Recycled Cotton
Gerrit Bouwhuis, Saxion - University of Applied Sciences, Netherlands (see attached document no. 3)

Presentation on Digital Printing & Finishing
Marc van Parys, UNITEX – TexZeppelin, Belgium (see attached document no. 4)

Activities in 2019
The ITMF Secretariat will inform in due time about activities planned in 2019.

Next Regular Meeting
The next regular meeting of the F&A-Committee will be in conjunction with the ITMF Annual Conference 2019 which will be held from October 20-22, 2019 in Porto/Portugal.
Report on the ITMF Audit Initiative

This Committee Meeting was transformed into a General Session (“ITMF’s Audit Initiative” on September 9 (open to all delegates) during the ITMF Annual Conference in Nairobi/Kenya.

Membership

Since the last meeting of the Committee of Management in September 2017 the following changes in the composition of the ITMF membership took place:

**ENTRIES:**

1. 88Spares (Indonesia, Corporate Member)
2. API (Indonesia, Associate Member)
3. Archroma (Switzerland, Corporate Member)
4. A.T.E. (India, Corporate Member)
5. Dan Liris (Indonesia, Corporate Member)
6. Duniatex (Indonesia, Corporate Member)
7. Kewalram (Indonesia, Corporate Member)
8. Lubhoo (Nepal, Corporate Member)
9. Pan Brothers (Indonesia, Corporate Member)
10. Saurer (Switzerland, Corporate Member)
11. Sritex (Indonesia, Corporate Member)
12. Sutlej Textiles (India, Corporate Member)

**WITHDRAWALS:**

1. TFIA (Australia, Member)
2. Hunan Yujin Group (China, Corporate Member)
3. Siyu Group (China, Corporate Member)
4. Deneb (South Africa, Corporate Member)
5. U.I.T. – French Textile Industry Assoc. (France, Member)
Date and Location of ITMF Annual Conference 2019

Mr. Bedi informed the Committee of Management that the Federation’s next Annual Conference will be held in Porto/Portugal from October 20-22, 2019.

The Committee of Management welcomed this invitation very much and thanked the Associação Têxtil e Vestuário de Portugal (ATP) for having invited the ITMF membership to convene in 2019 in Portugal.

Election of Honorary Officers

The Committee elected unanimously the following Honorary Officers for a term of two years as Executive Board Members:

- President: Kihak Sung (Korea Rep.)
- Vice President: Ruizhe Sun (China)
- Vice President: K.V. Srinivasan (India)
- Honorary Treasurer: Heinz Michel (Switzerland)

The Committee re-elected unanimously the following Honorary Officers for a term of two years as Non-Executive Board Members (in alphabetical order):

- Rafael Cervone (Brazil)
- Loek de Vries (Netherlands)

The Committee co-opted unanimously the following Honorary Officers for a term of two years as Non-Executive Board Members (in alphabetical order):

- John Cheh (Hong Kong, China)
- Peter Gnägi (Switzerland)
- Muharrem H. Kayhan (Turkey)
- Andrew Macdonald (Brazil)

The Committee elected new Honorary Officers for a term of two years as Executive Board Members (in alphabetical order):

- Mohammad Kassem (Egypt)
- Juan Parés (Spain)
- Michelle Tjokrasaputro (Indonesia)

The new President, Kihak Sung (Korea Rep.) thanked Mr. Jas Bedi (Kenya) for his excellent and outstanding services as Vice President and President of the Federation during the past six years and presented to him an engraved silver plate. Mr. Jas Bedi (Kenya) was elected Honorary Life Member of the Federation.

Mr. Bedi thanked his colleagues on the Board for their continuous support during his term as ITMF President. The meetings and discussions were always held in an amicable and
productive atmosphere. He specially thanked Mr. Kihak Sung and Mr. Ruizhe Sun for their support as Vice Presidents and Mr. Peter Gnägi for his excellent work as the Federation’s Honorary Treasurer during the past six years and presented to him an engraved silver plate.

Concluding Remarks by the President

Mr. Jas Bedi (Kenya) thanked the members of the Committee for their trust and support in the past two years. The Annual Conference of the Federation in Kenya has shown that an international platform for the world’s textile industry is attracting industry leaders from the entire textile value chain from around the world. The conference provides a neutral platform for discussions on topics relevant for the industry and a unique networking environment. The Federation’s objective is and needs to be also in the future to provide the members with services that are informative, relevant and meaningful. He stated that “ITMF Audit Initiative” and the active engagement in the Social Labour Convergence Project (SLCP) has demonstrated that the Federation can and should get involved on issues and in activities that are relevant to the industry on an international level thus acting as the voice of the global textile industry. Finally, he invited everyone to convene for the ITMF Annual Conference 2019 in Porto/Portugal.

January 2019
ITMF Spinners Committee:
Visit of Wood based Cellulose Fiber Plant, Austria
16th/17th March 2018
Participants

- Andrew Macdonald (Brazil)
- Steven Chen (Chinese Taipeh)
- Walter Simeoni (South Africa)
- Peter & Regula Gnägi (Switzerland)
- Olivier Zieschank (ITMF)
- Christian Schindler (ITMF)
- Wolfram Daubek (Austria)
Schedule

• March 16\textsuperscript{th}:
  • Arrival
  • City Tour of Salzburg

• March 17\textsuperscript{th}:
  • Plant Tour Lenzing AG
    • Raw Material (Wood, Pulp)
    • Viscose/Modal production
    • Downstream processing of fibers
  • Spinning, Weaving, Knitting, Finishing
Fibers on the world market

From synthetic polymers:
- Polyester
- Polyamide
- Polypropylene
- Polyurethane (Elastan)
- Acrylic
- Polytetrafluoroethylene

From natural polymers:
- Cellulose-based
  - Cotton & bast fibers: Cotton, Flax, Hemp, Jute etc.
- Protein-based
  - Wool, Silk, Angora, Cashmere, Casein, Collagen, Ardein, Zein etc.

From anorganic substances:
- Carbon
- Ceramics
- Glass
- Metall

Wood-based:
- Viscose, Modal, Lyocell, Cupro etc.
Global fiber consumption in 2017\(^1\)

Worldwide consumption = 105 mn. tons

- 64.2% Synthetic fibers
- 6.2% Wood-based cellulose fibers
- 24.1% Cotton
- 4.4% Other natural fibers
- 1.1% Wool

1) 2017 numbers based on expected values. Sources: ICAC, CIRFS, TFY, FEB, Lenzing estimates
Lenzing fibers produced from the raw material wood
Biorefinery: from wood to dissolving wood pulp

Lenzing site

Sustainable forests → Wood → Pulp factory → Dissolving wood pulp → Biorefinery products

- Lenzing™ Viscose fibers
- Lenzing™ Modal fibers
- Lenzing™ Lyocell fibers & filaments

Biorefinery products:
- Acetic acid
- Furfural
- Magnesium lignosulfonate
- Xylose
- Sodium carbonate

Black liquor → Power plant → Electricity + Heat
Production process for Lenzing™ Viscose fibers

Viscose production process

- Wood
- Pulp
- Sodium sulfate
- Recovery of process chemicals
- Fiber production
- Lenzing™ Viscose fibers
Production process for TENCEL™ branded lyocell fibers

Lyocell production process

Wood → Pulp → Fiber production → Lenzing™ Lyocell fibers

Water → Solvent → Recovery of solvent
REFIBRA™ technology
Contribution to circular economy

Cotton value chain

Long-term goal
Post-consumer waste

TENCEL™ Lyocell fibers production with REFIBRA™ technology

Pre-consumer cotton waste
(Cutting waste from garment making)

www.lenzing.com
LENZING™ fibers field of application

Textiles

Denim

Active

Intimate

Luxe

Home
LENZING™ fibers field of application

Nonwovens

Body

Surface

Beauty

Intimate
LENZING™ industrial applications

Industrial

- Agriculture
- Workwear
- Packaging
- Biorefinery Products
- Protective Wear
- Engineered Products
- Footwear
Development journey of our 3 fiber generations

Technological competence in fiber production

- 80 years: Lenzing™ Viscose
- 60 years: Lenzing™ Modal
- 25 years: Lenzing™ Lyocell

- Lenzing™ Ecovero™ since 2017
- Eco Soft technology since 2010
- Refibra™ technology since 2016
- Tencel™ Luxe since 2017

www.lenzing.com
Impressions: Lenzing, Austria

- Only integrated plant world wide
- Size 2.8 km²
Impressions: Wood Yard

- 2000 ton wood/day
- ¾ per train (=70 wagons/day)
Impressions: Wood Yard
Impressions: Wood Yard
Impressions: Wood Yard
Impressions: Wood Yard
Impressions: Wood Yard
Impressions: Wood Yard
Impressions: Dissolving Wood Pulp
Impressions: Fiber production
Impressions: Washing
Impressions: Dryed, ready fibers
Impressions: Ready Bales

- 1000 to fibers/day
- All three generations of MMCF: Viscose, Modal, Lyocell
Impressions: Fiber Processing & Testing Unit

- Spinning
- Weaving
- Knitting
- Dyeing
- Finishing
Impressions: Lyocell production plant
Impressions: Lyocell filament plant
Impressions: Water purification plant
Impressions: in the plant
Impressions: plant

www.lenzing.com
Test of the filtration properties of Lyocell filters
YESS: Yarn Ethically & Sustainably Sourced

Yarn Spinner Survey Results
February 2018
YESS Spinning Mill Research Survey

Responsible Sourcing Network (RSN) is conducting research for the initiative YESS: Yarn Ethically & Sustainably Sourced. The goal of YESS is to drive forced labor and the worst forms of child labor (WFCL) out of cotton production (www.sourcingnetwork.org/yess).

YESS will help train spinners on how best to implement an effective due diligence system to keep cotton that may have been produced with forced labor or WFCL out of their supply chains. The YESS program will include guidance documents, training materials, and a protocol that will verify participating spinners have established policies, material management systems, and transaction-level documentation to demonstrate they are only sourcing cotton free of forced labor and WFCL.

In an effort to develop an appropriate and effective protocol, we request the assistance from managers of spinning facilities with knowledge of cotton sourcing, processing, and sales to enhance our field research. The topics (all related to cotton) covered by the survey include:
- Sourcing models
- Supplier base
- Markets and sales model
Business Information

Businesses that took our survey were from the following countries:

- Bangladesh (4)
- Egypt (1)
- India (4)
- Indonesia (3)
- Italy (1)
- Pakistan (1)
- South Korea (1)
- Turkey (1)
Please indicate which documents you routinely RECEIVE for cotton purchases. (check all that apply)

For how long do you retain all of the documents from the date of the commercial transaction?

16 responses
Specialty Cotton – Better Cotton

- Do you process Better Cotton?
  - Yes: 81.3%
  - No: 18.8%

- Do you process physical Better Cotton separately from other types of cotton (and produce end products with 100% physical Better Cotton)?
  - Yes: 46.2%
  - No: 53.8%

- Do you blend physical Better Cotton with non-cotton fibers or filaments?
  - Yes: 38.5%
  - No: 61.5%

- Do you blend physical Better Cotton with virgin conventional cotton?
  - Yes: 76.9%
  - No: 23.1%

- Do you blend physical Better Cotton with other types of specialty cottons?
  - Yes: 61.5%
  - No: 38.5%
Specialty Cotton – Cotton Made in Africa (CMiA)

Do you process Cotton Made in Africa (CMiA)?
15 responses
80% Yes
20% No

Do you process CMiA cotton separately from other types of cotton (and produce end products with 100% CMiA cotton)?
3 responses
66.7% Yes
33.3% No
Do you process Fairtrade (FLO) or Fair Trade USA cotton (we will refer to either as "Fair Trade" in this survey)?

15 responses

- Yes: 80%
- No: 20%

Do you process Fair Trade cotton separately from other types of cotton (and produce end products with 100% Fair Trade cotton)?

3 responses

- Yes: 100%

Do you blend Fair Trade cotton with non-cotton fibers or filaments?

3 responses

- Yes: 66.7%
- No: 33.3%
Processing, Spinning, and Wastage

When using virgin cotton, do you only use cotton lint from one shipment (lot) when placing bales in a picking line?

16 responses

- Yes: 50%
- No: 37.5%
- We mixed different length cotton within Same State in India and also depends on the cotton parameters.
- It depends on the product (yarn) specifications.

Do you mix cotton lint from different countries when placing bales in a picking line?

- Yes: 37.5%
- No: 50%
- As per customers requirement/need

When do you weigh cotton in your processing? (check all that apply)

15 responses

- Receiving at Wash: 14 (93.3%)
- Initial Process: 3 (20%)
- Carding Waste: 6 (40%)
- Combing Waste: 7 (46.7%)
- Other Waste: 5 (33.3%)
- Other Process: 2 (13.3%)
- Final Product: 8 (53.3%)

Do you use non-cotton fibers or filaments?

- Yes: 53.3%
- No: 46.7%
When processing virgin cotton lint into OPEN END yarn, how much waste/by-product do you typically produce at each stage?

When processing virgin cotton lint into RING SPUN yarn, how much waste/by-product do you typically produce at each stage?

When do you weigh non-cotton fibers/filaments in your processing? (check all that apply)
Processing, Spinning, and Wastage

If you process RECYCLED cotton, do you experience the same amount of waste/by-product during CARDING?
8 responses
- Yes, recycled cotton produces the same amount of carding wastage: 75%
- No, recycled cotton produces less carding wastage: 12.6%
- No, recycled cotton produces more carding wastage: 12.6%

If you process RECYCLED cotton, do you experience the same amount of waste/by-product during COMBING?
6 responses
- Yes, recycled cotton produces the same amount of combing wastage: 83.3%
- No, recycled cotton produces less combing wastage: 16.7%
- No, recycled cotton produces more combing wastage: 0%
Products

Do you sell or reuse the by-product from carding (carding wastage)?
15 responses

- Yes: 93.3%
- No: 6.7%

Do you sell or reuse the by-product from combing (combing wastage)
15 responses

- Yes: 93.3%
- No: 6.7%

What entities do you sell carding wastage to? (check all that apply)
14 responses

- Spinning mills: 5 (35.7%)
- Small buyers: 7 (50%)
- Supply chain ag: 1 (7.1%)
- Merchants/traders: 9 (64.3%)
- Furniture/other: 3 (21.4%)
- To farmers for c...: 0 (0%)
- Used internally: 2 (14.3%)

What entities do you sell combing wastage to? (check all that apply)
14 responses

- Spinning mills: 8 (57.1%)
- Textile mills: 3 (21.4%)
- Vertical mill-gar...: 0 (0%)
- Small buyers: 7 (50%)
- Supply chain ag...: 1 (7.1%)
- Merchants/traders: 9 (64.3%)
- Furniture/money...: 3 (21.4%)
- Used internally: 4 (28.6%)
Products

**Do you sell any other by-products?**
15 responses

- Yes: 53.3%
- No: 46.7%

**Do you sell or internally use yarn?**
13 responses

- Yes: 30.8%
- No: 69.2%

**What entities do you sell other wastage to? (check all that apply)**
7 responses

- Furniture agents...
- Supply chain ag...
- Farms for cattle...
- Traders
- OPEN END UNI...
- SMALL BUYER

**What entities do you sell yarn to? (check all that apply)**
11 responses

- Spinning mills: -2 (18.2%)
- Textile mills: -10 (90.9%)
- Garments/home...: -8 (72.7%)
- Vertical mill - ga...
- Small buyers/st...
- Supply chain ag...
- Merchants/traders:
- Use internally In...
- Use internally In...
- Export
- Knitting Mills
Thank you for your contribution to YESS!

Questions? Email patricia@sourcingnetwork.org
Domestic cotton waste based virgin fiber

Gerrit Bouwhuis
September 9th, 2018
World Population Growth

Prosperity +95% in 2050

Cotton stable around 25 mio ton

Regenerated cellulose: 50% up over last 10 years
Why SAXCELL?
Fibre production

Design & confection

Distributor & retail

Consumer use & discard
Collecting

Discarded textile

Sorting

Unraveling

Pulp preparation

Feed stock virgin fiber production

Fiber production

Fiber production

Yarn production

Fabric production

Design

Retail

Use phase
Feed stock preparation
Spinning
Products
SA\text{X}CELL Rating

Criteria:
- Mechanical properties
- Dye ability
- Process ability
- Environment

Value/kg

Cotton
Viscose
Carbamate
SaXcel
Tencel
Refibra
Collecting
- Discarded textile

Sorting

Unraveling
- Pulp preparation
  - Feed stock virgin fiber production

Design

Retail

Use phase

Fabric production

Fiber production

Yarn production

Partnerships!

Existing industrial equipment

+50% over 10 year

Several batches up to 150 kg
Apparel

Household textiles

Technical Textiles

Single fiber and blends

Interior
Collaboration with industry:

production batch 5 ton

design production facilities/ economics and environmental

time to market: 4 years
Driver:

Textile industry: Greener
Many thanks to our:
students, researchers and partners
Digital Plugin for the Textile Factory of the Future

Prof. Dr. em. Marc Van Parys
UNITEX-TexZeppelin
info@texzeppelin.be

With a smile under way to the ITMF-event 2018 …
And if you do not have a smile, I’ll give you one of mine

Jambo
habari ya asubuhi
Digital technologies | Printing

Digital Printers
- > 37,000 digital printers in operation worldwide
- 2,300 new printers in 1st half of 2017

Digital Printed Textile
- > 1.7 billion m² digital printed textile - expected: 2 billion m² in 2020
- > 4% of textile printing market

Applications
- Fashion – Apparel (> 40%)
- Hometextile (12 %) (carpet – upholstery – curtains...)
- Tech Textile (tents – automotive - medical – sails – parasols ...)
- Visual communication (Displays – Signage)

Ink consumption
- > 17 mio liters

Source: Smithers - WTIN – Zimmer - Dystar
Inkjet inks
- Improved quality inkjet inks
- Better dispersion technology
- Broader range of inkjet inks
- White inks (pigment)

New generation print heads
- Higher firing frequency – speed
- High volume print heads
- Circulating print heads
- Self cleaning print heads

New Digital Printers
- Doubled-sided printers
- Printers for narrow fabrics - yarns
- Adapted printers for attributes (f.e. shoes, bags...)
- Width printers up > 5 - 12 m

Digital Textile Printers

<table>
<thead>
<tr>
<th>0-20 sqm/h</th>
<th>20-50 sqm/h</th>
<th>50-650 sqm/h</th>
<th>&gt; 650 sqm/h up 4000 or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi pass printers</td>
<td></td>
<td></td>
<td>Single pass printers</td>
</tr>
</tbody>
</table>

Fast Fashion & Fast Deco

Tony NASCHBERGER
Digital Textile Printers
Sublimation

Acid
Disperse
Reactive
Pigment

The selection is dictated by the textile material and the end-use (desired properties)

<table>
<thead>
<tr>
<th>Ink type</th>
<th>Fibre type</th>
<th>Chemical PTP-treatment</th>
<th>Light fastness</th>
<th>Wash fastness</th>
<th>Rub fastness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reactive inks</strong></td>
<td>CO - Vi - PA</td>
<td>yes</td>
<td>+/-</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td><strong>Acid inks</strong></td>
<td>PA - WO - Silk</td>
<td>yes</td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td><strong>Disperse direct inks</strong></td>
<td>PES</td>
<td>yes</td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td><strong>Sublimation inks</strong></td>
<td>PES</td>
<td>no</td>
<td>+</td>
<td>+ (+)</td>
<td>+</td>
</tr>
<tr>
<td><strong>Pigment inks</strong></td>
<td>All fibres, incl. blends</td>
<td>yes</td>
<td>+++</td>
<td>+</td>
<td>+/- (wet)</td>
</tr>
<tr>
<td><strong>Vat inks</strong></td>
<td>CO - Vi</td>
<td>yes</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
</tbody>
</table>

Digital Printers for narrow Fabrics @ Yarns

Double-sided Digital Printers

Waterborne Digital Inks:

The selection is dictated by the textile material and the end-use (desired properties)
Digital Printing with VAT inks

VAT Printing

- Home textiles
- Technical textiles
- Uniforms and workwear
- Camouflage prints

PRE-Coating > Drying > PRINTING > Drying > Foulard > Steaming > Washing > Drying

Water Consumption

Rotary 6 color printer
- 50-60 liter water/lm

Digital printer
- 14-20 liter water/lm or a saving of 60-70%

Suppose all linear meters printed change from rotary to digital - This means a saving of 760 billion liters of water

Which equals over 300,000 olympic swimming pools

Sustainability in Digital Printing
### Are there still challenges needed?

<table>
<thead>
<tr>
<th><strong>Missing inks</strong></th>
<th>Metallic inkjet inks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UV/LED curable inks for textile</td>
</tr>
<tr>
<td><strong>More flexibility</strong></td>
<td>Simplification of whole production process</td>
</tr>
<tr>
<td></td>
<td>Robotica</td>
</tr>
<tr>
<td><strong>Digital printers</strong></td>
<td>Smarter printers</td>
</tr>
<tr>
<td></td>
<td>Hybrid printers (enabling printing &amp; finishing on one printer)</td>
</tr>
<tr>
<td></td>
<td>Mobile printers for floor- &amp; wall covering</td>
</tr>
</tbody>
</table>

### Digital technologies for

<table>
<thead>
<tr>
<th>Pretreatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyeing</td>
</tr>
<tr>
<td>Functionalisation (finishing – coating)</td>
</tr>
</tbody>
</table>

---

**Mobile printer**
- UV/LED inks
- Printing on-site

**Relief-Printing**
- Special Effect Printing
Print heads enabling Digital Dyeing – Finishing – Coating

• Common features of large volume print heads
  • Non-contact
  • Jetting higher viscous fluids
  • Higher solids loading
  • Jetting higher volumes up to µl or even nanoliters
  • Variable drop volumes
  • Higher printed thickness via larger drop volumes
  • Jetting of larger particles up to 20 µm (f.ex. microcapsules)
  • Fluid freedom

• Print heads with circulating fluid (Piezo – DIMATIX)
• Self cleaning system (TTS)

Large volume print heads

<table>
<thead>
<tr>
<th>Print head</th>
<th>Kyocera KJ4</th>
<th>Starfire SG1024 (L)</th>
<th>CIJ Osiris</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pick-up m²/m²</td>
<td>X 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 pass</td>
<td>9.97</td>
<td>64.5</td>
<td>30.2</td>
</tr>
<tr>
<td>2 pass</td>
<td>19.9</td>
<td>123</td>
<td>60</td>
</tr>
</tbody>
</table>

Dimatix
Starfire (new Piezo)
Zimmer
Osiris
CIJ
Valve-jet
New generation large volume print heads

Creating

- The jet technology sets further boundaries for the material properties and fluid rheology of the formulation
- An ability to go beyond the inkjet boundaries to enhance application performance

Development of large volume PRINT HEADS

Printing (lower resolution)
- Pretreatment
- Dyeing
- Functionalisation

Spot formulations
Process formulations
We start with the printhead the customer has selected…

This lets us jet ink Printheads

ESSENTIAL FEATURES
DIGITAL DYEING

- Uniformity in dyeing is a must!
- The difference of front- and back side of the fabric is depending on fabric and jet volume
- Acceptable fastness properties

- Enabling suppliers to use digital printer also as a Dyeing unit (some cases)
- Change of colour on the fly!
- Lower cost to change over
- Reduced minimum order quantity
- Higher margin
- Lower cost inventory

Are you allergic for good news?
Digital Dyeing - Benefits

1. Dye savings
   > 25%

2. Water savings
   > 25-30%

3. Low waste

Digital Dyeing of PA-substrate
Acid inkjet inks (process colours)
Digital printer: Colaris – Dimatix print head
Source: Belgian Company

2. Functionalisation
   • Finishing
   • Coating

Digital technologies
NEW IDEAS never STOP!

Various developments are running to apply tailor-made functionalities via digital techniques replacing traditional finishing & coating processes.

Digital Finishing/Coating & Functionalisation Systems

TARGET APPLICATIONS
- Functionalisation
- Finishing - Coatings
  - Repellent
  - Antimicrobial
  - Antistatic
  - Chromic sensors
  - Electroconductive
  - Electroluminescent
  - ...

MATERIALS
- Wide range of viscosities, pH values and materials
- PU’s, Acrylates, silicones
- Pigments
- Nanoparticles
- Microcapsules
- ...

MARKETS
- Home Textiles and Apparel
- Attributes: belts, shoes ...
- Furniture
- Tech Textile
  - Medical textile
  - Automotive
  - Sport textile
  - ...

Digital Finishing/Coating & Functionalisation Systems
Advantages of Digital Functionalization

**Green**
- No waste, eco-friendly
- energy saving
- reduction of fresh water and waste water
- low water evaporation
- saving of chemicals...

**Low cost**
- Direct & partial application
- Less waste at application change
- Lower stock of finished textiles
- Minimal setup costs
- Short runs with many variations

**Functional**
- Local/patterned deposition or uniform application
- Multiple functions in a single process
- Front and back applications in one working pass (same or different functionality)
- Changing functionality on the fly

Digital finishing

- Performance
- Durability

The minimal amount jetted on the substrate must be sufficient to obtain the desired durable effects!
We start with the printhead the customer has selected… which lets us jet ink

Digital Finishing - Coating

ACTUAL DEVELOPMENTS

From Lab to Fab

Inkjet Spot Formulations

Functional Chemicals
Processing additives
- Wetting/dispersing agents
- Viscosity regulators
- Adhesion promoters
- Binders
- ...

Formulation adapted for
- Print head
- Textile substrate
Application of Digital Functionalization

Developments by Zimmer (AU)

**Digital Finishing**

**Surface Properties**
- Repellent inks
- Antimicrobial inks
- Antistatic inks
- Optical Brighteners
- Stain-repellent

With acceptable fastness properties
Local - Patterned
Digital Finishing - Coating

Digital technology: versatile technique for realizing high-accuracy patterns in a cost-effective manner

Functional Textile
Digital printing e-circuits with conductive inks
Ag-doped Cu particles
PEDOT/PPSS

Inkjet gets traction in new applications
Piezo-electric pads making music

- Digital Printing Electroluminescent inks (EL)
- Project: ‘Luminous wall-covering’

Realised Prototype
Invisible encoding

Development of waterborne IR- and UV-invisible inks

→ Anticounterfeiting fabrics
→ For tracking and tracing

Fluorescent wall-covering textile

“Digital technology breathes life into our wallcovering” - Fibertex
Chromic Sensors

- **Indicator function**
  - Smart inks can have an *indicator function*, such as the display of a contamination level

- **Sensory function**
  - Smart inks can measure *stress, strain, humidity, temperature, pollution* ...

*Already feasibility proven with large volume print heads!*

---

Designing with Chromogenic inks

High volume print heads: Jetting of microcapsules/binder

- **Functions**
  - **Indicator**
  - **Sensor**

- **Smart textile**, which interacts actively with its environment, i.e. it responds or adapts to changes in the environment

- **fragrances**
- **Thermochromics → heat**
- **Photochromics → light**
- **Hydrochromics → water**
- **Piezochromics (research) → pressure**
is painted with a paint, which contains piezochromic pigments with the ability to sense the force applied by the ball and reversibly change colour from its normal colour (green or blue) to a contrasting colour such as red or orange (Figure 6). The mark left by the ball should fade away slowly enough for the referee and players to decide whether it was in or out, for example 60 seconds. It is sufficient to use the piezochromic paint for the lines and near them, since the indecision only occurs in these regions and also because footprints due to the piezochromic effect all over the court would cause confusion. The same type of paint could be used for other courts such as squash courts, volleyball courts, and basketball courts.

Figure 6: Schematic depiction of temporary mark left by a tennis ball after hitting just next to the line.

Piezochromic bathroom and kitchen scales

There are many types of scales in the market today, used for different weighing purposes. Two types of scales used at homes are bathroom and kitchen scales. A common and elegant design used for bathroom scales involves a glass platform and a digital display. Unlike this electronic scale, our piezochromic scale concept does not need any batteries, mechanical or electronic parts. The product consists of a glass plate, under which there is a graphic design printed with piezochromic ink. This image will show the corresponding weight of the person with the help of colours, shapes, or numbers. The piezochromic image can be printed on a polymeric backing plate or it can be applied as a separate film. A similar approach can be used for a kitchen scale. However, in this case, a container is needed to contain the sugar, flour, or milk. Thus, a special container with a small base may be designed to provide more visibility for the piezochromic illustrations that must be seen by the user.

Piezochromic bathroom and kitchen scales

The use of piezochromic labels or surfaces in indicating overload conditions could be a useful application under different circumstances. Overloading of packaged items could be a problem especially with liquid, gas, or fragile solid contents. Common situations where overload might occur include stacking of many boxes in warehouses or supermarkets, which might cause damage to the lowermost box, and overloading of an individual box which, when lifted, may cause breakage or tearing of a box, resulting in injury to the person who lifts it. Piezochromic labels or surfaces can be used to indicate an overload condition in the box or package. A related application would be tamper-evident closures. A piezochromic film can be used in the closure area of a food or medicine container. Tampering or accidental damage to the closure area would be made visible through the colour change of the film. A similar idea was mentioned specifically for pharmaceutical bottles and jars [34].

Certain conditions in canned foods result in slight or obvious swelling or bulging of the container. For example, enzymatic action, non-enzymatic browning, and microbial growth cause carbon dioxide...
ITMF Congress 2018 – Nairobi

Many Thanks
Asante Sana

Prof. Dr. em. Marc Van Parys
Email: info@unitex.be