

Textile Education and Training in North-Rhine Westphalia

The EU Commission (DG Enterprise) has just launched a comprehensive research on the textile and fashion industry in Europe, focusing on various aspects of its situation and perspectives : trade, employment, SMEs, training etc.. The related call for tender has been won by a consortium led by Saxion University in the Netherlands, with the IFM (Institut Français de la Mode) being in charge of the Training Work Package. Our work is to be based upon the in-depth analysis of 3 major regions : among them, Nord-Rhine Westphalia has been selected as a key place to understand how issues relating to innovative textile skills supply and supply/demand matching are efficiently handled and where best practices can be found out.

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1. THE INDUSTRY

a. Present situation of the Germany and NRW textile and clothing industries

North Rhine Westphalia is the largest federal state in Germany with more than 17 million inhabitants and an unemployment rate of 8.5 % in total¹. In the last decade, NRW economy has seen a steep increase in export orientation. In 2010, NRW earned EUR 543 billion, 21.7 % of the total German GDP. Thus North Rhine Westphalia is economically the most important state in Germany, as well as one of the most important economical areas in the world.

The textile and clothing industry has a long tradition in Germany, and has been in a critical phase for several decades. Nevertheless the clothing industry was one of the first branches which had to react to the internationalisation process, and later to significant change of the mid-1990s due to globalisation effects. The German industrialists recognized very early how useful the machinery industry is, and the leadership of NRW textile industry is partly due to a lot of machine manufactories. Thus, the manufacture of machinery and equipment represents a total sales of EUR 41 billion and ranks as the second manufacturing industry in NRW, just behind the chemical industry².

Today, German textile market share is: Clothing 20 %, Home textile 20 %, Technical textiles 60 %³. Germany is the European market leader in the technical textiles sector which is projected to have the best growth potential due to manifold applications and high innovation grade. Classified according to German federal states, the textile and clothing industry centers are in North-Rhine-Westphalia, Baden-Württemberg, Bavaria and Saxony.

Leadership upgrading in quality is of primary importance for German businesses. Today, the German textile industry ranks 5th in innovative products rating⁴, just behind the German machinery industry (4th). The German electronics industry ranks 2nd, whereas the German chemistry industry only ranks 6th. Main key NRW textile areas are Münsterland, OWL (Ostwestfalen-Lippe), Wuppertal zone as Niederrhein with Mönchengladbach and Krefeld.

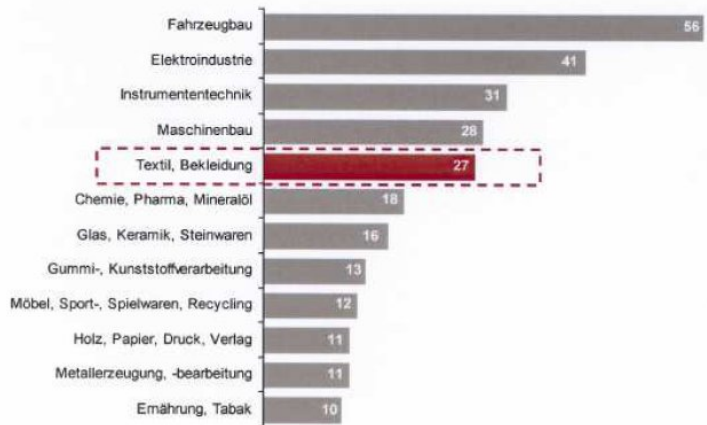
¹ Regional Labour Market North-Rhine-Westphalia (Germany), laboureconomics.wordpress.com, 27 April 2011

² Location Profile of NRW, NRW.INVEST, June 2011

³ according Dr. Dieter Veit, academic director, ITA of RWTH Aachen

⁴ Association of the Rhineland Textile Industry (Verband der Rheinischen Textilindustrie e.V), Lindlar, 26 Nov. 2010

Innovative products ratings in German industry, revenue generated by new products (%)



Umsatz durch Produktneuheiten in % (2007)

Source: Gesamtverband textil + mode, 2007

As a matter of fact, it is difficult to evaluate how many employees really work in the NRW textile industry. Today the chemical industry offers specific materials used in technical textiles and reinforcement textiles are useful in composite industry. So these industries have to be considered also.

Textile economy in NRW - 2009⁵:

companies of the textile industry	221
companies of the clothing industry	84
companies of the mechanical engineering industry	30
"textile" research institutes	12
employees of the textile industry	35 000
sales of the textile industry	6.6 euros billions

Machinery tests are made in Germany for China or India. Moreover, the chemical industry is strong, with leaders like BASF or Bayer. Most of the chemical companies do a lot of research to develop new fibres. Nevertheless, the textile chain is weakening in Germany. The machinery industry does not develop very sophisticated processes because main Asian end-users do not need them. Concerning chemical companies, it is not easy to have the right chemistry for niche products today. German industrialists have implemented major changes in their industrial organization and the future for the NRW textile industry is the competition in niche market products with European countries.

With 6% of the total EU 27 textile and fashion employment, but almost 15 %⁶ of the wages and salaries paid to the workforce in the EU, the German industry is a major economy of the sector. Sizes of units are very similar in Germany between textile and fashion manufacturers.

An important characteristic of the German textile industry is the dominance of companies with a large revenue, with an average of 94 employees per unit. Especially the technical textile industry has all characteristics of the German Mittelstand (SME - small and medium enterprise).

⁵ *Textile & Mode NRW - Structure and Activities*, ZiTex, april2010

⁶ IFM estimate based on Euratex and Eurostat data 2009.

Situation 2008	Units		Employees		Employees/unit		Empl.as % tot mfg	
	Germany	NRW	Germany	NRW	Germany	NRW	Germany	NRW
Textile	794	228	72 568	21 255	91,4	93,2	1,2	1,7
Fashion	381	80	37 882	6 642	99,4	83,0	0,6	0,5
Total TF	1 175	308	110 450	27 897	94,0	90,6	1,8	2,2

Source Eurostat NACE rev 1

Situation 2008	Employees		Wages		Wages per employee	
	Germany	NRW	Germany	NRW	Germany	NRW
Textile	72 568	21 255	2093	665	28 842	31 287
Fashion	37 882	6 642	1096	224	28 932	33 725
Total TF	110 450	27 897	3189	889	28 873	31 867

Source Eurostat NACE rev 1

b. Development of the Germany textile and clothing industry over the last decade

Over the last decade the German textile and clothing industry has lost a large number of manufacturing jobs and units to the benefit of outward processing areas namely in Asia. The number of units was almost halved, as total number of textile employees, but there was no significant change in the size of German textile enterprises.

Germany sector	Number of units			Number of employees			Empl. as % of total manufg		
	1 997	2 007	% change	1 997	2 007	% change	1 997	2 007	% change
Textile	1 295	875	-32%	131 626	81 362	-38%	2,1	1,4	- 0,7
Fashion	936	389	-58%	84 275	39 487	-53%	1,4	0,7	- 0,7
Total TF	2 231	1 264	-43%	215 901	120 849	-44%	3,5	2,1	- 1,4

Source Eurostat NACE rev 1

Germany mfg sector	Number of units			Number of employees			Employees per unit		
	1 997	2 007	% change	1 997	2 007	% change	1 997	2 007	% change
Textile	1 295	875	-32%	131 626	81 362	-38%	101,6	93,0	-9%
Fashion	936	389	-58%	84 275	39 487	-53%	90,0	101,5	13%
Total TF	2 231	1 264	-43%	215 901	120 849	-44%	96,8	95,6	-1%

Source Eurostat NACE rev 1

Despite this fragmentation process, over the same period of time, average wages per employee have grown up as evidenced below by 25%. This can be explained by the fact that technologists and technicians could find opportunities to use their skills in new jobs relating to the technical textile sector. By comparison, average wages per employee in London have grown by 37%, a statistic explained by the fact that the jobs in London tend to be linked to design rather than technology, and design jobs are typically better paid.

Germany mfg sector	Number of employees			Wages			Wages per employee		
	1 997	2 007	% change	1 997	2 007	% change	1 997	2 007	% change
Textile	131 626	81 362	-38%	3 201	2 341	-27%	24 319	28 773	18%
Fashion	84 275	39 487	-53%	1 789	1 139	-36%	21 228	28 845	36%
Total TF	215 901	120 849	-44%	4 990	3 480	-30%	23 112	28 796	25%

Source Eurostat NACE rev 1

Over the decade in the NRW area, the textile industry has also shrunk ⁷ in proportion with other industries in Germany: approximately 31,500 people were employed in manufacturing units in 2007.

NRW manufg sector	Number of units			Number of employees			Empl. as % of total manufg		
	1 997	2 007	% change	1 997	2 007	% change	1 997	2 007	% change
Textile	356	241	-32%	40 653	23 494	-42%	2,8	1,9	- 0,9
Fashion	167	89	-47%	17 842	8 050	-55%	1,2	0,6	- 0,6
Total TF	523	330	-37%	58 495	31 544	-46%	4,0	2,5	- 1,5

Source Eurostat NACE rev 1

NRW manufg sector	Number of units			Number of employees			Employees per unit		
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Textile	356	241	-32%	40 653	23 494	-42%	114,2	97,5	-15%
Fashion	167	89	-47%	17 842	8 050	-55%	106,8	90,4	-15%
Total TF	523	330	-37%	58 495	31 544	-46%	111,8	95,6	-15%

Source Eurostat NACE rev 1

NRW manufg sector	Number of employees			Wages			Wages per employee		
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Textile	40 653	23 494	-42%	1 075	732	-32%	26 443	31 157	18%
Fashion	17 842	8 050	-55%	439	264	-40%	24 605	32 795	33%
Total TF	58 495	31 544	-46%	1 514	996	-34%	25 883	31 575	22%

Source Eurostat NACE rev 1

c. Skills demanded by the industry

SME textile companies have about 6 % of graduates in the garment industry (business and technical) and 10 % of graduates in the technical textile industry. In former times, most of these graduates were textile engineers,

⁷ Same as above

but today only 40 % of the production and development graduates are textile engineers, all the others are PhD chemists, physicists, process engineers, machine engineers. In the technical textile industry, textile engineering is only a tool to produce, but knowledge about materials, physics, testing and other specialists are much more important due to manifold applications of technical textiles (in composites for instance).

2. THE EDUCATION SYSTEM

1. A highly productive area for technicians and engineers

In the NRW region, the number of students is higher than the German average due to the high density of higher education institutions and universities in the region. There are 14 universities and higher education institutions which can award doctorates, and 16 other universities of applied sciences. Many students are registered in technical subjects, such as mechanical engineering or electrical engineering. A flexible and well educated workforce is important for companies located in North Rhine Westphalia. Thus the state parliament is investing large sums in the education system, in order to improve workforce educational level to make NRW region more financially rewarding for overseas companies. Education in engineering sciences has a long tradition in NRW, with almost 90,000 students in 2009-2010, 17 % of the total number of students⁸.

Dual system of vocational education and training

Anyone learning in Germany is usually concerned by dual system of vocational education and training (VET), (about 60 % of trainees). Companies provide apprentices mostly with practical training. Part-time vocational schools supplement company-based training by theoretical instruction. The system is based on statutory training regulations and on the range of traditional, updated and newly emerging, up-to-date training occupations. The training period is usually two or three years. Under the "Capital for Work programme", SMEs (Small and Medium Enterprises) can apply for low-interest loans whenever they recruit additional apprentices. Industry and education and graduation institutions are working closely together. Engineers of textile industry deliver teaching at the universities, and textile industry firms provide jobs to prepare bachelors or masters theses. Textile companies send well-educated weavers to the university for studies. Usually industry pays the student's education and provides the student's first job in the company after graduation.

Vocational training

Education efforts are embedded in a system which ensures access, quality, mobility and innovative ability, regulated in the amended Vocational Training Act (BBiG- Berufsbildungsgesetz). Vocational academies (Berufsakademie) transferred the traditional system of vocational training to the tertiary education level. Thus the activities of state institutions of higher education and training facilities of the employment sector are integrated in a joint effort. This is a new way of practice-oriented education on the university level. Especially integration of companies as active partners into the higher education system leads to highly qualified graduates. Therefore vocational academies offer an attractive alternative to traditional universities and colleges of higher education.

Education funding

The Federal Ministry of Education and Research (BMBF) is supporting training structure development through its JOBSTARTER programme, supplying funding for 200 innovative projects in vocational training⁹. These projects are making an important contribution to structural development, for example by establishing cross-border training cooperation or launching collaborative training schemes.

The European Social Fund (ESF) is a key element of EU's strategy for growth and jobs targeted at improving skills and job prospects. The North-Rhine Westphalia region received a European Social Fund for further education¹⁰ (about EUR 684 million from 2007 until 2013). Since 1 January 2010, German Labour Ministry offers a "training check" supported by European Social Fund. Thus vocational training costs have become 50 % cheaper (maximum 500 €).

⁸ Location Profile of NRW, NRW.INVEST, june 2011

⁹ website: www.bmbf.de/en/2313.php

¹⁰ http://www.arbeit.nrw.de/esf/in_menschen_investieren/index.php

See Appendix, "Insight of funding program for the textile and clothing industry in NRW".

2. The textile education in NRW

NRW has 5 universities which offer study programs in the field of fashion and textiles:

- Technical University Bielefeld (fashion),
- University for Art and Design Halle (fashion and textile design),
- University Niederrhein-Mönchengladbach (Textile and clothing engineering, textile and clothing management),
- University Niederrhein- Krefeld (Textile Chemistry, engineering, design),
- Rheinisch-Westfälische Technical University (RWTH) Aachen (Textile engineering, textile technology)

Before the last decade, standard criticisms were: lack of vocational maturity, insufficient awareness-building about careers in textiles at school, deficit of social competences and motivation attitude due to low employment attractiveness of the textile industry for young people.¹¹

From 1998 until 2000, the German Federal Institute for Vocational Education and Training (BiBB¹²) was in charge of a research project entitled "Basic principles for a restructuring of the vocational training for textile and clothing professions", in cooperation with the Confederation of the German Textile and Fashion Industry and IG Metall¹³. The project aimed to develop an apprenticeship structure suitable to the current needs of the textile sector. Increasing internationalisation, and finally full globalisation, are essential factors for changing working and apprenticeship practices in the textile and clothing industry. In this context a maximum degree of flexibility in occupational careers is an important strategy¹⁴.

In the NRW textile industry, there are rarely very large companies. Most textile factories are located in small cities, so there is no problem to hire the right people, to attract them locally, and textile promotion is a local question.

Association of the North-West German Textile and Clothing Industry (TV Nordwest)¹⁵ helps also to promote the image of the textile sector. The department of "Ergonomics and Training" works in partnership with enterprises to improve their efficiency in the field of vocational education and professional training. In recent years TV Nordwest developed a comprehensive toolkit of business and management skills. The gender divide among employees in NRW is around 50/50, with the following age range: under 35 (25%), 36 – 45 (30%), 46 – 55 (30%), over 55 (15%)¹⁶. There is no data regarding how many textile jobs have been impacted by EU funding to improve textile skills, because they have never made respective surveys and they do not possess such facts about textile education & training in NRW.

The Fashion.Net project is financed with the help of the "Leonardo da Vinci" program, and develops instruments to support continuing vocational training in the German textile sector. Working through 16 intermediary organizations in eight countries, Fashion Net will promote innovation and technology transfer to SMEs. The project will use a wide range of tools to encourage SME participation, including two major conferences, and workshops and training sessions in each participating country, and a database for technical resources will reach 4,500 SMEs.

Since 2004 ZiTex¹⁷ is an independent organisation with several sponsors including:

- Association of the North-West German Textile and Clothing Industry (Münster)

¹¹ For instance, the two-year training for "textile darners" will be replaced by the two-year training for "product examiners - textile" in August 2007.

¹² Bundesinstitut für Berufsbildung

¹³ Since 1998 the former members of the GTB are part of the IG Metall, the labour union of metal industry

¹⁴ Structure of apprenticeship in the textile industry, translated source:

http://www.bibb.de/dokumente/pdf/a431_berufe-textilwirtschaft_ausbildungsstruktur.pdf

¹⁵ TV Nordwest is the largest regional association of German textile and clothing industry

¹⁶ Textilgewerbe (WZ 17), Branchenanalyse 2009, Untersuchungen zur Situation und Entwicklung der Branchen Textilgewerbe, Mai 2009

¹⁷ Future initiative textile NRW, based in Düsseldorf

- Association of the Rhineland Textile Industry (Wuppertal)
 - IG Metall trade union's regional office for North Rhine-Westphalia (Düsseldorf)
 - North-Rhine Association of the Clothing Industry (Krefeld)
- and in close cooperation with the State Government of North-Rhine Westphalia (NRW).

ZiTex provides services to the textile and clothing industry to improve the general framework, efficiency and competitiveness of companies, employees and research institutions, in the fields of training (training institutions, reform of study-courses, support of regional training management, composition of teaching material for schools ...). According to ZiTex, it would be helpful to support cooperation of employers, employees and R&D institutes in order to overcome the personnel-shortage via new personnel and continuing vocational trainings.

According to Mr. Detlev Braun, ZiTex project manager, some changes in education of textile industry are to be expected in the near future. Thus ZiTex will start a project to analyze the situation of education and training in NRW textile and fashion industry. First results are expected at the beginning of 2012.

3. Contents and skills taught

New topics for emerging sectors of production should be included in the new training courses, and there is high acceptance of staged apprenticeship "seen as a seminal model". Besides manual skills, widespread and comprehensive knowledge is another factor of success which becomes more and more relevant¹⁸. According to the Confederation of German Textile and Fashion Industry¹⁹, the number of branchspecific apprenticeships has increased by two thirds since 1994. The apprenticeship quota (ratio of trainees to employees in the branch) has more than doubled. Textile and clothing engineers are one of the most important occupations. Today, the clothing textile business is also abroad. So, multi-channeling and import/ export are also crucial activities.

3. TWO MAJOR UNIVERSITIES IN THE FIELD OF TEXTILE EDUCATION

- **University Niederrhein - Mönchengladbach, Faculty of Textile and Clothing Technology**

Textile and clothing technology education

Textile education has a long tradition in Mönchengladbach, going back 110 years. In 1971, all the applied sciences were concentrated and the Faculty of Textile and Clothing Technology was founded made up of Research Institute for Textile and Clothing (FTB), Public Textile Testing Institute (OP), Textile Fashion Institute (TFI), and Textile Fashion Network (TFN).

The Niederrhein University of Applied Sciences has responded to the continued globalisation trend within the textile and clothing industry. In addition to gaining expertise in the area of textile and clothing technology, students are expected to examine the increasingly significant aspects of management, quality, environment, cross-cultural competencies and languages. Today, all the textile chain is taught at Mönchengladbach, from the fibre to the final product, concerning clothing, interior textiles and technical textiles. The motto is "creativity 50%, engineering 50%".

¹⁸ One example is designer vocation which need to know more about special treatments of the manifold materials used today.

¹⁹ Gesamtverband Textil+Mode, 2005

Faculty of textile and clothing technology - Statistics and Facts in 2011

Students in total (from 52 countries)	around 1650
male students	17 %
female students	83 %
foreign students	20 %
freshman students WS 2010/2011	around 440
graduates per year	329
graduates in total	around 8 500

Most of graduates find employment before graduation. Degrees offered are Bachelor (B.Sc.) and Master (M.Sc.) with Dual System (apprenticeship degree plus university degree). Master courses are totally English-taught. There is a big demand for many textile applications, and textile and clothing education is very close to industry. Thus 80 % of projects come from industry. Last year occupational integration was evaluated to highlight that 95 % of graduates work worldwide after graduate, in Germany and abroad.

Technical degree programmes²⁰ (learning contents):

- The core study area in Textile Management delivers fundamental knowledge and insights extending from design theory via thread, surface and finishing technologies through to quality management and quality assessment of textile materials.
- Students in the core study area of Textile Technologies acquire a particular knowledge of the relevant technologies used in spinning, weaving, knitting, narrow fabrics, finishing and technical textiles. The curriculum further includes studies in forward-looking technologies, and quality management.
- The field of Textiles in the Master of Textile Products programme provides graduates with an understanding of how intelligent and innovative processes and textile products are created along the whole production chain and through to industrial manufacturing (patterning).
- Technology KIA²¹ Bachelor Study Course refers to different jobs like Textile machine operator, equipment operator, apparel sewers, apparel tailors, upholsterer, textile laboratory technician, textile product finisher, industrial clerk.

There are 3 focuses or specificities in Master: design, fashion and textile. The Bachelor program of "Textile and clothing management" is the most generalist and very welcome to industry.

The role of networks

The role of networks is strategic to elaborate textile education through collaboration. Thus TeXcellence (Kompetenznetz Textiler Niederrhein) connects the clothing and machinery industry and textile education to marketing textile. This network involves 45 very successful companies in the Niederrhein region, and organizes a lot of workshops to define current topics on problems of industry. TeXcellence - Textile innovation network - help to safeguard and increase employment in the textile business by promoting the new generation of textile and clothing specialists. Firmly interwoven with each other, enterprise representatives, researchers and experts from the Niederrhein University of Applied Sciences come together, in order to develop textile solutions for tomorrow in innovative fields:

- functionalizing textile, RFID
- energy saving and cheaper machines²²
- colour self- lighting (not dying)
- globalisation
- textile transportation capability integrated in the material

Funding

Students have to pay for their education (cost is about 1000 € to 2000 €). The best students get an education prize and they are sponsored by companies. In addition, companies help students who have no money (for instance, students from Bangladesh) and there is a special fund of about 60 000 euros.

²⁰ <http://www.hs-niederrhein.de/faculties/textile-and-clothing-technology/degree-programmes>

²¹ KIA (Kooperative Ingenieurausbildung) - Cooperative Engineer Training: Textile and Clothing

²² Conference on "BLUecoMPETENCE Initiative" at ITMA 2011 in Barcelona

The Faculty of Textile and Clothing Technology acquires machines for labs, often with a 50 % reduction (thanks to sponsors). Each faculty has its own financial organization.

International cooperation

The Faculty of Textile and Clothing Technology cooperates with foreign universities for teaching and research, and exchange of lecturers and students (European countries and Russia, Poland, Turkey, China ...). Double-degree doctorates are available in collaboration with other universities of applied sciences (Université de Haute Alsace, Mulhouse, France; North Carolina State University, Raleigh, USA ...).

The Faculty contributes to upgrade the image of the textile sector

The Faculty of Textile and Clothing Technology organizes a lot of marketing events: television (topics on textiles), job fairs (recruiting), public speeches, graduation ceremonies. Activities seminars are organized to promote the image of textile in the field of technical textiles like:

- nanotechnology,
- automotive industry,
- personal protective equipment in future,
- development of new fibres,
- medical textiles (hygienic textiles for surgery),
- 3D clothing,
- textiles sensors integrated in textile (for monitoring),
- flexible keyboard that can be rolled up,
- very simple screen (glass fibres integrated in textile structures),
- building (earthquake reduction),
- architecture (not strictly in building but interior building like illuminated curtains).

Other initiatives

The Faculty acts in concert with the Jakob Müller Institute of Narrow Fabric (JMINF). Scientific board members spoke in Narrow fabrics conference at ITMA 2011 in Barcelona, to promote fabric machinery and collaboration with research. Students of the Faculty of textile can create and experiment on Jakob Müller machines. KOPF - Future textile and clothing (Textilien und Bekleidung der Zukunft) is a competences centre created ten years ago. An example of KOPF projects is clothing for kindergartens where textile is a tool to learn colours and grasp (aspects and contrasts of textile, polysensoriality).

- **RWTH Aachen University, Institute for Textile Techniques (ITA)**

Technical textiles education (machinery and fibres)

RWTH Aachen University was founded in 1870 by industrial initiative. It is world leader in production technology, automotive technology, polymer research and development.

The Institute for Textile Techniques was founded in 1934, with a focus of research at the beginning.

In 1952, the first students arrived at ITA and the focus was on textile engineering, essentially training for mills. Furthermore, the main focus became textile machinery design (mid-20th century), and teaching on textile mills was learnt at Faculty of textile and clothing technology in Mönchengladbach.

The Institute of Textile Technology (ITA) at the Faculty of Mechanical Engineering is one of the largest institutes at RWTH Aachen. Its core competencies include the development of textile production technology, new textile structures and applications, as well as innovative products such as fibre-reinforced composites and medical textiles. Since 1990, teaching is closer to composites (which is a new focus), because there is a big technical textile market in composites.

At the present time, ITA employs more than 75 scientific staff, 40 service personnel and 130 graduate research assistants.

ITA is a service provider for fibre processing, yarn production, textile fabric production, product development, production technologies. The research services offered by the ITA are marketed and undertaken in collaboration with 3T Textil Technologie Transfer GmbH, a spin-off company of the Institute.

Finances for ITA education and research

	share funding	
RWTH Aachen	10 %	state funding
Industrial funding (3T)	30 %	strictly private
Industry-Related Public Funding	30 %	partially public
Fundamental Funding	30 %	public

The grant from ITA for research and development (half a million euros from state government) subsidizes publicly funded research as well as academic and industrial education.

The grant from 3T (Textil Technologie Transfer GmbH) for development and transfer subsidizes R&D projects and further education.

More than 80 % of education funding comes from industry and this share increases every year. The ITA conducts research projects for industry and offers continuing education seminars and creativity workshops. Companies provide also machines for learning.

Teaching and research are cross-dependant

Today at ITA, 3/4 of research is made on man-made fibres and coating (but not finishing) and 1/4 of research concerns textile machinery design. As regards teaching, a 3/4 share is about technical textiles (fibres essentially) and a 1/4 share is about professional activities (textile machinery). ITA trains 40 textile engineers per year, and it is not exactly a "Dual System follower". General mechanical engineering is taught with a major in textiles or automotive.

Technical degrees programmes (learning contents)

The Bachelor of Science (BSc) course offers:

- strong focus on mechanical engineering (mathematics, mechanics, thermodynamics, heat and mass transfer, hydrodynamics, electrical engineering)
- basics in textile technology on a high level (materials, processes, machines)
- two projects plus bachelor thesis with direct industry impact
- 10 weeks of industrial internships

The Master of Science (MSc) course offers:

- strong focus on advanced mechanical engineering (advanced heat and mass transfer and hydrodynamics, control engineering)
- advanced courses in textile technology on a high level (e.g. composites, simulation)
- master thesis with direct industry impact
- 10 weeks of industrial internships

Specificities of education practices at ITA:

ITA teaches students how to manage a project and they spend 80 to 90 hours on machines to do small processes tests.

Students learn to work together in a team project. During the Master project, they have to lead a research project.

All students work during 26 weeks (half a year) in industry, in a company, a laboratory, with an obligatory international experience. During the last term, students are expected to organize themselves, to study quickly, because "It costs time not to work quickly". This is a different approach from other universities.

There are different focuses on certain areas (automotive, textile ...) and the word "Applied" is important.

Concerning flexible training concept, ITA has great strengths compared with the American training system. At ITA, students organize themselves and it is easier for them to go abroad. So ITA students collect extensive and surprising information in most countries, and they recognize best practices internationally. In many other countries most textile students lack a lot of technical knowledge; in fact it is very important to learn both mechanical engineering and design for new machines.

Teaching and research are strongly connected

At ITA, researchers present what they do to students who see thereby state-of-the-art products. There is a specific Master on composites (aircraft, wind turbine) where lectures are organized about textile, resin part, design and simulation. Regarding medical textiles, ITA cooperates with a private hospital (Artz Klinik) where a

professor explains implants or tissue engineering. There is a research group and a real bridge between the clinic and the engineers. With regards to textile protection, like adding resin on textile, ITA acts in concert with the Institute of Plastics Processing at RWTH Aachen University (IKV).

Concerning overlapping between NRW chemical industry, textile machine manufactory (components) and textile industry (kind of yarn), it seems that a cross-industry dialogue is created at ITA. ITA has a good collaboration with the chemical factories which produce materials for spinning made-man fibre yarns. They also use carbon, basalt or glass fibres, but no natural fibres. According to the academic director of ITA, natural fibres have good mechanical properties, but are not cheap. (Besides, there are small quantities of natural fibres in nature and a conflict with resources for growing food. Today, there is a need for fibres that are cheaper to produce).

Education contents are prepared by the academic director himself, and exercises are prepared by researchers. General knowledge is constantly updated and all lectures are online (on a private access website for students). However students do not use e-learning tools. There are two different domains: what ITA does and what industry does. ITA asks industry what qualifications they need for graduates. Education contents are close to industry needs, so students never have to look long for jobs and graduates have a chance to work as they like (occupational integration is first-rate).

Vocational training

ITA also offers vocational training with 10 courses in technical textile, textile machinery (weaving spinning), and apprenticeships to operate for the machine technical design. There is special training for niche market products, with 2-day seminars on particular subjects close to customers needs. ITA has also established 2-week courses in September, for instance on composites in September 2011 (simulation part).

Promotion of textile

ITA contributes to upgrade the image of the textile sector with different courses of actions. There is communication at schools about textile education to explain what kind of qualification is appropriate. School teachers relay information including aspects on technical textiles. ITA opens two days for the family to appeal to them, for instance showing smart textiles. Pupils have to go for a 2-week internship in the textile industry where one gives them an idea about technical textiles. So textile is an attractive sector. ITA also organizes "Science track" at schools where they showcase what they do. The number of textile students is increasing and 60 to 70 % of students come from the NRW region due to this local textile promotion.

ITA presented an important exhibition at ITMA 2011 in Barcelona to promote textile machinery. At IFAI Advanced Textiles Europe 2011 in Barcelona, the Director of the Institute ITA, Professor Thomas Gries provided a presentation entitled "Latest Developments in Fabric Production".

International cooperation

Globalisation and internationalisation in the textile industry have impact on textile education and training. ITA has students from all over the world, about 20 students per year from other countries, except China, because "it's too dangerous" (This subject is close to the market, and it is hard to avoid the copying of machines). There is a very special contract for exchange, to protect intellectual property rights. Currently, 10 % of the ITA board is foreign (many countries increasing) because of textile globalization.

ITA does not really participate in Innovation Alliance of NRW universities. RWTH Aachen includes many institutes and has its own well-organized network. There is also a network to connect graduates to find a job quickly. A new cluster project focused on composites is emerging to bring together all sorts of facilities.

4. VOCATIONAL TEXTILE EDUCATION AND TRAINING: FOCUS ON INDUSTRIAL BACKGROUND

- **Schmitz-Werke GmbH & Co. KG, Emsdetten**

Company activities

Schmitz-Werke makes innovative mass textile products: ready-made awnings to protect from the sun, technical textiles which one finds a little everywhere (protection, small aircraft, filtration ...), curtains made with FR (Fire

Resistant) fabrics, or with treatment for air (cleaning air inside room). Schmitz-Werke already applies nano-finishing because it is the best form of protection. Schmitz-Werke uses solution containing nano-points (it uses no powder because this is more dangerous for human health).

Vocational education

Not many employees are graduates at Schmitz-Werke (about 20 % only). The company has used vocational education for a long time and has employees in apprenticeships, especially in the textile sector. Only 2 % of vocational training concerns ICT (software for machines). Schmitz-Werke spends an average of 10 000 euros monthly on vocational training. Employees learn a “formation block” at vocational school (Berufsschule) with a final evaluation test. For special knowledge, an apprenticeship is organized in another company. At first glance, vocational training costs a lot of money. However, it is important to propose the appropriate choice for each employee. Schmitz-Werke introduced Staufen Model²³ which is “an encouragement for the people who have the right motivation, with constant innovation process”.

Every year, Schmitz-Werke GmbH & Co, EMSA GmbH and Wedi GmbH organize the “week of vocational education”. Vocational training at Schmitz-Werke²⁴ (Ausbildungsberufe bei den Schmitz-Werke n) helps to improve textile and technical know-how. Trainees can obtain certificates after final examination in the state-recognized training occupation.

Range of occupations accessible to the holder of the certificates:

- industrial business management assistant
- management assistant in IT
- digital media designer
- mechatronic technician
- product designer
- machine and plant operator
- textile production mechanic
- product refiner for textiles
- garment manufacturer
- industrial mechanic
- electronic technician for administration

Official basis of the certificates:

- Name of status of the body awarding the certificate: Chamber of Industry and Commerce
- Level of the certificate (national or international): ISCED 3B
- International agreements: in the field of vocational training, joint declarations on the comparability of qualifications obtained in the respective vocational training systems have been signed on the basis of bilateral agreements concluded between Germany and France and between Germany and Austria.

Training in the “dual system”:

Teaching of the knowledge, skills and competences needed for an occupation is based on the typical requirements of work and business processes and prepares the trainees for a specific job. The training is provided in a company and at a part-time vocational school. In the company, the trainees acquire practical skills in a real working environment. On one or two days per week, the trainees attend part-time vocational school, where they are taught general and vocational knowledge related to their training occupation²⁵.

The designation of each specified certificate is based on the following texts: Council Resolution 93/C 49/01 of 3 December 1992 on the transparency of qualifications, Council Resolution 96/C 224/04 of 15 July 1996 on the transparency of vocational training certificates, and Recommendation 2001/613/EC of the European Parliament and of the Council of 10 July 2001 on mobility within the Community for students, persons undergoing training, volunteers, teachers and trainers²⁶.

²³ Lean Management and Turnaround Management

²⁴ <http://azubis.schmitz-werke.de>

²⁵ More information is available at: <http://berufenet.arbeitsagentur.de>

and National Europass Centre: <http://www.europass-info.de>

²⁶ More information on transparency is available at: www.europass.cedefop.eu.int/transparency

- **Technical Academy Wuppertal (TAW)**

After World War Two, there was a very old industry in Wuppertal with chemistry and textiles. The TAW was created sixty years ago in 1948. There were not many people who had skills to use technical equipment. Bayer helped to found the academy and it is a big member of the TAW.

There are 10 centres in existence in NRW, and elsewhere in Germany, that deliver a technical education depending on each special local industry²⁷. The biggest one is “House of techniques” near Hessen. Even though the traditional textile industry is weakening in Germany, employees still need to have a knowledge of textiles to understand how the textile is made and the specifications of textile products. TAW cooperates with Niederrhein University of Applied Sciences for special courses like safety textile or smart textiles. TAW collaborates also closely with STFI (Saxon Textile Research Institute in Chemnitz).

Companies decide the quality of courses, in collaboration with the TAW manager who has to know these people well to adapt the courses perfectly. 99 % of expenditure for training is paid for by companies. For companies it is very important to have “top of the knowledge” and skills for working place. Today, TAW offers 40 % technical training (textile process, quality, civil engineering ...) and 60 % general training (management, leading capabilities, law, finance, production logistics).

Most often, the education plan is decided by the human resources director. But it is important to note that, concerning technical skills, the training choice is made by the technical department whereas, regarding non-technical training, the choice is made by the human resources department.

TAW doesn't yet use e-learning tools because these are not easy to develop. However 3 weeks after courses, TAW offers a special web access to course materials for students to make courses easier to understand.

Certification procedure of further education:

TAW Cert GmbH is a certifying company for QM systems and staff (This is a subsidiary of the TAW Technical Academy Wuppertal e.V.) which realizes certification of further education and company employees. These tasks help to foster competitiveness. There are 3 kinds of certificates:

- First, certificate courses with block phases and correspondence lessons. For focused training, they have to define precisely the subject to be allowed to deliver a certificate.
- Second, for seminars or conferences, TAW delivers only a certificate of attendance.
- Third, accredited certificates are delivered when there are international standards with special accredited persons allowed to teach these courses.

5. CONCLUSION: ASSETS AND IMPROVEMENTS TO APPLY IN THE FUTURE

The NRW region was chosen for this European research considering its textile technological leadership with engineering of innovative items for consumers and industries. R&D spending has increased strongly in the last decade, largely due to investments from the private sector, but also from the governmental sector and higher education²⁸. Significant upwards developments are visible in top technology processing industries, chemistry, and services requiring in-depth knowledge. Networks of developers reflect the quite complex political, geographical, and economical structures in which the federal state is embedded. The NRW region has a strong historic record of regional development through collaboration, since the crisis of the coal and steel industries in the traditional industrial heartland of Germany's so-called “Ruhr Valley” resulted in a massive transformation of economic structures over the last 40 years.

Match of textile skills supply and demand

In NRW textile production, innovation and quality are in close coherence with research and development as well as with employees' vocational training. There is a real bridge between researchers, engineers and trainees.

²⁷ like the regional centers of CNAM (Conservatoire des Arts et Métiers), the French institution of long-standing and deep scientific tradition

²⁸ Eurostat New Cronos 2004

Education contents are close to needs, so students never have to look long for work and graduates have a chance to work as they like (occupational integration is first-rate). In many other countries most textile students lack a lot of textile technology knowledge. Yet it is very important for them to learn mechanical engineering and design for new machines. Usually the German textile machine industry is excellent for standard machines. For technical textiles very often there is a need for special machinery. Therefore one must have a good connection to special machine builders to engineer the machine on one's demand.

Changes required to make textile skills suitable to the present textile industry

According to Mr. Detlev Braun, ZiTex project manager, there are some changes to expect during the next period of time in the education of textile industry. Thus ZiTex will start a new project to analyze the situation of education and training in NRW textile and fashion industry. First results are expected at the beginning of 2012.

In the past most of the biggest fibre and monofilament producers had specialists who could explain what type of material you have to use to fulfil your demands. Nowadays this is no longer the case for cost reasons, and many of today's producers are located in Asia. In former times, the fibre and monofilament industry was an advisor, today it is a supplier only. So the textile industry has to have its own specialists who know the relation between material specifications and product demands. Textile industry needs specific skills suitable to these new textile vocations.

In NRW region, there is a strong overlap between the chemical industry, textile machine manufactories (components) and the textile industry (kind of yarn), that helps to have a real technical textile leadership. Technical textiles are projected to have the best growth potential due to the manifold applications and the high innovation grade of this sector. Therefore, those innovations are cross-sector technologies because technical textiles are often combined with other materials. Tomorrow, textiles will be integrated in a lot of new flexible materials with remarkable functionalities. Today the chemical industry offers specific materials used in technical textiles and reinforcement textiles are useful in composite industry. So these industries have to be considered in the field of technical textiles and a cross-disciplinary approach is an important asset to build the future of textile education.

In fact, textile education and training are not really suitable for today's textile industry in NRW. Especially in technical textiles the solution of tasks lies in the knowledge of material specifications and behaviour. Today in the technical textiles sector, it is more important to understand the physical, chemical and technical demands of a given problematic for technical textile products than to use well-known technologies like weaving or knitting.

There is no special training for niche products because innovative textile is subject to more and more cutthroat competition. (Nevertheless some textile research institutes are developing new technologies, products or methods, for example "Bionics").

The future of NRW textile education

In the last years, demographic change has emerged as one of the main future challenges for the NRW region. Since 1995, the population development is zero with a total of less than 17 million people in 2010 and 25 % over sixty years old²⁹. The process of an aging workforce is obvious, whereas human resources directions tend to concentrate on younger members of the workforce. Adequate measures are essential to keep innovation capability high, and to avoid negative consequence of a mismatch of workforce supply and demand. The aging textile workforce should be suitable to specific vocations like consultancy or teaching due to its large experience.

The EU economic strategy 2020 is the new major strategic guideline for Europe since the Lisbon strategy of 2000. Concerning Knowledge-Based Bio-Economy (KBBE), five key topics emerge in North-Rhine-Westphalia including biopolymers and biofunctional materials and surfaces³⁰. Two examples in which NRW shows potential are biofunctional implants and biofunctional textiles. Various disciplines come together with biotechnology depending on the application like material science and textile technology. Applying biotechnology could be integrated in the curriculum of skilled professions like textile engineer to create a broad knowledge base.

²⁹ Location Profile of NRW, NRW.INVEST, June 2011

³⁰ Nordrhein-Westfalen auf dem Weg in eine wissensbasierte Bioökonomie", Ministerium für Innovation, Wissenschaft und Forschung des Landes Nordrhein-Westfalen, 6. Juni 2011

APPENDICES

Insight of funding program for the textile and clothing industry in NRW

(ZiTex - Textil & Mode NRW, DBR , December 2010)

- Training bonus

Contributor: State agency for labour

Target group: workers who need funding for training

Amount of funding: 4,000 EUR when training allowance is less than 500 EUR
 5,000 EUR when training allowance is more than 500 EUR and less than 750 EUR
 6,000 EUR when training allowance is more than 750 EUR

Information: <http://www.arbeitsagentur.de>

- Education check Nordrhein-Westfalen

Contributor: State government NRW

Target group: employees who live in NRW and work in small or medium enterprise (max. 250 subscribers of social insurance)

Amount of funding: German Labour Ministry offers "training check" supported by European Social Fund. Thus vocational training cost became 50 % cheaper (maximum until 500 €).

Information: <http://www.nordrheinwestfalendirekt.de>

- Incentive for in-company vocational training (in work group)

Contributor: State government NRW

Target group: employees who live in NRW

Amount of funding: funding is equal to 50 % of spending up to max. of 4,500 EUR

Information: <http://www.mags.nrw.de>

- Incentive for vocational further education of employees (ESF - European Social Fund)

Contributor: Federal government

Target group: employees who have to acquire new skills for another vocation

Amount of funding: funding for duration of education (three years)

-> general-purpose education: small enterprise: 80 %, medium enterprise: 70 %, large enterprise: 60 %

-> specific education: small enterprise: 45 %, medium enterprise: 35 %, large enterprise: 25 %

Information: <http://www.initiative-weiter-bilden.de>

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