Co-funded by the
Erasmus+ Programme
of the European Union

Modernization of curriculum of Textile Engineering and Textile Technology in Indonesia, Malaysia and Pakistan

SMARTEX

WP1: Deliverable 1.1.

Competence profile for graduates of textile related bachelor studies in compliance with the needs of the labour market and EU good practices

[Competence profile for graduates of textile related bachelor studies in compliance with the needs of the labour market and EU good practices – Deliverable 1.1. and WP1]

Project acronym:	**SMARTEX**
Project full title:	**Modernisation of curriculum of Textile Engineering and Textile Technology in Indonesia, Malaysia and Pakistan**
Grant agreement no.:	**2019-2154/0001-001**
Responsible partner for deliverable:	**P1: University of West Attica (UNIWA)**
Contributing partners:	**P5 UNIVERSITI TEKNOLOGI MARA MALAYSIA (UiTM) leader for Malaysia** **P6 UNIVERSITI TUN HUSSEIN ONN MALAYSIA** **P7 POLITEKNIK STTT BANDUNG INDONESIA leader for Indonesia** **P8 INSTITUT TEKNOLOGI BANDUNG** **P9 BAHAUDDIN ZAKARIYA UNIVERSITY PAKISTAN** **P10 NED UNIVERSITY OF ENGINEERING AND TECHNOLOGY PAKISTAN, leader for Pakistan**
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Distribution level:	**Public**
Total number of pages:	**140**
Version:	**FINAL**
Language	**English**
Reviewed by:	**P5, P6**
Status:	**FINAL**
Delivery date:	**30/10/2020**

This project has been funded with support from the European Commission. This [communication] reflects the views only of the author, and the Commission cannot be held responsible publication for any use which may be made of the information contained therein.

Version control

Number	Date	Description
V0.1	30/03/2020	Initial draft by UNIWA
V0.2	30/05/2020	Additions Malaysia, reviewed by UNIWA
V0.3	28/07/2020	Additions Indonesia, reviewed by UGENT
V0.4	05/09/2020	Additions Indonesia, reviewed by UPV
V0.5	30/09/2020	Final Draft by UNIWA
V0.6	10/10/2020	Peer reviewed by P5, P6
V0.7	15/10/2020	Modifications as suggested in the Peer Review report
Final	30/10/2020	Final version

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Abbreviations and Acronyms

EACEA	Education, Audiovisual and Culture Executive Agency
EC	European Commission
EU	European Union
GA	Grant Agreement
HEI	Higher Education Institution
ICT	Information and Communication Technologies
PC	Project Coordinator
WP	Work Package

Executive Summary

This report titled "Competence profile for graduates of textile related bachelor studies in compliance with the needs of the labour market and EU good practices" provides a comprehensive information about Malaysia, Indonesia and Pakistan regarding their existing situation of textile industry, general description of qualification attained by the technical workforce in these countries along with the activities associated with their qualification. In addition, sectoral studies, related occupational and competence profile and specification of competence profile are also part of this report which were gathered through a survey conducted after getting the desired data of respective stakeholders compiled.

It is evident from this report that the textile industry in all these three countries (Malaysia, Indonesia and Pakistan) are very well established and hence, it is the major contributor towards their export which include the related manufactured goods. Indonesia itself is amongst the top ten largest textiles and garment producing countries of the world.

A comprehensive study which had been conducted in each of these countries using a bibliographic survey with a focus towards the status and general requirements of the textile industry both in terms of the qualities *(in addition to the qualification obtained from the higher education institutions)* desired by them from the manpower hired by them as well as any other expectations from the government primarily in terms of any incentives. Although, the higher education institutes in the participating Asian countries have managed to supply the industry with qualified labour force but apparently, the industry is looking for people with high level of competency in new technologies specific to technical textile.

The three Asian countries, Malaysia, Indonesia and Pakistan, involved in the SMARTEX project have been found to have the common trait of their economies substantially depending upon the textile and clothing industry, and on its ability to adjust and propagate new technologies in the field. A dire need for a well-trained employee was also observed who had studied the latest curriculum which can eventually help build a skilled workforce for their respective country. Since, technical textile is the fast-growing area, therefore, there is a common feeling that the curriculum for the programmes of Textile Engineering and Textile Sciences should include updated courses of this specialised domain. Conventional Textiles of course is no doubt the main crux, however, non-conventional ones like technical textiles encompassing Buildtech, Clothtech, Geotech, Indutech, Meditech, Mobiltech, Packtech, Sportech and Protech should be an area to focus upon especially for future perspective.

The minor variation which exists in the ground realities of each of the three Asian countries involved in this project had compelled there to have minimal variation in the survey for each of these countries. The stakeholders' survey for Malaysia was based upon three components which are a) Importance of fundamental knowledge required by the respondents is technology for materials production b) Physicochemical and technical characteristics of conventional raw materials and c) Quality control and management whereas, in Indonesia, it was based upon three attributes which included a) Psychological Knowledge b) Social Knowledge and c) Cultural Knowledge of the students. In Pakistan, however, the survey was based upon gathering information regarding a) Knowledge necessary for students and employees in textile & fashion industry, specific fields of textile application and in development of innovative and smart textile with advanced properties. b) Professional skills necessary for students and employees in textile and fashion industry c) Personal qualities and attitudes for students and employees in textile and fashion industry. So, as such on a common platform with three major players in Asia, all nine attributes have been addressed which would of course provide a general perspective of all three countries.

One major difference observed depicts that the textile industry in both Indonesia and Malaysia is mainly dependent on the imported raw material whereas, Pakistan being one of the large cottons producing countries is more tilted towards export of cotton related products with least value addition.

The traditional textile still being the focus in these Asian countries has resulted in limited competency of engineers produced in these countries with an invisible obstruction towards gaining knowledge in advanced domains. For example; in terms of graduate competence profile, Malaysia’s textile engineering programme aims to develop graduates' understanding on the textile industry, textile process, and technical textile. In contrast to that, Indonesia aims to develop graduates with the ability to demonstrate the capability to apply science, technology, and art within his/her scope of expertise and adaptable to various situations of problem solving. As far as Pakistan is concerned, it has a wide and varied industry which continuously provides numerous challenges for its textile related higher educational institutions for producing highly skillful labour so as to fulfil their workforce needs. It has also been observed that in comparison to the engineers from any other discipline, the textile engineers after spending sometime in core technical areas get swift promotion and reach to the mid-level management where they find themselves well placed for playing their role at policy making.

In conclusion, it was found that the curriculum of textile engineering and relevant disciplines offered in these countries must be updated and modernised by having topics such as functional apparels for sports, leisure, medical uses, nano materials, nanotechnologies in textile and fashion, also new fibres and textile structures should be made part of it so as to cater the needs to develop the textile industry and its production further. In this regard, the cooperation between partner Europe and Asian universities will be vital and fruitful as both sides will be able to share their experiences and also get equipped to fill in any gap that may exist at any part. In the long term, this will help address the ever-increasing demand of textile related products world over as well as assist in the development of the economy of partner countries in particular and the world at large in general.

1 Introduction

SMARTEX is a curriculum development CBHE Erasmus+ project. It is a curriculum development project consistent with the respective regional and cross-cutting priorities. This developing curriculum is designed to implement a series of joint activities. It involves three EU universities (from Greece, Belgium, and Spain), a training and consultancy company from Greece, 2 universities from Malaysia (Universiti Teknologi MARA and Universiti Tun Hussein Onn), 2 from Indonesia (Institut Teknologi Bandung and Politeknik STTT Bandung), and 2 from Pakistan (Bahauddin Zakariya University College of Textile Engineering and NED University of Engineering and Technology), all having departments in the field of textiles engineering and fashion to modernize the curriculum of involved HEIs in partner countries. Participating organizations from Partner Countries consist of staff and students, and high-tech textile firms.

In this prospect, the cooperation of universities from the 6 countries involved will be beneficial for everyone involved. SMARTEX project focuses on adopting the latest evolutions and findings regarding technical and smart textiles, meaning that it will be a technology- and business-oriented project. All partners will work jointly on an equal basis, recognizing and respecting the cultural diversity of each other, as non-academic staff will also learn through participating in the capacity building activity on how to organize and manage internship placements of university students in companies nationally and internationally. The topic around which the project is built is a curriculum on technical and smart textiles. This topic is complex, comprising fascinating technological evolutions and applications in many sectors of activity. Textiles and fashion production have, to a great extent, shifted from Europe to other parts of the world. Partner countries represented in the SMARTEX partnership are among the most prominent textile producers.

The focus of this project is on the development of the curriculum of Textile Engineering and Textile Technology studies at the bachelor level for universities in Pakistan, Malaysia, and Indonesia. The three Asian countries, Malaysia, Indonesia and Pakistan, involved in the SMARTEX project have the common trait of their economies depending to a substantial extent on the textiles and clothing industry and on its ability to adapt and engender new technologies in the field. This factor, of course, relies on the existence of a well-trained workforce, including managing staff and engineers, hence the importance of a CBHE project introducing curricula on smart and technical textiles, which are the future of the trade. All 3 partner countries have a very developed textile industry, and high dependency on it as critical indicators (employment, GDP, exports, etc.) are concerned. The new and updated curriculums will focus on textile engineering, especially on smart and technical textiles. Technical and smart textiles are a fast-growing area of textiles. They combine new material with innovative applications. Unlike conventional textiles, their applications are very diverse. They include Buildtech, Clothtech, Geotech, Indutech, Meditech, Mobiltech, Packtech, Sportech and Protech. Due to a wide range of applications, the development of technical and smart textile products requires knowledge from different fields.

This project will support the modernization and internationalization of Asian HEIs. It will result in the sharing of good practices with partners and upgrade competences of textile engineering graduates, which will enable the development of new products. This project has started in early 2020 and will last until 2023 (3 years). The implementation of this project is divided into 8 work packages (WP); which include the preparatory phase, the course development, international exchange (staff and students), project management, quality insurance, and dissemination phase.

More specifically, the framework of SMARTEX is described as follow:

- Participating HEIs from Partner Countries will collaborate with HEIs from EU member States to develop new curricula on smart and technical textiles at a Bachelor degree or updating already existing curricula. The development of curricula will include ECTS credits for each component of them. Development of curricula will be based on analysis of competencies needed and state of the art analysis of bachelor degree courses on the specific topic of smart and technical textiles. For each Asian university, Curriculum development will be based on the particular needs of the respective university.
- HEIs from the three Partner Countries will undertake to accredit new curricula.
- Participating HEIs, both Asian and European, will collaborate and develop new courses or update existing courses on smart and technical textiles and develop learning materials to be used in these courses.
- IDEC, the Greek technical partner, will upload the learning material on an e-learning platform and be responsible for the quality monitoring of the project. Furthermore, as the only representative of the private sector, IDEC will help with the design and implementation of international internships of students from Asian Universities.
- There are previewed 6 exchanges and training sessions (one in each partner country Greece, Belgium, Spain, Malaysia, Indonesia, and Pakistan) for capacity building of university teaching staff and administrative staff of Asian universities. Capacity building of academic staff refers to the new curricula and administrative staff. It relates to internationalization and the organization/management of internships-placements of students of Asian universities in textile companies (both in their own country and in European companies).
- Asian HEs will deliver new and updated courses using blended learning (including the e-learning resources developed within SMARTEX uploaded on the e-learning platform).
- There will be a promotion of university-enterprise cooperation. This will entail context analysis for students of Asian Universities' internships-placements to local textile companies and international mobilities of students of the same universities in European textile companies, respectively. Before the actual placements of students in companies takes place, the partnership will undertake the development and accreditation of the

internship program framework for each Partner Country University and the establishment of agreements with companies regarding apprenticeships. It is also previewed that internships/ placement of Asian students will take place in European textile companies, which will last for 3 months.

As a general approach, SMARTEX activities and results will meet the needs of target groups, taking account of its first activity. The "Analysis of the competencies needed, related to smart textiles and technical textiles in Asia universities," will be based on all other activities and results of the project. The main target groups of the SMARTEX project are three:

1. University staff (academic and administrative) of the 6 Asian HEIs participating in the project,
2. Students of these universities, future graduates of textile engineering, and
3. Textile Producing companies in Malaysia, Indonesia, and Pakistan.

Benefits of SMARTEX for students and university staff will be:

- Undergraduate students
  Increase their benefit from their studies as they will attend a new state of the art curriculum on technical and smart textiles, jointly developed with European Universities with ECTS credits. They will enjoy blended learning, and they will have the opportunity to be placed as interns in high-tech textile companies in Europe and in their country, thus boosting their employability and value in the labor market.

- University staff of Asian HEIs
  Work jointly with their colleagues in European universities, developing new or updating existing curriculum and learning materials on a technology edge subject, such as technical and smart textiles. In this way, they will meet their need for internationalization and keeping their knowledge updated. Through exchanges and training, academic staff will learn European practices on accreditation, ECTS, and validation of knowledge acquired through on-the-job training and how to use blended learning facilities. Finally, they will learn from contacts and exchanges with other European and Asian colleagues and their connection with technical and smart textile companies in their country and Europe.

In general, this project is an embodiment of cooperation between the EU and Asian countries through joint initiatives and by sharing good practices. This project supports the modernization and internationalization of Higher Education Institutes in Malaysia, Indonesia, and Pakistan in the context of the priorities identified in the New EU Consensus in Development and the EU Higher Education in the World. As a result, the project hopes to improve the level of competencies and skills in Asian HEIs by reforming bachelor degree programs, which will bring national education systems up to the EU standards level and enhance the competitiveness of graduates in the labor market.

1.1 Aims

This report aims to provide (1) a general picture of the participating Asian countries (Malaysia, Indonesia, and Pakistan) on their current textile industry condition, (2) a comprehensive information on their textile higher education system and graduates profile, and (3) an in-depth analysis of the industry needs and perception about smart textiles and textile graduates. The information will serve as a basis for the implementation of the project and in the development of curriculum for the modernisation of Asian higher education in textile for the future.

1.2 Methodological aspects

As mentioned above, the principle objective of this project is to support the modernisation and internationalisation of Higher Education Institutions in Malaysia, Indonesia, and Pakistan. The project is divided into eight work packages. This section describes the methodology and activities of Work Package (WP) 1.1 which was conducted to attain the first objective: competence profile for graduates of textile related bachelor studies in compliance with the needs of the labour market and EU good practice.

The work package 1.1 is the preparatory phase for gathering all necessary information for the implementation of SMARTEX. Furthermore, this WP aims to examine the impact from implementing the SMARTEX project, not only for the partner countries (P5 - P10), but to developing countries in Asia in general. The methodology used for this study involved bibliography research and data collection from stakeholders of each participants' countries. The target of stakeholders for each country was a minimum 20 stakeholders from different backgrounds. All Asian partners were involved in the study with the determined leader for Malaysia was P5, the leader for Indonesia was P7, and the leader for Pakistan was P10.

The tool used for data collection was determined by each country, depending on the capability. The main instrument for data collection was a questionnaire, however, several additional tools were used, such as structured interview and focus group discussion. Quantitative and qualitative data were expected to gather from the data collection.

The questionnaire consists of six parts. Part one, two and three from the questionnaire contain Likert Scale questions. These parts aim for measuring the level of importance of each question and level of knowledge of the stakeholder toward each question. Each of the Likert scale data questions has an additional comment to gain deeper understanding from each question. Part four, five and six from the questionnaire contain open questions for each part. These parts aim for extracting additional information from the stakeholders about other knowledge, skills, tasks and activities that are important for professionals of textile and fashion industry.

This survey employed a purposive sampling method, known as non-probability sampling. The aim of applying purposive sampling in this study was to meet the target groups of this project which are the expertise (expert sampling). The target participants for this survey were (i) a person who has a background in textile engineering, technology and design or (ii) a person who has experience working with a person with that background. The selected participants for this study were required to meet at least one criterion or both. Participants with the textile engineering, technology and design background had the ability to explain the textile graduate competency. Whilst, participants who have worked with the textile graduates with the textile engineering, technology and design background could give a perspective of what the market needs within the current situation. To reach a broader perspective, the survey attempted to reach different occupations within the area. Those occupations are consultants, entrepreneur, manager, designer, retail, wholesaler, engineer, academic, or other. The report from this WP 1.1 includes an analysis of the competences needed for graduates of textile engineering bachelor's degrees, analysis of the requirements of educational standards to the level of formation of professional competence of future textile engineers, analysis of the legislative and regulatory framework of higher education and industry.

2 Competence profile

2.1 Malaysia

2.1.1 Bibliography review

2.1.1.1 General description of the qualification

According to the Malaysian Industrial Development Authority (MIDA), the Malaysian Textile and Apparel Industry has been the nation’s 13th largest exporting industry in 2018, landing approximately RM12 billions of Malaysia’s total manufactured goods exports. For several years, the USA is still the top market for Malaysia’s export textile products, purchasing RM1.6 billion (13%) of the industry’s total exports in 2018.

The Malaysian government has ambitious plans for the industry, and an export target of US$6 billion has been set for 2020. Moreover, the continuing importance of the textile and clothing industry to Malaysia is highlighted in the country's Third Industrial Master Plan (IMP3), which has identified industrial and home textiles, functional fabrics, high-end fabrics and garments, and ethnic fabrics as growth categories. Furthermore, the textile industry in Malaysia benefits from low import duties on industrial goods, membership of the Association of Southeast Asian Nations (ASEAN) and bilateral trade agreements with the EU, Chile, India, New Zealand, Pakistan and Turkey. Nevertheless, Malaysia faces increased competition from lower cost competitors in countries such as Bangladesh and Cambodia. Also, the textile and clothing industry in Malaysia is dependent on the importing of raw materials-particularly for the manufacture of fabric. However, as the industry shifts towards the manufacture of higher added value products, Malaysia has the potential to develop industrial and home textiles, functional fabrics and high value fabrics and clothing, having features such as fire-resistant, anti-bacteria, wrinkle-free and ultraviolet protection, high-end apparel and many others.

As highlighted in the Third Industrial Master Plan (IMP3), set from 2006 until 2020, 12 industries in the manufacturing sector have been set for development and promotion, including the Textile & Apparel Industry. Table 2.1 shows the targets for export and investment for the 12 industries.

Today, the Textile and Apparel Industry is a matured industry, thanks to a past of fast-paced growth as a result of Malaysia’s export-oriented industrial transformation in the early 1980s. Today, investment opportunities lie in the higher end of the global value chain and the diversified production of higher value-added products.

To recap, in 2018, a total of 18 projects were approved in the textiles and textile products industry with investments totalling RM851 million. DDI led the way, with RM566.3 million (66.5%), with foreign investments amounting to RM284.7 million (33.5%).

The 18 projects consist of primary textiles (RM398 million), specialised apparel (RM181.6 million), technical textile (RM108.6 million), made-up garments (RM14.3 million), and textile products (RM148.5 million). The majority of these were new projects, with six expansion/diversification projects that were worth RM392 million.

The approved projects have resulted in 912 new jobs, of which 312 are in the managerial, technical, and supervisory categories. The industry recorded a Capital Investment Per Employee (CIPE) of RM807,708 in 2018, which is over three times the CIPE of RM231,757 in 2017. This implies a higher level of automation and technology used in the industry.

In the Eleventh Malaysia Plan (2016 – 2020), the manufacturing sector was set to transit towards more high-value, diverse and complex products, driven by three catalytic subsectors, namely the chemicals, E&E and machinery & equipment (M&E) as well as industries with high potential growth such as medical devices, aerospace and the textile industry. These sub sectors have strong interlinkages to other manufacturing subsectors and have demonstrated capabilities and potential to deliver more complex and high value-added products. The manufacturing sector is expected to grow at 5.1% per annum and contribute 22.5% to GDP as well as 18.2% of total employment by 2020. This transition will be underpinned by enhanced R&D, more sustainable manufacturing practices, greater compliance to global standards, and collaboration between stakeholders. To this end, five strategies (B1 to B5) have been identified to grow and energise the manufacturing sector, as shown in Figure 2.1.

According to the 3rd Industrial Master Plan, there is a shortage of technical expertise and trained and skilled personnel in the industry, such as textile technologists, designers, chemists, colour specialists and maintenance technicians. There is also a mismatch in the supply of the human resource, where qualification of graduates does not meet the industry's requirement.

At present, only a limited number of specialized textiles-based related courses are offered by local colleges and universities. Nevertheless, graduates from the related textile courses are employed as executives and department managers mostly within the manufacturing sector of Textiles & Apparel, or in the Fashion, Design and retail industry, or become entrepreneurs within the industry. Since there are limited graduates specialized in these fields every year, graduates usually have no problem in getting their first jobs.

Table 2.1: Export and Investment Targets for Twelve Industries

Sub-Sector	Exports			Investments	
	2006-2020		2020	2006-2020	2020
	(RM billion)	Average Annual Growth (%)	Share (%)	(RM billion)	Share (%)
Total	**11,403.2**	**7.1**	**100.0**	**362.5**	**100.0**
Non-resource based	**9,202.5**	**7.1**	**80.6**	**232.8**	**65.3**
Electrical and electronics products	7,533.9	6.3	65.9	82.4	23.1
Metal products	514.6	7.6	4.5	44.2	13.6
Machinery and equipment	494.4	6.4	4.3	30.8	7.7
Textiles and apparel	248.8	7.8	2.1	13.7	3.1
Transport equipment	232.5	6.3	2.0	42.3	11.6
Medical devices	178.3	7.6	1.6	19.4	6.2
Resource based	**2,200.7**	**7.1**	**19.4**	**129.7**	**34.7**
Palm oil	781.7	7.6	7.0	26.1	7.6
Wood-based products	545.2	6.4	4.7	25.4	6.2
Petrochemical products	377.4	6.3	3.3	34.0	9.4
Food	244.6	7.8	2.2	24.6	6.2
Rubber products	239.0	7.6	2.1	12.9	3.0
Pharmaceuticals	12.8	6.3	0.1	6.7	2.3

Source: Ministry of International Trade & Industry (MITI)

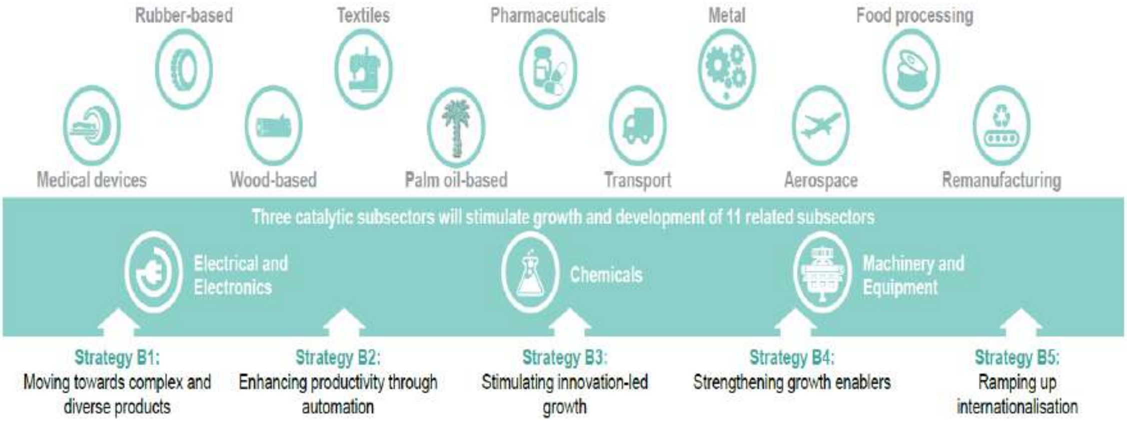

Rubber-based
Textiles
Pharmaceuticals
Metal
Food processing
Medical devices
Wood-based
Palm oil-based
Transport
Aerospace
Remanufacturing
Three catalytic subsectors will stimulate growth and development of 11 related subsectors
Electrical and Electronics
Chemicals
Machinery and Equipment
Strategy B1: Moving towards complex and diverse products
Strategy B2: Enhancing productivity through automation
Strategy B3: Stimulating innovation-led growth
Strategy B4: Strengthening growth enablers
Strategy B5: Ramping up internationalisation

Figure 2.1: Strategic framework for manufacturing sector (11th Malaysia Plan)

2.1.1.2 Activities associated with the qualification

Both programs at UiTM have a compulsory internship module which usually allows the students to be trained in the Textile & Apparel industry as well as the retail industry within Textiles and Fashion. Duration of the internship for Diploma level is 12 weeks, while for the BSc. level, 8 weeks.

For UTHM, the students under this program undergo industrial training for the duration of 24 weeks in their final semester of study. The aim of the training is to provide the students with working experience in the industry by applying the engineering technological skills obtained from their studies into practice in any engineering or textile related field.

There are a few associations within the Textile, Apparel and Fashion industry in Malaysia which are

- Malaysian Textile and Apparel Centre (MATAC)
- Malaysian Textile Manufacturers Association (MTMA)
- Malaysian Knitting Manufacturers Association (MKMA)
- Malaysian Footwear Manufacturers Association (MFMA)
- Federation of Malaysian Fashion, Textile and Apparel (FMFTA) – established in 2019

2.1.1.3 Sectoral studies

With regards to the Textile Science, Technology and Engineering field, there are 2 main universities in Malaysia offering such programs as shown in Table 2.2. Universiti Teknologi MARA (UiTM) offers 2 programs at the Diploma and Bachelor of Science level, while Universiti Tun Hussein Onn Malaysia (UTHM) offers Bachelor of Mechanical Engineering Technology (Industrial Textiles) with Honours.

Table 2.2: Textile Science, Technology and Engineering Programs in Malaysia

Institution	Programme Name	Level	Duration	Year Established
Universiti Teknologi MARA (UiTM)	Textile and Clothing Technology	Diploma	2.5 years	1974
	Textile Science & Fashion Technology	Bachelor of Science (Honours)	3 years	2000
Universiti Tun Hussein Onn Malaysia (UTHM)	Industrial Textiles	Bachelor of Mechanical Engineering Technology	4 years	2012

At present, the intake of students for UTHM has been temporarily frozen and the textiles courses are embedded into the Bachelor of Mechanical Engineering Technology (Manufacturing) as elective courses. One of the main reasons is due to the low number of student's enrolling. Nevertheless, the move to freeze student intake allows for a comprehensive review and changes to the program structure to suit the current social and industry needs.

2.1.1.4 Related occupational and competence profile

All the programs established in the Malaysian Higher Education system have to comply with the procedures and standards set out by the Malaysian Qualification Agency (MQA). MQA is the statutory body set up under the Malaysian Qualifications Act 2007 to accredit academic programs provided by educational institutions providing post-secondary or higher education and facilitate the accreditation and articulation of qualifications.

In addition, both the Diploma in Textile and Clothing Technology, and Bachelor of Science (Honours) in Textile Science & Fashion Technology, in UiTM have recently applied for accreditation from the Malaysia Board of Technologists (MBOT). MBOT is a professional body that gives Professional recognition to Technologists and Technicians in related technology and technical fields. The board also gives accreditation to higher education programmes that meet the technological and technical aspects of the curriculum.

The Bachelor of Science (Honours) in Textile Science & Fashion Technology of UiTM is currently accredited by the Textile Institute, Manchester, United Kingdom from 2018 until 2022.

The Bachelor of Mechanical Engineering Technology (Industrial Textiles) with Honours is accredited by the Engineering Technology Accreditation Council until 2022. The textile engineering technology programme aims to develop understanding of the textile industry, textile process and technical textile. Furthermore, the programme prepares the graduates with knowledge, problem solving ability and skill to enter into the respective careers in textiles industries.

2.1.1.5 Specification of the competence profile

I. Diploma in Textile and Clothing Technology, Faculty of Applied Sciences, UiTM

The Programme Educational Objectives are as follows:

- Textile and clothing technologists who apply knowledge, understanding and laboratory skills in engaging society and stakeholders
- Textile and clothing technologists who proactively manage information and life-long learning, and innovatively administer managerial and entrepreneurial skills.
- Textile and clothing technologists who proactively manage information and life-long learning, and innovatively administer managerial and entrepreneurial skills.

The Programme Learning Outcomes are as follows:

- Apply basic knowledge of textile and clothing studies in general practice in textile and clothing industries.
- Display the scientific and technical skills in the textile and clothing industries.
- Demonstrate social skills and responsibilities relevant to textile and clothing industries, social and stakeholders.
- Adhere with positive attitudes, ethics, and professionalism in their scientific pursuit.
- Integrate effective communication and taking roles as a leader and a member of a diverse team.
- Analyse data and problem solving in relation to the textile and clothing industries.
- Demonstrate information management and engage in life-long learning.
- Display good managerial and entrepreneurial skills.

II. Bachelor of Science (Hons) Textile Science and Fashion Technology, Faculty of Applied Sciences, UiTM

The Programme Educational Objectives are as follows:

- A Textile technologist who synthesizes and applies the knowledge, understanding and laboratory experiences to provide quality services to government agencies and textile related industries
- A textile technologist who leads and engages in teams in problem solving tasks across disciplines through effective communicative abilities.
- A textile technologist who continues to advance his/her knowledge and abilities and utilizing ICT to explore business opportunities in the textile- related industries.
- A textile technologist who practices ethical and professional values in providing services to the recipients and provider of the science-related industry

Upon completion of the studies, the graduates acquire:

Knowledge

- Able to analyse problems in textile industries by applying knowledge, theories and principles of science and mathematics and textile technology

Practical skills

- Able to safely prepare samples, operate and use laboratory and textile equipment.

Problem solving and scientific skills

- Able to identify problems, design and/or conduct experiments; analyse and interpret experimental data.
- Able to apply the scientific reasoning in solving authentic problems.
- Able to communicate scientific ideas effectively in written form.

Communication, leadership & Team skills

- Able to verbally communicate scientific ideas effectively.
- Able to work in a team of multi-disciplinary projects.
- Able to demonstrate leadership skills

Values, attitudes and professionalism

- Able to apply values, ethics, morality and professionalism in their scientific pursuit.

Information management and lifelong learning skills

- Able to manage information and engage in life-long learning.

Managerial and entrepreneurship skills

- Able to acquire and apply managerial and entrepreneurial skills.

Capacities:

- Understand production processes starting from fibres until garment.
- Identify and understand different types of fibres, fibre properties, yarn and fabric structures
- Designs garments according to the fashion requirements.
- Aware of new technologies in fibre, fabric production, dyeing process and garment production
- Able to solve production cost and statistical production data.
- Handles quality control instruments.
- Handle and plan CAD / CAM systems.
- Solves and handle research related to textile materials and products
- Create and develop visual merchandising display
- Understand fashion marketing, retailing and international trade in textile and apparel industries.

III. Bachelor of Mechanical Engineering Technology (Industrial Textiles) with Honours, Department of Mechanical Engineering Technology, Faculty of Engineering Technology, UTHM

The Programme Educational Objectives can be defined as the specific goals consistent with the mission and vision of UTHM and are responsive to the expressed interest of programme stakeholders describing expected achievements of graduates in their career and professional life after graduation. The Programme Educational Objectives for the program are listed below. It needs to be achieved by the graduates 3 – 5 years after graduation.

The Faculty's engineering technology programme shall produce Mechanical Engineering Technologist (Industrial Textiles) who:

- Practice with strong fundamental knowledge in Mechanical Engineering Technology (Industrial Textiles).
- Engage in activities related to Mechanical Engineering Technology (Industrial Textiles) with technical competency.
- Communicate with people in the related profession and stakeholders.
- Adapt to changes related to engineering technology and environment.

In addition, the program has 13 Programme Learning Outcomes which are mapped to the 12 Programme Outcomes of the Engineering Technology Accreditation Council. The Programme Learning Outcomes are listed below:

Knowledge: Apply knowledge of mathematics, science, mechanical engineering fundamentals and an engineering specialisation in textile industry to defined and applied engineering procedures, processes, systems or methodologies

Modern Tools Usage: Select and apply appropriate techniques, resources, and modern engineering tools to broadly-defined engineering problems, with an understanding of the limitations.

Communications: Communicate effectively on broadly-defined engineering activities with the engineering community and with society at large, by being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Investigation: Conduct investigations of broadly-defined problems; locate, search and select relevant data from codes, databases and literature, design and conduct experiments to provide valid conclusions.

Individual & Teamwork: Function effectively as an individual, and as a member in diverse teams.

Lifelong Learning: Recognize the need for, and have the ability to engage in independent and life-long learning in specialist technologies.

Project Management & Finance: Demonstrate entrepreneurship skills for career development.

Ethics: Understand and commit to professional ethics and responsibilities and norms of engineering technology practice.

Leadership skill: Demonstrate effective leadership responsibility in a team and able to manage projects in multidisciplinary environments.

Design/Development of Solutions: Design solutions for broadly-defined engineering technology problems and contribute to the design of systems, components or processes to meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

Problem Analysis: Identify, formulate, research literature and analyse broadly-defined engineering problems reaching substantiated conclusions using analytical tools appropriate to mechanical engineering technology and specialization in textiles industry.

Environment & Sustainability: Understand and evaluate the sustainability and impact of electronics engineering technology work in the solution of broadly-defined engineering problems in societal and environmental contexts.

Engineering Technologist & Society: Demonstrate understanding of the societal, health, safety, legal and cultural issues and the responsibilities relevant to engineering technology practice and solutions to engineering problems.

Employment Data

The graduate employability data was obtained from the university's Transformation Division. The data is shown in Table 2.3 below.

Table 2.3: Graduate employability data (2017-2019)

Programme	Average of graduate employability for the past three year (%)
Diploma in Textile Technology, UiTM	80.3
BSc (Hons) Textile Science and Fashion Technology, UiTM	80.23
Bachelor of Mechanical Engineering Technology (Industrial Textiles), UTHM	89.67

2.1.2 Stakeholders' survey

2.1.2.1 Methodology

This section discusses the results from the "Survey on Employer Expectations on Graduates in Textile Related Programmes". The survey is conducted to gauge the readiness of textile related industry/ organizations/ businesses (including fiber formation, yarn and fabric manufacturing, technical textiles, apparel, shoes, fashion and design) to recruit graduates from textile related studies and the competencies of those graduates in context with the present and future requirements of the organizations/businesses and the global setting. The survey also covers the economic conditions of textile related industries in Malaysia.

Two partners contributed to this deliverable from Malaysia are:

1. Universiti Teknologi MARA (UiTM)
2. Universiti Tun Hussein Onn Malaysia (UTHM)

The survey was targeted to 20 respondents with 50% respondents being from the industry. Due to the COVID-19 pandemic, the survey was conducted in two ways; using interviews and google forms. The questionnaires were structured based on 5 parts (Annex I). Section 1 explains the demographic study including the stakeholders' background, length of services, nature of organization, number of workers and their education background. Section 2 to 4 describes the readiness of stakeholders to recruit new graduates, internship (or practical training) and competencies of graduates, respectively. The last section provides the summary and conclusion from the survey result. The content of the survey has been divided into five sections;

demographic, readiness to recruit new graduates, internship (or practical training), competencies of graduates and textile related industries.

2.1.2.2 Overview of respondent

A total of 21 participants from different backgrounds participated in this survey which were conducted through personal interviews (online streaming) and email distribution. Table 2.4 shows the names of organizations or businesses that participated in the survey.

Table 2.4: Description of Local Textile & Apparel Companies Involved in the Interviews and Correspondence

No	Name of Organisation/Business:	Job Title	Nature of organisation/business	Number of employees in the organisation
1	Akemi International Sdn Bhd	Manager	Manufacturing (fibre, spinning, weaving, knitting, garment, dyeing, nonwoven, etc)	501 – 1000
2	B.U.M Marketing (M) Sdn Bhd	Executive	Retailing (apparel, clothing, fashion store, boutique, shoes, etc)	101 – 300
3	Bravado Designs	Manager	Retailing (apparel, clothing, fashion store, boutique, shoes, etc)	Below 100
4	DREF Corporation Sdn Bhd	CEO	Manufacturer of DREF Friction Spinning Machines	Below 100
5	Eadeco Sdn Bhd	Executive	Home Furnishing	301 – 500
6	Eadeco Sdn Bhd	Manager	Home Furnishing	101 – 300
7	Fibertex Personal Care Sdn Bhd	Executive	Technical Textiles (automotive, medical, geotextiles, composites, etc)	301 – 500
8	Fibertex Personal Care Sdn Bhd	Executive	Technical Textiles (automotive, medical, geotextiles, composites, etc)	301 – 500

Table 2.4 (Continued)

No	Name of Organisation/Business:	Job Title	Nature of organisation/business	Number of employees in the organisation
9	Inter Couture Sdn Bhd	CEO	Manufacturing (fibre, spinning, weaving, knitting, garment, dyeing, nonwoven, etc)	Below 100
10	Malaysian Textile and Apparel Center (MATAC)	Manager	Association	Below 100
11	Maxim Textile Technology Sdn Bhd	Engineer	Manufacturing (fibre, spinning, weaving, knitting, garment, dyeing, nonwoven, etc)	301 – 500
12	Maxim Textile Technology Sdn Bhd	Manager	Manufacturing (fibre, spinning, weaving, knitting, garment, dyeing, nonwoven, etc)	301 – 500
13	Malaysian Industrial Development Authority (MIDA)	Senior Deputy Director	Government Agency	501 – 1000
14	NanoTextile Sdn Bhd	CEO	Technical Textiles (automotive, medical, geotextiles, composites, etc)	Below 100
15	Perindustrian Shunhon Sdn Bhd	Manager	Manufacturing (fibre, spinning, weaving, knitting, garment, dyeing, nonwoven, etc)	101 – 300
18	Recron Malaysia Sdn Bhd	Manager	Manufacturing (fibre, spinning, weaving, knitting, garment, dyeing, nonwoven, etc)	Above 1001
19	Siti Khadijah Apparel Sdn. Bhd.	Executive	Retailing (apparel, clothing, fashion store, boutique, shoes, etc)	301 – 500
20	Tai Wah Garments Industry Sdn Bhd	Executive	Manufacturing (fibre, spinning, weaving, knitting, garment, dyeing, nonwoven, etc)	501 – 1000

Table 2.4 (Continued)

No	Name of Organisation/Business:	Job Title	Nature of organisation/business	Number of employees in the organisation
21	Tai Wah Garments Industry Sdn Bhd	Executive	Manufacturing (fibre, spinning, weaving, knitting, garment, dyeing, nonwoven, etc)	501 – 1000

2.1.2.3 Competence profile

Section 1: Demographic study

There were 21 responses received from different organizations. Figure 2.2 shows that the participants were mainly engineers, managers and CEO of the respective organizations. The three main nature of organization are from the manufacturing, technical textiles and retailing sector. Responses were also received from an association within the textile and apparel industry (Malaysian Textile and Apparel Center) and from a government agency that handles and promotes foreign investment into the textile and apparel industry, the Malaysia Investment Development Authority (MIDA).

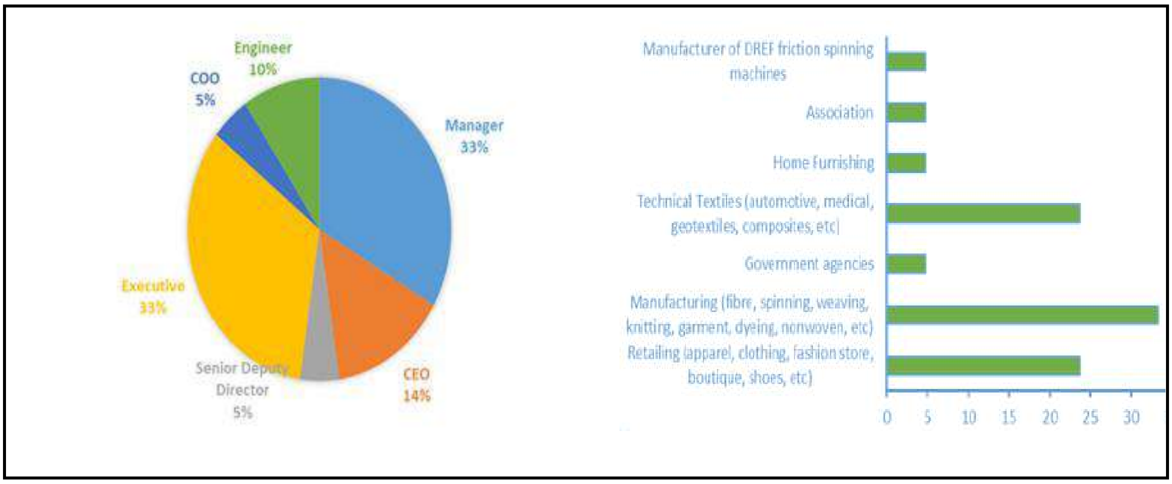


Figure 2.2: Stakeholder's background

Section 2: Readiness to recruit new graduates

As shown in Figure 2.3, 71% of the employers are willing to recruit new textile graduates for year 2020 until 2025. The positions that can be offered for new textile graduates are mostly as technologists, executives and engineers. The employers strongly believed that the Malaysian textile graduates are suitable to work in production, laboratory & quality control and in technical aspects due to their strong science and technology background.

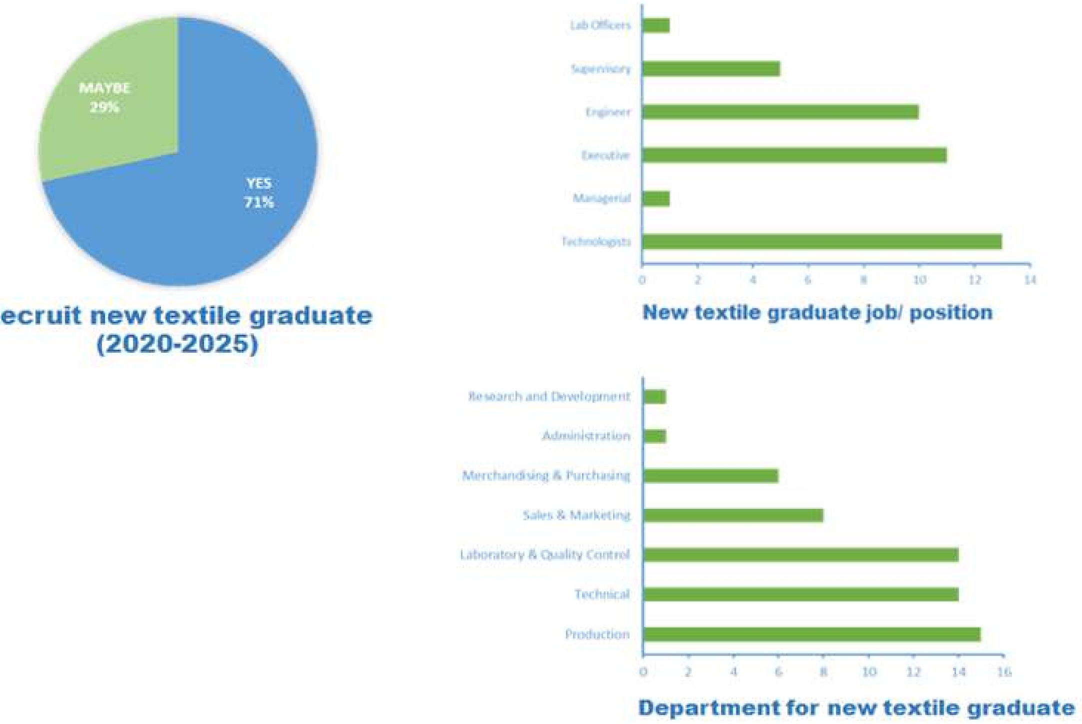


Figure 2.3: Readiness to recruit new graduates

Section 3: Internship (or practical training)

Figure 2.4 shows the results under the internship section. More than 50% of respondents agree that internships are an important part of the curriculum and 57% chose 6 months for the best training duration. Some 67% of the respondents agree that they are willing to recruit students for internships. More than 70% respondents agree that the university should provide a proper internship plan for the students. However, they are also willing to provide the planning and schedule to assist the university. More than 86% of respondents are willing to provide allowances to the students, however, only 5% are willing to pay above RM1200 per month. When asked regarding their willingness to accept interns from overseas, 19% responded yes and 67% responded maybe.

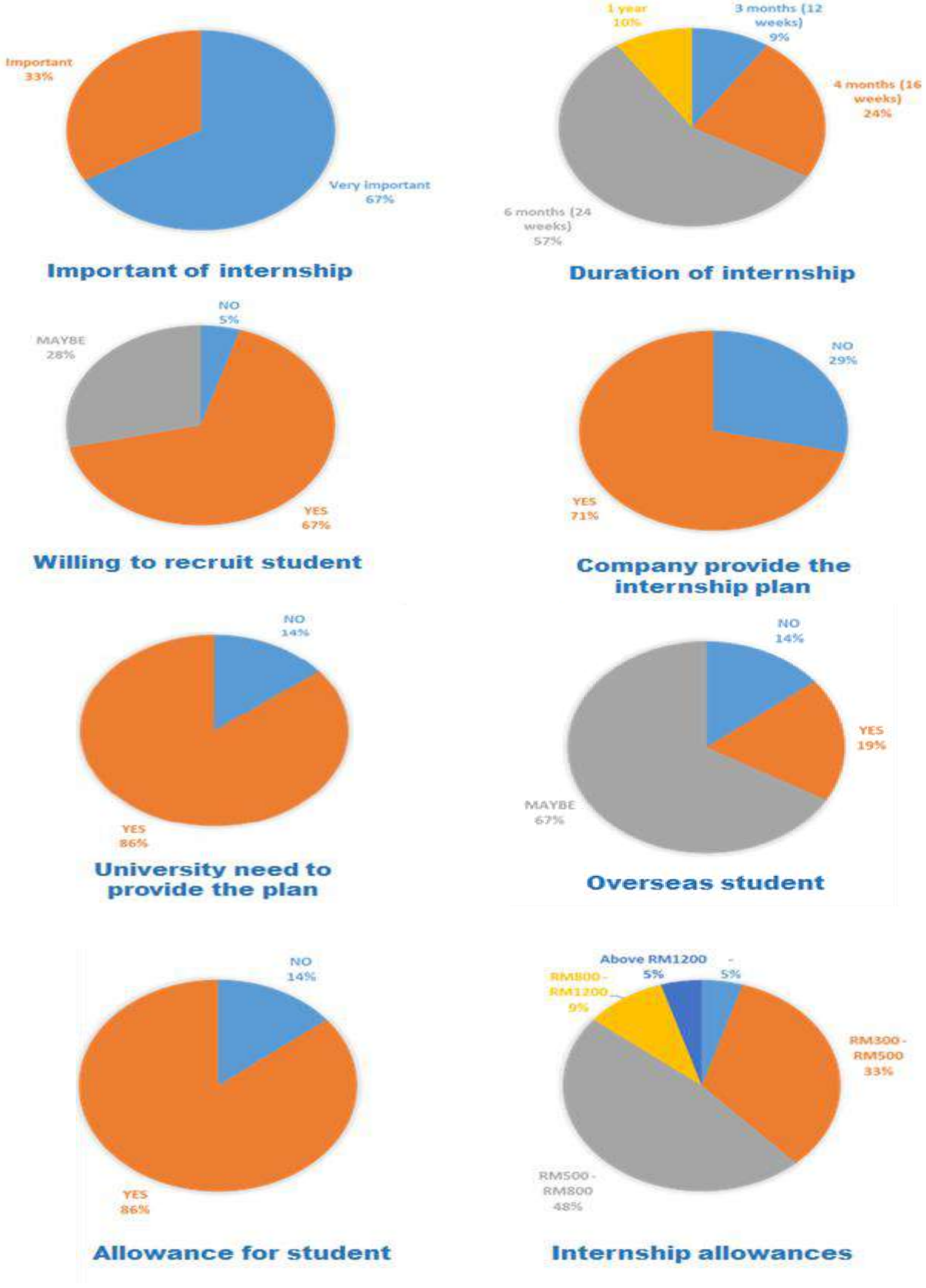


Figure 2.4: Internship program

Section 4: Competencies of graduates

Figure 2.5 shows the top three skills ranked important in terms of communication, self-reliance, entrepreneurship, technical and management skills. From the survey, the most important fundamental knowledge required by the respondents is technology for materials production (machinery, processes) (16 respondents); followed by physicochemical and technical characteristics of conventional raw materials (fabrics and yarns) (13 respondents); quality control and management (11 respondents), technologies for manufacturing (11 respondents); health and safety issues in production and manufacturing (9 respondents); basic science (chemistry, mathematics, physics and IT) (9 respondents); understanding in sustainability in design and production (7 respondents); understanding in auxiliary processes in manufacturing and production (automation, machinery) (7 respondents); chemical raw materials (7 respondents); understanding in managerial and techno-economical aspects of production (6 respondents); understanding in applications of technical and nano-textiles (6 respondents); art (fashion and design) (6 respondents); and knowledge in technologies for design (methods, IT infrastructure) (5 respondents). Figure 2.6 shows the detail of the data.

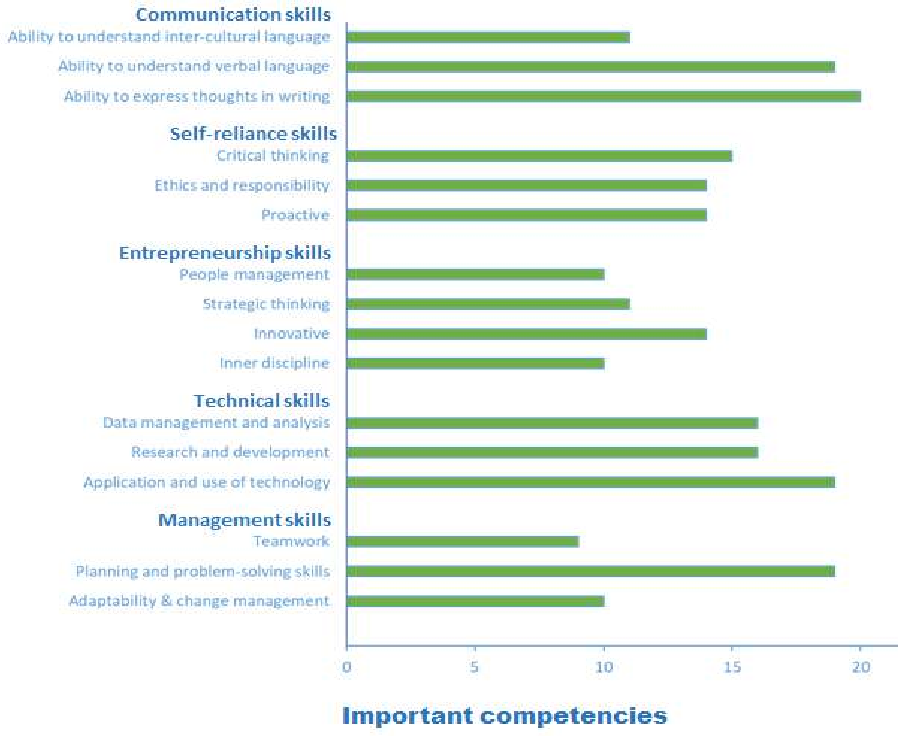


Figure 2.5: Important competencies in terms of communication, self-reliance, entrepreneurship, technical and management skills

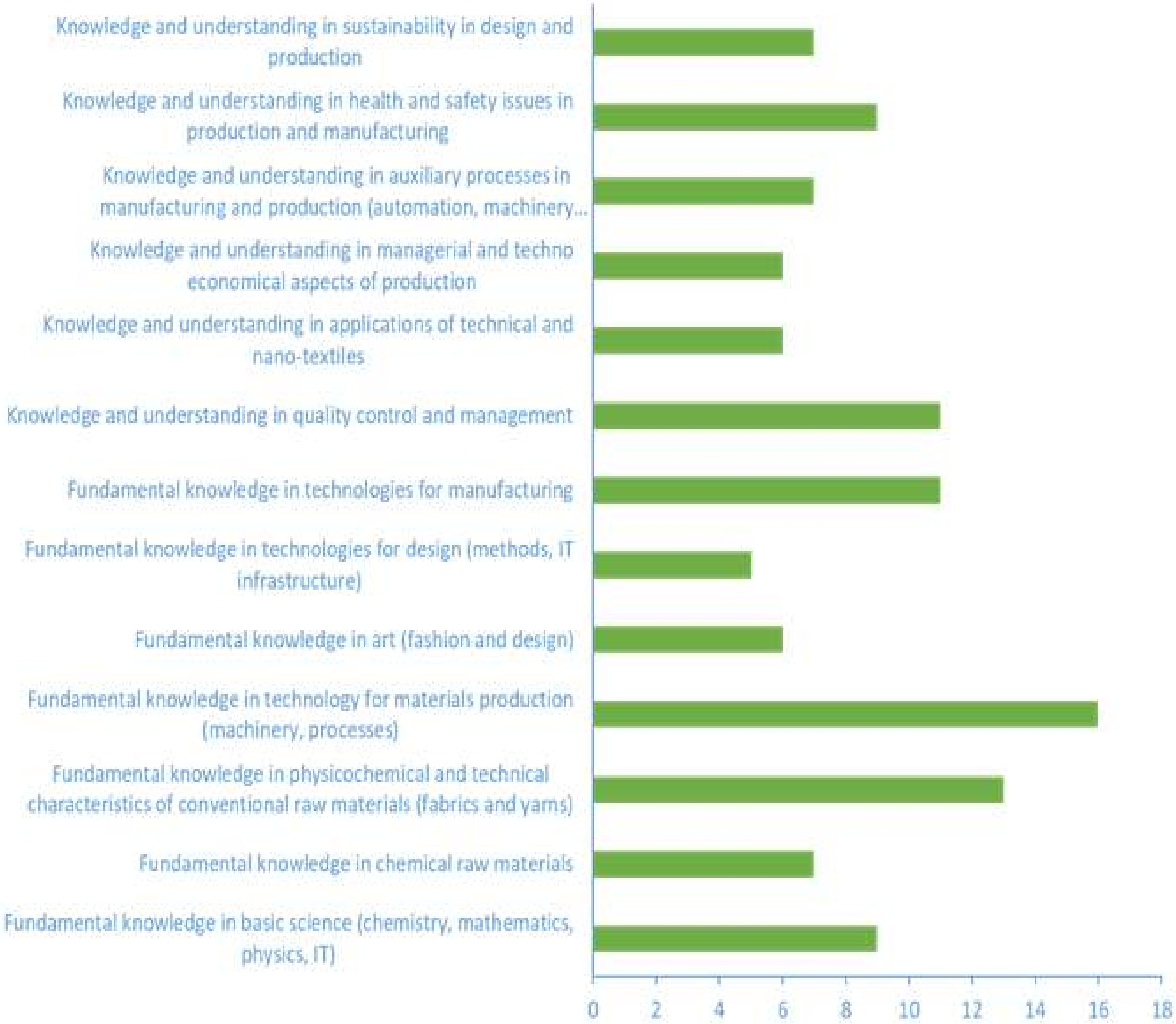


Figure 2.6: Fundamental knowledge required

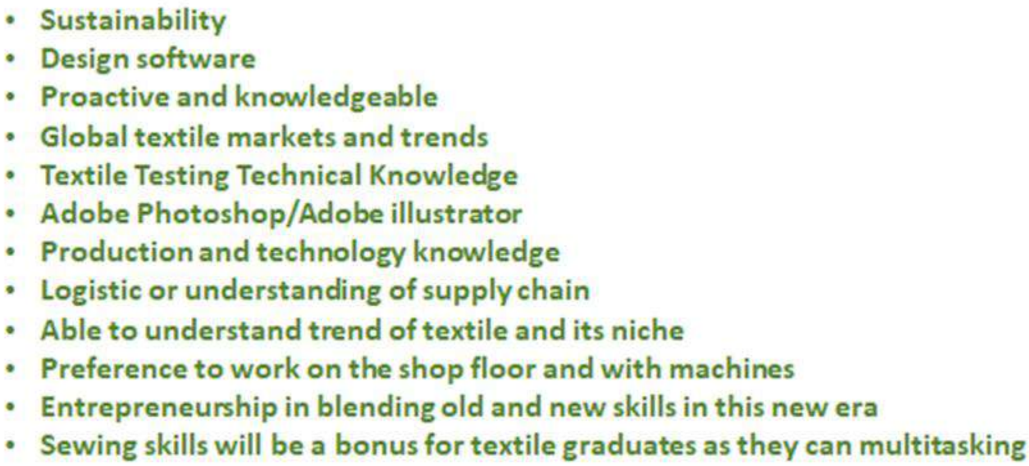
Next, respondents were asked to rate the importance of knowledge in textile application and in development of innovative and smart textile with advanced properties. Likert scale questions were used to measure the level of importance of each question. The scale for level of importance are explained in Table 2.5. The data was generated by calculating the average score for level of importance from all participants. This data is provided in Table 2.6. Figure 2.7 shows the knowledge and skill deemed important in the textile and fashion industry according to the stakeholders.

Table 2.5: Likert Scale on level of importance

Level of Importance
1 = I do not know 2 = Unimportant 3 = Important 4 = Very Important

Table 2.6: Summary of survey's answers in average

Question number	**Description of qualifications**	**Average**
		Level of Importance
Part 1 Knowledge in specific fields of textile application		
1.1	Textile for medical and health care	3.50
1.2	Protective textile	3.36
1.3	Architecture and interior textile	2.86
1.4	Transport and aerospace textile	2.86
1.5	Agriculture and geotextile	3.00
1.6	Sports and active leisure clothing	3.27
1.7	Smart clothing	3.00
1.8	Eco textile	3.18
1.9	Military textile	3.14
Part 2 knowledge in development of innovative and smart textile with advanced properties.		
2.1	Nanomaterials and nanotechnologies in textiles and fashion	3.18
2.2	Micro-electronics in textiles and fashion	2.73
2.3	Biotechnologies in textiles and fashion	3.18
2.4	Fibrous and textiles-based composites	3.32
2.5	New fibers and textile structures	3.45

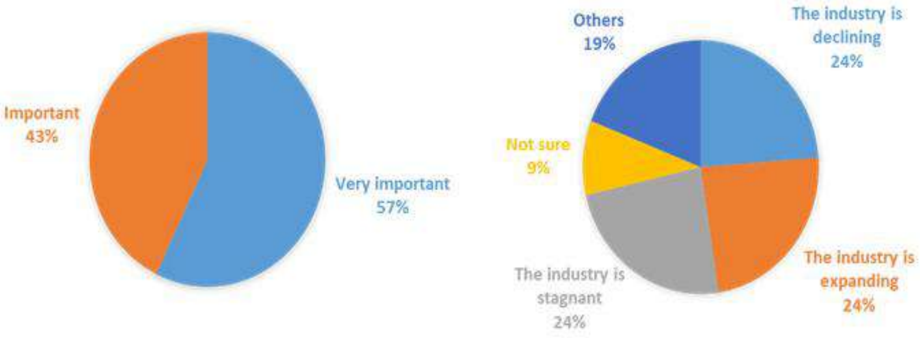


- Sustainability
- Design software
- Proactive and knowledgeable
- Global textile markets and trends
- Textile Testing Technical Knowledge
- Adobe Photoshop/Adobe illustrator
- Production and technology knowledge
- Logistic or understanding of supply chain
- Able to understand trend of textile and its niche
- Preference to work on the shop floor and with machines
- Entrepreneurship in blending old and new skills in this new era
- Sewing skills will be a bonus for textile graduates as they can multitasking

Figure 2.7: Knowledge and skills important for professionals of textile and fashion industry.

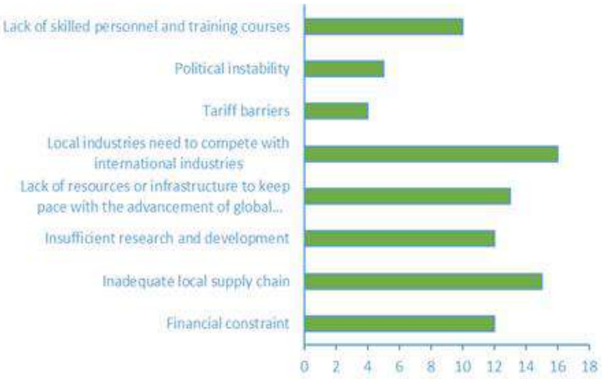
Section 5: Textile related industry

More than 50% of respondents agree that the textile industry is important for Malaysia's national economy. The top three highest challenges faced by the local industries are that the local industries need to compete with international industries, inadequate local supply chain and lack of resources or infrastructure to keep pace with the advancement of global technologies. The opportunities or benefits gained by textile related industry in Malaysia are high quality of textiles produced by local industries, reasonable selling price of textiles products and high demand of local textile products. The stakeholders are looking forward to implementing Industrial Revolution 4.0 (IR 4.0) in the industry, having a sustainable supply chain and having more skillful and knowledgeable graduates working in the industry. Lastly, the respondents were asked how the Covid-19 impact their organization / industry, and 76% think it has badly impacted their organization / industry. Figure 2.8 shows detailed analysis of section 5.

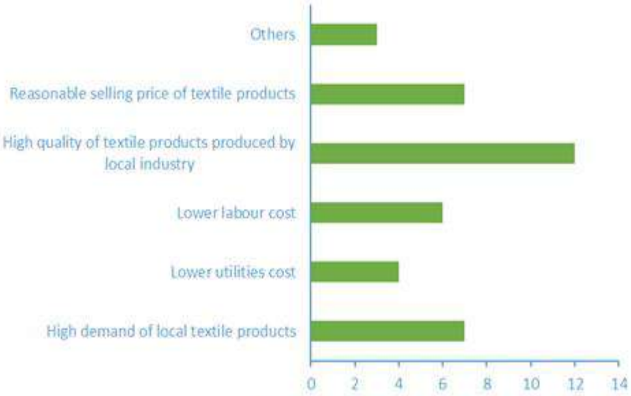


Malaysia textile industry on national economy

Current textile industry

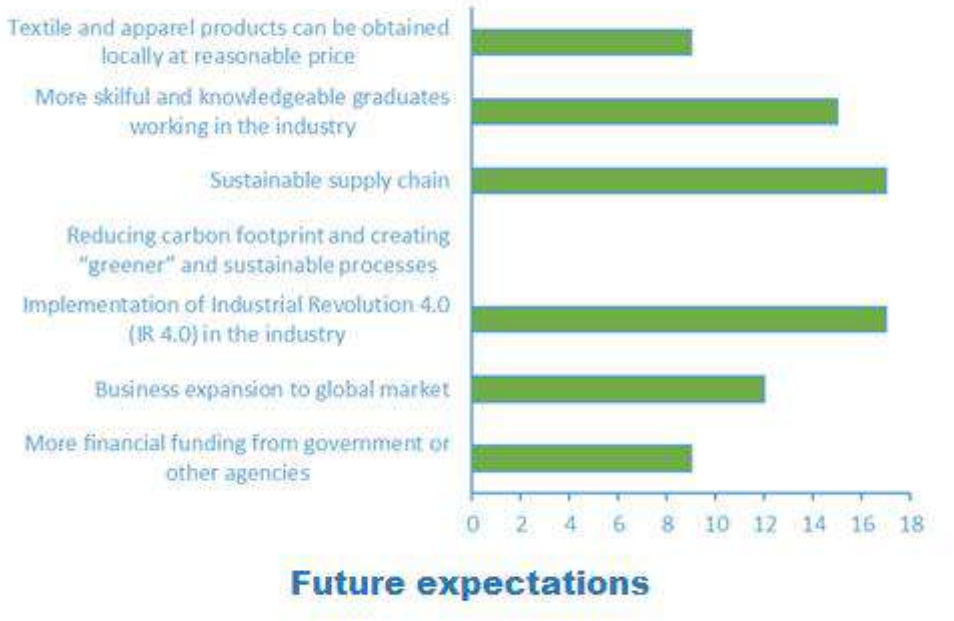


Challenges



Opportunities

Figure 2.8: Some Opinions on the Current State of Textile related industry



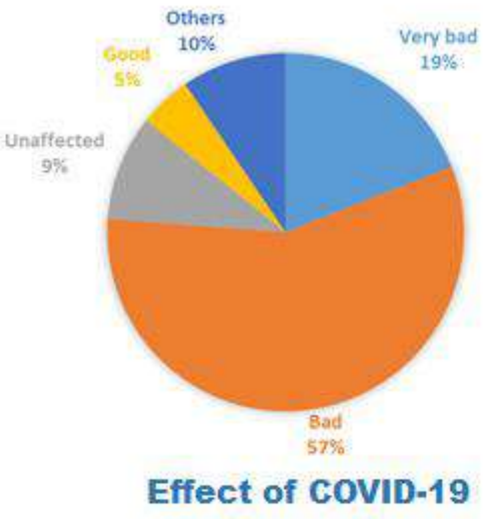


Figure 2.8: Some Opinions on the Current State of Textile related industry (Continued)

2.1.2.4 Conclusion and suggestions

The Textiles and Apparel industry in Malaysia is one of the main industries that contributes to the Malaysian economy in terms of exports and employment. Over the years, the industry has been seen to shift towards the manufacture of higher added value products and have been strongly urged by the government to develop products for industrial and home textiles, functional fabrics and high value fabrics and clothing.

The job opportunity for textiles, apparel and fashion graduates is still good but there is a lack of supply as there are only a few institutions offering knowledge and technical competence in the area and the industry depending on foreign workers. It is hoped that further improvement in the higher education of related textiles related courses would change that landscape and provide suitable solutions and alternatives for the local industries to move beyond 2020. The survey revealed that the followings are important for textile graduates:

- Fundamental knowledge in materials production (machinery, processes) and physicochemical and technical characteristics of conventional raw materials (fabrics and yarns)
- Specific knowledge in textiles for medical and health care and protective textiles
- Developments in fibrous and textiles-based composites as well as new fibres and textile structures

2.2 Indonesia

2.2.1 Bibliography review

Indonesia has long been known as one of the world's largest textile manufacturers. This labour intensive and export-oriented industry has helped Indonesia make its way to the world's top ten largest textile and garment producing countries. The Indonesian government has set a target to increase the export value of textiles and garments to USD 75 billion by 2030 to contribute 5% to global exports which will put the country among the top five global textile manufacturers.

After experiencing a slowdown in 2014, following the decline in global oil prices and the increase rates of gas and electricity, Indonesia's textile sector managed to reverse the trend and record positive growth again in the first and second quarters of 2017. According to the data published by Statistics Indonesia, the country's textile industry grew by 3.65% in Q2 2017. This surpassed the growth in the previous quarter of 0.16%. The overall textile export value from January-May 2017 reached USD 5.11 billion or up 3.4% compared to the same period in the previous year. Meanwhile, according to the Investment Coordinating Board (BKPM), investment realisation in the first semester of 2017 reached 7.47 trillion IDR. This consists of domestic investment of 5.02 trillion IDR and foreign investment of 2.45 trillion IDR. Understandably, Indonesia's Ministry of Industry is optimistic that the textile sector will grow by 7% in 2017. Similarly, the Association of API expects the sector to record a surplus of USD 5 billion, up from USD 4.6 billion in 2016.

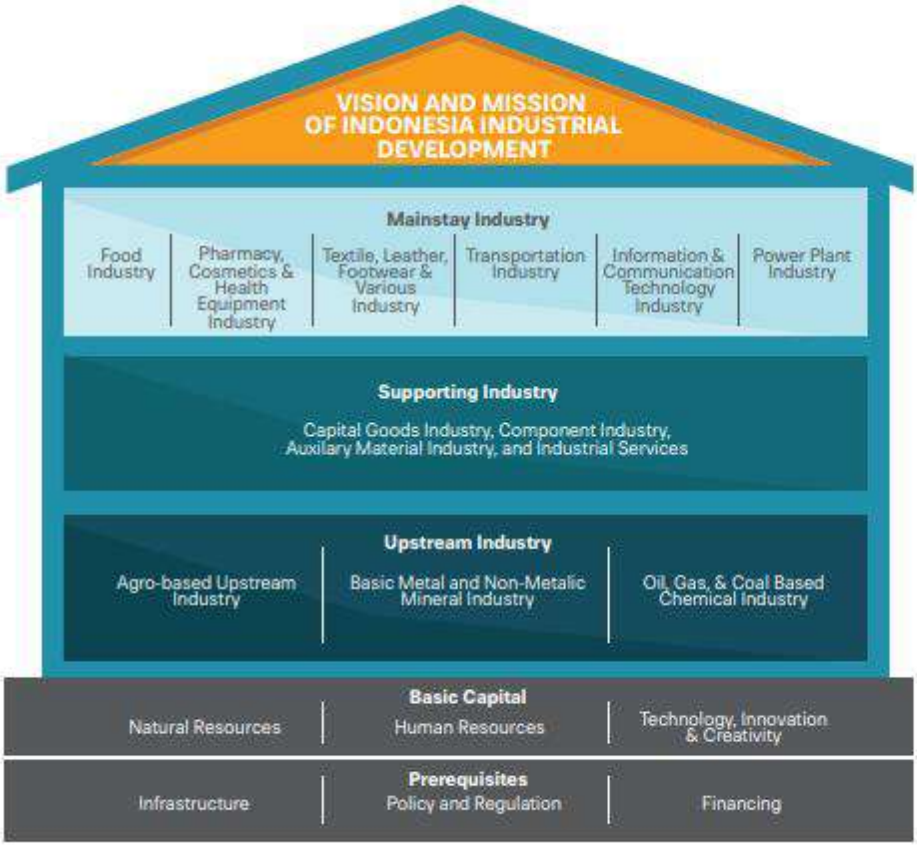

VISION AND MISSION OF INDONESIA INDUSTRIAL DEVELOPMENT
Mainstay Industry
Food Industry
Pharmacy, Cosmetics & Health Equipment Industry
Textile, Leather, Footwear & Various Industry
Transportation Industry
Information & Communication Technology Industry
Power Plant Industry
Supporting Industry
Capital Goods Industry, Component Industry, Auxilary Material Industry, and Industrial Services
Upstream Industry
Agro-based Upstream Industry
Basic Metal and Non-Metalic Mineral Industry
Oil, Gas, & Coal Based Chemical Industry
Basic Capital
Natural Resources
Human Resources
Technology, Innovation & Creativity
Prerequisites
Infrastructure
Policy and Regulation
Financing

Figure 2.9: The position of textile and apparel industry in Indonesia's industrial structure in the Masterplan of National Industry Development 2015-2035.

Nationally, the textile and apparel industry have been long known as one of the top economic contributors and largest employment sources in the country. In 2016, with a value of USD 11.87 billion, its contribution to the total industrial export was the second largest after the food and beverages industry. For these reasons, the textile and apparel industry has been included as one of the mainstay industries in the **Masterplan of National Industry Development 2015-2035** (Figure 2.9) and one of the five priority industries in the recently launched Indonesia’s industrial policy of “**Making Indonesia 4.0**” (Figure 2.10).

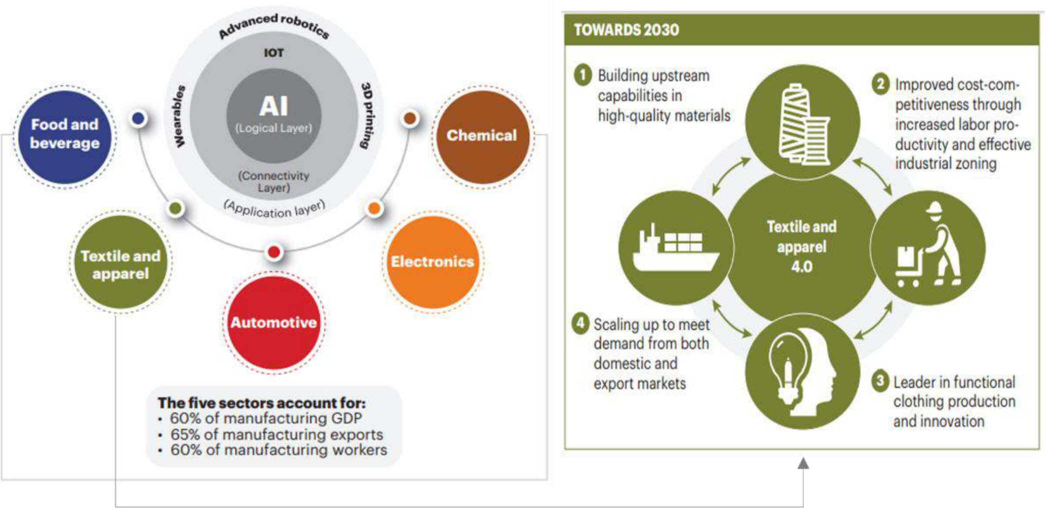

Advanced robotics
IOT
Wearables
3D printing
AI
(Logical Layer)
(Connectivity Layer)
(Application layer)
Food and beverage
Chemical
Textile and apparel
Electronics
Automotive
The five sectors account for:
• 60% of manufacturing GDP
• 65% of manufacturing exports
• 60% of manufacturing workers
TOWARDS 2030
1 Building upstream capabilities in high-quality materials
2 Improved cost-competitiveness through increased labor productivity and effective industrial zoning
Textile and apparel 4.0
4 Scaling up to meet demand from both domestic and export markets
3 Leader in functional clothing production and innovation

Figure 2.10: Textile and apparel industry in Indonesia's newly launched industrial development policy “Making Indonesia 4.0”.

Table 2.7: The current condition of textiles and textile products industry in Indonesia in 2020.

Category	Upstream		Midstream	Downstream		Total	Unit
	Fibre Making	Spinning	Fabric	Garments	Others		
Number	33	294	1,540	2,995	765	-	Big Industries
Number	-	-	131,000	407,000	-	-	Small Industries
Capacity	3.31	3.97	3.13	2.18	0.68	-	Million. Ton
Utilization	47.58	56.6	41.95	56.7	43.9	-	%
Labour	33,087	244,059	678,360	1,788,265	89,507	-	People
Export value	0.68	2.33	1.13	8.43	0.63	13.2	Billion USD
Import value	2.44	0.72	4.83	0.8	1.22	10.1	Billion USD
Balance Export-Import	-1.76	1.61	-3.7	7.63	-0.59	3.19	Billion USD

Source: Ministry of Industry Report. 2020

Table 2.7 shows the current condition of the textiles and textile products industry of Indonesia in 2020 according to the report issued by the Ministry of Indonesia. It can be seen that the garment industry is still the leading sector for export in Indonesian textile industry with a net value of USD 8.43 billion, followed by the spinning sector with a net value of USD 2.33 billion. The total value of export is USD 13.2 billion with USD 10.1 billion total value of import, resulting in a net value of export as much as USD 3.19 billion, which comes from the contribution by the garment sector. However, one must be cautious with this contribution because the fabric used in the exported garments are largely imported, which account for almost 50% of the total imported value for the textile industry.

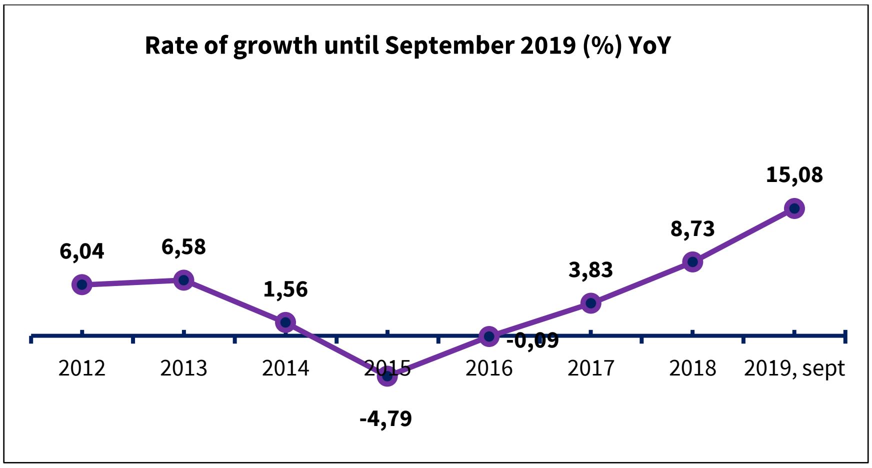


Figure 2.11: The growth rate of textile industry in Indonesia in 2020
Source: Ministry of Industry Report 2020.

Depicted in Figure 2.11 is the growth of Indonesian textile industry showing a significant increase from 2015 onward after slowing down in three previous years, which is in accordance with the observation and analysis made by the *Global Business Guide Indonesia* previously. The growth according to the report was supported by new investments in the fiber making sector giving result to an amount of 320 thousand tonnes of production annually. As can be seen in Figure 2.12, the growth was not readily followed by its contribution to the national GDP. In fact, it took 2 years before it showed an increase in 2017 and steadily rises toward 6.49 in 2019.

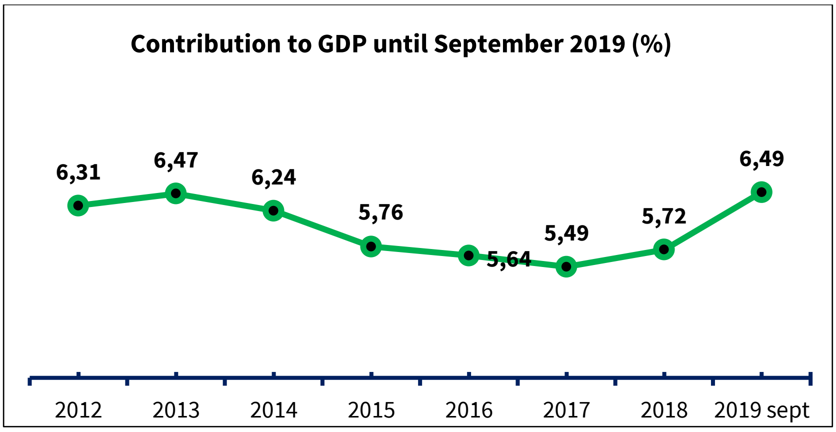


Figure 2.12: Textile industry's contribution towards Indonesia's GDP
Source: Ministry of Industry Report 2020.

Despite the promising figures, Indonesia's textile and apparel industry is still facing a series of problems and challenges which include increased competition from its neighboring countries, notably Vietnam, and high dependency on raw material imports. In order to improve its competitiveness, not only does it have to address these and some other challenges, which targets to improve comparative competitiveness, Indonesia's textile and apparel industry must strive to build stronger competitive advantages by strengthening its technical capability and technology. One of the problems in the importation of raw materials, particularly by the clothing industry, is the lack of technical capabilities of Indonesia's textile manufacturers in producing specialty materials with high technical specifications. This is clearly identified by the high number and fraction of imported fabrics reaching 49% of the total textile imports. The problems, according to industrial practitioners as well as observation by the governments, are coming from the lack of capacity and capability mainly in the midstream sector or the so-called "converter", which are due to several reasons:

1. Lack of sufficient infrastructure and required technology to supply fabric for the garment sector. It is then confirmed with the fact that the machines' condition and the supporting tools in the midstream sector are outdated, old, and not efficient. (Ministry of Industry's Report – 2020)
2. Lack of enough skilled and competent manpower for producing fabric to supply the demand of the garment sector. This is then proven with the data that the availability of research and development divisions in the midstream industry is not sufficient compared to the number of existing industries.
3. Relatively higher energy cost to competing countries causing the product price to be less competitive. It is also proven with a relatively higher gas price (LPG and LNG) for industry.

The preferential situation for imports has created a pressure on the whole supply chain of the textile and apparel industry in Indonesia and weakened its competitiveness. In order not only to survive but more importantly to have a self-sustained industry with sustainable growth, Indonesia must acquire high technology for its textile and apparel industry and step up to the production of higher end products to compete globally.

2.2.1.1 General description of the qualification

Higher education in textiles and textile products in Indonesia is held by a number of institutions under the management of the government and also private universities. Two universities that are involved in this project are Politeknik STTT Bandung (Polytechnic of Textile Technology) and the Craft Study Program, Faculty of Arts and Design (Fakultas Seni Rupa dan Desain), Institute of Technology Bandung (Craft FSRD ITB). Profiles of each university are described in Table 2.8. Following sections explain the working area for graduates (section 2.2), the textile graduates' qualification (2.3), the learning profile and associated competencies (section 2.4) and employment data (section 2.5) from both universities.

Table 2.8: Profile of Politeknik STTT Bandung and Craft Study Program FSRD ITB

Institution	Abbreviation	Number of students	Level
Politeknik STTT Bandung	STTT Undergraduate: Diploma-4 (4-year vocational study)	355	Bachelor of Applied Science in Textile Engineering
		399	Bachelor of Applied Science in Textile Chemistry
		273	Bachelor of Applied Business in Garment Production
		162	Bachelor of Applied Business in Garment Production with concentration on Fashion Design
	STTT Postgraduate: S2 Applied master	31	Master of Applied Science in Textile Engineering and Apparel Technology
Craft Study Program, Faculty of Art and Design, Institute Technology of Bandung	Craft FSRD ITB	212	Strata 1 (4-year academic study): Bachelor of Design

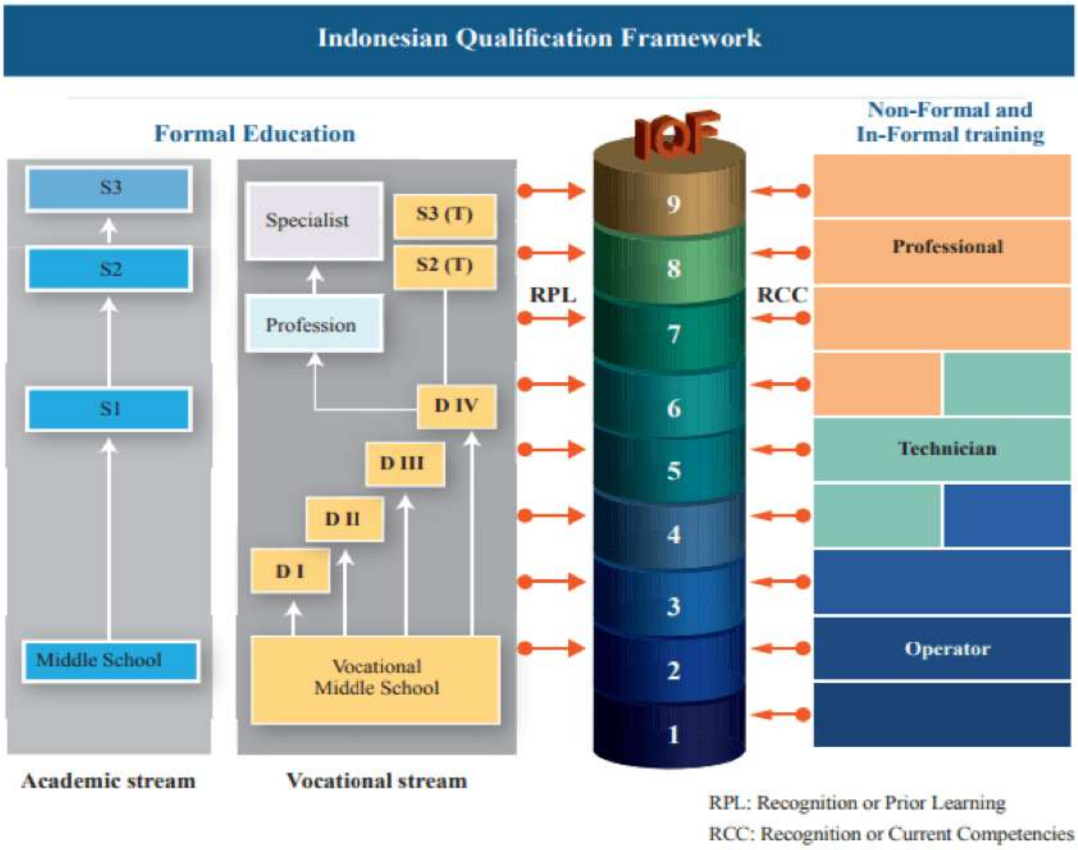
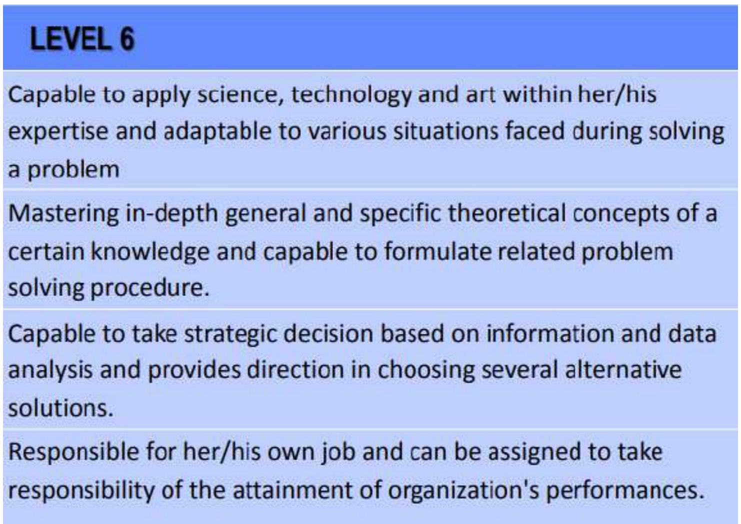

Indonesian Qualification Framework
Formal Education
Non-Formal and In-Formal training
IQF
S3
S2
S1
Middle School
Specialist
S3 (T)
S2 (T)
Profession
D IV
D III
D II
D I
Vocational Middle School
RPL
RCC
9
8
7
6
5
4
3
2
1
Professional
Technician
Operator
Academic stream
Vocational stream
RPL: Recognition or Prior Learning
RCC: Recognition or Current Competencies

Figure 2.13: The Indonesian National Qualification Framework. S1 and DIV (D4) is a 4-year undergraduate study program; S2 and S3 is a postgraduate study program for master and doctoral level respectively. (Source: https://sea-vet.net/images/country-profiles/indonesia/)

The competency profile that must be demonstrated by graduates is described in the Indonesian National Qualification Framework (IQF) or the *Kerangka Kualifikasi Nasional Indonesia* (KKNI) (Figure 2.13). Based on the IQF or KKNI, a set of criteria is formed on the graduate's profile related to their level of education. From Figure 2.13, according to the IQF, the 4-year study program of S1 (academic) and DIV (or D4, vocational) are equivalent at the level of qualification 6 (Table 2.9). It also refers to the graduate's level profile from the Regulation of Minister of Research and Higher Education No. 49 Year 2014 regarding the National Standard of Higher Education. In addition, specific competencies are designed independently by each of the education institutions or in cooperation with other institutions such as the professional certification body or *Lembaga Sertifikasi Profesi* (LSP). Detailed explanation of the graduate's competency for each of the Institution is explained in the following sections.

Table 2.9: The competencies at the level of qualification 6 in the IQF.



LEVEL 6
Capable to apply science, technology and art within her/his expertise and adaptable to various situations faced during solving a problem
Mastering in-depth general and specific theoretical concepts of a certain knowledge and capable to formulate related problem solving procedure.
Capable to take strategic decision based on information and data analysis and provides direction in choosing several alternative solutions.
Responsible for her/his own job and can be assigned to take responsibility of the attainment of organization's performances.

2.2.1.2 Activities associated with the qualification

According to the level of qualification that has been set in IQF as presented in Table 2.9, the graduates must be able to demonstrate the capability to apply science, technology and art within her/his scope of expertise and adaptable to various situations of problem solving. In order that the students reach this level of competency by the time of graduation, they must be involved in different types of situations that require them to exercise their knowledge and skills to solve the problems they are facing either in simulated environments as well as in real situations. So, in that regard, practical activities in the laboratories with simulated problems are very important and vital to the development of the competency. They learn how to apply the theories discussed in class to solve the practical problems in the real world through simulated problems in the laboratories. This forms the second competency, which is mastering in-depth general and specific theoretical concepts to formulate related and effective problem-solving procedures. These practical works in the laboratories are part of the intracurricular activities alongside with the theoretical classes. For Diploma 4 vocational programs, the practical courses comprise 60% of the total hours of learning activities in a week per semester. The opposite applies for S1 academic programs that put the theoretical hours 60% with practical hours 40%.

Later on, in semester 5 or 7, students are required to go for an internship in the industry for several months. It may differ between one study program to another, but it would normally take between 1-3 months working calendar days. For students in Fashion Design (STTT) and Arts Textile Crafts (ITB), they can be involved in a design project with the designers, production houses, or fashion outlets to hone their aesthetic and design skills as well as other skills that are required in the business. In general, from this exposure, the students are projected to acquire the third and fourth competencies in the level of qualification 6 in Table 2.9.

2.2.1.2.1 The Politeknik STTT Bandung learning profile and associated competencies of the textiles graduate

Politeknik STTT Bandung is a government owned textile higher education institution under the Ministry of Industry, which *de facto* has been in existence since 1922 under the Dutch colonial administration with the name of *Textiel Inrichting Bandoeng en Batik Proefstation* (TIB) or Center for Textile Design and Batik Testing Bandung. After the independence of Indonesia in 1945, the centre was taken over by the government and in 1954 was established as School of Textile Technology with two-years study programs, Textile Engineering and Textile Chemistry. The Department of Garment Production was established much later in 2005, and it grows tremendously fast compared to its two predecessors for the last 10 years.

The three departments have been consistently accredited A by the National Agency of Accreditation for Higher Education (Badan Akreditasi Nasional Perguruan Tinggi – BAN PT) since 2008. This is followed in the year of 2019 by the accreditation A for the institution. Politeknik STTT Bandung is one of only a few polytechnics in Indonesia (only seven) that are accredited A by BAN PT. The learning profile and associated competencies of textile graduates from each of the departments are described below.

1. Bachelor of Applied Engineering. Politeknik STTT Bandung, **Textile Engineering** Program
   To reach the study competency, graduate needs to have:
   Affective aspect, consist of:
   a. Being faithful and pious to the One Almighty God
   b. Uphold the values of humanity, civilization and diversity
   c. Nationalist, law abiding, and discipline
   d. Internalized the academic values, norms, and ethics

   Cognitive aspect (general & specific), consists of:

   a. Grasping the theoretical concept of natural science and its application, engineering and practical application
   b. Grasping the theoretical concept of textile engineering in yarn and fabric making
   c. Grasping the principles and system design engineering, process and technological products
   d. Grasping the updated textile knowledge and technology
   e. Grasping the knowledge on the safety, procedures, and laboratory operations

   Psychomotor aspect (general & specific), consists of:

a. Applying logical thinking, critical, innovative, becoming an independent performance, qualified and measurable
b. Providing right decision, cooperative and responsible toward team's achievement
c. Able to document, save, and secure data
d. Able to design, execute and lead textile engineering process
e. Able to control the quality process and product of textile yarn and fabric
f. Able to evaluate, control and upgrade the quality of textile product and process
g. Able to understand national standard or international standard for textile testing
h. Able to adapt with the development of modern textile technology

2. Bachelor of Applied Science. Politeknik STTT Bandung, **Textile Chemistry** Program
To reach the study competency, graduate needs to have:
Affective aspect, consist of:
a. Being faithful and pious to the One Almighty God
b. Uphold the values of humanity, civilization and diversity
c. Nationalist, law abiding, and discipline
d. Internalized the academic values, norms, and ethics

Cognitive aspect (general & specific), consists of

a. Grasping the concept of natural science with its application, engineering and its practical application
b. Grasping the principles and system design engineering, processing, and technological products.
c. Grasping the updated knowledge and technology on textile
d. Grasping the knowledge on the safety, procedures, and laboratory operations
e. Grasping the knowledge and theoretical concept on textile finishing technology
f. Grasping the knowledge and theoretical concept on raw materials, dyes, auxiliaries
g. Grasping the concept and processing techniques to produce standardized items
h. Grasping the knowledge on textile machineries with their mechanisms
i. Grasping the knowledge on various product quality standards.
j. Grasping the principles and textile product testing engineering and able to read data from evaluation's result

Psychomotor aspect (general & specific), consists of

a. Applying logical thinking, critical, innovative, becoming an independent performance, qualified and measurable

b. Providing right decision, cooperative and responsible toward team's achievement
c. Able to document, save, and secure data
d. Able to design, execute and lead textile finishing process
e. Able to manage quality process and textile finishing product
f. Able to identify and characterized materials, dyes and auxiliaries
g. Able to design and lead maintenance for production and laboratory machineries
h. Able to design and determine formulation for textile finishing process
i. Able to provide solution and right decision for problems
j. Able to design, plan and lead textile water and waste treatment

3. Bachelor of Applied Business, Politeknik STTT Bandung, **Garment Production** Major

To reach the study competency, graduate needs to have:
Affective aspect, consist of:
a. Being faithful and pious to the One Almighty God
b. Uphold the values of humanity, civilization and diversity
c. Nationalist, law abiding, and discipline
d. Internalized the academic values, norms, and ethics

Cognitive aspect (general & specific), consists of

a. Grasping the design, technology and quality assurance of garment
b. Grasping the principles and management concept of garment products
c. Grasping the principles and the latest issue in economy, social, and ecology in general
d. Grasping the knowledge on the latest development of garment technology
e. Grasping the knowledge on the safety, procedures, and laboratory operations
f. Having vision on small and medium garment business planning

Psychomotor aspect (general & specific), consists of

a. Applying logical thinking, critical, innovative, becoming an independent performance, qualified and measurable
b. Providing right decision, cooperative and responsible toward team's achievement
c. Able to document, save, and secure data
d. Able to design, execute and lead textile finishing process
e. Able to create an exact garment product design
f. Able to conduct garment assembly operation, machine maintenance, and product evaluation

g. Able to understand and assess efficiency, effectiveness of garment production lines.
h. Having professional managerial skills
i. Able to identify small and medium garment business opportunity

4. Bachelor of Applied Business. Politeknik STTT Bandung, **Fashion Design Concentration, Garment Production Program**

To reach the study competency, graduate needs to have:
Affective aspect, consist of:
a. Being faithful and pious to the One Almighty God
b. Uphold the values of humanity, civilization and diversity
c. Nationalist, law abiding, and discipline
d. Internalized the academic values, norms, and ethics

Cognitive aspect (general & specific), consists of

a. Grasping the design, technology and quality assurance of garment
b. Grasping the principles and management concept of garment products
c. Grasping the principles and the latest issue in economy, social, and ecology in general
d. Grasping the knowledge on the latest development of garment technology
e. Grasping the knowledge on the safety, procedures, and laboratory operations
f. Having vision on small and medium garment business planning

Psychomotor aspect (general & specific), consists of

a. Applying logical thinking, critical, innovative, becoming an independent performance, qualified and measurable
b. Providing right decision, cooperative and responsible toward team’s achievement
c. Able to document, save, and secure data
d. Able to design, execute and lead textile finishing process
e. Able to create an exact garment product design
f. Able to conduct garment assembly operation, machine maintenance, and product evaluation
g. Able to understand and assess efficiency, effectiveness of garment production lines.
h. Having professional managerial skills.

It has been very clear from the Masterplan 2015-2035 and the document of “Making Indonesia 4.0” that the Indonesian government is focusing on innovation and high technology to improve the global competitive edge of the nation’s textile and apparel industry, which covers mainly the area of high performance and specialty fibres, smart textiles and functional textiles. The policy requires investments not only on high technology research and production facilities, but equally important is capacity building for higher education institutions in textile science and technology. Politeknik STTT Bandung (STTT) has long realized the problem and the need for a comprehensive approach to address it on a national level together with all the stakeholders. As the only higher education of textile in Indonesia, STTT realizes that it has become its sole responsibility and role in the development of the textile and apparel industry in Indonesia, particularly in the area of research and industrial human resource development. In response to the challenges, pertaining to the need of industrial human resource for Indonesia's future textile industry, STTT introduced in 2016 new courses for the future which include technical textiles and smart textiles to undergraduate curriculum of all the three departments:

- **Department of Textile Engineering**: Technology of Nonwoven, Technical Textiles, Mechatronics Design in Textile Engineering
- **Department of Textile Chemistry**: Smart Textiles and Fashionable Technology, Textile Biotechnology
- **Department of Garment Production and Fashion Design**: Advanced Garment

In the same year, a study was conducted to establish the first master program in textile in Indonesia, out of an urgent need for a higher-level textile education. The program was officially launched in July 2018 as **Master of Applied Science in Textile Engineering and Apparel Technology** and started its first Academic Year in September 2018. The structure of its curriculum is centered around and aiming to build excellence in smart textiles, technical textiles, and sustainable textiles and clothing (Figure 2.14).

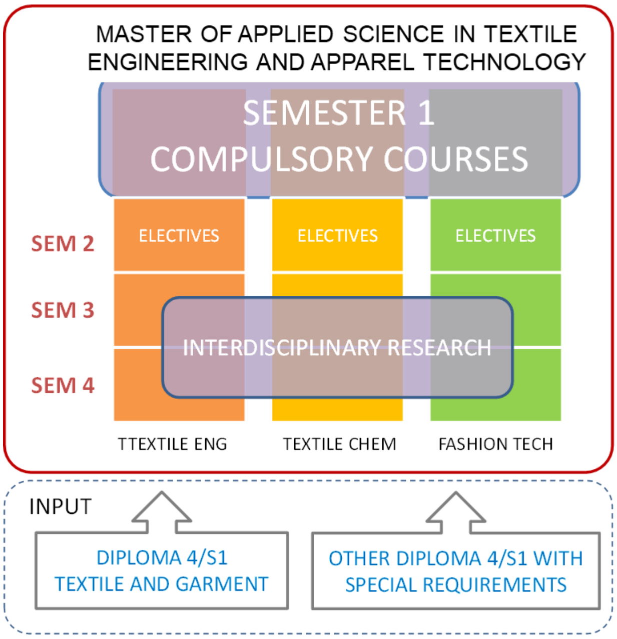

MASTER OF APPLIED SCIENCE IN TEXTILE ENGINEERING AND APPAREL TECHNOLOGY
SEMESTER 1
COMPULSORY COURSES
SEM 2
SEM 3
SEM 4
ELECTIVES
ELECTIVES
ELECTIVES
INTERDISCIPLINARY RESEARCH
TTEXTILE ENG
TEXTILE CHEM
FASHION TECH
INPUT
DIPLOMA 4/S1 TEXTILE AND GARMENT
OTHER DIPLOMA 4/S1 WITH SPECIAL REQUIREMENTS

Figure 2.14: Structure of curriculum of Master of Applied Science in Textile Engineering and Apparel in Politeknik STTT Bandung.

The curriculum is designed with the aim to generate and produce graduates who are able to:

a. Develop innovative textile products and apparel using alternative sustainable and renewable materials.
b. Design technology and products for smart textile applications in the fields of health and medical as well as defences and security.
c. Design and manage the manufacture and production processes of textiles and garment that are environmentally friendly and sustainable.
d. Provide solution(s) to industrial problems that have substantial and long-term effects to the improvement of processes and product quality.
e. Develop textile products that utilize and/or are based on nanotechnology.

2.2.1.2.2 The Craft FSRD ITB learning profile and associated competencies of textile graduates

ITB was founded in 1920 and has grown to include science, technology, art, and humanities. It has 211 scientific groups and 12 faculties (Figure 2.15), one of which is the Faculty of Visual Art and Design, Craft Department in the craft and tradition science groups. These scientific levels start from S-1 (Bachelor Degree), S-2 (Master Degree) and S-3 (Doctoral Degree).

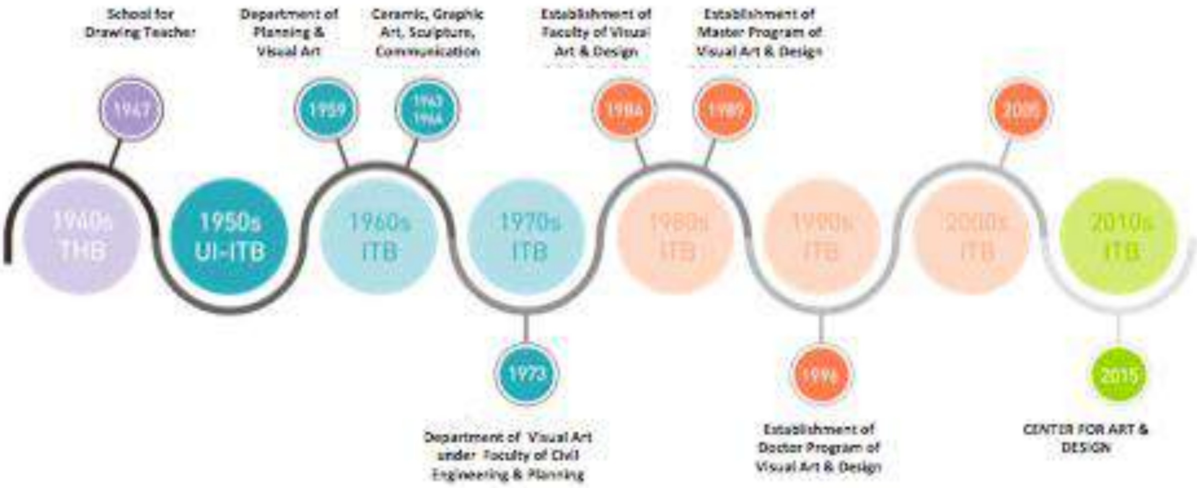

School for Drawing Teacher
1947
Department of Planning & Visual Art
1959
Ceramic, Graphic Art, Sculpture, Communication
1963 1964
Establishment of Faculty of Visual Art & Design
1984
Establishment of Master Program of Visual Art & Design
1989
2005
1940s THB
1950s UI-ITB
1960s ITB
1970s ITB
1980s ITB
1990s ITB
2000s ITB
2010s ITB
1973
Department of Visual Art under Faculty of Civil Engineering & Planning
1996
Establishment of Doctor Program of Visual Art & Design
2015
CENTER FOR ART & DESIGN

Figure 2.15: The history of Faculty of Art and Design ITB

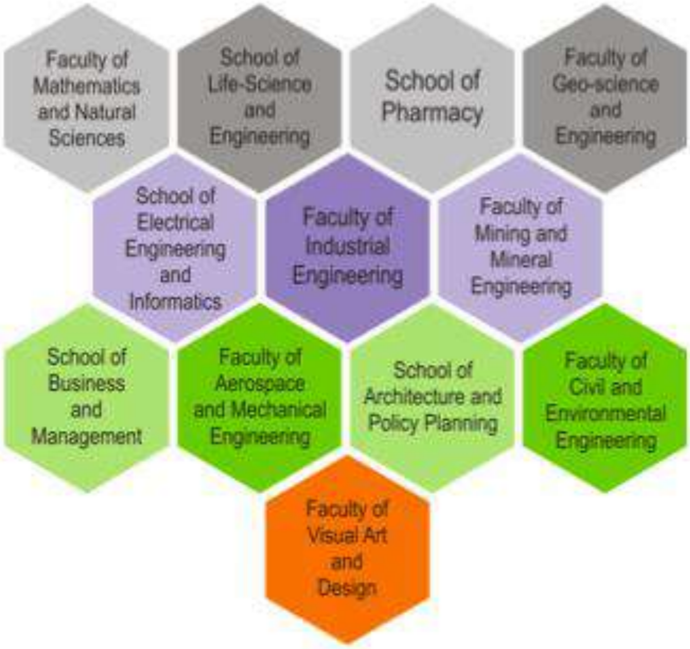
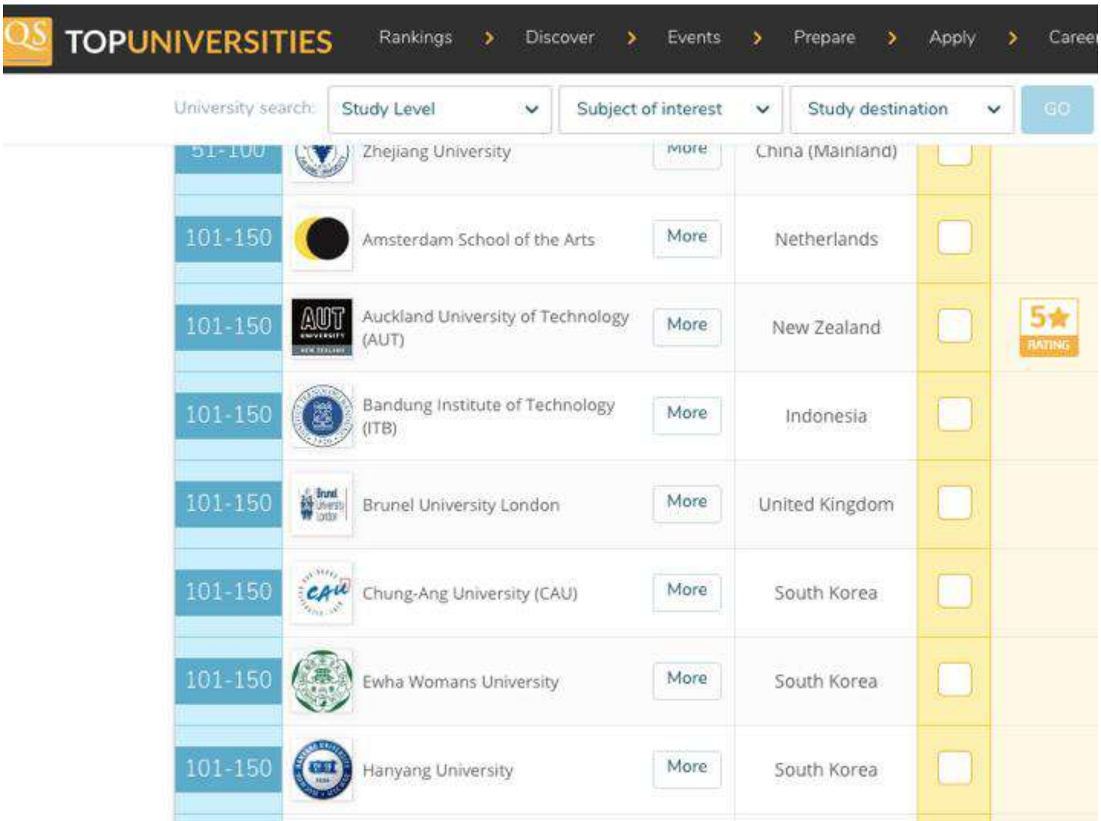

Faculty of Mathematics and Natural Sciences
School of Life-Science and Engineering
School of Pharmacy
Faculty of Geo-science and Engineering
School of Electrical Engineering and Informatics
Faculty of Industrial Engineering
Faculty of Mining and Mineral Engineering
School of Business and Management
Faculty of Aerospace and Mechanical Engineering
School of Architecture and Policy Planning
Faculty of Civil and Environmental Engineering
Faculty of Visual Art and Design

Figure 2.16: Twelve faculties in ITB

The word *kriya* (Sanskrit) has been paired with the word *craft* (English). Both words mean work, deed, or create. Therefore, craftsmen are people who are closely related to producing a work or creating something. An activity that is generally close to the creative process (hand power plus mind power – Morris-Ruskin) such as the process of knowing, exploring, and designing or making in the context of art must be beautiful or contain aesthetic (beautifying) values and also high social value. The word *aesthetic* can be simply understood as something that has fulfilled its practical requirements (good design) and also pleasing to the eye.

The definition of craft continues to change along with the development and problems of the growing world. In the last ten years, the development of craft has been largely influenced by technology and environmental problems. This has been developed in the Craft FSRD ITB by creating cross-scientific collaborative results in addition to fine arts and design. Within the scope of **Globally Respected, Locally Relevant**, ITB has a strategic position in the creative industry with a *hi-tech* touch and counterweights of *hi-concept* and *hi-touch* are needed. They are honed to improve the ability to create artistic, craftsmanship, and emotional beauty. The following is an example of a student dissertation that uses *ramie* as a weaving product (Figure 2.18). In conclusion, nowadays craft not only produces beautiful work with a variety of methods, but craft also provides contributions for the future.



51-100	Zhejiang University	More	China (Mainland)	☐	
101-150	Amsterdam School of the Arts	More	Netherlands	☐	
101-150	Auckland University of Technology (AUT)	More	New Zealand	☐	5★ RATING
101-150	Bandung Institute of Technology (ITB)	More	Indonesia	☐	
101-150	Brunel University London	More	United Kingdom	☐	
101-150	Chung-Ang University (CAU)	More	South Korea	☐	
101-150	Ewha Womans University	More	South Korea	☐	
101-150	Hanyang University	More	South Korea	☐	

Figure 2.17: Rank 103 in QS World Art and Design

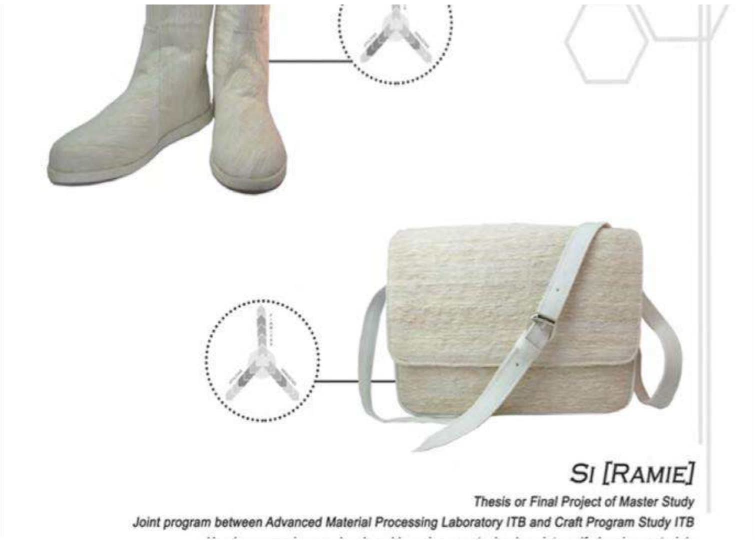

SI [RAMIE]
Thesis or Final Project of Master Study
Joint program between Advanced Material Processing Laboratory ITB and Craft Program Study ITB

Figure 2.18: A student collaborated Kriya (Craft) and Material Science, which produces innovative products using natural fibers, which in particular is from ramie.

Table 2.10: Comprehensive review of questionnaire and SMARTEX ITB

	STRENGTHS	**WEAKNESSES**
OPPORTUNITIES	**Strategy to take opportunities by utilizing strength (S-O STRATEGY)**	**Strategy to utilize opportunities to overcome weakness (W-O STRATEGY)**
	S-O Strategy in the direction of Development: Building and motivating the students, researchers and designers to comprehend the processes of smart textile for human needs.	**W-O Strategy** in the direction of Development field: The curriculum can facilitate the adjustment of sciences that are currently lacking the relevant courses in the craft department. Laboratories are really helpful in understanding the creative process.
	S-O Strategy in management policy: The SUBJECT SMARTEX MODULE is expected to be useful in delivering the knowledge appropriate with the level of education: S-1, S-2, and S-3.	**W-O Strategy** in policy management field: PUBLICATION - CITATION are the requirements for the students and lecturers in completing their studies. The SMARTEX studies can certainly improve the publication in both national and international journals.

Table 2.10 (Continued)

	S-O Strategy in the strategic program field: Bachelor students of ITB are superior students who have good potential in conducting the SMARTEX program. For example, there have been many students interested in developing the Smarted topic.	**W-O Strategy** in strategic program field: Cooperation with industries is currently minimal. It is expected that this SMARTEX program can improve cooperation in terms of science and knowledge of the field.
THREATS	**Strategy to overcome threats by utilizing strength (S-T STRATEGY)**	**Strategy to avoid threats and protect weaknesses at the same time (W-T STRATEGY)**
	S-T Strategy in the direction of Development: The theme of ITB 2020 is that in 5 years will become GLOBALLY RESPECTED and LOCALLY RELEVANT. The academicians in ITB are expected to realize it.	W-T **Strategy** in the direction of Development field: The MULTI CAMPUS CRAFT DEPARTMENT of ITB is located in two places, Bandung dan Cirebon. They will complete each other in developing the SMARTEX project. Bandung is close to the textile industrial area and Cirebon has a specific traditional Indonesian cloth, Batik.
	S-T Strategy in the management policy field: POST COVID-19 PANDEMY will be the main topic in the next three years, either in teaching and learning activities or in field work.	**W-T Strategy in management policy field:** In APPLIED DESIGN, it is expected that the selection of curriculum can be relevant to the needs of related product development.
	S-T Strategy in strategic program field: QS. World ranking 2020 is the benchmark in which FSRD is currently at the 103rd rank for art and design.	**W-T Strategy** in strategic program field: CRITICAL REVIEW: STUDENT AND TEACHER. It is expected that the SMARTEX curriculum can motivate the lecturers and students in developing science.
STRATEGIC STATEMENTS 1. BUILDING A MULTIDISCIPLINARY ECOSYSTEM (SCIENCE, TECHNOLOGY, ART, AND HUMANITIES) 2. BUILDING AND COOPERATING WITH INDUSTRIES TO PRODUCE USEFUL PRODUCTS FOR THE SOCIETY 3. GUIDING STUDENTS IN UNDERSTANDING THE PROCESS OF ADVANCED TEXTILE IN CREATING USEFUL WORKS FOR THE PRESENT AND THE FUTURE		
Conclusion	The SMARTEX Program can improve the educational institution especially the Craft Textile Department, including the lecturers and students. The questionnaire results are helpful to sharpen the courses that ITB will choose relevant to the theme of Globally Respected and Locally Relevant. The course program can be enrolled by students of S-1, S-2, and S-3, hence there will be stages that support each other according to the level.	

2.2.1.3 Sectoral studies

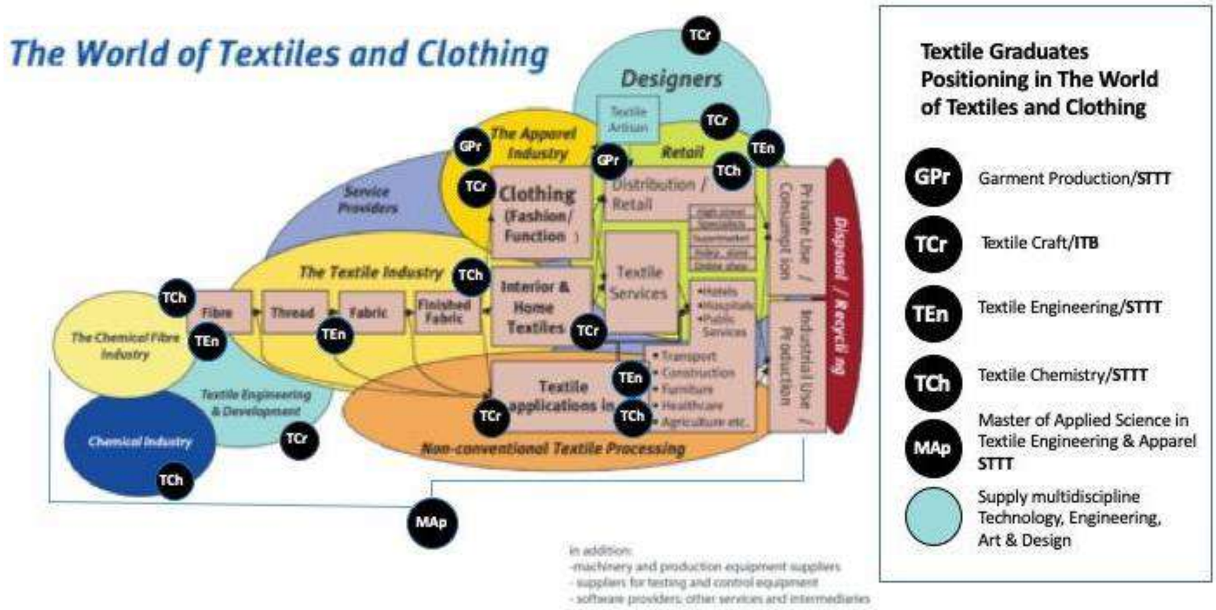

The World of Textiles and Clothing
Designers
Textile Artisan
The Apparel Industry
Retail
Service Providers
Clothing (Fashion/ Function)
Distribution / Retail
Textile Services
The Textile Industry
Interior & Home Textiles
Fibre
Thread
Fabric
Finished Fabric
The Chemical Fibre Industry
Textile Engineering & Development
Chemical Industry
Textile applications in
•Hotels
•Hospitals
•Public Services
• Transport
• Construction
• Furniture
• Healthcare
• Agriculture etc.
Non-conventional Textile Processing
Private Use / Consumption
Industrial Use / Production
Disposal / Recycling
GPr
TCr
TEn
TCh
MAp
in addition:
-machinery and production equipment suppliers
- suppliers for testing and control equipment
- software providers: other services and intermediaries
Textile Graduates Positioning in The World of Textiles and Clothing
GPr Garment Production/STTT
TCr Textile Craft/ITB
TEn Textile Engineering/STTT
TCh Textile Chemistry/STTT
MAp Master of Applied Science in Textile Engineering & Apparel STTT
Supply multidiscipline Technology, Engineering, Art & Design

Figure 2.19: The distribution of STTT and Craft FSRD ITB graduates in the textile and clothing industry. (Note: The clusters in the industrial map are obtained from the “European Technology Platform for Textiles and Clothing 2020”, which is in accordance with the clustering in Indonesian textile industry.)

Traditionally, the graduates from STTT found their “homes” in the textile manufacturing industry, starting from spinning, weaving through to dyeing, finishing and garment industry. A small portion of the graduates found their career in the textile chemicals companies and suppliers as well as textile machinery companies and fibre making industry. While the main areas still hold to these days, the trend is now shifting with more graduates being self-employed as business owners in many different fields in the textile supply chain and related businesses. However, the areas of textile functional, technical textiles and more advanced sectors like smart textiles are still almost like an unknown territory to many of the graduates although these textiles have been around in the corner for more than a while in Indonesia.

The majoring in STTT therefore follows the traditional supply chain of textiles and textile products (garments and apparel), forming sectoral studies represented by the three departments in the undergraduate studies: Textile Engineering (study of fabric making), Textile Chemistry (study of textile/fabric processing by chemicals and according to the principles of chemistry), Garment Production (study of garment manufacturing technology and system).

Additionally, the more advanced aspects of the study is covered by the postgraduate program Master of Applied Science in Textile Engineering and Apparel Technology.

From ITB, the graduates are mostly working in the area of clothing and fashion industry, textile crafts, interior and home textiles, retails and designers as well as textile artisan. It can be readily seen from Figure 2.19 that graduates from both institutions cover the whole area of textile and clothing industry in Indonesia which can be looked upon as representation of the two institutions.

2.2.1.3.1 Related occupational and competence profile

2.2.1.3.2 The Politeknik STTT Bandung employment data

Higher education in the subject of textile has been graduating students with a Bachelor of Textile degree (Bk.Teks., which is a unique degree issued only by STTT but not given anymore) since established in 1954. To date, graduates in the bachelor level have been well absorbed to work in textile and textile product industry sectors with its supporting industries. The data for working graduates from Politeknik STTT Bandung based on the percentage from the total number of graduates are provided in the following Table 2.11. The data support the account reported in the previous section.

Table 2.11: The number and percentage of working graduates from Politeknik STTT Bandung

Sector	Level education	Percentage from total graduates	Total employees' number (s)
Upstream (fiber making, spinning)	D 4 D 1	23.1 7.8	89 30
Midstream (weaving, knitting, pretreatment, dyeing, finishing, printing)	D 4 D 1	28.8 7.8	111 30
Downstream (garment & fashion designing)	D 4 D 1	24.7 7.8	95 30
Others/Supports (accessories, machinery, dyestuff, auxiliaries, government, consultant, etc.)	D 4	1.3	5

Source: Academic section. Politeknik STTT Bandung. 2019

Graduates with a diploma in textile and textile product, with their skills and knowledge background are working in a vast field to support the textile and textile product industry in the main and supporting sectors. Those vast areas cover education, government, textile factory, garment factory, machines factory, dye and auxiliaries, product standardization and testing, fashion design, textile design, consultant, finance and even entrepreneurship. Generally, the graduates within the textile and textile product sectors.

2.2.1.3.3 The Craft FSRD ITB employment data

Graduates from the Craft FSRD ITB are widespread to various expertise areas with the majority working in a creative industry field. Based on our tracer study data (year 2017-2019), most graduates from the Craft FSRD ITB are working as entrepreneurs, by creating their own label. The existing businesses focus on different types or areas, such as craft products, culinary, and entertainment. Whilst, the other graduates are recorded working as a textile designer, a fashion stylist, a fashion designer, a creative consultant, and also an academic.

This section describes the survey result based on the answer given by ITB graduates. ITB has provided various fields of studies, including a wide range of engineering fields, science, and also art and design. Every year, thousands of graduates from 37 different majors participated in this survey, and one of them includes the Craft FSRD ITB graduates.

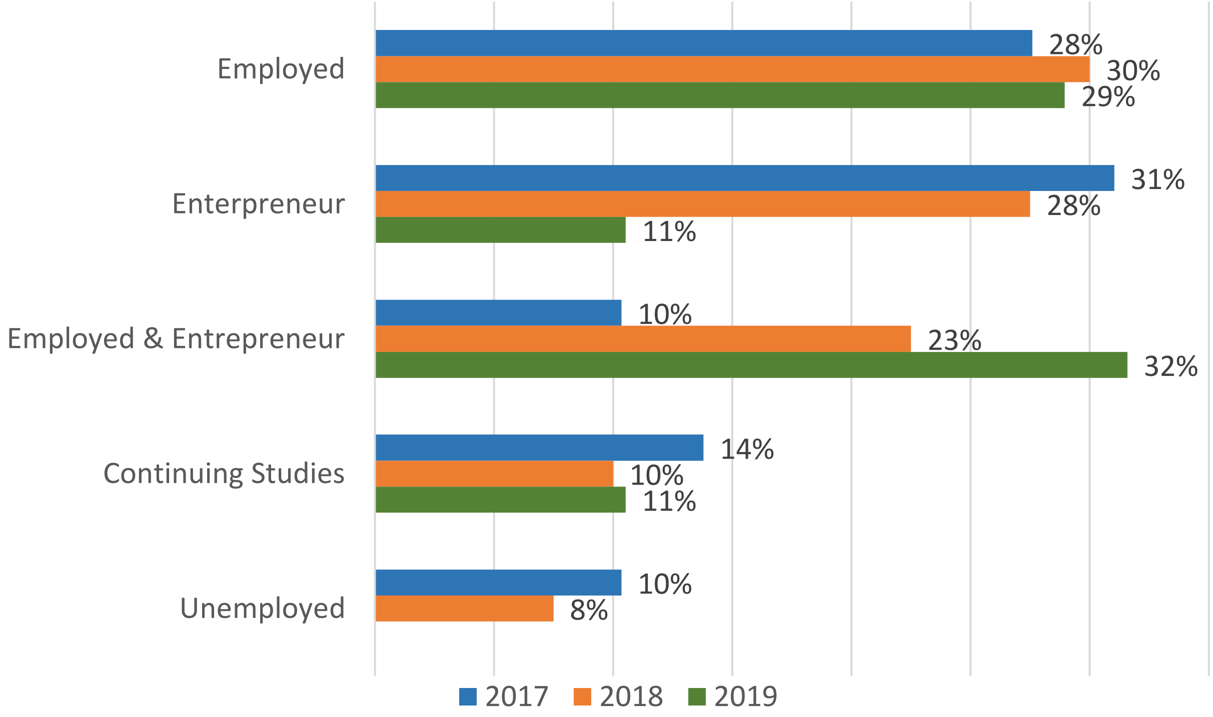


Figure 2.20: Employment Rate and Working Status of Graduates from Craft FSRD ITB

In the process of this survey, each department is also intensely evaluated based on their graduates' employment history. The graduates are analyzed based on the given questionnaires, which provides a summary of their three-year working experiences after finishing their studies. The presented data below shows the average of employed graduates is at 73%, followed by 11% continuing their education (Figure 2.20).

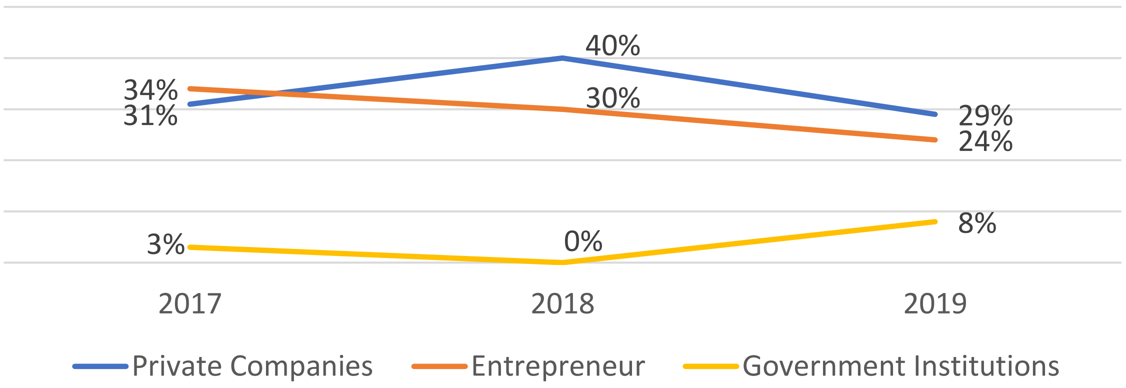


Figure 2.21: The Rate of Work Fields Employed by Craft FSRD ITB Graduates

As shown in Figure 2.21**,** most craft graduates work in private companies and corporates, followed by building their brand as entrepreneurs, and lastly, working in governmental institutions. Also, the data shows that the graduates' interest in working in government institutions are slowly rising. In contrast, the entrepreneur field seems to decrease from time to time. Due to the high rate of employment in private companies and corporates, the working graduates' position at these workplaces is determined based on their given answers. Figure 2.22 shows that the majority of working graduates are the staff. The position of manager yet declines every year. In this case, many graduates prefer having their businesses or brands than gaining a higher position in other companies.

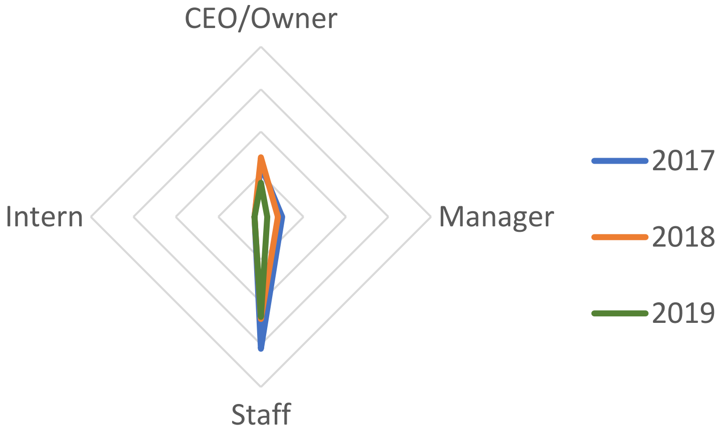


Figure 2.22: The Rate of Working Positions Employed by Craft FSRD ITB Graduates

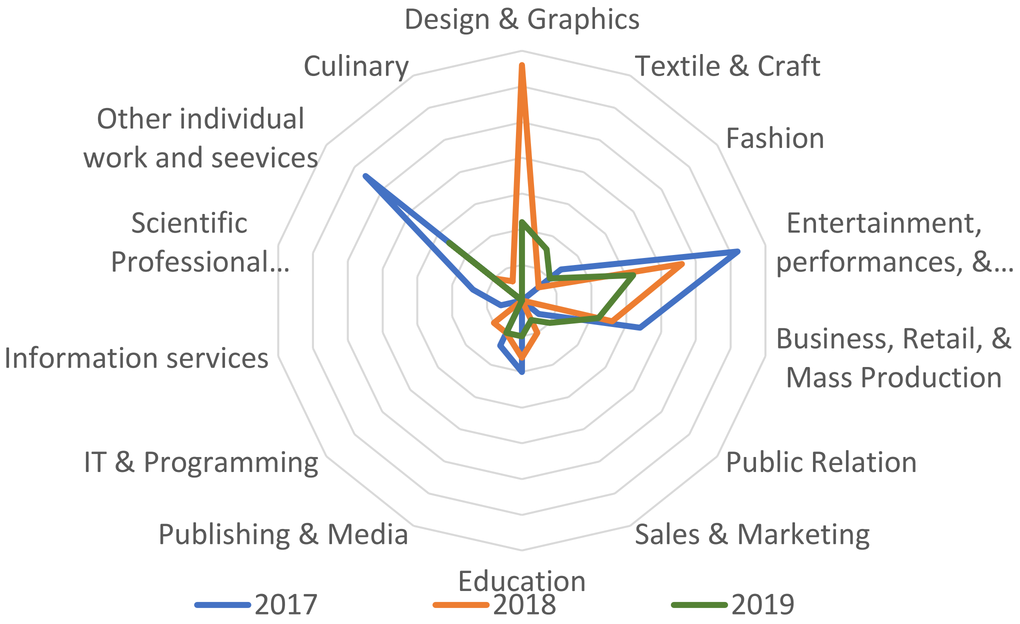


Figure 2.23 Types of Working Fields Employed by Craft FSRD ITB Graduates

The type of working fields applied by craft graduates, in general, are still related to design, based on the results of the survey, most craft graduates continue their designing skills in their work field through various sectors, including graphic design and interior design. Figure 2.23 reveals that general design and graphics are the most type of working field joined by graduates on average, followed by entertainment, performance, and other creative approaches. Based on the field of study itself, the average rate interest in textile craft does not show quite as much. However, the percentage continues to increase each year.

This survey also interviews the affiliated companies mentioned by the participants in terms of monitoring their satisfactory level upon the craft graduate's working ethics and ability. The conclusion provided based on the diagram in Figure 2.24. In supporting their design work, craft graduates generally have a higher level of skills in the design process and individual work compared to other standards of aspects. The survey shows that the design skills are employed mainly in graphic design. However, these sets of skills are mostly applied in supporting retail companies or interior design firms in textile pattern designs. In summary, this survey shows the diversity and flexibility of craft studies in ITB in terms of design-related work and activities.

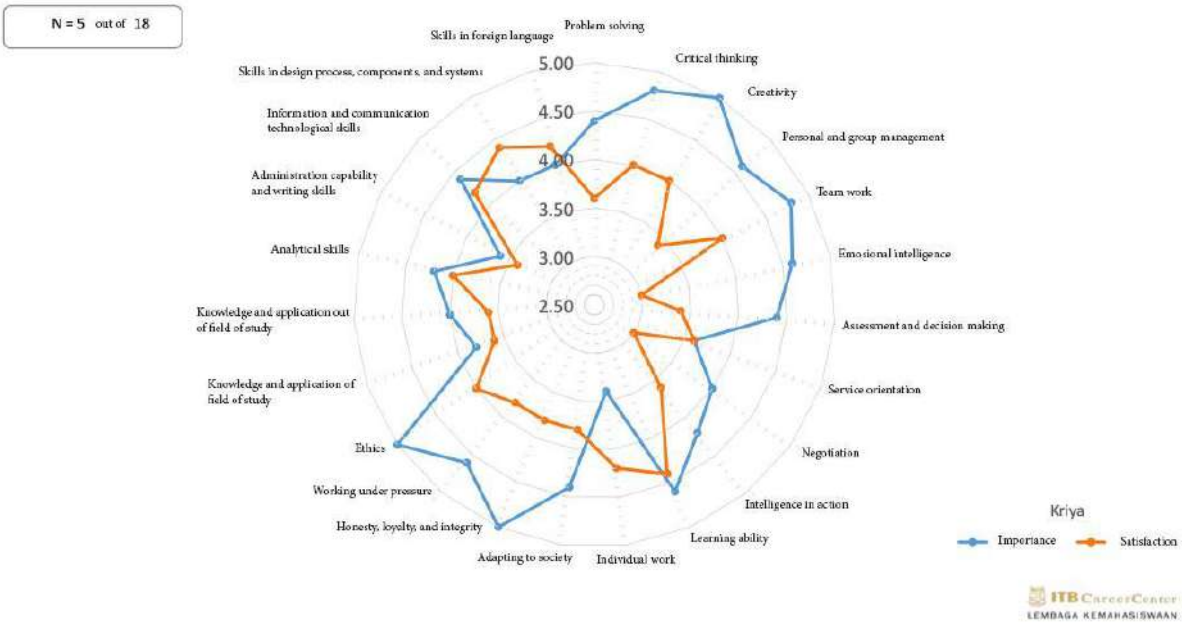


Figure 2.24: Importance and Satisfaction Level towards Craft FSRD ITB (Kriya) Graduates
Source: User Survey, ITB Career Center, 2018

2.2.1.4 Specification of competence profile

2.2.1.4.1 The Politeknik STTT Bandung

Further to the previous description on activities related with the qualification, the current Polytechnic’s curriculum is to build a deeper understanding for future graduates using the application of knowledge and practice based on higher education vocational concepts. The curriculum is designed with the involvement of industries as strategic partners for the polytechnic; therefore, the learning outputs are created based on the current situation in the industry.

As an amplifying factor for graduate’s qualification, at the end of the curriculum, internship programs are conducted within 90 days period in textile industries and other supporting industries. This will help to create a real working experience in applying knowledge for the future graduates. That valuable experience will become a very important factor when they enter the working environment.

In addition, a final assignment in the form of a scientific paper is required as the final requirement in the diploma education process. The process largely is where the future graduates promote a solution in the form of a report from problems occurring in the industry. With it, a mutual symbiosis is expected to occur between the future graduates and the industry.

2.2.1.4.2 The Craft FSRD ITB

Level of qualification for undergraduates according to the Indonesian National Qualification Framework (KKNI) contains 4 (four) learning achievements, namely Ethics, Knowledge, General Skills, and Special Skills. The Craft Study Program's educational objectives are:

- Individuals who are able to be professional, independent, and have the integrity to undergo a career in the field of craft;
- Graduates who are able to do craft work systematically, creatively, innovatively, and can be accounted for;
- Graduates who are able to develop industry-oriented craft or entrepreneurship with social, cultural and environmental sensitivity;
- Individuals who have the desire to continue to broaden their horizons, develop knowledge, and lifelong learning.

The craft students' competencies are spread out on the Craft Study Program curriculum. All undergraduate courses in the Craft Study Program are related to the learning achievements of the Craft Study Program's educational objectives. The craft students have to pass two stages to be qualified for a bachelor degree. In the first stage, the craft student learns a fundamental art and design knowledge for one year together with other art and design students, this stage is called TPB (Tahap Persiapan Bersama). Once the students pass the first stage, they can continue to the second stage called the undergraduate stage. The second stage has three academic years.

In the second year, the students learn about the essential craft. In their third year, the students are given options between 2 specialities, namely textile major and ceramic major. For students who decide to take a textile major, they learn about various types of textile processing techniques. At the end of the third academic year, the students are required to earn 160 hours of professional work (internship). Professional work is expected to train both of the students' soft skills and hard skills. The professional work can be conducted either on Small Medium Enterprise (SME) or on the industry level. The internship programme option is also advised to link with the students' future final project.

In the final year, students are required to create a final project that can show innovation and/or a problem solving for the current issues. The objective of the final project is to sharpen the students' ability to create divine craftworks. A final report and an exquisite display on a group exhibition are also required as an additional point of the students' final project.

2.2.2 Stakeholders' survey

This section discusses the methodology and results from the survey of competences for graduates of textile related bachelor studies in compliance with the needs of the labor market and EU good practices. The survey is expected to define the needs of textile graduates in the market, especially in Indonesia's market. This section starts with describing the methodology that was conducted in Indonesia (section 2.2.2.1). Then, continue with section 2.2.2.2 was the overview of participants, explaining the stakeholders' background. Last, section 2.2.2.3 describes the competencies' profiles based on the survey result in general.

2.2.2.1 Methodology

The objective of this survey was to identify the competencies required for the textile graduates. The main focus of the survey was to analyze the essential problems affecting the textiles industry concerning skills and competences in terms of young textile graduates' capacities in technical textiles. The tool used for this survey was a questionnaire which consists of six parts (Annex II). The quantitative and qualitative data was expected to gather with the questionnaire.

Part one, two and three from the questionnaire contain Likert Scale questions. These parts aim for measuring the level of importance of each question and level of knowledge of the stakeholder toward each question. The scale for both level of importance and level of knowledge are explained in Table 2.12**.** In addition to the Likert scale data, each participant was asked to give an additional comment on each question. The data was generated by calculating the average score for level of importance and level of knowledge each question from all participants (30 participants).

Part four, five and six from the questionnaire contain open questions for each part. These parts aim for extracting additional information from the stakeholders about other knowledge, skills, tasks and activities that are important for professionals of textile and fashion industry. The answers from these parts were analyzed by constructing a general idea of each question. Both quantitative and qualitative data from all parts are provided in the later section.

Table 2.12: Likert Scale on part 1, 2, and 3 from the questionnaire.

Level of Importance	Level of knowledge
1 = I don’t know 2 = Unimportant 3 = Not very important 4 = Important 5 = Very Important	1 = low knowledge 2 = medium knowledge 3 = deep knowledge

This survey employed a purposive sampling method, known as non-probability sampling. The aim of applying purposive sampling in this study was to focus on a specific population who has the expertise to answer the research questions (expert sampling). The target participants for this survey were (i) a person who has a background in textile engineering, technology and design or (ii) a person who has experience working with a person with that background. The selected participants for this study were required to meet at least one criterion or both. Participants with the textile engineering, technology and design background had the ability to explain the textile graduate competency. Whilst, participants who have worked with the textile graduates with the textile engineering, technology and design background could give a perspective of what the market needs within the current situation. To reach a broader perspective, the survey attempted to reach different occupations within the area. Those occupations are consultants, entrepreneur, manager, designer, retail, wholesaler, engineer, academic, or other. Most of participants have already had a connection with the HEI participants (STTT and ITB) in different levels and collaborations, such as an internship programme, joint research, etc.

The potential participants were approached by sending them an email with an information sheet attached explaining the survey aim, the details of the study location, research procedures, voluntary action and data protection scheme. Once the participant agreed to take part, the next step was to send the questionnaire through email. The participant was expected to fill the questionnaire and send it back within 1-2 weeks. The initial structure for this survey was to have a structure interview as an additional part from the survey. However, due to the COVID-19 pandemic situation within March-April 2020, the team decided to do an online survey as a more effective way to reach the participants. In result, the questionnaire had attained the survey goal.

In total, 30 participants met the criteria with different occupations. Data of each participant is provided in Annex III and the overview of respondents is discussed in the later section.

2.2.2.2 Overview of the respondents

There were 30 stakeholders from different backgrounds participating in this survey. The percentage of participants' background is described in Figure 2.25 showing that the participant distribution has covered every background. The majority of participants are coming from industry which account for more than 50%. The academics involved in this survey are from different fields that related to textile technology, engineering and also design. The background details of each participant are presented in Appendix A.

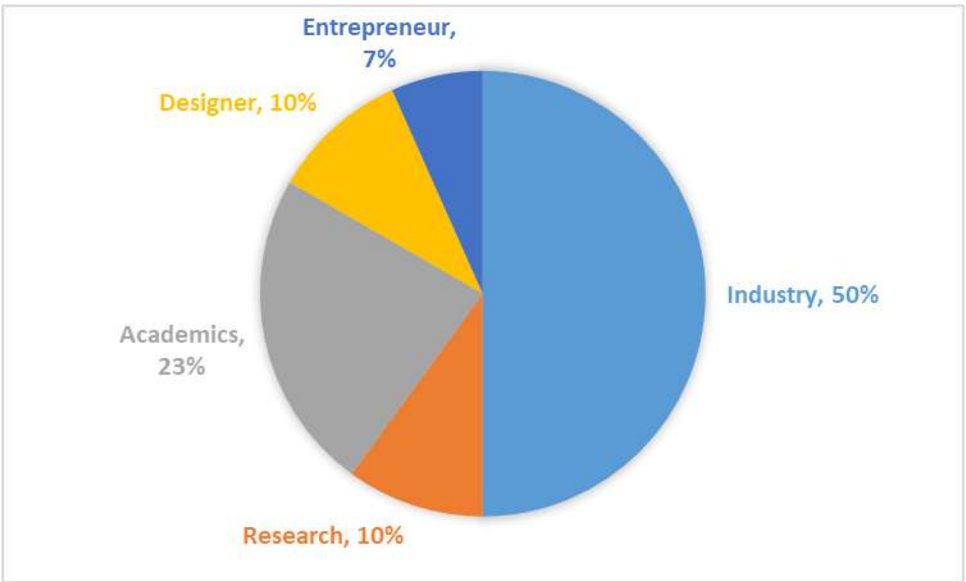


Figure 2.25: Stakeholders' background

2.2.2.3 Competence profile

This section describes the competence profile that needs to be built or added to the existing profile based on the results from the survey. The background information of the stakeholders and the cooperation with STTT and ITB have been described and explained in the previous section and relevant appendix. Therefore, the focus of this section will be on the survey and its results. The description of each part in the questionnaire is explained as follows:

1. Knowledge necessary for students and employees in textile and fashion industry;
2. Professional skills necessary for students and employees in textile and fashion industry;

3. Personal qualities and attitudes for students and employees in textile and fashion industry
4. Other knowledge and skills important for professionals of textile and fashion industry
5. Tasks and activities that are important for graduates of textile related bachelor studies
6. Additional comments

The discussion of the survey results is divided into two sections. The first section analyses part 1-3, and the second section discusses part 4-6.

2.2.2.4 Discussion of section one (1-3) of the questionnaire

Part one, two and three from the questionnaire are contained in Likert Scale questions for measuring the level of importance of each question and level of knowledge of the stakeholder toward each question. The scale for both level of importance and level of knowledge are explained Table 2.13. The data was generated by calculating the average score for level of importance and level of knowledge each question from all participants (30 participants). This data is provided in Table 2.14 and illustrated in Figure 2.26 and 2.27.

Table 2.13: Likert Scale on part 1, 2, and 3 from the questionnaire.

Level of Importance	Level of knowledge
1 = I don’t know 2 = Unimportant 3 = Not very important 4 = Important 5 = Very Important	1 = low knowledge 2 = medium knowledge 3 = deep knowledge

Table 2.14: Summary of survey's answers in average (total participant: 30)

QUESTION NUMBER	DESCRIPTION OF QUALIFICATIONS	AVERAGE	AVERAGE
		Level of Importance	level of knowledge
PART 1	Knowledge necessary for students and employees in textile and fashion industry		
1.1	Fundamental knowledge in basic science (chemistry, mathematics, physics, IT)	4.45	2.24
1.2	Fundamental knowledge in physicochemical characteristics of chemical raw materials	4.38	1.97
1.3	Fundamental knowledge in physicochemical and technical characteristics of conventional raw materials (fabrics and yarns)	4.52	2.17
1.4	Fundamental knowledge in technology for materials production (machinery, processes)	4.62	2.17
1.5	Fundamental knowledge in art (fashion and design)	4.10	1.86
1.6	Fundamental knowledge in technologies for design (methods, IT infrastructure)	3.93	1.69
1.7	Fundamental knowledge in technologies for manufacturing	4.55	2.14
1.8	Knowledge and understanding in quality control and management	4.48	2.14
1.9	Knowledge and understanding in applications of technical and nano-textiles	4.45	2.00
1.10	Knowledge and understanding in managerial and techno economical aspects of production	3.90	1.55
1.11	Knowledge and understanding in auxiliary processes in manufacturing and production (automation, machinery maintenance)	4.14	1.69
1.12	Knowledge and understanding in standardization and certification	4.21	2.14
1.13	Knowledge and understanding in customer relationship management	4.10	2.00
1.14	Knowledge and understanding in marketing	4.07	1.93

1.15	Knowledge and understanding in health and safety issues in production and manufacturing	4.45	2.17
1.16	Knowledge and understanding in logistics aspects	3.86	1.59
1.17	Knowledge and understanding in sustainability in design and production	4.55	2.24
1.18	Knowledge in specific fields of textile application		
1.18.1	Textile for medical and health care	4.34	1.79
1.18.2	Fashionable protective textile	4.21	1.79
1.18.3	Fashionable architecture and interior textile	3.86	1.62
1.18.4	Fashionable transport and aerospace textile	3.76	1.52
1.18.5	Agriculture and geotextile	4.14	1.34
1.18.6	Fashionable sports and active leisure clothing	4.38	1.93
1.18.7	Fashionable smart clothing	4.41	1.86
1.18.8	Fashionable ecotextile	4.41	2.10
1.18.9	Fashionable military textile	3.90	1.59
1.19	Knowledge in development of innovative and smart textile with advanced properties		
1.19.1	Nanomaterials and nanotechnologies in textiles and fashion	4.31	1.86
1.19.2	Micro-electronics in textiles and fashion	3.45	1.34
1.19.3	Biotechnologies in textiles and fashion	3.90	1.69
1.19.4	Fibrous and textiles-based composites	3.97	1.76
1.19.5	New Fibres and Textile structures	4.45	1.90
PART 2	Professional skills necessary for students and employees in textile and fashion industry		
2.1	Ability to analyse and estimate recent information about new materials and technologies (Bibliography research and up to date informative)	4.48	2.07
2.2	Ability to apply new methods and technologies in design and development of new materials and/or products, processes (reengineering of processes, according to new requirements like sustainability, quality, corporate Social responsibility)	4.45	2.14
2.3	Ability to analyse problems and situations (problem Solving, synthesis of existing knowledge from other domains into practical solutions for the job)	4.45	2.17

2.4	Capability for entrepreneurship: leadership, risk-taking, creativity	3.90	1.93
2.5	Ability to apply innovation in the whole of the value chain	4.14	1.90
2.6	Ability to apply innovation in the whole of the value chain	4.07	1.93
2.7	Ability to market new innovative fashion products	4.00	1.76
PART 3	Personal qualities and attitudes for students and employees in textile and fashion industry		
3.1	Ethical behaviour in the job	4.76	2.17
3.2	Collaboration, Communication and Ability to act in a global and multicultural environment	4.38	2.28
3.3	Linguistic capabilities	4.34	2.03
3.4	Cultural tolerance	4.24	2.17
3.5	Appraisal of different opinions and attitudes	4.41	2.17

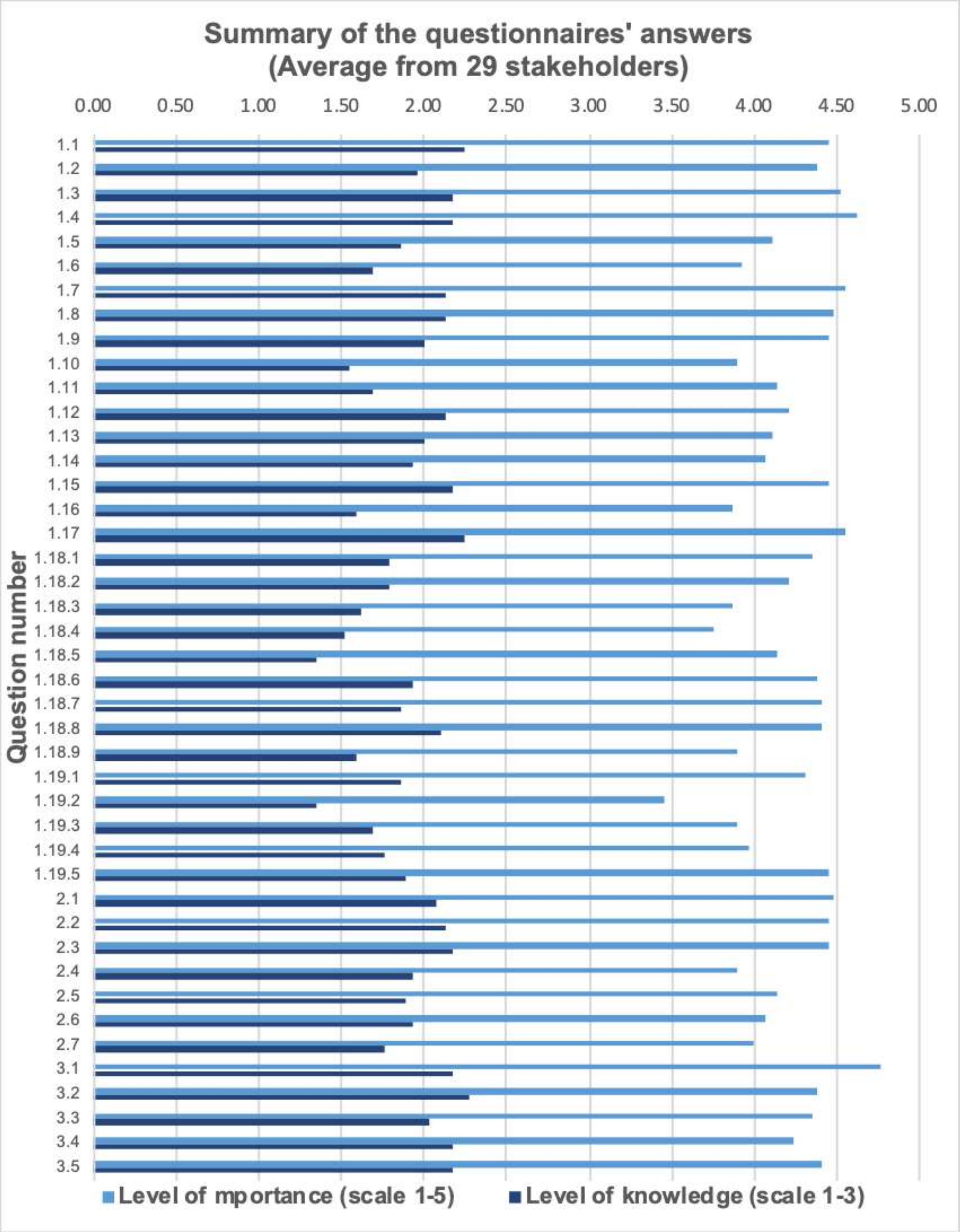


Figure 2.26: Illustration of the survey's answers on the level of importance and the level of knowledge on each question from part 1, 2 and 3 of the questionnaires.

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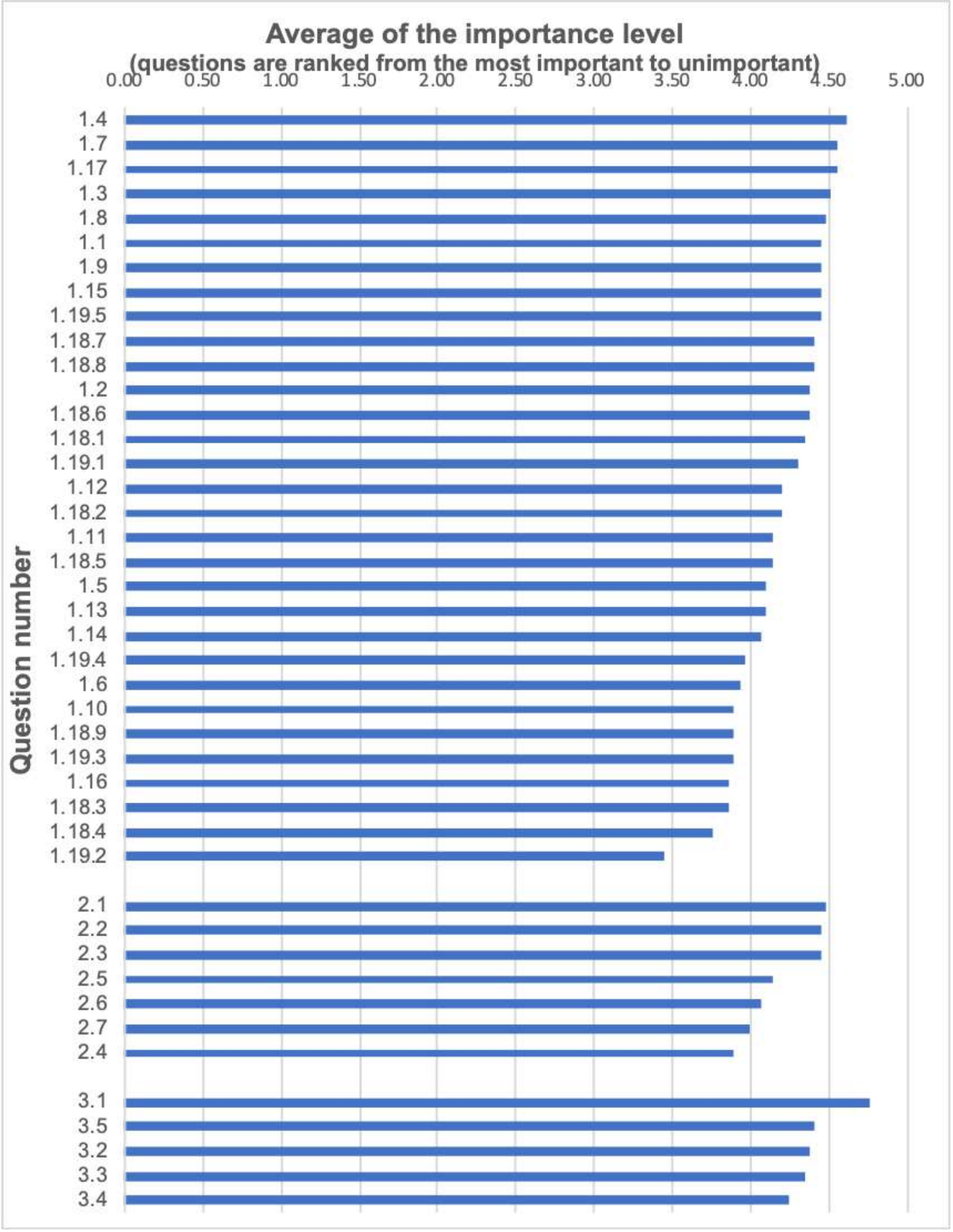

Figure 2.27: Illustration of the level of importance (from the most important to unimportant) on each question from part 1, 2 and 3 of the questionnaires.

This project has been funded with support from the European Commission. This [communication] reflects the views only of the author, and the Commission cannot be held responsible publication for any use which may be made of the information contained therein.

After generating the average score of each question, the analysis was taken by translating the score to the Likert Scale in Table 2.13. The objective of this analysis is to examine the most important qualification based on the stakeholders' answers. Therefore, the average score was ranked from the highest score to the lowest score (Figure 2.26). Table 2.15 provides a number of qualifications that have ranged from 5 (very important) to 4 (important) of each part (part 1-3). Five questions from each part are considered to be the most important qualifications for the textile bachelor graduate.

Table 2.15: Rank of the most important competency, skills and personal attitude that are required for the textile bachelor graduate based on survey (part 1-3)

RANK	PART 1 Knowledge necessary for students and employees in textile and fashion industry	
1	Q 1.4	Fundamental knowledge in technology for materials production (machinery, processes)
2	Q 1.7	Fundamental knowledge in technologies for manufacturing
3	Q 1.17	Knowledge and understanding in sustainability in design and production
4	Q 1.3	Fundamental knowledge in physicochemical and technical characteristics of conventional raw materials (fabrics and yarns)
5	Q 1.8	Knowledge and understanding in quality control and management
6	Q 1.1	Fundamental knowledge in basic science (chemistry, mathematics, physics, IT)
7	Q 1.9	Knowledge and understanding in applications of technical and nano-textiles
8	Q 1.15	Knowledge and understanding in health and safety issues in production and manufacturing
9	Q 1.19.5	Knowledge in development of innovative and smart textile with advanced properties (New Fibres and Textile structures)
10	Q 1.18.7	Knowledge in specific fields of textile application (Fashionable smart clothing)
11	Q 1.18.8	Knowledge in specific fields of textile application (Fashion Eco textile)
12	Q 1.2	Fundamental knowledge in physicochemical characteristics of chemical raw materials
13	Q 1.18.6	Knowledge in specific fields of textile application (Fashionable sports and active leisure clothing)

Table 2.15 (Continued)

14	Q 1.18.1	Knowledge in specific fields of textile application (Textile for medical and health care)
15	Q 1.19.1	Knowledge in development of innovative and smart textile with advanced properties (Nanomaterials and nanotechnologies in textiles and fashion)
16	Q 1.12	Knowledge and understanding in standardization and certification
17	Q 1.18.2	Knowledge in specific fields of textile application (Knowledge and understanding in standardization and certification)
18	Q 1.11	Knowledge and understanding in auxiliary processes in manufacturing and production (automation, machinery maintenance)
19	Q 1.18.5	Knowledge in specific fields of textile application (Agriculture and geotextile)
20	Q 1.5	Fundamental knowledge in art (fashion and design)
21	Q 1.13	Knowledge and understanding in customer relationship management
22	Q 1.14	Knowledge and understanding in marketing
RANK	PART 2 Professional skills necessary for students and employees in textile and fashion industry	
1	Q 2.1	Ability to analyse and estimate recent information about new materials and technologies (Bibliography research and up to date informative)
2	Q 2.2	Ability to apply new methods and technologies in design and development of new materials and/or products, processes (reengineering of processes, according to new requirements like sustainability, quality, corporate Social responsibility)
3	Q 2.3	Ability to analyse problems and situations (problem Solving, synthesis of existing knowledge from other domains into practical solutions for the job)
4	Q 2.5	Ability to apply innovation in the whole of the value chain
5	Q 2.6	Ability to apply innovation in the whole of the value chain
6	Q 2.7	Ability to market new innovative fashion products
RANK	PART 3 Personal qualities and attitudes for students and employees in textile and fashion industry	
1	Q 3.1	Ethical behavior in the job

Table 2.15 (Continued)

2	Q 3.5	Appraisal of different opinions and attitudes
3	Q 3.2	Collaboration, Communication and Ability to act in a global and multicultural environment
4	Q 3.3	Linguistic capabilities
5	Q 3.4	Cultural tolerance

In addition to the Likert scale result, additional comments are provided by some stakeholders. They thought that basic knowledge in science and physicochemical characteristics of chemical raw materials is a very important qualification for textile graduates. That knowledge will help the students to understand how to develop the products and keep the quality of the products to a high standard. By knowing the fundamental knowledge, it also accommodates the textile graduates to collaborate with another field specialist efficiently. Furthermore, sustainability knowledge is also considered as an essential point to keep the balance of the production system by minimizing the negative impacts in many aspects. On the professional skill and personal attitude, the textile graduates are also required to sharpen their collaboration and communication skills to speed up the invention improvement.

2.2.2.5 Discussion of section two (4-6) of the questionnaire

The second section of this discussion is summarized from the 30 stakeholders' comments on part 4, 5, and 6 from the questionnaire. Although the comments are not provided by every respondent, the summary of each part can be described as follows:

- **Part 4** aims to examine other knowledge and skills that are important for professionals of the textile and fashion industry. There are three skills required for professionals of the textile and fashion industry, which are:
  1. Psychological Knowledge
     The students are expected to have a positive and open-minded attitude to work in an agile environment.
  2. Social Knowledge
     The students need to develop a robust skill which can help to build a critical understanding in creating transformative design innovation.
  3. Cultural Knowledge
     The students aspire to gain historical, traditional, and wisdom knowledge from their country in order to enrich their thinking process and create an innovative invention while preserving the culture.

- **Part 5** has an objective to discuss the type of tasks and activities that are important for the textile graduates (bachelor studies). Some stakeholders pointed out that the critical tasks and activities for the textile graduates (bachelor studies) are:
    1. Tasks that give the students professional experience before entering "the real world". It is expected that those tasks would build their confidence.
    2. Activities that could develop research and experimentation as part of the students' daily life.
    3. Tasks and activities that could enrich the students' knowledge of community diversification. It could be achieved by getting involved throughout various communities (e.g. textile science community, textile design community, and other non-textile related communities).

- **Part 6** is an additional part that accommodates the stakeholders to give further comments. The highlight from this part is a recommendation for the student to start everything from something they love; thus, they can reach the maximum level of their work capability.

2.2.3 Summary of the survey results

This section provides key points from analysing the survey results (part 1 – 6 of the questionnaire). Taking all points that had been discussed above, the important qualification for textile graduates (bachelor's degree) in technical textiles in Indonesia, which also defines the need for skills and further training, can be summarized as follow:

1) **Professional qualification:**
    a. The textile graduates require a fundamental knowledge in physicochemical and technical characteristics of conventional raw materials (fabrics and yarns).
    b. The textile graduates require a fundamental knowledge in technologies for machinery, process, and manufacturing.
    c. The textile graduates need to have a knowledge and understanding in sustainability in design and production.
    d. The textile graduates are expected to earn knowledge and understanding in quality control and management.
    e. The textile graduates should have the ability to analyze and estimate recent information about new materials and technologies.
    f. The textile graduates should have the ability to apply new methods and technologies in design and development of new materials and/or products, processes, also in the whole value chain processes.

g. The textile graduates should develop problem solving skills that can synthesize the existing knowledge from other domains into practical solutions.
h. The textile graduates should understand the ethical behavior in the job.
i. The textile graduates are expected to have a high linguistic capability to face the global challenge and support a possibility to build a global collaboration.

2) **Personal qualification:**

a. **Psychological Knowledge**
   The students are expected to have a positive and open-minded attitude to work in an agile environment. It also relates to the appraisal of different opinions and views in the working environment.
b. **Social Knowledge**
   The students have to be able to collaborate, communicate and act in a global and multicultural environment. Also, the students have to develop a robust skill which can help to build a critical understanding in creating transformative design innovation.
c. **Cultural Knowledge**
   The students aspire to have a cultural tolerance and also gain historical, traditional, and wisdom knowledge from their country in order to enrich their thinking process and create an innovative invention while preserving the culture.

2.2.4 Conclusion and suggestions

Indonesia’s textile industry enjoys a strong and favourable position in the national stage for being one of the mainstay industries in the Masterplan for the Development of National Industry 2015-2035 and the more recent national development of Making Indonesia 4.0. The past three years has witnessed the promising growth and yet challenging situation for the nations’ textile industry. One of the biggest challenges that has been consistently faced by the industry is the low level of competitiveness due to lack of technological capacity and capability.

The results from the survey confirm and strengthen the vision of the two institutions, STTT and FSRD ITB, in regard with the curriculum and the competencies to be demonstrated by the graduates. There are new and interesting ideas shared by the participants, particularly pertaining personal qualification that can be included into the curriculum. Gaps were also identified for the improvement of curriculum in STTT and FSRD ITB, which are not necessarily the same. For example, smart textiles in STTT has been developed and inducted as an individual course in the undergraduate and postgraduate (master) curriculum, whereas it still does not exist as an individual course in FSRD ITB. On the other hand, FSRD ITB has courses that are related with product design and development, which does not exist in STTT. Or, sustainability in design and production, which both institutions probably need to develop.

Overall, the curriculum that will be developed in this project must be directed to serve for the improvement of global level of competitiveness for Indonesia’s textile industry.

2.3 Pakistan

Pakistan with its population being more than 220 million has remained an agricultural country. Manufacturing industry has also contributed towards its GDP but proportionally lesser than that of agricultural products and especially the textile products. Textile industry is the major industrial sector which plays an important role in the economic growth of the Country. It continues to be the largest industry of Pakistan mainly due to its locally produced raw material and commands the strongest comparative advantages in the resources utilization. It is a labour-intensive industry and offers entry-level jobs for unskilled labour, especially in the clothing sector which has been particularly suitable for female workers who had limited income opportunities other than domestic or the informal income activities.

The industry has expanded significantly since independence and now developed into one of the strongest export-based industrial sub-sectors. Since the raw cotton production has potential to increase, therefore, there is great potential for horizontal and vertical expansion in the domestic production of textile and textile goods.

2.3.1 Bibliography review

The textile industry of the Country mainly consists of large-scale organized sector as well as highly fragmented cottage/small scale sector. The organized sector is essentially the integrated Textile Mills – large number of spinning units and a very small number of shuttle-less looms units. The downstream industry (Weaving, Finishing, Garment, Towels & Hosiery), which has a great export potential, though exists but in an unorganized sector. Some units have well grown to the international scale and are progressive in business philosophy.

As of June 2018, Pakistan textile industry comprises 517 textile units (40 composite units and 477 spinning units). There are 28,500 shuttle-less looms and 375,000 conventional looms The Spinning Sector has grown with export demand & cotton production. The Weaving & Processing Sector has also followed the same trend. Air-Jet weaving units have been set up either as independent units or together with spinning or processing units. Some of the clothing units are in the process of backward integration while on the other hand, spinning units are in the process of developing weaving, finishing and making up facilities to complete the chain. However, both Textile & Clothing sectors are complementing each other and horizontally/ vertically integrated either under the same management or business tie-ups.

2.3.1.1 General description of the qualification

The youngsters having desire to pursue a career in the textile domain get their undergrad education either in Textile Engineering or Textile Sciences. After the completion of their undergraduate degree, they are hired by the textile manufacturing industries mainly as

Management Training Officers. Later, based upon their personal interest and technological knowledge they are shifted to different areas e.g. production lines, marketing and merchandising sections. It has been observed through alumni and employer surveys that within a couple of years' times, they have been promoted to middle management level.

According to Pakistan Engineering Council being the sole regulatory body to monitor the performance and quality of engineering degrees being awarded by different higher education institutions, following are the only institutions offering textile engineering programmes in a country of more than 220 million people with major export is based upon textile products:

1. National Textile University, Faisalabad
2. University College of Textile Engineering (Bahauddin Zakariya University, Multan)
3. Mehran University of Engineering and Technology, Jamshoro
4. NED University of Engineering and Technology, Karachi
5. Balochistan University of Information Technology, Engineering and Management Sciences, Quetta

Moreover, there are several other institutions which are providing degree and non-degree programmes in the textile related areas which include Garment Design, Garment Manufacturing, Textile Design etc. These institutions are also required to get approval from the Higher Education Commission of Pakistan before offering any such programme.

2.3.1.2 Activities associated with the qualification

When the graduates enter into the industry, they are already familiar with the industrial environment. During the regular course of studies, students are provided Internship at third year level and final year design projects at final year stage are mandatory for the completion of the degree. In order to broaden the horizon of the students, the university arranges industrial visits, internships and technical lectures for the students on a regular basis. These activities provide practical exposure to the students, and help them understand the theoretical concepts clearly along with gaining familiarity with the industry.

The design project is one of the essential requirements for a 4-year degree program. This exercise is carried out during the final year of the degree programme. The purpose of this exercise is to encourage the student to apply their knowledge and skills to a specific problem towards engineering design. Students usually work on industrial problems in association with the industry and faculty members.

In general, every year 500-600 students graduate from Pakistani institutions getting degrees in textile engineering, textile science, and garment engineering at bachelors' level.

2.3.1.3 Sectoral studies

The Pakistan Textile Industry contributes substantially to Pakistan export earnings. The exports basket contains a wide range of items viz Cotton fibers, yarn and cloth, yarn other than cotton yarn, tents, canvas, bed wears, towels, carpets, made-ups and variety of garments. However, to maintain its position and move into high value-added products for the increased market share, a large investment in machinery equipment and new technology is essential.

The training of workers, improvement in labor productivity, research & development, product diversification and branding are the immediate areas for each company to focus. Table 2.16 and Table 2.17 highlight the key statistics as extracted from the website of relevant government authorities.

Table 2.16: Growth Capacity & Production

GROWTH IN CAPACITY & PRODUCTION				
CAPACITY	**2014-15**	**2015-16**	**2016-17**	**2017-18**
Spindles (Million)	13.180	13.414	13.414	13.410
Rotors	185,387	187,259	198,801	198,801
Looms (Mill Sector)	7,934	8,188	9,084	9,084
Shuttle less	28,500	28,500	28,500	28,500
Power looms	375,000	375,000	375,000	375,000
Total Looms:	**411,434**	**411,688**	**412,584**	**412,584**
Production				
Yarn Production (M. Kgs)	3,369.7	3,397.3	3,428.1	3,430.1
Cloth Production (M. Sq. Mtrs)				
Mill Sector	1,036.9	1,039.1	1,043.3	1,043.7
Non-Mill Sector	8,089.6	8,120.1	8,126.4	8,127.2
Total Cloth Production:	**9,126.5**	**9,159.2**	**9,169.7**	**9,170.9**

Table 2.17: Exports of Textiles and Share in Country Export

EXPORTS OF TEXTILES & SHARE IN COUNTRY EXPORT					
					In million US$
Products	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**
Cotton & Cotton Textile	13,349	13,139	12,168	12,205	13,220
Synthetic Fabrics	383	331	288	204	310
Wool & Carpets	125	119	98	79	76
Total Textile	13,858	13,589	12,553	12,531	13,606
All Exports	25,132	23,885	20,802	20,448	23,222
Textile as % of Total Exports	**55.1%**	**56.9%**	**60.3%**	**61.3%**	**58.6%**

The segment of textile in Pakistan has a giant impact on the business economy and overall contributing towards the country's exports with its volume being the highest i.e. 57%. In recent years, cotton yarn textiles and apparel cloth garment were the main focus of the clothing industry, because of the vast amount of agro-cotton yarn produced in the country making it the fourth highest cotton producing country across the world after India and China.

There are a large number of textile mills, spinning mills, weaving and knitting mills, textile processing units, textile machinery and dyeing and printing industry which have mostly developed and grown during the last five years. Further breakup of textile related commodities with having share in export are detailed in Table 2.18.

Table 2.18: Comparative Exports of Selected Commodities

Comparative Exports of Selected Commodities				
			July-Feb, 2018-19	**July-Feb, 2019-20**
	Commodities	**Units**	**Quantity**	**Quantity**
1	Raw cotton	Million TON	9392	12621

2	Cotton yarn	Million TON	283860	302868
3	Cotton cloth	000 SQM	1828630	1719312
4	Cotton carded or combed	Million TON	135	66
5	Yarn other than cotton yarn	Million TON	6660	7498
6	Knitwear	ooo Dozen	79524	85158
7	Bedwear	Million TON	280450	305805
8	Towels	Million TON	120854	128419
9	Tents, canvas & Tarpaulin	Million TON	22422	24697
10	Readymade garments	000 Dozen	33520	38857
11	Art Silk & synthetic textile	000 SQM	248242	317209
12	Carpets rugs & mats	000 SQM	1046	1130
	Sports goods			
13	i) football	000 Dozen	2126	2386
14	ii) Gloves	000 Dozen	1295	1054
15	iii) Other sports goods			
	Leather tanned	000 SQM	14070	12093
16	Leather manufacturers			
17	i) Leather garments	000 Dozen	683	775
18	ii) Leather gloves	000 Dozen	3667	4022
19	iii) Other Leather manufacturer			
	Footwears	000 Pairs	7515	11018
20	i) Leather footwear	000 Pairs	4668	5168
21	ii) Canvas footwear	000 Pairs	27	69
22	iii) Other footwear	000 Pairs	2820	5781
23	Surgical goods/medical instruments			
24	Onyx manufactured	Million TON	1242	2620.8

Table 2.18 shows the export related to textile products from Pakistan. From Table 2.18, it can be seen that there is much room available for the technical textiles products to be manufactured and exported from Pakistan. Value addition can easily be carried out in this particular area of technical textile.

2.3.1.4 Related occupational and competence profile

Recent expansion of the higher education sector in Pakistan and abroad has necessitated the focus on quality of engineering education. The quality and competence of graduates, and their relevance is critical for socio-economic uplift and technical manpower required to meet the needs of the Country. In this regard, Pakistan Engineering Council (PEC) has to undertake multiple tasks; one of them is to regulate the conduct of engineering education. All those programmes associated with BE/BS in Textile Engineering are affiliated with PEC, hence; they are regulated by this body.

2.3.1.5 Specification of the competence profile

Pakistan Engineering Council is very much determined to maintain quality in the education imparted by the institutions. They are also ensuring that the graduates are inculcated with the professional qualities desired by the industry and other stakeholders. Hence, BS/BE textile programmes are aligned with the following professional attributes and on completion of the studies, the graduates are expected to possess the following professional **attributes**:

i. **Engineering Knowledge:** An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

ii. **Problem Analysis:** An ability to identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using principles of mathematics, natural sciences and engineering sciences.

iii. **Design/Development of Solutions:** An ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations

iv. **Investigation**: An ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.

v. **Modern Tool Usage:** An ability to create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities, with an understanding of the limitations.

vi. **The Engineer and Society:** An ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the responsibilities relevant to professional engineering practice and solution to complex engineering problems.

vii. **Environment and Sustainability:** An ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

viii. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

ix. **Individual and Team Work:** An ability to work effectively, as an individual or in a team, on multifaceted and /or multidisciplinary settings.

x. **Communication:** An ability to communicate effectively, orally as well as in writing, on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

xi. **Project Management:** An ability to demonstrate management skills and apply engineering principles to one’s own work, as a member and/or leader in a team, to manage projects in a multidisciplinary environment.

xii. **Lifelong Learning:** Ability to recognize the importance of, and pursue lifelong learning in the broader context of innovation and technological developments.

Textile engineers are expected to have sound knowledge about the raw material, yarn and fabric manufacturing processes and machinery used in this sector along with being well versed with textile dyeing and printing techniques and processes, quality control of a process and a textile product, automation and control.

They may use this knowledge to analyze different processes and recommend any modification; if required, design new techniques and products, apply sustainable and best industrial practices, solve industrial problems, work with safety and professional ethics.

2.3.2 Stakeholders’ survey

Mainly the textile graduates and the industry representatives/owners were targeted to get their feedback though this survey. The format proved by Smartex was used during this survey. Two partners from Pakistan contributed to this deliverable are:

1) NED UET: NED University of Engineering & Technology
2) BZU: Bahauddin Zakariya University

2.3.2.1 Methodology

The methodology for the survey was set in such a way that 50% questionnaires were targeted for the industry representatives/owners whereas the remaining 50% were targeted for the textile graduates/experts who are working in the industry. Accordingly, ten interviews each from both categories were also successfully conducted. Due to the COVID-19 pandemic, these interviews were conducted over the phone and interviewee were asked to Email/WhatsApp their filled forms back to both partners.

The response to the questionnaire/feedback was overwhelming. However, 20 feedbacks/questionnaires were selected, 10 from each category i.e. from the "Industry representatives/owners" and "Textile alumni/Textile Experts". It should be noted that feedback obtained reflects the level of cooperation extended by the stakeholders and also their desire for bringing improvement in the area.

2.3.2.2 Overview of respondent

It follows the summarization of the answers, the comparison between the two target groups and the evaluation of the answers with high scores.

In order to analyse the result of the survey, the answer of the survey is coded. For the importance of the knowledge, the answer is coded in Table 2.19**.** For the level of knowledge, the answer is coded in Table 2.20.

Table 2.19: Code of importance of knowledge.

Code	Answer
1	I don't know
2	Unimportant
3	Not very important
4	Important
5	Very Important

Table 2.20: Code of Level of knowledge.

Code	Answer
1	Low knowledge
2	Medium knowledge
3	Deep knowledge

This can also be viewed in annex IV-Interviews-Pakistan. The questionnaire used was provided by the SMARTEX Project head.

A. Focus group 1: Industry representative / owners (IR/O)

CODE	ANSWER	Total Importance	Total level of knowledge
1	**Knowledge necessary for students and employees in textile and fashion industry**		
1.1	Fundamental knowledge in basic science (chemistry, mathematics, physics, IT)	**46**	**26**
1.2.	Fundamental knowledge in physicochemical characteristics of chemical raw materials	**46**	**22**
1.3	Fundamental knowledge in physicochemical and technical characteristics of conventional raw materials (fabrics and yarns)	**48**	**25**
1.4	Fundamental knowledge in technology for materials production (machinery, processes)	**47**	**26**
1.5	Fundamental knowledge in art (fashion and design)	**41**	**23**
1.6	Fundamental knowledge in technologies for design (methods, IT infrastructure)	**46**	**19**
1.7	Fundamental knowledge in technologies for manufacturing	**46**	**24**
1.8	Knowledge and understanding in quality control and management	**50**	**26**
1.9	Knowledge and understanding in applications of technical and nano-textiles	**46**	**18**
1.10	Knowledge and understanding in managerial and techno economical aspects of production	**46**	**24**
1.11	Knowledge and understanding in auxiliary processes in manufacturing and production (automation, machinery maintenance	**40**	**20**
1.12	Knowledge and understanding in standardization and certification	**47**	**26**
1.13	Knowledge and understanding in customer relationship management	**43**	**27**
1.14	Knowledge and understanding in marketing	**46**	**28**
1.15	Knowledge and understanding in health and safety issues in production and manufacturing	**48**	**26**
1.16	Knowledge and understanding in logistics aspects	**41**	**22**
1.17	Knowledge and understanding in sustainability in design and production	**48**	**25**
1.18	**Knowledge in specific fields of textile application**		

1.18.1	Textile for medical and health care	**45**	**21**
1.18.2	Fashionable protective textile	**42**	**20**
1.18.3	Fashionable architecture and interior textile	**40**	**18**
1.18.4	Fashionable transport and aerospace textile	**39**	**16**
1.18.5	Agriculture and geotextile	**40**	**15**
1.18.6	Fashionable sports and active leisure clothing	**41**	**18**
1.18.7	Fashionable smart clothing	**42**	**18**
1.18.8	Fashionable ecotextile	**41**	**20**
1.18.9	Fashionable military textile	**39**	**18**
1.19	**Knowledge in development of innovative and smart textile with advanced properties**		
1.19.1	Nanomaterials and nanotechnologies in textiles and fashion	**42**	**18**
1.19.2	Micro-electronics in textiles and fashion	**35**	**17**
1.19.3	Biotechnologies in textiles and fashion	**40**	**17**
1.19.4	Fibrous and textiles-based composites	**44**	**19**
1.19.5	New Fibres and Textile structures	**46**	**20**
2	**Professional skills necessary for students and employees in textile and fashion industry**		
2.1	Ability to analyse and estimate recent information about new materials and technologies (Bibliography research and up to date informative)	**47**	**20**
2.2	Ability to apply new methods and technologies in design and development of new materials and/or products, processes (reengineering of processes, according to new requirements like sustainability, quality, corporate Social responsibility)	**48**	**23**
2.3	Ability to analyse problems and situations (problem Solving, synthesis of existing knowledge from other domains into practical solutions for the job)	**45**	**23**
2.4	Capability for entrepreneurship: leadership, risk-taking, creativity	**47**	**27**
2.5	Ability to apply innovation in the whole of the value chain	**46**	**24**
2.6	Ability to apply innovation in the whole of the value chain	**43**	**22**
2.7	Ability to market new innovative fashion products	**41**	**21**
3	**Personal qualities and attitudes for students and employees in textile and fashion industry**		
3.1	Ethical behavior in the job	**50**	**30**

3.2	Collaboration, Communication and Ability to act in a global and multicultural environment	**49**	**27**
3.3	Linguistic capabilities	**47**	**26**
3.4	Cultural tolerance	**50**	**28**
3.5	Appraisal of different opinions and attitudes	**48**	**25**

B. Focus group 1: Textile Alumni / Textile Experts (TA/TE)

CODE	**ANSWER**	**Total Importance**	**Total level of knowledge**
1	**Knowledge necessary for students and employees in textile and fashion industry**		
1.1	Fundamental knowledge in basic science (chemistry, mathematics, physics, IT)	**45**	**21**
1.2.	Fundamental knowledge in physicochemical characteristics of chemical raw materials	**39**	**18**
1.3	Fundamental knowledge in physicochemical and technical characteristics of conventional raw materials (fabrics and yarns)	**43**	**22**
1.4	Fundamental knowledge in technology for materials production (machinery, processes)	**46**	**24**
1.5	Fundamental knowledge in art (fashion and design)	**39**	**15**
1.6	Fundamental knowledge in technologies for design (methods, IT infrastructure)	**39**	**17**
1.7	Fundamental knowledge in technologies for manufacturing	**45**	**20**
1.8	Knowledge and understanding in quality control and management	**46**	**24**
1.9	Knowledge and understanding in applications of technical and nano-textiles	**41**	**18**

1.10	Knowledge and understanding in managerial and techno economical aspects of production	**41**	**20**
1.11	Knowledge and understanding in auxiliary processes in manufacturing and production (automation, machinery maintenance	**36**	**16**
1.12	Knowledge and understanding in standardization and certification	**41**	**19**
1.13	Knowledge and understanding in customer relationship management	**45**	**23**
1.14	Knowledge and understanding in marketing	**42**	**20**
1.15	Knowledge and understanding in health and safety issues in production and manufacturing	**45**	**21**
1.16	Knowledge and understanding in logistics aspects	**38**	**17**
1.17	Knowledge and understanding in sustainability in design and production	**43**	**20**
1.18	**Knowledge in specific fields of textile application**		
1.18.1	Textile for medical and health care	**38**	**18**
1.18.2	Fashionable protective textile	**35**	**17**
1.18.3	Fashionable architecture and interior textile	**31**	**13**
1.18.4	Fashionable transport and aerospace textile	**36**	**12**
1.18.5	Agriculture and geotextile	**34**	**13**
1.18.6	Fashionable sports and active leisure clothing	**38**	**15**
1.18.7	Fashionable smart clothing	**42**	**14**
1.18.8	Fashionable ecotextile	**34**	**13**
1.18.9	Fashionable military textile	**33**	**16**

1.19	**Knowledge in development of innovative and smart textile with advanced properties**		
1.19.1	Nanomaterials and nanotechnologies in textiles and fashion	**41**	**13**
1.19.2	Micro-electronics in textiles and fashion	**35**	**12**
1.19.3	Biotechnologies in textiles and fashion	**34**	**13**
1.19.4	Fibrous and textiles-based composites	**36**	**15**
1.19.5	New Fibres and Textile structures	**41**	**17**
2	**Professional skills necessary for students and employees in textile and fashion industry**		
2.1	Ability to analyse and estimate recent information about new materials and technologies (Bibliography research and up to date informative)	**40**	**19**
2.2	Ability to apply new methods and technologies in design and development of new materials and/or products, processes (reengineering of processes, according to new requirements like sustainability, quality, corporate Social responsibility)	**44**	**18**
2.3	Ability to analyse problems and situations (problem Solving, synthesis of existing knowledge from other domains into practical solutions for the job)	**44**	**18**
2.4	Capability for entrepreneurship: leadership, risk-taking, creativity	**39**	**20**
2.5	Ability to apply innovation in the whole of the value chain	**37**	**20**
2.6	Ability to apply innovation in the whole of the value chain	**37**	**19**
2.7	Ability to market new innovative fashion products	**40**	**16**
3	**Personal qualities and attitudes for students and employees in textile and fashion industry**		

3.1	Ethical behaviour in the job	**47**	**25**
3.2	Collaboration, Communication and Ability to act in a global and multicultural environment	**46**	**24**
3.3	Linguistic capabilities	**41**	**20**
3.4	Cultural tolerance	**43**	**23**
3.5	Appraisal of different opinions and attitudes	**41**	**21**

C. Comparison of answer to questionnaires between Industry Representatives/Owners &Textile Alumni/Textile Experts

CODE	**ANSWER**	**Total Importance**	
		IR/O	**TA/TE**
1	**Knowledge necessary for students and employees in textile and fashion industry**		
1.1	Fundamental knowledge in basic science (chemistry, mathematics, physics, IT)	**46**	**45**
1.2.	Fundamental knowledge in physicochemical characteristics of chemical raw materials	**46**	**39**
1.3	Fundamental knowledge in physicochemical and technical characteristics of conventional raw materials (fabrics and yarns)	**48**	**43**
1.4	Fundamental knowledge in technology for materials production (machinery, processes)	**47**	**46**
1.5	Fundamental knowledge in art (fashion and design)	**41**	**39**
1.6	Fundamental knowledge in technologies for design (methods, IT infrastructure)	**46**	**39**
1.7	Fundamental knowledge in technologies for manufacturing	**46**	**45**
1.8	Knowledge and understanding in quality control and management	**50**	**46**

1.9	Knowledge and understanding in applications of technical and nano-textiles	**46**	**41**
1.10	Knowledge and understanding in managerial and techno economical aspects of production	**46**	**41**
1.11	Knowledge and understanding in auxiliary processes in manufacturing and production (automation, machinery maintenance	**40**	**36**
1.12	Knowledge and understanding in standardization and certification	**47**	**41**
1.13	Knowledge and understanding in customer relationship management	**43**	**45**
1.14	Knowledge and understanding in marketing	**46**	**42**
1.15	Knowledge and understanding in health and safety issues in production and manufacturing	**48**	**45**
1.16	Knowledge and understanding in logistics aspects	**41**	**38**
1.17	Knowledge and understanding in sustainability in design and production	**48**	**43**
1.18	**Knowledge in specific fields of textile application**		
1.18.1	Textile for medical and health care	**45**	**38**
1.18.2	Fashionable protective textile	**42**	**35**
1.18.3	Fashionable architecture and interior textile	**40**	**31**
1.18.4	Fashionable transport and aerospace textile	**39**	**36**
1.18.5	Agriculture and geotextile	**40**	**34**
1.18.6	Fashionable sports and active leisure clothing	**41**	**38**
1.18.7	Fashionable smart clothing	**42**	**42**
1.18.8	Fashionable ecotextile	**41**	**34**
1.18.9	Fashionable military textile	**39**	**33**

1.19	**Knowledge in development of innovative and smart textile with advanced properties**		
1.19.1	Nanomaterials and nanotechnologies in textiles and fashion	**42**	**41**
1.19.2	Micro-electronics in textiles and fashion	**35**	**35**
1.19.3	Biotechnologies in textiles and fashion	**40**	**34**
1.19.4	Fibrous and textiles-based composites	**44**	**36**
1.19.5	New Fibres and Textile structures	**46**	**41**
2	**Professional skills necessary for students and employees in textile and fashion industry**		
2.1	Ability to analyse and estimate recent information about new materials and technologies (Bibliography research and up to date informative)	**47**	**40**
2.2	Ability to apply new methods and technologies in design and development of new materials and/or products, processes (reengineering of processes, according to new requirements like sustainability, quality, corporate Social responsibility)	**48**	**44**
2.3	Ability to analyse problems and situations (problem Solving, synthesis of existing knowledge from other domains into practical solutions for the job)	**45**	**44**
2.4	Capability for entrepreneurship: leadership, risk-taking, creativity	**47**	**39**
2.5	Ability to apply innovation in the whole of the value chain	**46**	**37**
2.6	Ability to apply innovation in the whole of the value chain	**43**	**37**
2.7	Ability to market new innovative fashion products	**41**	**40**
3	**Personal qualities and attitudes for students and employees in textile and fashion industry**		
3.1	Ethical behaviour in the job	**50**	**47**

3.2	Collaboration, Communication and Ability to act in a global and multicultural environment	**49**	**46**
3.3	Linguistic capabilities	**47**	**41**
3.4	Cultural tolerance	**50**	**43**
3.5	Appraisal of different opinions and attitudes	**48**	**41**

In order to view these answers a **bench mark has been decided in such a way that the significance will be given to answers who have 90% (score 45).** Kindly review Figure 2.28. The answers to the questionnaires of the two focus groups are illustrated to the following figures:

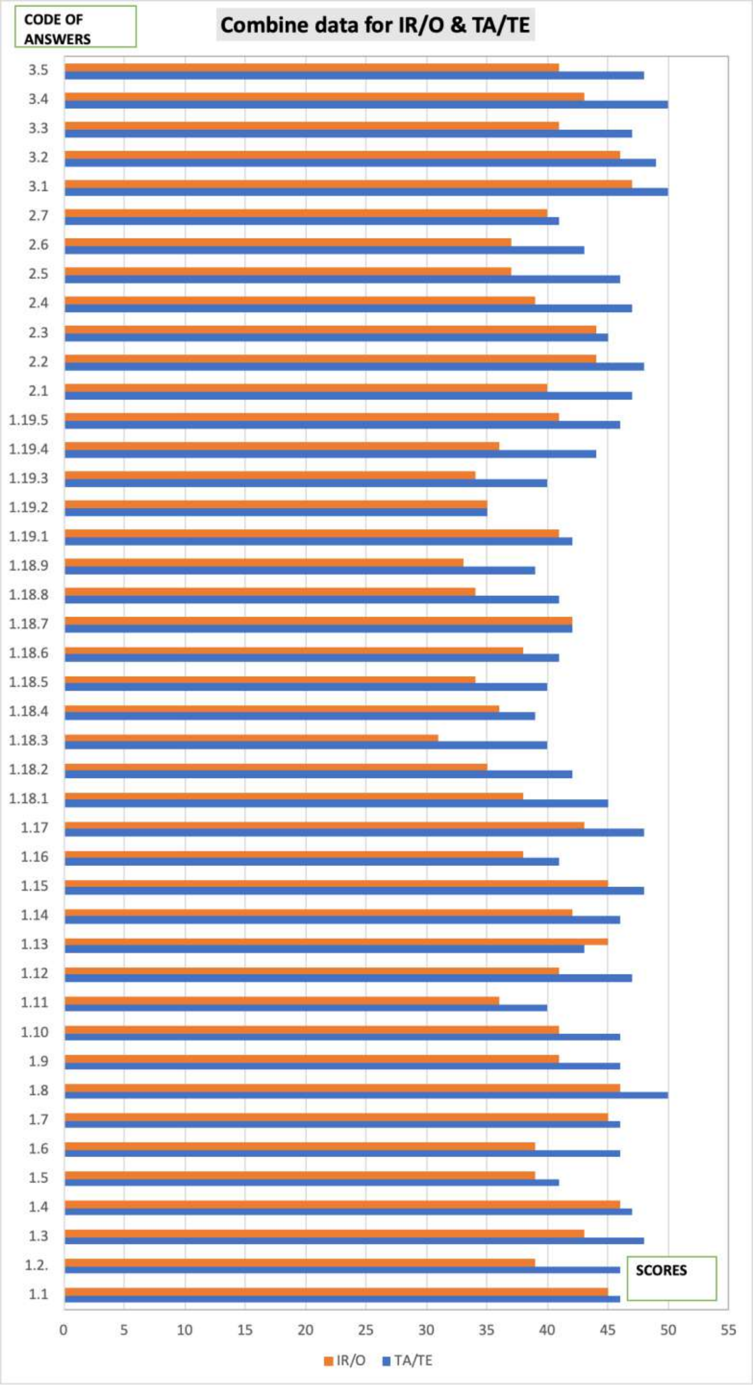

Figure 2.28: Combine data for IR/O & TA/TE

2.3.2.3 Competence profile

Two academic institutions which are NED University of Engineering & Technology and Bahauddin Zakariya University were the key partners. Both institutions obtained the feedback from relevant industry and the graduates. The industry mainly consisted of export oriented and ranges between mediocre to highly sophisticated industries.

Extraordinary support was received from all stakeholders. As a result of their cooperation with minimal time period and under the COVID-19 pandemic the task was completed in a short span of time. Since, obtaining feedback is a routine activity for the industry as well as academia, therefore, it did not require any major preliminary training activity and the task was completed as per expectations.

2.3.3 Survey analysis

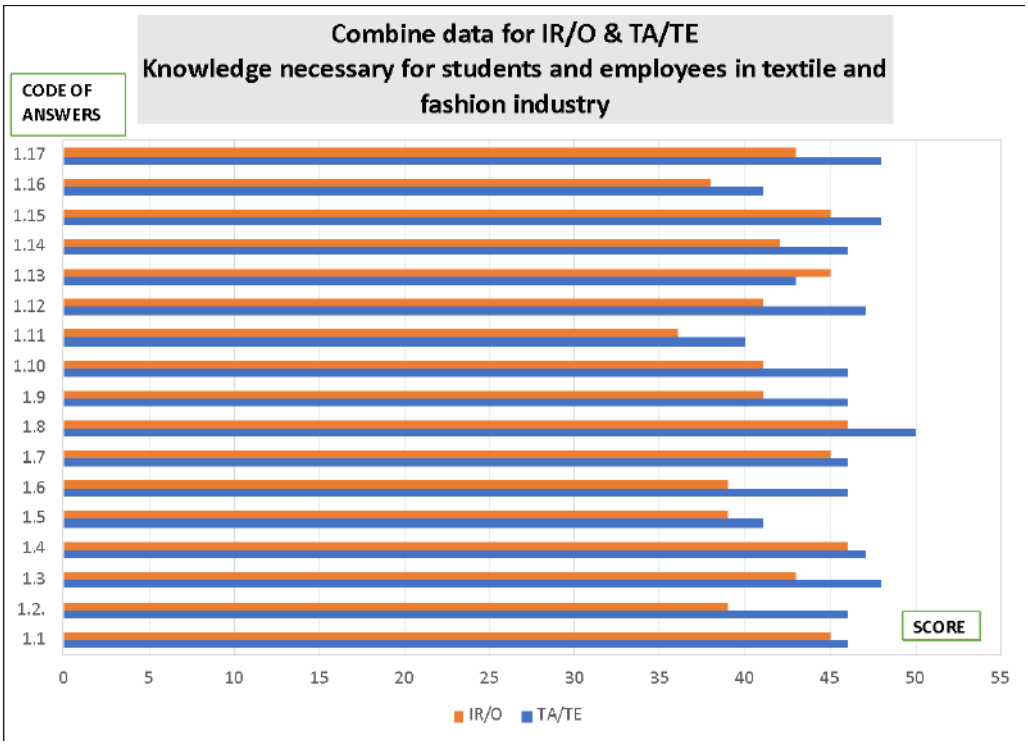

Figure 2.29 Knowledge necessary for students and employees in textile and fashion industry

In Figure 2.29 Knowledge necessary for students and employees in the textile and fashion industry has been graphed. Both the groups find following codes essential for the fashion industry.

Code	Essential Knowledge
1.1	Fundamental knowledge in basic science (chemistry, mathematics, physics, IT)
1.4	Fundamental knowledge in technology for materials production (machinery, processes)
1.7	Fundamental knowledge in technologies for manufacturing
1.8	Knowledge and understanding in quality control and management
1.15	Knowledge and understanding in health and safety issues in production and manufacturing

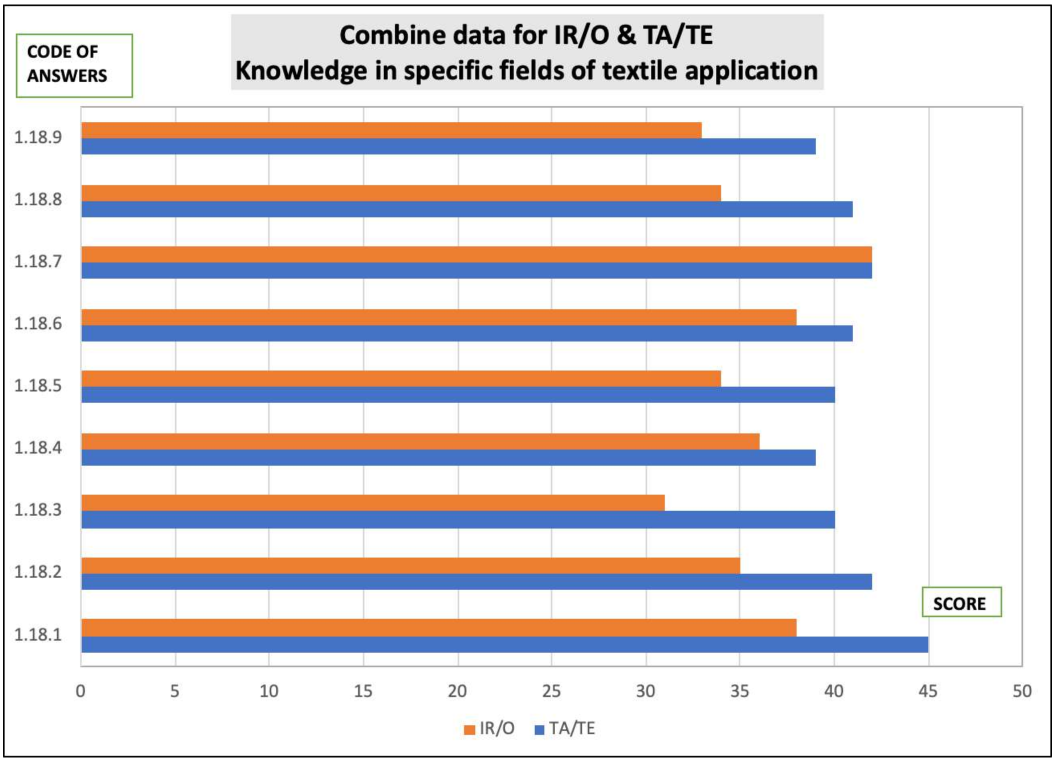

Figure 2.30 Knowledge in specific fields of textile application

According to 2.30 both the groups do not highlight anything in the 90% area. However, the need of knowledge in the field of fashionable smart clothing which is the code 1.18.7 is highlighted.

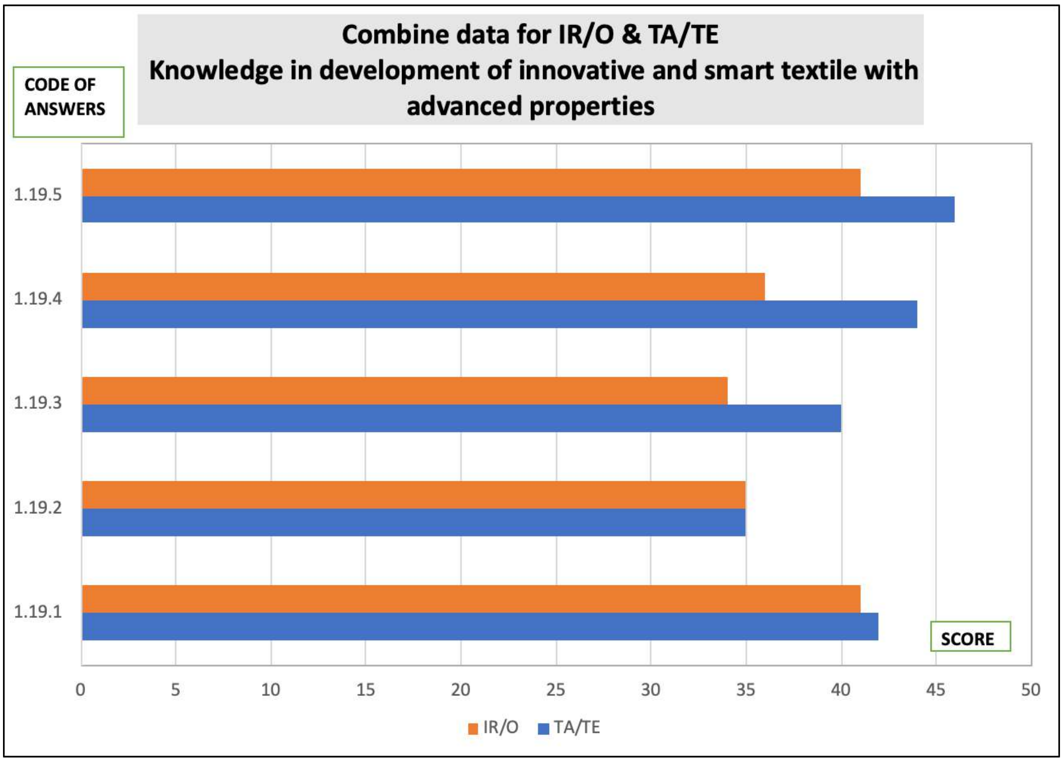

Figure 2.31 Knowledge in development of innovative and smart textiles with advanced properties

According to 2.31 both the groups do not highlight anything in the 90% area. However, the need of nanomaterials and nanotechnologies in textile and fashion and need of new fibers and textile structures are highlighted (their codes are 1.19.1 & 1.19.5).

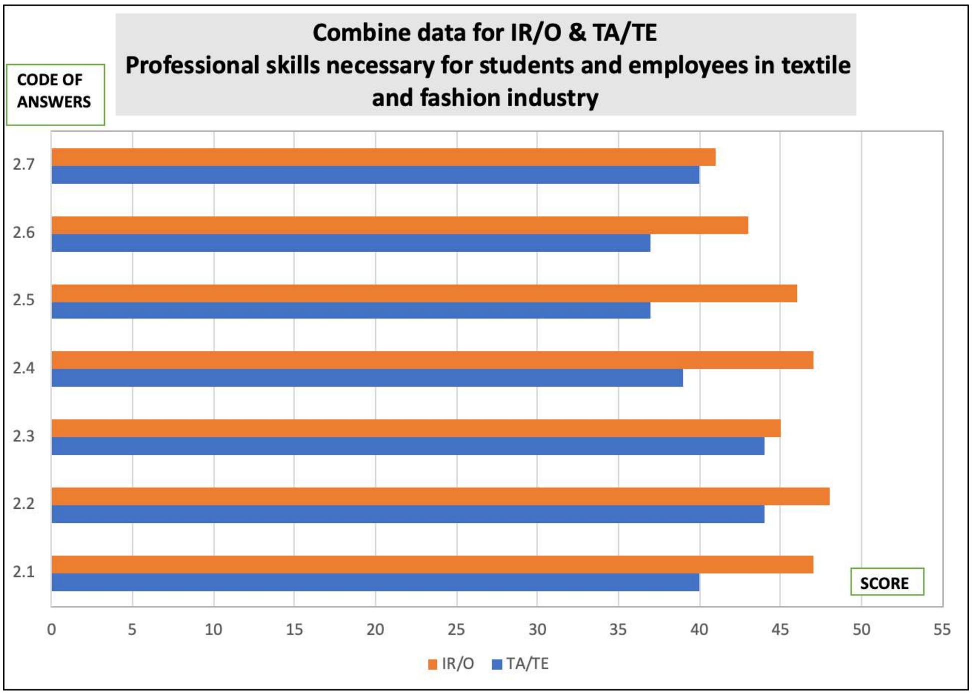

Figure 2.32 Professional skills necessary for students and employees in textile and fashion industry

In Figure 2.32 industry representatives thought that abilities like code (2.1, 2.2, 2.3, 2.4, 2.5) are very much required and should be present in the students. However, the alumni and textile experts thought that only abilities like code (2.2 and 2.3) might be necessary.

Code	Abilities
2.1	Ability to analyse and estimate recent information about new materials and technologies (Bibliography research and up to date informative)
2.2	Ability to apply new methods and technologies in design and development of new materials and/or products, processes (reengineering of processes, according to new requirements like sustainability, quality, corporate Social responsibility)
2.3	Ability to analyse problems and situations (problem Solving, synthesis of existing knowledge from other domains into practical solutions for the job)
2.4	Capability for entrepreneurship: leadership, risk-taking, creativity
2.5	Ability to apply innovation in the whole of the value chain

This is an interesting finding that the industry wants to be able to have abilities all around. The best part of this analysis is that textile experts also want students to be able to analyse and understand new materials and new technologies. Also, they should have over the ability to handle new technologies.

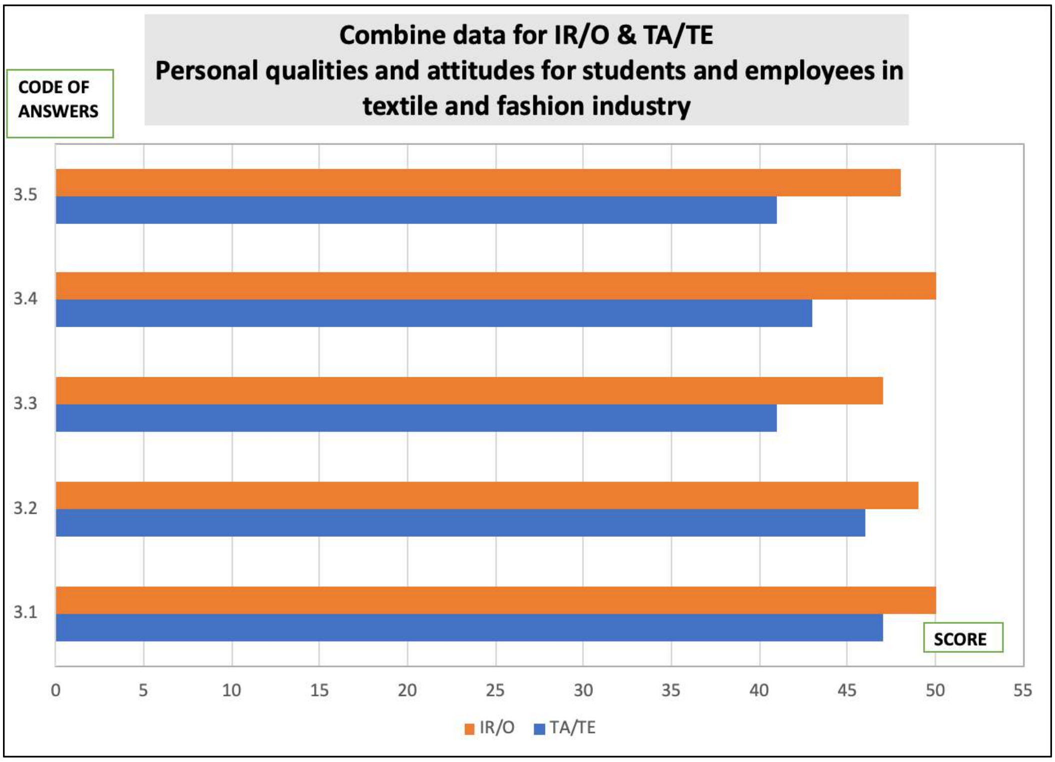

Figure 2.33 Permanent qualities and attitudes for students and employees in textile and fashion industry

In Figure 2.33 Permanent qualities and attitudes for students and employees in the textile and fashion industry were graphed. According to both the groups cultural tolerance and appraisal of different opinions and attitudes is very much required in the students and employees. However, the industrial representatives though all the qualities in this section are very much required in the students.

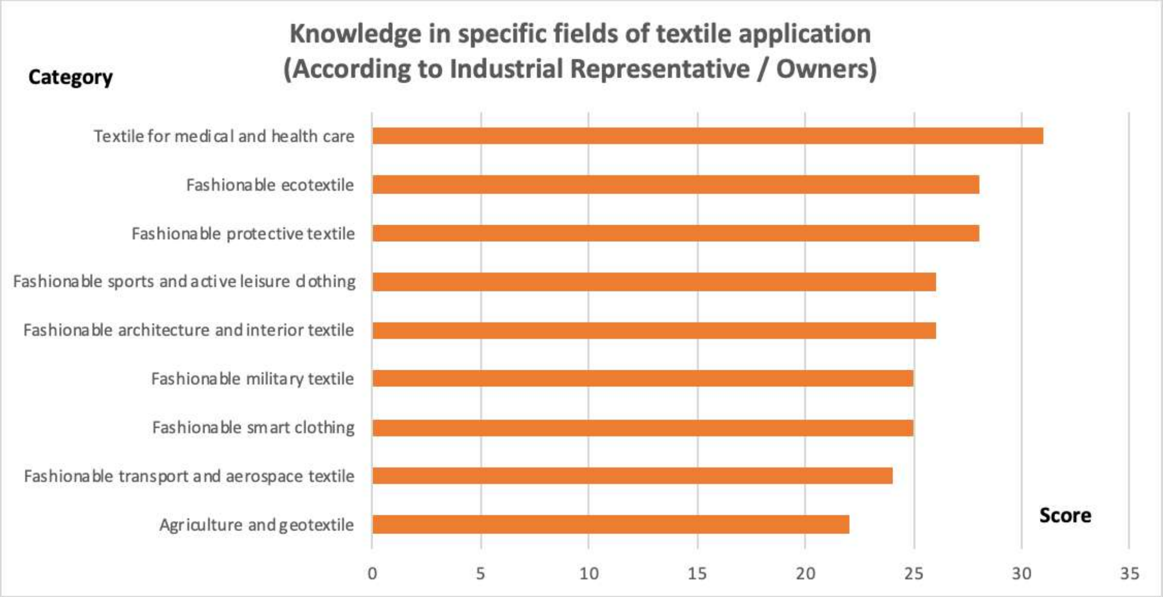

Figure 2.34 Knowledge in specific fields of textile application according to Industrial Representatives / Owners

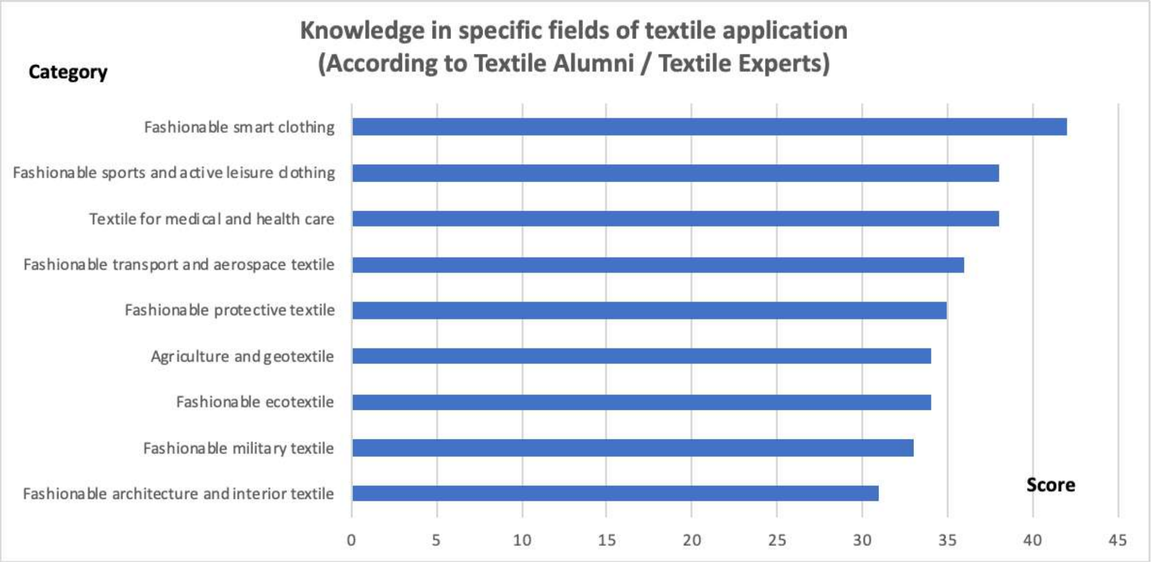

Figure 2.35 Knowledge in specific fields of textile application according to Textile Alumni / Textile Experts

In Figures 2.34 and in 2.35, it can be seen that there are three common categories which are highlighted by both Industry representatives/owners & Textile graduates/Textile experts. These categories are:

- Fashionable sports and active leisure clothing
- Fashionable protective textiles
- Textile for medical and health care

Moreover, industry also highlighted the need for knowledge in the area of fashionable architectures and interior textiles as well as in fashionable eco-textiles. However, textile experts emphasized the need for fashionable smart clothing and fashionable transport and aerospace textiles.

2.3.4 Conclusion

In view of the high-scored answers in the questionnaires, we realized that both students/academics and industry representatives consider the curriculum with novel subjects related to technical textiles as being the fundamentals which require enrichment. More specifically:

- Fashionable sports and active leisure clothing
- Fashionable protective textiles
- Textile for medical and health care
- Nano materials and nanotechnologies in textile and fashion
- New fibers and textile structures

Moreover, some abilities are very much needed. These are:

- Ability to apply new methods and technologies in design and development of new materials and/or products, processes.
- Ability to analyze problems and situations
- Cultural tolerance and appraisal of different opinions and attitudes.

3 Comparative analysis of the result

The key points from the three countries findings with significant similarities and several conditions being common are discussed as under:

3.1 General attributes

The general attributes of the three countries viz. Malaysia, Indonesia and Pakistan based upon specifically their textile sector are as under:

Malaysia's textile and apparels industry remained as the 13th largest exporting industry during the year 2018. The volume of Textile and apparel in its export was only 2.1%. Similarly, the magnitude of government investment in this sector was merely 3.1%. The Government however, is willing to improve this sector with a specific focus on industrial and home textiles, functional fabrics, high-end fabrics and garments as it has high potential in these areas. Being part of the Association of Southeast Asian Nations (ASEAN) and having bilateral trade agreements with the EU, Chile, India, New Zealand, Pakistan and Turkey, Malaysia enjoys low import duties on industrial goods. The Country lacks relevant human resources where the qualification of graduates does not meet the specific requirements of the industry. Along with that very limited technical and skilled personnel, such as textile technologists, designers, chemists, color specialists and maintenance technicians is also one of the major impediments in the Country.

In contrast to that Indonesia remained far better in this domain and is known as one of the world's largest textile manufacturers with its contribution being 5% of global export in textile. This sector constantly remained at a high level during the previous years as well as in 2020. Government's industrial policy of 'Making Indonesia 2.0' has helped all sectors including the textile sector. There is however, one concern being the import of fabric at the tune of 50% of the total volume used for making the garments which are eventually exported. Another major concern is the Country's textile and apparel industry facing a series of problems and challenges pertaining to increased competition from its neighboring countries, notably Vietnam, and high dependency on raw material imports. In addition, lack of skilled and competent manpower required by the garment industry also exists in Indonesia. Despite having high investment from the government, insufficient infrastructure and technology, and relatively higher energy cost causing the product price to be less competitive are some of the challenging areas in this Country.

As far as Pakistan is concerned, it has edge on many avenues such as its locally produced raw material including cotton and the Country with high labor-intensive industry which offers entry-level jobs for unskilled labor, especially in the clothing sector; particularly suitable for female workers with having limited income opportunities other than domestic or the informal income activities. The industry comprises a combination of large-scale organized sector essentially the integrated Textile Mills with large number of spinning units and a small number of shuttle-less looms units, and highly fragmented cottage/small scale sector. On the other hand, the downstream industry (Weaving, Finishing, Garment, Towels & Hosiery) which has a great export potential also exists here but cannot be considered as an organized sector. Textile sector substantially contributes towards Country's export earnings with its products including a wide range of items viz. Cotton fibers, yarn and cloth, yarn other than cotton yarn, tents, canvas, bed wears, towels, carpets, made-ups and variety of garments. However, to maintain its position and move into high value-added products for the increased market share, a large investment in machinery equipment and new technology is essential. Technical textile products have high potential for being manufactured and exported from Pakistan. Value addition can easily be carried out in this particular area of technical textile.

3.2 Activities associated with the qualification

Malaysia has limited institutions offering education in this sector. There are mainly two Universities which are Universiti Teknologi MARA (UiTM) and Universiti Tun Hussein Onn Malaysia (UTHM) imparting education in this discipline. Both diploma and degree level education is provided in this Country. The quality of degree is also critically monitored and maintained by relevant regulatory authorities. Due to having limited institutions, a small number of graduates are produced who have higher job opportunities being more than 80%.

Similarly, in Indonesia there are several institutions imparting education in this domain. However, there are two institutions involved in this project are Politeknik STTT Bandung (Polytechnic of Textile Technology) and Institute of Technology Bandung (Craft FSRD ITB). Both departments have been consistently accredited by the National Agency of Accreditation for Higher Education (Badan Akreditasi Nasional Perguruan Tinggi – BAN PT). In pursuance of Indonesian government policy regarding focusing on innovation and high technology specifically in the areas of high performance and specialty fibers, smart textiles and functional textiles requires investments on technology research, production facilities, and capacity building for higher education institutions in textile science and technology with specific to functional textiles, technical textiles and more advanced sectors like smart textiles. More than 90% of graduates easily get the jobs. They are mainly engaged in the textile manufacturing industry, starting from spinning, weaving through to dyeing finishing and garment industry. A small portion of them pursue careers in the textile chemicals companies and suppliers as well as textile machinery companies and fiber making industry. Supply chain areas of clothing and fashion industry, textile crafts, interior and home textiles, retails and designers are an area where a small number of students find their career.

In Pakistan there are mainly five higher education institutions offering degrees in textile engineering. In addition, there are several other institutions which are providing degree and non-degree programmes in the textile related areas which include Garment Design, Garment Manufacturing, Textile Design etc. On average, 500-600 graduates are produced in this Country who are well equipped with the knowledge of textile and relevant industry. There is a high career growth of textile graduates in Pakistan which makes this discipline to be comparatively attractive from other disciplines.

3.3 Stakeholders' survey results

The stakeholders' survey conducted in Malaysia which was based upon three components which are **a)** Importance of fundamental knowledge required by the respondents is technology for materials production **b)** Physicochemical and technical characteristics of conventional raw materials and **c)** Quality control and management provided interesting information:

i. 71% of the employers are willing to recruit new textile graduates as they believe textile graduates are suitable to work in production, laboratory & quality control and in technical aspects.

ii. More than 50% of respondents agree that internships are an important part of the curriculum and 57% chose 6 months for the best training duration.

iii. Communication, self-reliance, entrepreneurship, technical and management skills are mainly considered as the essential tools for the graduates.

Local industries need to compete with international industries. Moreover, inadequate local supply chains and lack of resources or infrastructure to keep pace with the advancement of global technologies are also taken as major challenges. The industry in this country is anxiously looking forward to implementing Industrial Revolution 4.0 (IR 4.0). More than 50% of respondents believe that the textile industry is important for Malaysia's national economy.

In Indonesia, the survey was based upon three attributes which include **a)** Psychological Knowledge **b)** Social Knowledge and **c)** Cultural Knowledge of the students. Basic knowledge in sciences and physicochemical characteristics of chemical raw materials was given due importance as being a major ingredient for a qualified textile graduate. Here again, professional skills including communication skills and personal attitude were considered as essential requirements for textile graduates. Some innovative suggestions were also received which included engaging students in specified tasks so as to gain professional experience before entering into the industry and also building their confidence; also getting them involved in various communities (e.g. textile science community, textile design community, and other non-textile related community) so as they may get acquainted with the textile world.

In Pakistan, the survey was conducted based upon **a)** Knowledge necessary for students and employees in textile & fashion industry, specific fields of textile application and in development of innovative and smart textile with advanced properties. **b)** Professional skills necessary for students and employees in the textile and fashion industry. **c)** Personal qualities and attitudes for students and employees in the textile and fashion industry. As a result of this survey, very interesting information was gathered. Here the industry desires the graduates to have knowledge in all areas which appears to be sometimes over-expectation. They feel that the graduates to have the ability to analyse problems and situations (problem solving, synthesis of existing knowledge from other domains into practical solutions for the job) and then apply new methods and technologies in design and development of new materials and/or products, processes (reengineering of processes, according to new requirements like sustainability, quality, corporate social responsibility). Of course, the graduates would eventually acquire knowledge in all these domains but from beginning soon after graduation expecting a lot from them becomes unfair.

The industry had the desire of the graduates possessing knowledge in the field of nanomaterials and nanotechnologies in textile and fashion, and also of new fibres and textile structures, fashionable smart clothing. In addition, fashionable sports and active leisure clothing, fashionable protective textiles & textiles for medical and health care were also highlighted as need of the hour. Hence, it is evident that modern technologies with high levels of value addition are being focused upon which require a high amount of investment both in infrastructure as well as human resource.

3.4 Summary of the combined findings

All three countries have a variety of opportunities along with distinct challenges. However, all three countries are apparently on one page regarding the need of shifting towards the manufacturing of value-added products especially functional fabrics are deemed necessary. They all believe that good job opportunities can easily be created for textile graduates in both the conventional textile sector and technical textile sector. It requires introducing modern and updated textiles related courses enriched with advanced knowledge would change the landscape of the textile industry and provide suitable solutions and alternatives for the local industries to move beyond 2020.

Along with that, major challenges like low level of competitiveness due to lack of advanced technological capacity and capability can also be addressed by updating the curriculum and making it align with modern curriculum.

In addition, inculcation of some skills in the graduates were highlighted which include ability to apply new methods and technologies in design and development of new materials and/or products, processes, to analyze problems and situations and cultural tolerance and appraisal of different opinions and attitudes.

Following areas were generally tagged as to be the focus for future as they have the potential for export and economical contribution for the Country:

- Fashionable sports and active leisure clothing
- Fashionable protective textiles
- General Protective Textiles
- Textile for medical and health care
- Nano materials and nanotechnologies in textile and fashion
- New fibers and textile structures
- Interior Textiles with respect to ecosystem

There are however, few things which are common. In all these countries Textile is considered to be a major player for increase in export and strengthening the economy. Another important thing is the acceptability of diverting the focus towards technical and functional textile rather than continuously depending upon the traditional textile. Some of the improvement in the curriculum to make it align with the international curriculum is also being considered as the immediate step for producing the graduates who fulfil the industrial demand.

3.5 Competences graduates need to improve

The report emphasizes the competencies of graduates that need to be improved in Malaysia, Indonesia and Pakistan. The selection of the competencies is based on competence profile and question survey as reported by each country.

3.5.1 Malaysia

For Malaysia, the textile industries have highlighted several competencies that need to be improved by the graduates. The competencies are divided into three components:

a) Knowledge necessary for students and employees in the textile & fashion industry

The most needed fundamental knowledge was in technology for materials production associated with machinery and processing know-how. Second highest response was depicted on fundamental knowledge of physicochemical and technical characteristics of conventional raw materials (fabric and yarns). The fundamental knowledge of quality control and management as well as fundamental knowledge of manufacturing technologies were listed on top four responses. All these fundamental knowledges could affect graduates’ competences skills. In addition, the stakeholders were asked to rate the importance of knowledge in specific fields of textile application and the results for the top three were textile for medical and health care, protective textile and Eco textile. The textile industry in Malaysia is still new in the area of innovative and smart textile. The stakeholders pointed out that graduates need to have more knowledge in new fibres and textile structures and fibrous and textiles-based composites.

b) Professional skills necessary for students and employees in the textile and fashion industry.

Under this component, graduates need to enhance five important skills including communication, self-reliance, entrepreneurship, technical and management skills. These five skills can develop the graduates' ability to analyse problems and situations and lead in problem solving using suitable and practical knowledge for the job. For communication skills, most graduates need to understand intercultural language verbally and express well in writing. About 75% of respondents voted to gain on critical thinking skills, ethics and responsibility, and proactive skills. In terms of entrepreneurship, graduates need to be innovative, have strategic thinking skills as well as inner discipline while technical skill requires the application and usage of technology including data management, analysis and research and development. Lastly, the management skill is also playing an important key as teamwork, adaptability and change in management can also lead to planning and problem-solving skills

c) Personal qualities and attitudes for students and employees in the textile and fashion industry.

With the multiracial community in Malaysia, it is essential for graduates in this field to have cultural tolerance, appraisal of different opinions and attitudes and be able to be an industrial representative through all the qualities. Therefore, competencies in these areas are indispensable for the graduates.

3.5.2 Indonesia

Textile and fashion industry are huge in Indonesia. There are many different majors in textile studies in Indonesia i.e. textile engineering, textile chemistry, apparel production and fashion design. Therefore, graduates in this area are required to have different specialisation and competencies which have been described below.

a) Knowledge necessary for students and employees in the textile & fashion industry.

Textile and fashion industry are huge in Indonesia. There are many different majors in textile studies in Indonesia i.e. textile engineering, textile chemistry, apparel production and fashion design. Therefore, graduates in this area are required to have different specialisation. To cater the industry, graduates in this field need to have fundamental knowledge on the materials production i.e. machinery and processes. Apart from that, they must be equipped with the knowledge in technologies regarding manufacturing. Other than that, knowledge and understanding in sustainability in design and production are also necessary, as well as the physicochemical and technical characteristics of conventional raw materials. In addition, the stakeholders also pointed out that the graduates should have the knowledge in quality control and management. Extensive laboratory skills are also needed to make sure the graduates are well equipped for the industry.

b) Professional skills necessary for students and employees in the textile and fashion industry.

In regards to this area, the stakeholders chose the ability to analyze and estimate recent information about new materials and technologies as the main professional skill that needs to be acquired by the graduates. Apart from that, the ability to apply new methods and technologies in design and development of new materials and/or products or processes e.g. reengineering of processes, according to new requirements like sustainability, quality, corporate social responsibility, is also pointed out as one of the necessary skills for the graduates. They also need to be able to analyze the problems and situation as well as apply innovation in the whole of value chain.

c) Personal qualities and attitudes for students and employees in the textile and fashion industry.

The highly sought personal quality for an employee is the ethical behavior related to the job. Additionally, an employee should be able to appraise different opinions and attitudes. In order to work in the industry, graduates also need to be able to collaborate, communicate and act in a global and multicultural environment, as well as having linguistic capabilities and cultural tolerance. Apart from that, high confidence level and creativity in preserving the national heritage will be an added value to the graduates to sustain in the industry.

3.5.3 Pakistan

In Pakistan, the quality and competence of graduates are important for socio-economic uplift and technical manpower required for industries. Thus, the graduates are expected to be proficient in the following competencies.

a) Knowledge necessary for students and employees in the textile & fashion industry.

Graduates in this field need to have fundamental knowledge on basic sciences, material production and technologies for manufacturing. Since Pakistan has a huge textile manufacturing industry, these basic knowledges are essential for the industry. Apart from that, graduates also need to have profound interests and knowledge in various other applications such as fashionable smart clothing, sports and active leisure clothing, protective textiles, textile for medical and health care, fashionable eco-textiles, nanomaterials and nanotechnologies in textile and fashion, agricultural and geotextiles, aerospace textiles, new fibres and textile structures. These applications fall under the Technical Textiles industry which are the future niches for most developed and developing countries. In addition, the graduates need to understand quality control and management as well as health and safety issues in production and manufacturing.

b) Professional skills necessary for students and employees in the textile and fashion industry.

Under this component, graduates need to have skills to analyse problems and situations and this include problem solving, synthesis of existing knowledge from other domains into practical solutions for the job. They need to apply and engage in new methods and technologies in design and development of new materials and/or products and processes such as reengineering of processes, according to new requirements like sustainability, quality, corporate social responsibility. The graduates are also expected to have the capability for entrepreneurship, leadership, risk-taking, creativity and be able to apply innovation in the whole of value chain.

c) Personal qualities and attitudes for students and employees in the textile and fashion industry.

Since the industry is huge in Pakistan, graduates in this field need to get involved in cultural tolerance, appraisal of different opinions and attitudes and be able to be an industrial representative through all the qualities. Therefore, competencies in these areas are essential for the graduates.

3.5.4 Summary of the combined findings

All three countries have a variety of competences that need to be improved based on the responses gained from stakeholders. There were three main components that were highlighted in the report. In terms of fundamental knowledge, all three countries highlighted knowledge in technology for materials production associated with machinery and processing, technologies in manufacturing and quality control and management. In regards to professional skills, graduates are needed to have problem solving skills, leadership and entrepreneurship skills. They need to be innovative and keep track with recent technologies in design and development of new materials, products and processes. For personal qualities and attitudes, all the countries highlighted that the graduates need to be able to communicate and collaborate in a global and multicultural environment.

4 Overall conclusions of the report

The three Asian countries (Indonesia, Malaysia, and Pakistan) that are participating in this project share one thing in common, that is the strong dependency of their national economy on the textile industry sector. Textile has been the mainstay industry in each of those countries for decades and regarded as one of the prime movers for the nation's economy. The numbers provided in each of the countries shows a fascinating figure for its impact towards the countries' economy. Nevertheless, the textile industries in these countries are commonly found in a stagnant yet still promising due to the condition that most of the technology applied are still from the industry 3.0 era with its relatively standard technology. The industry is characterized by a high number of labor intensity. The textile industry in both Indonesia and Malaysia is having problems due to their high dependence on imported materials, especially fabrics. Whilst Pakistan is having problems on restructuring their production line which are still loosely connected to each other along the line textile industries. In terms of the labor quality that the industry requires, higher education institutes in the participating Asian countries have managed to supply the industry with qualified labor force. Unfortunately, a gap exists when comparing the current textile development in Asia and Europe, which is now on the level of functional textile and aiming to develop advanced use of textile technology and smart textile into more applicative solutions for human lives. In Asia, the development of textile technology is generally still focusing on traditional use of textile.

The textile higher education system in Asian countries varies coherently based on their needs. Indonesia has a polytechnic that specifically provides vocational higher education in textile engineering, textile chemistry and garment production for undergraduate and master of applied science in textile engineering and apparel technology. Most of the contents of the curriculum deal with textile manufacturing process with elective courses focusing on smart textiles. Another participating institution in Indonesia focuses on a 4-year academic program for bachelor of design in textile craft. Malaysia has developed its higher textile education system in two universities that have education systems ranging from a bachelor textile science and fashion technology, and a diploma in textile and clothing technology. They also have a bachelor in industrial textile but unfortunately, it is currently only an elective course because of the low number of interested students. Pakistan has quite many universities that provide bachelor education in textile engineering, textile science, and garment engineering for a 4-year degree program and they have a relatively high interest from students to enter the programs.

In terms of its graduate competence profile, Malaysia's textile engineering program aims to develop graduates' understanding on the textile industry, textile process, and technical textile. Graduates do not have any difficulties having their first job prior to graduation but the survey from parties involved in the textile industry shows that graduates from Malaysia need to be able to compete with qualified foreign workers. Therefore, the solution provided is by improving the curriculum sector with topics about: fundamental knowledge in material production, physicochemical and technical characteristics of conventional raw materials, specific knowledge in medical textiles, and developments in fibrous and textiles-based composites as well as new fibers and textile structures. They hope those changes would lift students' interest in textile subjects. Indonesia aims to develop graduates with the ability to demonstrate the capability to apply science, technology, and art within his/her scope of expertise and adaptable to various situations of problem solving. Surveys conducted to different groups of parties involved in the textile industry show that the mastery of new technology and new materials and the application of new methods and new technology is utmost important in the development of industry. Thus, updating existing subjects within the curriculum with new topics of smart textiles, such as: specialty fibers and functional textiles, is very important. Focusing on innovation and high technology is believed to improve the global competitive edge of the nation's textile and apparel industry. Pakistan, with its wide and varied industry provided some challenges for its textile higher educational institution to produce highly skillful labor to fill in the workforce. The textile universities in Pakistan aim to produce graduates with a sound knowledge in raw materials, yarn and fabric manufacturing process and machineries and also well versed in all of the process of textile production. Due to the modernization in the industry, the industry in Pakistan always demands for more qualified experts and workers. Consequently, enriching novel subjects in the curriculum with the latest topics in smart textile and functional textile would be the firm step to do in the beginning of their curriculum development. Topics such as functional apparels for sports, leisure, medical uses, Nano materials, nanotechnologies in textile and fashion, also new fibers and textile structures would be adapted to cater the needs to develop the textile industry and production further.

Europe as one of the centres for the textile technology development in the world provides a standard to follow for the development of textile in the future. Textile curriculum in Europe is now in an advanced stage where advanced textile topics such as nanofibers, smart textiles, and polymer have already been embedded within their curriculum. Therefore, it is a welcomed experience for the European universities to share their advances, standards, and their EU good practices to their Asian partners. Universities in Asia would need to propel its technological advances by acquiring new textile machineries for them to study with that is up to the standard used in Europe for their research. Advanced topics need to be adapted and embedded into the Asian universities to create highly qualified graduates with global competitiveness and in accordance with EU good practice. In conclusion, this cooperation between Europe and Asian universities in terms of textile would be considered a valuable opportunity for Europe and Asia to become equal partners in the global textile technology development.

5 Annexes

5.1 Annex I – Interviews- Malaysia

Questionnaire of competences for graduates of textile related bachelor studies in compliance with the needs of the labour market and EU good practices

Introduction

The survey is conducted to gauge the readiness of textile related industry/ organisations/ businesses (including fibre formation, yarn and fabric manufacturing, technical textiles, apparel, shoes, fashion and design) to recruit graduates from textile related studies and the competencies of those graduates in context with the present and future requirements of the organisations/businesses and the global setting. The survey also covers the economic conditions of textile related industries in Malaysia.

The results of the survey will be used for a study in collaboration with universities from several countries offering textile related programs. These countries include Indonesia, Pakistan, Spain, Greece and Belgium. The outcome of the study will be used to design a much better textile curriculum and to enhance competitiveness of graduates in local and global markets. It should take no more than 15 minutes to complete the questionnaire. Most of the questions can be answered by clicking boxes that have the best correspondence with your expectations.

We would appreciate your contribution in filling the survey. The link to the survey: https://forms.gle/pvvMnLE7xSNGyGEd9.

Or you may return your completed questionnaire by email.

SECTION 1: Demographic

1. Name of organisation/business -

2. Job title
    a. CEO
    b. Manager
    c. Entrepreneur
    d. Executive
    e. Supervisor
    f. Other: ………………………………………………………………………………………

3. Length of service in textile related industry/organisation/business
    a. Less than 2 years
    b. 2 - 3 years
    c. 4 - 5 years
    d. 6 – 8 years

e. more than 8 years

4. Nature of organisation/business
    a. Manufacturing (fibre, spinning, weaving, knitting, garment, dyeing, nonwoven, etc)
    b. Retailing (apparel, clothing, fashion store, boutique, shoes, etc)
    c. Technical Textiles (automotive, medical, geotextiles, composites, etc)
    d. Craft products & items (songket, batik, design house, etc)
    e. Other: ………………………………………………………………………………

5. Number of employees
    a. Below 100
    b. 101 – 300
    c. 301 – 500
    d. 501 – 1000
    e. Above 1001

6. Education background of graduates working in the organisation/business (You may select more than one answer).
    a. None
    b. Certificates in any background
    c. Certificates in textile or fashion related studies
    d. Diploma in textile or fashion related studies
    e. Diploma in any background
    f. Bachelor degree in textile or fashion related studies
    g. Bachelor degree in any background
    h. Masters degree in textile or fashion related studies
    i. Masters degree in any background
    j. PhD
    k. Other: ………………………………………………………………………………

SECTION 2: Readiness to recruit new graduates

1. Do you employ textile engineers/technologists currently?

    a. YES
    b. NO
2. Are you willing to recruit new employees with a degree in textile related studies (within 2020 – 2025)? If NO, proceed to the next section.

    a. YES
    b. NO
3. If YES, what is the level of job for the new employees with degree in textile related studies (you may tick more than one level)

   a. Managerial
   b. Executive
   c. Engineer
   d. Technologists
   e. Supervisory
   f. Others: ……………………………………………………………………………………………….

4. Choose which department(s) that most likely suit new employees a degree in textile related studies (you may select more than one department)

   a. Production
   b. Administration
   c. Technical
   d. Laboratory & Quality Control
   e. Sales & Marketing
   f. Merchandising & Purchasing
   g. Other: ……………………………………………………………………………………………….

SECTION 3: Internship (or practical training)

1. From the point of view of employers, how important are internships for university students before they graduate.

   a. Very important
   b. Important
   c. Unimportant
   d. I do not know

2. For a university student internship, how long is the best training duration?

   a. 3 months (12 weeks)
   b. 4 months (16 weeks)
   c. 6 months (24 weeks)
   d. 1 year
   e. Other: ……………………………………………………………………………………………….

3. Would your organization be willing to recruit students for internships? If NO, proceed to the next section.
   a. YES
   b. NO

4. Would your organization be willing to provide a proper internship?
   a. YES
   b. NO

5. Does your organization expect the university to provide a proper internship plan for the students?
    a. YES
    b. NO

6. Would your organization consider giving monthly allowances to the interns?
    a. YES
    b. NO

7. If YES, what is the range of monthly allowance the company will or can provide?
    a. RM300 – RM500
    b. RM500 – RM800
    c. RM800 – RM1200
    d. Above RM1200
    e. Other: ……………………………………………………………………………………………….

8. Will you accept interns or practical training students from overseas (such from other Asian countries and Europe?)
    a. YES
    b. NO
    c. MAYBE

SECTION 4: Competencies of graduates

Management Skills (Please select the TOP THREE (3) most important competencies.)

a	Decision management
b	Project management
c	Customer orientation
d	Marketing
e	Leadership skills
f	Adaptability & change management
g	Planning and problem-solving skills

Technical Skills (Please select the TOP THREE (3) most important competencies.)

a	Application and use of technology
b	Data management and analysis
c	Computer and software proficiency
d	Website design
e	Mobile marketing
f	Social marketing
g	Technical writing
h	Research and development

Entrepreneurship Skills (Please select the TOP THREE (3) most important competencies.)

a	Innovative
b	Able to take risk
c	Change-oriented
d	Strategic thinking
e	People management
f	Visionary
g	Persistency
h	Inner discipline

Self-Reliance Skills (Please select the TOP THREE (3) most important competencies.)

a	Proactive
b	Able to build networking
c	Multi-tasking

d	Operating globally
e	Ethics and responsibility
f	Intellectual ability
g	Critical thinking
h	Creativity

Communication Skills (Please select the TOP THREE (3) most important competencies.)

a	Ability to express thoughts in writing
b	Ability to understand verbal language
c	Ability to understand non-verbal language
d	Ability to converse in different languages
e	Ability to understand intercultural language

In your opinion, what are the fundamental knowledge required for the industry? You may choose more than one.

a. Fundamental knowledge in basic science (chemistry, mathematics, physics, IT)
b. Fundamental knowledge in chemical raw materials
c. Fundamental knowledge in physicochemical and technical characteristics of conventional raw materials (fabrics and yarns)
d. Fundamental knowledge in technology for materials production (machinery, processes)
e. Fundamental knowledge in art (fashion and design)
f. Fundamental knowledge in technologies for design (methods, IT infrastructure)
g. Fundamental knowledge in technologies for manufacturing
h. Knowledge and understanding in quality control and management
i. Knowledge and understanding in applications of technical and nano-textiles
j. Knowledge and understanding in managerial and techno economical aspects of production
k. Knowledge and understanding in auxiliary processes in manufacturing and production (automation, machinery maintenance, etc.)
l. Knowledge and understanding in health and safety issues in production and manufacturing
m. Knowledge and understanding in sustainability in design and production

Please rate the importance of knowledge in specific fields of textile application

1. Textile for medical and health care
Very important ○ Important ○ Unimportant ○ I do not know ○

2. Protective textile
Very important ○ Important ○ Unimportant ○ I do not know ○

3. Architecture and interior textile
Very important ○ Important ○ Unimportant ○ I do not know ○

4. Transport and aerospace textile
Very important ○ Important ○ Unimportant ○ I do not know ○

5. Agriculture and geotextile
Very important ○ Important ○ Unimportant ○ I do not know ○

6. Sports and active leisure clothing
Very important ○ Important ○ Unimportant ○ I do not know ○

7. Smart clothing
Very important ○ Important ○ Unimportant ○ I do not know ○

8. Ecotextile
Very important ○ Important ○ Unimportant ○ I do not know ○

9. Military textile
Very important ○ Important ○ Unimportant ○ I do not know ○

Please rate the importance of knowledge in development of innovative and smart textile with advanced properties.

1. Nanomaterials and nanotechnologies in textiles and fashion
Very important ○ Important ○ Unimportant ○ I do not know ○

2. Micro-electronics in textiles and fashion
Very important ○ Important ○ Unimportant ○ I do not know ○

3. Biotechnologies in textiles and fashion
Very important ○ Important ○ Unimportant ○ I do not know ○

4. Fibrous and textiles-based composites
Very important ○ Important ○ Unimportant ○ I do not know ○

5. New fibres and textile structures
Very important ○ Important ○ Unimportant ○ I do not know ○

Please specify other knowledge and skills that you think is important for professionals of the textile and fashion industry.

……
……
……………………………………………………

Please specify/suggest tasks and activities that are important for graduates of textile related bachelor studies.

……
……
……………………………………………………

SECTION 5: Textile Related Industry Economic Climate

1. How do you rate the importance of the textile industry for the national economy?
    a. Very Important
    b. Important
    c. Unimportant
    d. I do not know
2. What is your opinion on the current economic situation of textile related industry in Malaysia?
    a. The industry is expanding
    b. The industry is declining
    c. The industry is stagnant
    d. Not sure
    e. Other: ……………………………………………………………………………………………
3. What is/are the challenge(s) faced by the textile related industry in Malaysia? (you may choose more than one answer.)
    a. Financial constraint
    b. Inadequate local supply chain
    c. Insufficient research and development
    d. Lack of resources or infrastructure to keep pace with the advancement of global technologies

   e. Local industries need to compete with international industries
   f. Tariff barriers
   g. Political instability
   h. Lack of skilled personnel and training courses
   i. Other: ……………………………………………………………………………………………

4. What is/are the current opportunity(ies) or benefits gained by textile related industry in Malaysia? (you may choose more than one answer)
   a. High demand of local textile products
   b. Lower utilities cost
   c. Lower labour cost
   d. High quality of textile products produced by local industry
   e. Reasonable selling price of textile products
   f. Other: ……………………………………………………………………………………………

5. What is/are the future expectation(s) of your industry/business? (you may choose more than one answer)
   a. More financial funding from government or other agencies
   b. Business expansion to global market
   c. Implementation of Industrial Revolution 4.0 (IR 4.0) in the industry
   d. Reducing carbon footprint and creating “greener” and sustainable processes
   e. Sustainable supply chain
   f. More skilful and knowledgeable graduates working in the industry
   g. Textile and apparel products can be obtained locally at reasonable price
   h. Other: ……………………………………………………………………………………………

6. How does covid-19 phenomenon affect your company?
   a. Very bad
   b. Bad
   c. Unaffected
   d. Good
   e. Very good
   f. Other: ……………………………………………………………………………………………

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Feel free to write any comments/suggestions for the improvement of textile programmes / industries.

……
……
……………………………………………………

5.2 Annex II – Interviews- Indonesia

INTERVIEW

Note: Please mark the correct answer for each question
Personal and professional details:
Name :
Position :
Area of your professional :
Name of the company :
Length of work in the position :
Alumni of STTT : Yes/No

1.	**What is your involvement with technical and/or nanotextiles, especially in relation with smart textiles?**
	Consultants ○ **Entrepreneur** ○ **Manager** ○ **Designer** ○ **Retail** ○ **Wholesaler** ○ **Engineer** ○ **Academic** ○ **Other …………….**
2.	**How do you rate the importance of technical and/or nanotextiles (including those related to smart textile) for the national economy?**
	Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ……
3.	**Do you employ textile engineers currently and/or do you plan to employ in the near future?**
4.	**What have you experienced with textile engineers so far?**
5.	**How do you rate the importance of technical and/or nanotextiles (especially in relation with smart textiles) for your business?**
	Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments:……
Capacities of textile engineering bachelor graduates, entering the labour market: In order to identify the competence profile of the graduates of textile engineering bachelor's degrees, please rate the importance of the following subjects.	
1.	**Knowledge necessary for students and employees in textile, garment and fashion industry**
	1.1 **Fundamental knowledge in basic science (chemistry, mathematics, physics, IT):** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know

		My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ………
	1.2.	**Fundamental knowledge in physicochemical characteristics of chemical raw materials:** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ………
	1.3	**Fundamental knowledge in physicochemical and technical characteristics of conventional raw materials (fabrics and yarns):** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ……
	1.4	**Fundamental knowledge in technology for materials production (machinery, processes):** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ………
	1.5	**Fundamental knowledge in art (fashion and design):** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ………
	1.6	**Fundamental knowledge in technologies for design (methods, IT infrastructure):** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ………
	1.7	**Fundamental knowledge in technologies for manufacturing:** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ……………………………………………………………………………
	1.8	**Knowledge and understanding in quality control and management:**

		Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ………
	1.9	**Knowledge and understanding in applications of technical and nano-textiles, especially in relation with smart textiles:** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ………
	1.10	**Knowledge and understanding in managerial and techno economical aspects of production:** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ……
	1.11	**Knowledge and understanding in auxiliary processes in manufacturing and production (automation, machinery maintenance:** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ………
	1.12	**Knowledge and understanding in standardization and certification:** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ……..
	1.13	**Knowledge and understanding in customer relationship management:** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ……
	1.14	**Knowledge and understanding in marketing:** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know

		My level of knowledge: ○ ○ ○ deep knowledge ǀ medium knowledge ǀ low knowledge Comments: ……	
	1.15	**Knowledge and understanding in health and safety issues in production and manufacturing:** Importance: ○ ○ ○ ○ ○ very important ǀ important ǀ not very important ǀ unimportant ǀ I don't know My level of knowledge: ○ ○ ○ deep knowledge ǀ medium knowledge ǀ low knowledge Comments: ……	
	1.16	**Knowledge and understanding in logistics aspects:** Importance: ○ ○ ○ ○ ○ very important ǀ important ǀ not very important ǀ unimportant ǀ I don't know My level of knowledge: ○ ○ ○ deep knowledge ǀ medium knowledge ǀ low knowledge Comments: ………..	
	1.17	**Knowledge and understanding in sustainability in design and production:** Importance: ○ ○ ○ ○ ○ very important ǀ important ǀ not very important ǀ unimportant ǀ I don't know My level of knowledge: ○ ○ ○ deep knowledge ǀ medium knowledge ǀ low knowledge Comments: ……	
	1.18	**Knowledge in specific fields of textile application**	
		1.18.1	**Textile for medical and health care:** Importance: ○ ○ ○ ○ ○ very important ǀ important ǀ not very important ǀ unimportant ǀ I don't know My level of knowledge: ○ ○ ○ deep knowledge ǀ medium knowledge ǀ low knowledge Comments: ……
		1.18.2	**Fashionable protective textile:** Importance: ○ ○ ○ ○ ○ very important ǀ important ǀ not very important ǀ unimportant ǀ I don't know My level of knowledge: ○ ○ ○ deep knowledge ǀ medium knowledge ǀ low knowledge Comments: ……
		1.18.3	**Fashionable architecture and interior textile:** Importance: ○ ○ ○ ○ ○ very important ǀ important ǀ not very important ǀ unimportant ǀ I don't know My level of knowledge: ○ ○ ○ deep knowledge ǀ medium knowledge ǀ low knowledge

			Comments: ……….
		1.18.4	**Fashionable transport and aerospace textile:** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ……….
		1.18.5	**Agriculture and geotextile:** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ……….
		1.18.6	**Fashionable sports and active leisure clothing:** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ……….
		1.18.7	**Fashionable smart clothing:** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ……….
		1.18.8	**Fashionable ecotextile:** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ……….
		1.18.9	**Fashionable military textile** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ……….

	1.19	**Knowledge in development of innovative and smart textile with advanced properties**	
		1.19.1	**Nanomaterials and nanotechnologies in textiles and fashion:** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ……
		1.19.2	**Micro-electronics in textiles and fashion:** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ……
		1.19.3	**Biotechnologies in textiles and fashion:** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ……
		1.19.4	**Fibrous and textiles based composites:** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ……
		1.19.5.	**New Fibres and Textile structures:** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge Comments: ……
2.	**Professional skills necessary for students and employees in textile, garment and fashion industry**		
	2.1	**Ability to analyse and estimate recent information about new materials and technologies (Bibliography research and up to date informative):** Importance: ○ ○ ○ ○ ○ very important | important | not very important | unimportant | I don't know My level of knowledge: ○ ○ ○ deep knowledge | medium knowledge | low knowledge	

		Comments: …………………………………………………………………………………………………
	2.2	**Ability to apply new methods and technologies in design and development of new materials and/or products, processes (reengineering of processes, according to new requirements like sustainability, quality, corporate Social responsibility):** Importance: o o o o o very important | important | not very important | unimportant | I don't know My level of knowledge: o o o deep knowledge | medium knowledge | low knowledge Comments: …………………………………………………………………………………………………
	2.3	**Ability to analyse problems and situations (problem Solving, synthesis of existing knowledge from other domains into practical solutions for the job):** Importance: o o o o o very important | important | not very important | unimportant | I don't know My level of knowledge: o o o deep knowledge | medium knowledge | low knowledge Comments: …………………………………………………………………………………………………
	2.4	**Capability for entrepreneurship: leadership, risk-taking, creativity** Importance: o o o o o very important | important | not very important | unimportant | I don't know My level of knowledge: o o o deep knowledge | medium knowledge | low knowledge Comments: …………………………………………………………………………………………………
	2.5	**Ability to apply innovation in the whole of the value chain:** Importance: o o o o o very important | important | not very important | unimportant | I don't know My level of knowledge: o o o deep knowledge | medium knowledge | low knowledge Comments: …………………………………………………………………………………………………
	2.6	**Ability to apply innovation in the whole of the value chain:** Importance: o o o o o very important | important | not very important | unimportant | I don't know My level of knowledge: o o o deep knowledge | medium knowledge | low knowledge Comments: …………………………………………………………………………………………………
	2.7	**Ability to market new innovative fashion products:** Importance: o o o o o very important | important | not very important | unimportant | I don't know My level of knowledge: o o o deep knowledge | medium knowledge | low knowledge Comments: …………………………………………………………………………………………………
3.	**Personal qualities and attitudes for students and employees in textile, garment and fashion industry**	
	3.1	**Ethical behavior in the job:** Importance: o o o o o very important | important | not very important | unimportant | I don't know

		My level of knowledge: ○ deep knowledge I ○ medium knowledge I ○ low knowledge Comments: ……………………………………………………………………………………………………
	3.2	**Collaboration, Communication and Ability to act in a global and multicultural environment:** Importance: ○ very important I ○ important I ○ not very important I ○ unimportant I ○ I don't know My level of knowledge: ○ deep knowledge I ○ medium knowledge I ○ low knowledge Comments: ……………………………………………………………………………………………………
	3.3	**Linguistic capabilities:** Importance: ○ very important I ○ important I ○ not very important I ○ unimportant I ○ I don't know My level of knowledge: ○ deep knowledge I ○ medium knowledge I ○ low knowledge Comments: ……………………………………………………………………………………………………
	3.4	**Cultural tolerance:** Importance: ○ very important I ○ important I ○ not very important I ○ unimportant I ○ I don't know My level of knowledge: ○ deep knowledge I ○ medium knowledge I ○ low knowledge Comments: ……………………………………………………………………………………………………
	3.5	**Appraisal of different opinions and attitudes:** Importance: ○ very important I ○ important I ○ not very important I ○ unimportant I ○ I don't know My level of knowledge: ○ deep knowledge I ○ medium knowledge I ○ low knowledge Comments: ……………………………………………………………………………………………………
4.	**Please specify other knowledge and skills important for professionals of textile, garment and fashion industry:**	
5.	**Please specify tasks and activities that are important for graduates of textile related bachelor studies**	
-	**Other comments, suggestions:**	

5.3 Annex III – List of Stakeholders

Participant number	Occupation category	Description
P1	Industry: Integrated textile manufacturer	PT Daliatex Kusuma The Section head, Alumni of STTT with 1-3 years' experience in the industry
P2	Industry: Fiber making-spinning industry	PT Indo Bharat Rayon Randy Azmi, S.S.T. Sale & Marketing manager, Alumni of STTT
P3	Research center: Center of Textile Testing and R&D -under the Indonesian Ministry of Industry	Balai Besar Tekstil Dr. Doni Sugiyana Researcher in textile and environmental technology
P4	Industry: Testing and certification of Oeko Tex	PT Testex Indonesia (affiliated to Oekotex) Pipit F. Hayati, S.Si.T. Director, Alumni of STTT
P5	Industry & Professional: In Quality Assurance	PT Under Armour Kunto Antariksa, A.T., M.M. Senior Manager - Quality South East Asia Region, Alumni of STTT
P6	Industry: Testing and certification service company	PT Intertex (Testing & certification service company) Made Widyani Manager (Testing) Softlines & Hardlines
P7	Industry:	PT Ateja Tritunggal Kiecky Hiwanudin

	Integrated textile manufacturer	Head of Sub Dept. R&D Braiding, Alumni of STTT
P8	Industry: Textile auxiliary’s manufacturer	PT Croda Indonesia The Section head, 1-3 years’ experience, Alumni of STTT
P9	Industry: Fiber making-spinning industry	PT Asia Pacific Fibre Rudiansyah, S.Si.T. Marketing manager, Alumni of STTT
P10	Research center	BPPT Dr. Sudirman Habibie Senior researcher in material science and technology, Alumni of STTT
P11	Academic	NM Susyami Hitariat, S. Teks., M.Si. Senior lecturer in the Dept. of Textile Chemistry, Politeknik STTT Bandung, Alumni of STTT
P12	Academic/Designer	Irfa Rifaah, M.Ds. Junior lecturer in the Dept. of Garment Production, Politeknik STTT Bandung
P13	Industry: Textile auxiliary’s manufacturer and supplier	PT Dai Ichi Kimia Raya Okta Sakti, S.S.T. Bandung area manager, Alumni of STTT.
P14	Industry Dyeing and Finishing industry	PT Visionland Dyeing and Finishing Mfg Sukmawan, A.T., M.M. Fabric Outsourcing Manager, Alumni of STTT
P15	Research center: Indonesian Institute of	LIPI (Indonesian Research Institute) Dr. Andri Hardiansyah

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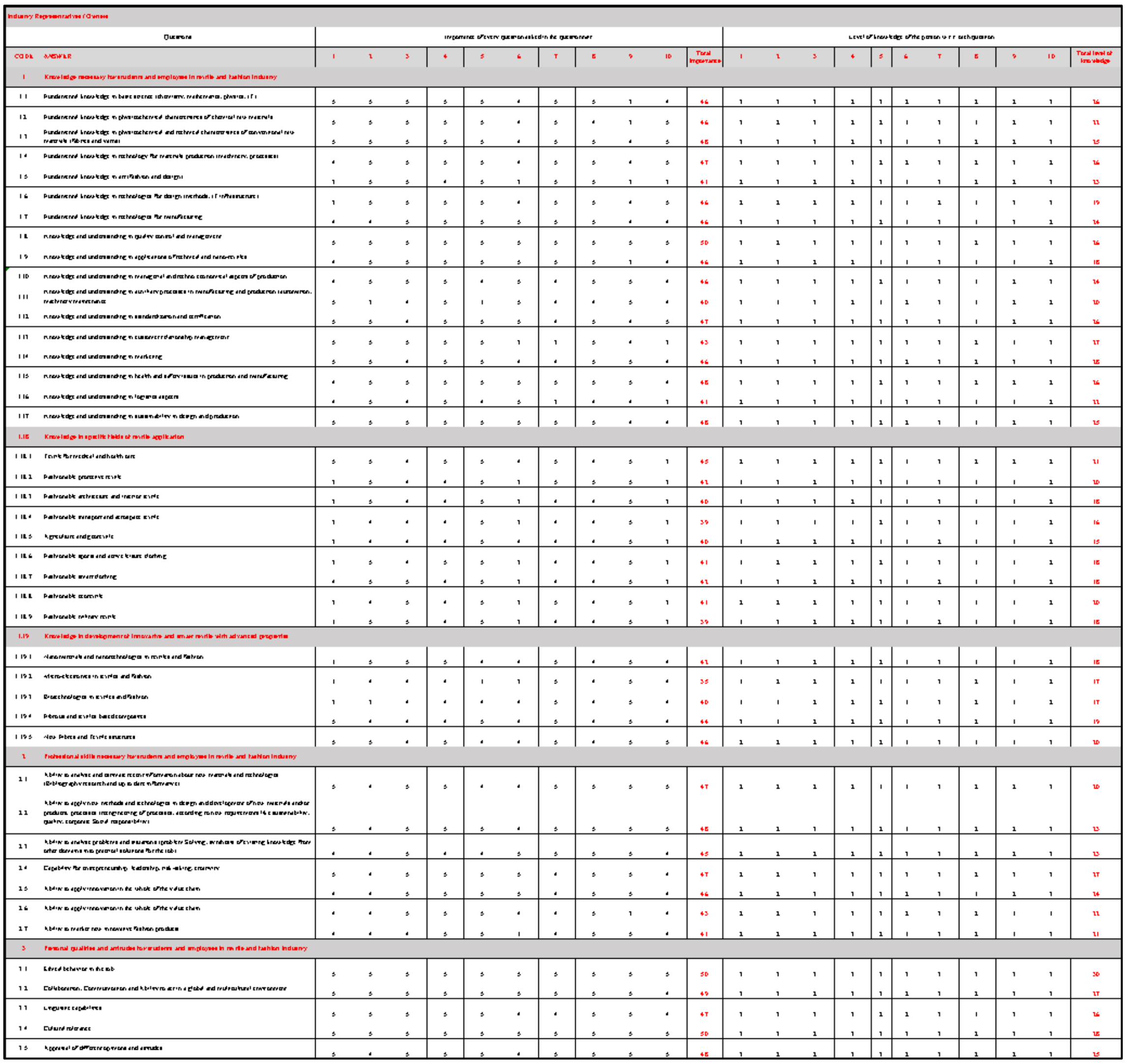
	Science – owned by the Indonesian government	Researcher in Advanced Functional Material
P16	Industry: Fabric absorbent company	PT Mipako Yudi Sudarmadi Owner and Director, Alumni of STTT
P17	Industry: Fiber making manufacturer	PT South Pacific Viscose Hardian Wijayanto, S.Si.T. TCS Specialist Non-Woven & Co Products SEA, BD for Lenzing FR for Protective Wear, Alumni of STTT
P18	Industry: Authorized distributor of “Lectra” CAD software	PT Fratekindo Jaya Gemilang Hendrayana Marketing Executive
P19	Industry: Authorized distributor of “Gerber” CAR software	PT Brothersindo Sonny Tanjung Gerber Software Product Manager
P20	Industry: Textile auxiliary’s supplier	CV i-Chem Textile Solution Tisna Kusumah, S.Si.T. Owner/Director, Alumni of STTT
P21	Academic	Prof. Ir. Hermawan Kresno Dipojono MSEE, Ph.D. Former Director of Research Center for Nanoscience and Nanotechnology ITB and Lecturer of Physics Engineering ITB.
P22	Academic/Designer	Gamia Dewanggamanik, S.Ds., MA., Ph.D (c.) Textile designer with master’s degree in Material Futures, Central Saint Martin, and PhD Student in

		The School of Innovation, Glasgow School of Art, UK.
P23	Entrepreneur	David Kim CEO of Visionland One of the results of the effort of VISIONLAND is “Natural Dyeing” products to preserve the environment and save the earth.
P24	Designer	Denny R Priyatna Product Designer | Founder of @aievl dennypriyatna.com http://www.csm-madesign2017.com/portfolio/denny-r-priyatna/
P25	Academic/Entrepreneur	Muh. Hisbul Marketing manager of Batik Chems Indonesia, and PhD Candidate in Natural Product Chemistry, University of Leeds, UK.
P26	Designer	Nidiya Kusmaya S.Ds., M.Ds. Mycotech Textile designer/ Biocolorist
P27	Academic	Xenia Mutter PhD Candidate in Textile technology at the School of Design, University of Leeds, UK.
P28	Academic	Suprijanto, Dr. ST. MT Associate Professor & Lecturer Bandung Institute of Technology | ITB · Medical Instrumentation Laboratory, Department of Engineering Physics
P29	Academic	Bintan Titisari S.Ds., M. Ds,. Ph.D. (c.) Lecturer of Textile Design at the Faculty of Art and Design, ITB.
P30	Academic	Prof. Fenny Martha Dwivany Professor & Lecturer

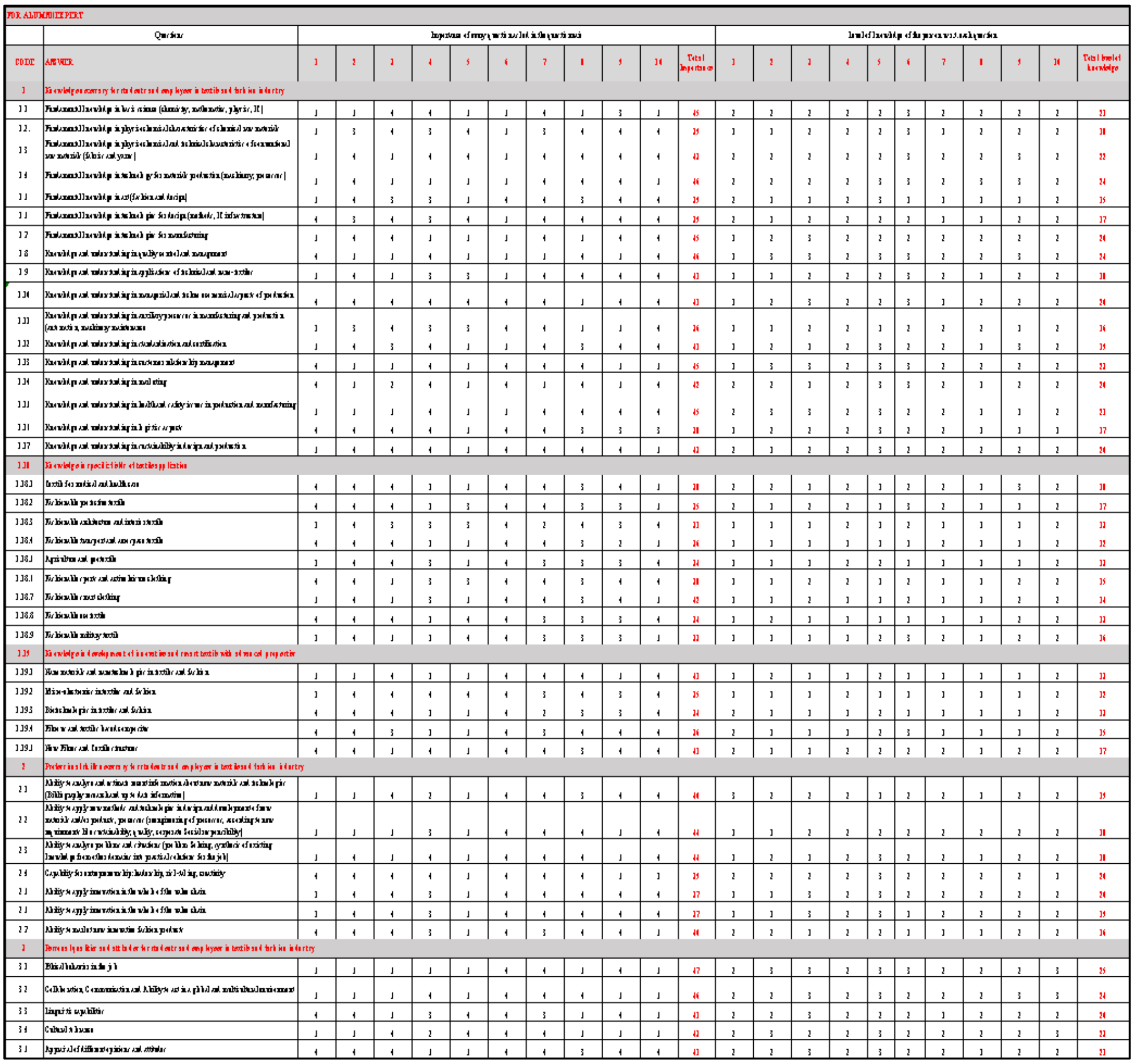
		School of Life Sciences & Technology, Bandung Institute of Technology

5.4 Annex IV - Interviews- Pakistan

5.4.1 Answer to Questionnaire: Industry Representatives / Owners



5.4.2 Answer to Questionnaire: Textile Alumni / Textile Experts



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