

Report of the Quinquennial Review Team 2012-2017



भा.कृ.अनु.प. - केंद्रीय कपास प्रौद्योगिकी अनुसंधान संस्थान

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June, 2018



Report of the

Quinquennial Review Team

On

ICAR-Central Institute for Research on Cotton Technology
Mumbai 400019 (MS) INDIA

For the Period 2012-2017

Submitted to the

Indian Council of Agricultural Research
New Delhi - 110 012

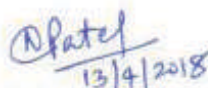
June, 2018

Foreword

The Indian Council of Agricultural Research (ICAR) constituted the Quinquennial Review Team (QRT) vide Office Order F.No A.Engg./1/3/2017-IA-II(AE) dated 15/05/2017 to review the functioning and progress of the Central Institute for Research on Cotton Technology (CIRCOT), Mumbai for the period of 2012-2017. The Team comprised Dr.N.C.Patel, Chairman and Vice Chancellor, Anand Agril. University, Dr.G.R.Anap, Dr.N.J.Thakor, Dr.V.D.Gotmare, Dr.M.K.Sharma as Members and Dr.Sujata Saxena as Member Secretary. The schedule of meetings and visits is presented in **Annexure – II**. The QRT Report on ICAR-CIRCOT for the period 2012-2017 is submitted in this document along with suggestions and recommendations for consideration of Indian Council of Agricultural Research.

The QRT acknowledges with gratitude the excellent arrangements made by the Dr.P.G.Patil, Director, ICAR-CIRCOT and his team for making the visits and deliberations of the QRT useful and valuable, thereby facilitating timely submission of this Report.

Chairman




(N.C.Patel)

Vice Chancellor

Anand Agricultural University, Anand

Members



(G.R.Anap)

Former International Cotton Ginning Consultant (World Bank) for Africa & Former, Head, Technology Transfer Division, ICAR-CIRCOT, Mumbai



(N.J.Thakor)

Former Dean, DBSKKV, Dapoli.



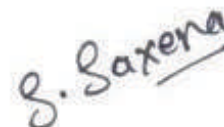
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Acknowledgement

QRT Chairman, Dr. N. C. Patel and Members Dr. G. R. Anap, Dr. N. J. Thakor, Dr. V. D. Gotmare, Dr. M. K. Sharma hereby convey their gratitude to Hon'ble Dr. T. Mahapatra, Secretary, Department of Agricultural Research & Education and Director General, ICAR, Ministry of Agriculture, Krishi Bhavan, New Delhi for appointing them to carry out this important task of reviewing the work of ICAR- Central Institute for Research on Cotton Technology, Mumbai and its regional units at Nagpur, Surat, Coimbatore, Dharwad, Guntur and Sirsa for the Quinquennial Review period 2012-2017 . The QRT also wishes to express its sincere thanks to Dr. K. Alagusundaram, Deputy Director General (Engineering) and Dr. S.N. Jha, Assistant Director General (PE), Indian Council of Agricultural Research, New Delhi for their support and guidance in smooth conduct of quinquennial review work of CIRCOT, Mumbai.

Special thanks of the QRT are also due to Dr. P.G. Patil, Director, Central Institute for Research on Cotton Technology, Mumbai for extending valuable support by providing background information on activities of CIRCOT for the period of 2012-2017 and extending utmost help and valuable cooperation during the conduct of review. The QRT is also thankful to the Director, CIRCOT for enabling the participation of stakeholders for deliberations and eliciting their views that were useful to formulate the QRT recommendations. The QRT is also thankful to all the Heads of Divisions and staff for their cooperation during QRT review.

The QRT also wishes to place on record its thanks to Officers-in-charge of the Quality Evaluation Units of CIRCOT at Sirsa, Surat, Dharwad, Coimbatore, Guntur and Scientist-in-charge of Ginning Training Centre at Nagpur for the enthusiastic cooperation extended by them to facilitate the work of quinquennial review.

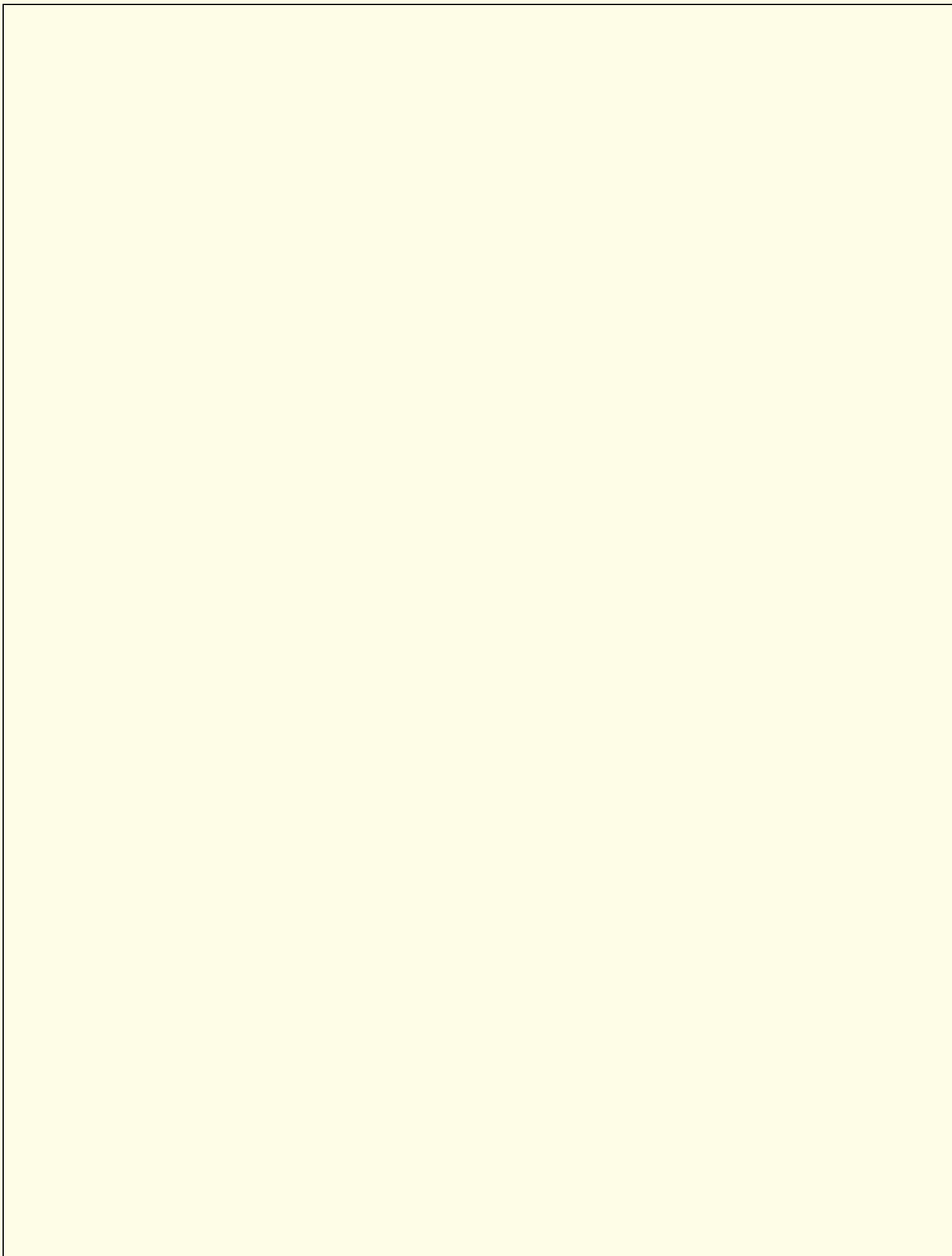
Thanks are also due to stakeholders' representatives from Public and Private Sectors, Cottonseed Industry, Seed Industry, Trade, Cotton Association of India (CAI) and Textile Industry for providing valuable information and contributing to discussions. Thanks are also due to CIRCOT staff members who helped in organizing QRT meetings, visits and in compilation of proceedings, documents related to quinquennial review work. The QRT wishes to place on record its thanks to Scientific, Technical, Administrative, Finance and Supporting Staff of CIRCOT for their excellent cooperation.

Quinquennial Review Team



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Chapter 1

Introduction

The quinquennial review of ICAR institutes through a specifically constituted Quinquennial Review Team (QRT) is an important time-tested mechanism for monitoring and evaluating their research and development programmes. The quinquennial review team for CIRCOT for reviewing its work during 2012-2017 constituted by ICAR in May, 2017, started its deliberations in June, 2017. The review of the progress of research, keeping in view its relevance to the mandate of the institute was carried out as per ICAR guidelines of 2009. The QRT also examined the constraints, potentials, strategies and plans for scientific research and management. The action taken on recommendations (ATR) of the last QRT of CIRCOT (*Annexure I*) were duly considered during the present review. The review is thus retrospective and prospective as well.

1.1 Constitution and Composition of the Review Panel

The review should be considered as an independent external review and its membership should be broad-based. Considering this aspect in mind, ICAR constituted the QRT for CIRCOT which consisted of 6 members including Chairman. The composition of the QRT is given below:

1	Dr. N. C. Patel, Hon'ble Vice Chancellor, Anand Agricultural University, Anand	Chairman
2	Dr. G. R. Anap, Former International Cotton Ginning Consultant (World Bank) for Africa & Former Head, Technology Transfer Division, ICAR-CIRCOT, Mumbai	Member
3	Dr. (Prof.) N. J. Thakor, Former Professor & Head, Department of APE, DBSKKV, Dapoli	Member
4	Dr.(Prof.) V. D. Gotmare, Head, Dept. of Textile Manufacturing, VJTI, Mumbai	Member
5	Dr. M. K. Sharma (Economist), President and whole time Director, Bajaj Steel Industries Ltd, Nagpur	Member
6	Dr. Sujata Saxena, Principal Scientist & Head I/c, CBPD, ICAR-CIRCOT, Mumbai	Member - Secretary

1.2 Terms of Reference of the Quinquennial Review Team

QRT has addressed in its Report all the Terms of Reference (ToR) assigned to it in a comprehensive manner. QRT examined whether the research and development programmes of CIRCOT are in conformity with the priorities of the ICAR and the nation.

The following are the ToRs:

(i) Research achievements and impact

- To critically examine and identify research achievements of the Institutes and their Regional Stations and Sub-Stations, since the previous quinquennial review and critically evaluate them. Commensurate with the objectives, mandates and resources of the organization, the socio-economic impact of research on farmers/beneficiaries, and transferability of results to farmers through extension should be critically reviewed.
- The research and its impact should be brought out in quantifiable benchmarks wherever possible.
- To know the value for money, QRT should assess and bring out the physical outputs and outcomes vis-a-vis the budget spent during the period under report. If the likely outcomes are going to take considerable time, the projected outcomes should be indicated.
- The socio-economic impact of research on farmers/beneficiaries and transferability of results to farmers being an important aspect of research outcome, the transferability should be mandatory for major research projects.

(ii) Research relevance and budget allocation

To examine objectives, scope and relevance of the research programmes and budget of the institute for the next 5 years in relation to overall state/regional/national plans, policies and long and short-term priorities and also the Perspective Plan for Vision 2020/Vision 2030 documents.

(iii) Relationship/collaboration with SAUs and other stakeholders

To pinpoint whether the research programmes of the past and proposals for future are in harmony with the vision of the ICAR (HQ) and the programme of the related centres of research and agricultural universities, state government, private sector, etc.

(iv) Linkages with clients/end-users

To examine the kind of linkages established with the clients and end-users of the research results, i.e. farmers and the extent of interest displayed in conducting "on-farm research" in farmers' fields and in organizing demonstrations/training courses for the transfer of technology to extension agencies and KVKs of the ICAR.

(v) Proposed changes in organization, programmes and budget

To examine whether any changes in the organizational set-up are called for in respect of manpower and funds allocation. The decentralization in day-to-day working and transparency should be highlighted. Further the Committee may also examine the resource generation efforts and implementation and project-based budgeting.

(vi) Constraints

To examine the constraints hindering the institute in achieving its objectives and implementation of its programme and goals, and to recommend ways and means to minimise or eliminate them.

(vii) Looking forward

To look into any other point considered relevant by the Committee or referred to it by the ICAR, the Institute Director or the Management Committee, in respect of future programme development, research prioritization and management changes.

1.3 The Process

Introductory meeting of the Chairman QRT with Deputy Director General (Engg.) was held at KAB-II, Pusa, New Delhi on April 20, 2017. The meeting was attended by the Chairman, Dr. N.C. Patel, Dr. K. Alagusundaram (DDG, Engg.), Dr. P. G. Patil (Director, CIRCOT) and Dr. S.N. Jha, ADG (PE). In this meeting, the composition of committee was decided and other members were selected. The composition of QRT was communicated to the institute in May 2017. QRT conducted this review by making visits to CIRCOT, Mumbai, its regional units at Coimbatore, Sirsa, Guntur, Surat and Ginning Training Centre, Nagpur (*Annexure II*). At Head Quarters, the QRT visited the laboratories, other facilities and held discussions with Director, HODs, Scientists, Technical Officers, other staff categories and various committee representatives besides representatives of different stakeholder groups. During visits to the regional units, QRT visited the laboratories and facilities, interacted with in-charges, staff and stake holders including researchers and officials from the Agri University/ institute where the unit was located to have a proper understanding of cotton and its post

harvest scenario in that region. This report was also presented before the Institute Management Committee. The brief account of the process followed by the QRT in the course of the Review in chronological order is given below.

1.3.1 The Planning Meeting: The Planning Meeting of the Quinquennial Review Team (QRT) was held on June 28, 2017 in the Conference hall of CIRCOT, Mumbai. The meeting was attended by chairman, Dr. N. C. Patel, Hon'ble, Vice Chancellor of AAU, Anand and all members of QRT. Dr. P.G. Patil, Director, CIRCOT welcomed all members and presented salient achievements of the institute. Dr. S. N. Jha, ADG (PE), ICAR, New Delhi, explained the purpose of the Quinquennial Review and expectations of Council from the team. Dr. Sujata Saxena, Principal Scientist, CIRCOT and member Secretary, QRT presented the Action Taken Report on the recommendations of the last QRT which was followed by a presentation by Director CIRCOT, Dr. P.G. Patil on overall achievements of the institute during the review period (2012-17). This meeting was also attended by all HODs, SAO and AFAO of CIRCOT who provided inputs in their respective fields. Thereafter, the team visited major facilities of the institute and visitors' room to understand the research work being carried out by the institute.

1.3.2 The second Meeting: QRT visited the Ginning Training Centre of CIRCOT, Nagpur on 25th July 2017. At GTC, in addition to the various facilities available there for ginning and ginning training e.g. DR gin, saw gin, rotary knife gin etc and bale press, various pilot plant facilities and cotton fibre testing instruments were demonstrated to the team. Dr. S.K. Shukla, Senior Scientist & in-charge, GTC presented an account of the various activities undertaken by GTC during the five year review period. The Committee also interacted with stakeholders of CIRCOT during Stakeholders' Meet arranged in the afternoon which was attended by the machinery manufacturers, Licensees of CIRCOT technologies, ginnery, traders and farmers. QRT also visited factories of CIRCOT licensees, viz. Bajaj Steel Industries Ltd., Nagpur and Precision Tooling Engineers and examined the manufacturing facilities and products.

1.3.3 The third Meeting: The QRT visited the Quality Evaluation Unit of CIRCOT, Coimbatore on 29th & 30th Aug. 2017. Dr. S. Venkatakrishnan, CTO & in-charge of unit presented the report of the activities/work done by unit during the review period. The QRT inspected the facilities of the unit and interacted with scientists and I/c of CICR Regional Research Station, Coimbatore, fibre testing machinery (HVI) manufacturers and spinners who attended the stakeholders' meet. The QRT also visited M/s Appache Cotton Pvt. Ltd., Pollachi manufacturing eco friendly cotton garments.

1.3.4 The fourth Meeting: QRT visited Quality Evaluation Unit (QEU) of CIRCOT, Sirsa on 7th Oct. 2017. QRT along with QEU staff first interacted with centre I/c and scientists of CICR regional station, Sirsa, to know about the cotton scenario in North zone. It visited fields which had many *arboreum* cotton varieties developed by the station and then interacted with other stake holders which included scientists from Sirsa research station of CCSHAU, Hisar, progressive farmers, entrepreneurs involved in collection and chipping of cotton stalks and supply of chipped stalks to brick kilns, representatives from seed companies, ginning and seed crushing units. Dr. Hamid Hasan, I/c of the unit presented the activities and achievements of the unit during past five years. QRT then visited the laboratory and listened to the issues and suggestions from the staff. QRT also visited Sharda ginning factory at Sirsa which was operating both Saw and DR gins for cotton ginning and was engaged in seed crushing also.

1.3.5 The Fifth Meeting: The Quinquennial Review Team (QRT) held this meeting at ICAR- CIRCOT, Headquarters Mumbai on 20th and 21st Nov. 2017. Stakeholders consisting of representatives from cotton trade, textile and cottonseed machinery manufacturers, textile processing auxiliary suppliers, textile processors and garment exporters attended this meeting and expressed their views on performance of the institute and how its impact can be further enhanced in their respective sectors. After that, QRT held separate meetings with various categories of staff viz. scientific, technical, administrative and supporting. It interacted with IJC and Women's complaints committee members and also listened to the problems, opinions and grievances of the staff.

1.3.6 The sixth Meeting: The Quinquennial Review Team (QRT) held its sixth meeting on 22nd Nov. 2017 at QEU-CIRCOT, Guntur located in the premises of Acharya NG Ranga Agricultural University, Guntur. Team reviewed the available facilities and the work carried out by the unit for the past five years. An interactive meet with university cotton scientists and a few other stake holders was arranged. The team also visited M/s Kallam Agro Oil Products (P) Ltd. a large scientific cottonseed crushing industry located nearby, viewed the operations and listened to the issues faced by them.

1.3.7 The seventh Meeting: The QRT on 15th Feb, 2018, visited Anand Agricultural University, Anand and its Viramgam cotton research station working on *herbaceum* cotton prevalent in that area. After visiting the fields, the team visited M/s Shreeji Ginning Mills, involved in ginning *herbaceum* cotton and M/s Uma Ginning Mills, ginning Bt cotton. QRT then held its seventh meeting on 16th Feb. 2018 at

Quality Evaluation Unit of CIRCOT located at Main Cotton Research Station (MCRS) of Navsari Agricultural University, Surat. Prior to the meeting, QRT reviewed the facilities and listened to the problems faced by the unit. Hon'ble Vice Chancellor of Navsari agricultural university, Dr. C.J. Dangaria, and Director, CIRCOT, Dr. P.G. Patil also attended this meeting. Dr. B.G. Solanki, Scientist I/c, Cotton of MCRS presented activities of their station and activities of QEU were presented by Dr P.K. Mandhyan, Head I/c, QEID of CIRCOT. As QRT could not visit QEU, Dharwad, I/c of the unit, Mrs. V. Udikeri, TO, also attended the meeting and presented activities and issues related to the Dharwad unit to QRT. The QRT along with Director CIRCOT also visited MANTRA (Manmade Textiles Research Association) and held discussions with its Director to explore future prospects for QEU, Surat.

1.3.8 The eighth Meeting: The QRT Chairman, members and member Secretary held a meeting on 17th Feb. 2018, at AAU, Anand to finalize the structure and content of report.

1.3.9 The ninth meeting: QRT chairman and members finalised the report and recommendations in this meeting held during 11-13th April at ICAR- CIRCOT, Mumbai. QRT also had an interactive meeting with Institute Management Committee of CIRCOT on 12th April, 2018 in which chairman and members briefed the IMC about the major recommendations of the team based upon various visits, meetings and interactions.

Chapter 2

CIRCOT: Brief History and Contributions

2.1 Brief History

The Indian sub-continent has long been recognised as an accredited home of cotton and cotton textile manufacture. Though the first textile mill was established in the first half of the nineteenth century in India, it was not till the second decade of the twentieth century that some concerted efforts were made towards increasing the production of cotton in India and improving fibre quality. This was necessitated by a serious reduction in the cultivation of cotton in the United States of America on account of the ravages by the boll weevil and closure of supply caused by World War I. Though India then enjoyed the position as the second largest cotton producing country in the world, nearly three fourths of the cotton produced was below 17 mm staple. In order to examine this situation, the Government of India appointed the Indian Cotton Committee in 1919. One of the most important recommendations of the committee was that an Indian Central Cotton Committee should be constituted and entrusted with the task of improving and developing the quality, cultivation, production and marketing of Indian cottons. The Indian Central Cotton Committee (ICCC) was accordingly constituted in March, 1921 and given a statutory position in May, 1923, with the passing of the Indian Cotton Cess Act, which provided the Committee with funds necessary for undertaking research programmes.

Another important recommendation of the Indian Cotton Committee was that the ICCC should appoint a cotton technologist on its staff, to carry out laboratory tests on Indian cottons to ensure authoritative evaluation, arrange for spinning test and also carry out basic research on the properties of the cotton fibre. In order to give immediate effect to the above recommendations, the ICCC established a Technological Laboratory. The construction of the building for the Spinning Section of the Laboratory started in September, 1923 and action was taken to procure and install spinning machinery and other items of equipment. Dr. A. J. Turner took charge as the first Director of the Laboratory in January 1924.

In the beginning, the main work of the Laboratory was to assist the cotton breeders and other research workers in the evaluation of the quality of new strains evolved under various research schemes and to carry out basic research investigations on fibre properties and spinning performance of cottons besides studying the inter-relationships between fibre characters and yarn quality. The Testing and Research Sections set up to fulfil these objectives were Fibre Testing, Spinning, Yarn Testing,

Physics, Chemistry, Microscopy and Statistics. As the usefulness of the work carried out at the Laboratory began to be realised by the cotton trade and industry, the scope of the work at the laboratory was increased by the addition of various new Sections from time to time such as Testing House (1937), Ginning Section (1941), X-ray Section (1954) etc. This Laboratory came under the administrative control of the Indian Council of Agricultural Research (ICAR) from April 1, 1966 consequent upon the abolition of ICCC. The name of the Laboratory was then changed to Cotton Technological Research Laboratory (CTRL). Later, as per the recommendation of the Quinquennial Review Team (QRT), the Institute was renamed as Central Institute for Research on Cotton Technology (CIRCOT) with effect from April 1, 1991. The institute is working on all aspects of post harvest processing of cotton and its by product utilisation.

2.2 CIRCOT's Contributions

The Central Institute for Research on Cotton Technology (CIRCOT) is the only institute in the country dedicated to post-harvest processing of cotton. It has been striving continuously to provide technology backup for the country's cotton breeding programmes under AICCIP (now, AICRP on cotton) leading to development of elite varieties like, Suvin, Varalaxmi, Hybrid.4, MCU.5, DCH.32, LRA.5166 etc.

CIRCOT is the only institute in the country having a full-fledged Ginning Training Centre catering to the needs of ginners and gin fitters. GTC offers structured training programmes to enhance skills of gin operators whereby productivity of ginneries can be augmented and cotton quality ensured. GTC is also engaged in ginning machinery design and has developed several prototypes. The R&D efforts have brought out pre-cleaner, several lab model gins such as, CLOY gin, HIPRO gin, modified Double Roller Gins etc. CIRCOT is also in the forefront in developing technologies in textile processing namely bio-scouring of cotton and its blends, eco-friendly finishing and dyeing with natural dyes and waterless textile finishing processes by using plasma. Institute has also contributed in development of cotton varieties suitable for absorbent cotton and eco- friendly processes for preparation of absorbent cotton.

A couple of novel blended products such as, cotton: ramie, cotton: Angora rabbit hair, and cotton: pashmina wool were made on cotton system. Blending cotton with bamboo or PLA fibre improved moisture management properties and in- situ finishing with nano ZnO imparted durable anti bacterial finish to these textiles. Friction spinning

technology has been used to prepare technical textiles using coconut fibres, jute fibres and cotton and good quality composites have also been developed from these fabrics.

One important contribution of CIRCOT in recent years has been the development of calibration cotton needed by all cotton testing laboratories in India. CIRCOT calibration cotton has country-wide acceptance and is substituting the imported material from USDA. Besides, it is also generating revenue for the Institute.

CIRCOT has utilized cotton plant stalks for preparing pulp and paper, composite boards, for raising edible mushrooms and for making briquettes and pellets. A process for faster composting of these stalks has also been developed. The Institute has installed biogas plants in selected textile mills based on the use of willow-dust generated there. A microbial process for reducing the gossypol content in cottonseed cake and meal for its use in poultry and fish feed has been developed. CIRCOT is a Referral Lab and is actively involved in commercial testing, contract research, and consultancy programmes all of which have helped the Institute to earn considerable revenue. It is also conducting various training programmes which help in capacity building and earn revenue for the institute. Many CIRCOT scientists are recognised guides affiliated to Mumbai University, and are guiding M.Sc and Ph.D students in Physics, Chemistry and Microbiology.

Apart from conducting regular institute-funded programmes in R&D, CIRCOT also grabbed a major share under NAIP scheme and successfully implemented six projects. Cotton Value-chain was a major NAIP project where a modified value chain with better economic returns for stake holders was demonstrated. Methodology standardised to prepare nano cellulose from cotton linters was scaled up during the review period to establish the first ever nano cellulose pilot plant in Asia. Machines were fabricated to obtain fine and coarse fibres from the mechanically extracted coconut fibre. Novel fabrics were made and impregnated with rubber to set up inflatable check dams and the technology was successfully demonstrated for collecting rain water at different locations in Odisha and Maharashtra. Funds for a number of projects were also received from NFBSFARA of ICAR.

The institute implemented the Cotton Technical Assistance Programme (TAP) originating from the Second Africa-India Forum Summit (AIFS) wherein, it contributed towards the development of cotton sector in C-4 (Benin, Burkina Faso, Mali and Chad), Nigeria, Uganda and Malawi countries by training their participants in cotton post harvest processing and value addition to cotton plant by products and residues at the

institute as well as in their respective countries and establishing the Regional Knowledge Cluster cum Training Centre at Bohicon, Benin.

2.3 Cotton Scenario

Cotton is a unique and very important crop commercially grown in 10 states of India by nearly 6.5 to 7 million farmers. India is the only country in the world where all four cultivated species of cotton are grown. Cotton is also the first crop in India, where genetic engineering technology was commercialized in the form of insect-resistant Bt cotton in the early years of this millennium. Since then, cotton production scenario has undergone a dramatic change and Indian cotton has not only dominated the international production picture but attracted the attention of all global players in the commodity for its persistent growth.

Currently, India has the largest area under cotton cultivation as well as largest cotton production in the world. During 2011-2012, cotton was cultivated in 122 lakh hectare area which was about 32% of the total world area under cotton which got marginally reduced during next two years. After peaking at 128.46 lakh ha in 2014-15, it has reduced and was likely to fall to 105 lakh ha in 2016-17. Though India is the largest producer of cotton in the world since 2014-15, cotton production after peaking at 398 lakh bales (of 170 kg each) in 2013-14 has declined and approximately 351 lakh bales were produced in 2016-17. Peak cotton productivity of 566 kg/ha achieved in 2013-14 has declined thereafter due to reasons such as erratic rains and pest attacks. Good monsoon rains during 2017-18 are expected to improve it in spite of the reports of pink boll worm damage from Maharashtra and Andhra.

Cotton is the backbone of Indian textile industry constituting about 59 % of its total fibre consumption. It accounts for 34% of the country's exports and fetches about Rs.50,000 crores annually to the exchequer. India is now the second largest cotton consumer using about 27 million bales annually and also the largest exporter of raw cotton as nearly 50 million bales were exported in 2016- 17. Around 6.5 million farmers in 10 states grow this crop and it provides employment and sustenance to a population of nearly 42 million people, who are directly or indirectly involved in cotton production, processing, textiles and related activities. Cotton is also the source of edible oil, cake and meal for livestock, linters, hull and huge amount of biomass as dried cotton stalks. About 35 million persons are employed directly by the huge textile industry which apart from organized mills and hosiery sector also consists of power-loom and hand loom sectors. The textile industry has been gradually expanding over

the years with the number of established mills and their installed capacity consistently growing.

To meet the quality requirements of this industry especially for extra long staple (ELS) cotton, about 15 lakh bales cotton on an average has been imported by the country every year during 2012-2017. Therefore, cotton production in India has a far-reaching impact not only on the livelihood of farmers and economy of the country, but also on international trade.

Chapter 3

Organisation and Management

3.1 Introduction

Established in the year 1924 as Technological Laboratory of Indian Central Cotton Committee (ICCC), the Institute is now 93 years old. After take-over by the ICAR in 1966, the laboratory was renamed as Cotton Technological Research Laboratory. The name was again changed to Central Institute for Research on Cotton Technology in the year 1991.

CIRCOT has four research Divisions viz., Quality Evaluation and Improvement Division, Mechanical Processing Division, Chemical and Bio-chemical Processing Division and Division of Transfer of Technology. Apart from these, there are service sections such as Library, AKMU, PME Cell, Administration and Finance & Accounts. The Institute has a Ginning Training Centre at Nagpur under Division of Transfer of Technology and five Regional Quality Evaluation Units at Sirsa, Surat, Guntur, Dharwad and Coimbatore, under Quality Evaluation and Improvement Division. The organisational Chart is given in Fig 3.1.

3.2 Vision, Mission and Mandate

(a) Vision

Global Excellence in Cotton Technology

(b) Mission

To provide scientific and managerial interventions of post-harvest processing and value addition to cotton and utilization of its by-products to maximize economic, environmental and societal benefits

(c) Mandate

A look at the overall function of CIRCOT by the QRT indicates that it has matured and undergone a metamorphosis over time since its inception in 1924 as a small laboratory. It has grown in stature into a magnificent institution as it stands today under the ICAR. The Institute has been undergoing continuous modernization in structure and functions, and is recognised for its excellence in fulfilling its mandates and social responsibilities to cotton farming community and the textile industry.

CIRCOT mandate was revised on recommendations of the 2002-2007 QRT which is given below:

1. To develop new technologies and machinery for better utilization of cotton and other textile fibres by carrying out basic, applied, strategic and anticipatory research in post-harvest technology.

2. To extend effective technological support for improvement of quality of Indian cottons and cotton products.
3. To act as a nodal centre for diversified utilisation of cotton plant by-products and processing waste, and other crop residues.
4. To provide services like training, education and consultancy to textile industry, Government and private agencies and to function as a referral laboratory for textile testing.

This mandate was revised in 2016 and **the revised mandate** is listed below:

1. Basic and Strategic Research on Processing Cotton and its Agro-Residues, Development of Value Added Products and Quality Assessment
2. Skill Development and Business Incubation Services and Function as Referral Laboratory for Cotton Fibres

3.3 Staff

The Institute has four categories of staff viz. Scientific, technical, administrative and supporting to carry out its functions smoothly and the number of sanctioned posts under each category and status of staff in position as on 31.03.2017 under various category is listed in the Table below

Staff strength as on 31.03.2017

Category	Sanctioned	In Position	Vacant
Director (RMP)	1	1	-
Scientific	50	26	24
Technical	112	68	44
Administrative	47	33	14
Supporting	57	38	19
Total	267	166	101

The above figures show manpower crunch at the institute with about 38% posts lying vacant. Maximum crunch is seen in respect of scientists where about 48% posts are vacant which is followed by 39% vacancies in technical category. All four Head of Division posts are also vacant. This needs urgent attention. The organizational structure of ICAR-CIRCOT is given in Figure 1.1

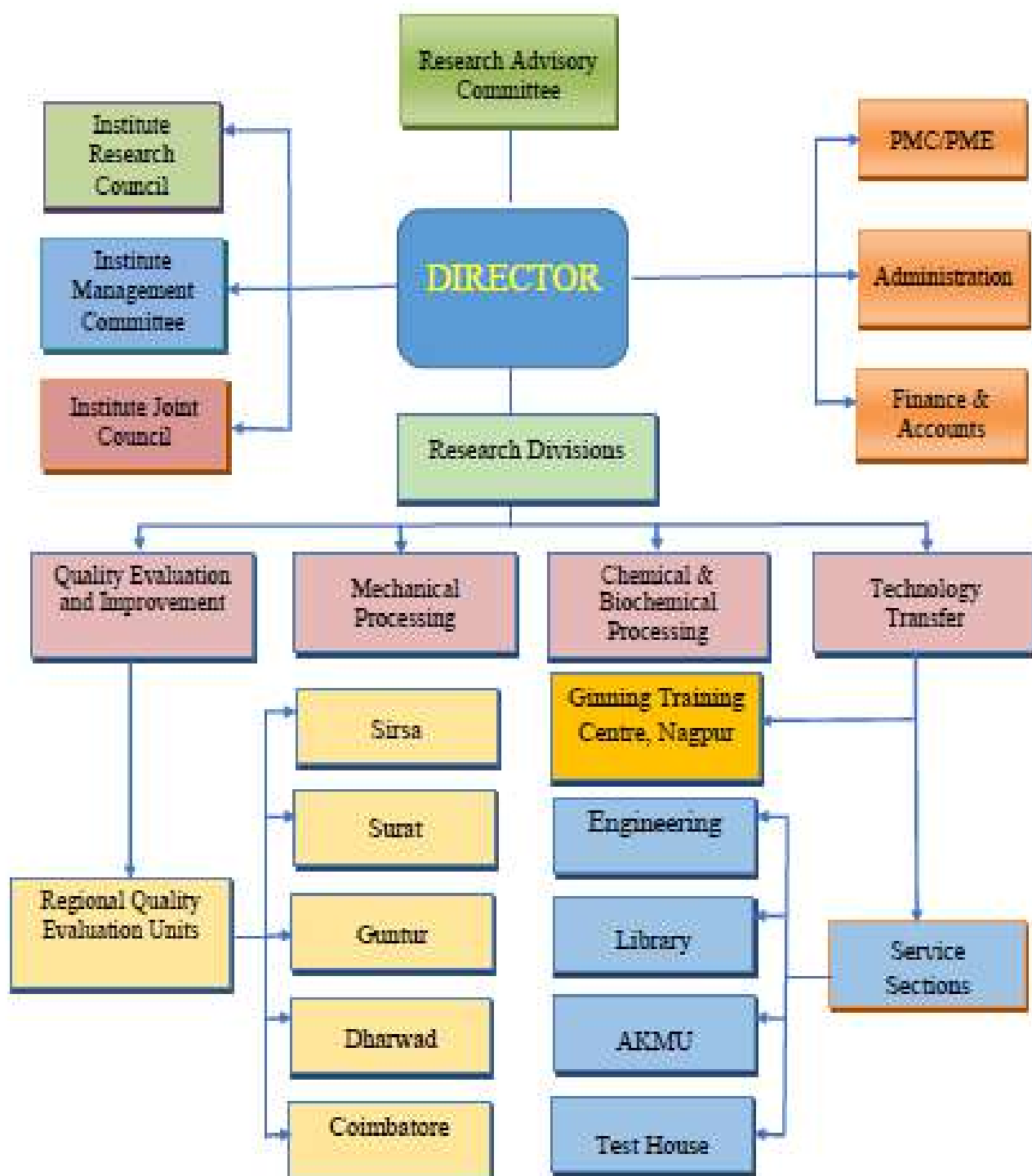


Figure 1.1 Organogram of ICAR-CIRCOT

Discipline-wise break-up of scientists in position, including Director, at CIRCOT

as on 31.03.2017

S.No.	Discipline	No. of Scientists
1.	Farm Machinery and Power	3
2.	Agricultural Process Engineering	5
3.	Physics	1
4.	Electronics and Instrumentation	1
5.	Textile Manufacture	5
6.	Textile Chemistry	4
7.	Organic Chemistry	2
8.	Agricultural Microbiology	2
9.	Plant Bio-chemistry	1
10.	Agricultural Economics	1
11.	Flexi discipline- Composites	1
12.	Flexi discipline- Technical Textiles	1
Total		27

3.4 Infrastructure

(a) Office building

The Institute headquarters in Mumbai is housed in four separate buildings including one six storied building on a plot of land admeasuring 6,845 sq.mtr. (73,652 sq.ft.). After the construction of a new annexe building consisting of basement and ground plus two floors, built up area of Institute is around 95,000 sq.ft. These buildings are

- Mechanical Processing Building (16,274 sq.ft.)
- Two storied Building (21,608 sq.ft.) renamed as RLN Iyengar Bhavan
- Multi-storeyed Building (36,050 sq.ft.) renamed as V. Sundaram Bhavan
- Heritage Building including the annexe building (23,723 sq.ft.) renamed as Yashwantrao Chavan Bhavan

(b) Laboratories and Equipment

CIRCOT laboratories are well equipped with instruments and machineries for studies on post harvest processing of cotton, technological evaluation of cotton and textile quality, structural studies, wet processing and finishing of textiles, preparation and

characterisation of nano materials, chemical and microbiological studies, cottonseed and cotton biomass utilisation including some pilot plant facilities. Major equipments installed during the QRT review period are given in *Annexure III*.

(c) Library Facilities

CIRCOT Library is holding literature on wide range of areas in cotton technology, textiles and allied subjects. The Library treasures some of the renowned textile journals since year 1924. QRT observed that, some library books and other assets are procured with funds from external projects also. During reporting period, Rs.65.87 lakh, Rs. 4.6 Lakh and Rs. 5.58 lakh were spent under Institute plan fund and contingencies, non plan contingencies and CRP natural fibre project respectively. This is about 64% of the amount spent on library facilities during previous plan. It is also observed that about 51% of this budget was spent in the first year itself and therefore budgetary provisions during later four years were unsatisfactory and subscription to many foreign journals had to be curtailed. Details of the year-wise fund allocation are given in *Annexure IV*.

Besides the staff of the Institute, students and researchers from various colleges affiliated to Mumbai University, sister Institutions and textile consultants availed of the library facilities of the Institute. QRT observed that many journals and databases are now available in electronic format and therefore a few computer terminals with access to these items may be provided for the benefit of visitors and readers. Library facilities should also be provided to the regional units.

(d) Computer and Internet facilities

All scientists and most of the technical staff have been provided with Personal computers and High Speed internet. Internet connectivity of 1GBPS is provided by the National Knowledge network and as backup, 10 MBPS connection from *Railtel* is available. Online access to many scientific journal and books through CeRA (Consortium of e resources in agriculture) is thus available. Many of the administrative staff are also been provided with Personal computers.

3.5 Functions

CIRCOT functions as per the ICAR-approved mandates and caters to the needs of cotton farmers and textile industry. The institute collaborates with various institutions to develop better cottons of desirable fibre quality required by the textile

industry and also technologies to make better and effective use of cotton and its by-products besides promoting entrepreneurship in the country.

The Institute is the main agency for training in modern ginning practices whereby the processing industry is able to provide clean cotton to textile mills and other users. It is also involved in capacity building activities in many other fields of cotton post harvest technology. The CIRCOT is preparing and supplying calibration cottons that are in great demand from industry in India and other countries. CIRCOT is a NABL-accredited laboratory under ISO 17025 and a Referral Laboratory for testing of textiles/cotton fibres. It received ISO 9001: 2008 certification in June 2014.

3.6 Management

Indian Council of Agricultural Research has developed a system for ensuring better research, administration and financial management for its Institutes which is updated in line with government directives. As per instructions from Council, *MIS-FMS* system has been implemented for official work. All purchases are being made through e-procurement/ GeM portal as applicable as per government directions. Biometric attendance system is in place. The QRT looked into the schedules of holding the meetings of various institute committees such as Research Advisory Committee, Institute Management Committee etc. and observed that there had been good regularity in organizing meetings of various committees.

(a) Institute Management Committee (IMC)

CIRCOT has a Management Committee constituted by the Indian Council of Agricultural Research. The IMC of CIRCOT has met 5 times during the reporting period and decided on the issues placed before it from time to time ensuring that the decisions are in tune with the policies of ICAR and mandate of the Institute. The Committee deliberated on the action taken on the recommendations made in previous meetings, progress of expenditure, progress of works, welfare measures, functioning of the IJSC and Grievance Committee, etc. By and large, the suggestions and recommendations are implemented in compliance with ICAR's policies and decisions.

(b) Institute Research Council (IRC)

The CIRCOT's Institute Research Council meetings were held every six months and its actions were consolidated annually as per the requirements. New project proposals were discussed and approved and progress in on-going projects was discussed in these meetings by the project handling scientists and associated technical officers of the

Institute Headquarters and Regional Units. Proceedings of the meetings were circulated to all scientists and technical officers. The research project files are maintained by the PME cell as per ICAR norms and proceedings of the Institute Research Council of CIRCOT with a copy of approved files sent to investigators.

(c) Research Advisory Committee (RAC)

The RAC constituted for CIRCOT by the ICAR has met once every year prior to the annual IRC and reviewed the progress in R&D activities of the Institute and suggested modifications, improvements / new programmes wherever necessary in tune with CIRCOT mandate. Most of the recommendations of a technical nature have been implemented by the Institute. Many of the new implementable programmes suggested by RAC have also been executed.

(d) Institute Joint Staff Council (IJSC)

The number of meetings held and decisions and action taken have been found to be as per prescribed procedures and ICAR Rules.

(e) Annual Reports of CIRCOT

CIRCOT has been up-to-date in the publication of its annual reports and during the review period, all annual reports in English as well as Hindi have been timely published as per ICAR norms. It was worth noting that all Hindi translation required for Hindi annual report introduced since 2012-13 has been carried out in- House.

3.6.1 Budget & Finance

(Rs in lakhs)

Period	Plan			Non Plan*		
	R.E.	Expenditure	Utilization %	R.E.	Expenditure	Utilization %
2012-13	410.50	410.49	99.99	2159.88	2159.88	100.00
2013-14	210.00	207.24	98.68	2560.35	2560.35	100.00
2014-15	295.00	294.97	99.98	2924.77	2724.77	93.16
2015-16	425.25	425.17	99.98	2916.01	2916.01	100.00
2016-17	329.60	329.56	99.98	2927.84	2927.78	100.00
Total	1670.35	1667.43	99.82	13488.85	13288.79	98.63

* Including Pension, Loan and Advance

Budget utilisation throughout the review period had been very good. It is also observed that compared to previous plan period, total plan budget allocated to the institute has reduced by about 40% with reduction being higher during 2013-14 and 2014-15. Situation was better in next two years and institute could also get some funds from the overall amount of Rs. 130 crore and 108.97 crore provided to the institute during 2015-16 and 2016-17 respectively for CRP project on Natural Fibres. Details of budget allocated to the institute from the above overall budget are listed below.

Allocation to CIRCOT under CRP project on Natural Fibres

Head	(Amount in Rs lakhs)		
	2015-16	2016-17	Total
Grant in Aid (Capital)	32.0	29.68	61.68
Grant in Aid (General)	35.07	21.75	56.82
Total	67.07	51.43	118.5

3.6.2 Resource Generation

Figures for the revenue generated by the institute through various means e.g. training, testing, licensing of technologies, royalty, consultancy etc are appearing in following Table.

Revenue generation by the institute over the period

Period	Target	(Rs in lakhs)
		Revenue generated
2012-13	55	153*
2013-14	66	60
2014-15	66	93
2015-16	137.4	106
2016-17	171.75	86
Total	496.15	498

**83 lakhs generated through sale of products developed under NAIP-CVC project*

QRT observed that during reporting period, i.e. 2012-2017, ICAR-CIRCOT generated total revenue of Rs. 498 lakhs against the ICAR target of Rs. 496.15 lakhs which is

100.3% of the target. Revenue generation during previous period was Rs. 348.69 lakh which was 99% of the target.

3.7 Technology Management

The Indian Council of Agricultural Research had formulated Guidelines for Management and Technology Transfer/Commercialization and taken several steps towards developing and strengthening IP management system. Its implementation involved setting up of ITMU and ITMC at the institute level and creation of BPD-ZTMC units in five geographical zones. West Zone unit was located at CIRCOT in view of its vast experience in IP related matters and close proximity to the Mumbai Patent office. It served as a bridge between ICAR headquarters and 18 ITMUs of West Zone.

(a) Institute Technology Management Unit (ITMU)

ITMU acts as a facilitating and supporting unit to identify the emerging technologies and to manage the IP portfolios of the institute. The unit scrutinizes and processes the cases brought before it for filing of patent applications. ITMU addresses the issues under IP regime and technology transfer as governed by the Institute Technology Management Committee (ITMC) following ICAR policy guidelines.

At institute level, various primary activities such as patent search, filing of application at concerned granting authorities, pre-grant and post-grant follow up, offering, advertising for commercialization, commercializing, license fee/royalty collection, etc., are handled by the Institute Technology Management Unit.

Prioritization, Monitoring & Evaluation (PME) Cell also supports in reviewing and making suggestions regarding technology commercialization.

(b) Institute Technology Management Committee (ITMC)

This institute level committee is chaired by the Director, CIRCOT and aids in providing decision support system at the institute level. It helps in addressing the IP related matters of the institution.

(c) Zonal Technology Management- Business Process Development (ZTMC- BPD) Unit

ZTM-BPD, West Zone Unit at CIRCOT, supported by ICAR under NAIP was catering to the individual and collective needs of the 18 ICAR institutes in West zone in matters related to IP protection, maintenance and technology transfer/commercialization. It

conducted entrepreneurship development programmes, pre-commercialization workshop, trainings, demonstrations, workshops for budding entrepreneurs and start-ups and its efforts led to the commercialization of many agribusiness technologies. ZTM & BPD unit was functioning at CIRCOT till 30th June, 2014.

(e) ICAR-CIRCOT-ABI Centre

ICAR-CIRCOT Agri Business Incubation (ABI) Centre was established under Component II (Incubation Fund) of National Agricultural Innovation Fund (NAIF) Scheme of the ICAR in January 2016 to facilitate incubation facilities to new startups/entrepreneurs & enterprises for innovative technologies before successful establishment of enterprises. The ICAR-CIRCOT-ABI Centre is currently working towards achieving the following objectives.

- ❖ Incubation and business development in cotton and its by-products
- ❖ Techno-entrepreneurial activities in cotton value chain for building prospective clientele
- ❖ Skill development in selected stakeholders related to cotton sector.

3.8 Facilities for Staff, Transport and Guest House

(a) Departmental Canteen

A departmental canteen serving tea, coffee, snacks and lunch at subsidized rates is functioning at CIRCOT. A spacious canteen hall has been provided with tables and chairs as well as a well-equipped kitchen along with continuous supply of fuel gas. Canteen is managed by a Canteen Committee consisting of five members appointed by the Director of the Institute.

(b) Recreation facilities

Space at CIRCOT headquarters is limited, still facilities for playing indoor games like Carom, Table Tennis, Chess, etc. are provided and employees are encouraged to participate in sports. Recently, a gymnasium is created in the basement of newly constructed annexe of Yashwantrao Chavan Bhavan. Various facilities like treadmill, multi-gym and ab machine are available apart from weights and dumbbells.

(c) CIRCOT Employees' Co-operative Credit Society

To enable staff members to get medium term loan at nominal interest rates (presently 9 % p.a.) a co-operative credit society has been functioning at CIRCOT. All staff members with service of three years or more are eligible to become members of the Society, which grants loans up to Rs.1.00 lakh depending upon the shareholding of

individual members. The profit is distributed as a dividend to eligible members at the end of every financial year. The Society is run by managing committee consisting of 9 members, 7 elected by members and 2 members nominated by the Director who is the ex-officio President of the Society. The accounts of the Society are audited every year by external auditors appointed by the registrar of co-operative credit societies.

(d) Transport Facilities

CIRCOT has five vehicles, one Ambassador car, one Tempo Traveller with a seating capacity of fourteen, and three jeeps each with a seating capacity of seven i.e. Scorpio, Bolero and Tata Sumo. The Scorpio jeep is for use by Director, for his official visits in Mumbai and for travel of visiting dignitaries for local use. The Bolero jeep and Ambassador Car are also used for the local travel of visiting dignitaries. The Bolero jeep and the Tempo Traveller are employed for making local purchases, collection of cotton samples from railway stations and also for the visits of trainees to various institutions as part of training programmes. The Tata Sumo, with a seating capacity of seven purchased in 2009-10 is for official use of Ginning Training Centre, Nagpur.

(e) Guest House/ Trainee Hostel

CIRCOT has recently modernized its guest house facilities available at CIRCOT office complex itself. The guest house is managed by an in-charge with administrative support provided by CIRCOT. CIRCOT has in all 12 rooms consisting of six bedded two rooms, four bedded one room, three bedded two rooms, single bedded one room, two VIP rooms, and two bedded four rooms. The total occupancy of the guest house is 35. All the rooms are air conditioned and provided with TV. CIRCOT has also provided a separate lift facility for the occupants. Two VIP rooms have been provided with internet facility.

(f) CIRCOT Employees Welfare Fund (CEWF)

CIRCOT Employees Welfare Fund established with the personal voluntary contribution of staff members has always been a good support to staff. Director is its ex officio President and a management committee for a term of three years is elected by the AGM which conducts regular meetings and offers loans up to Rs 40,000/- to needy persons for medical needs (interest free) and for education purposes (at 3% simple interest). It also offers awards to meritorious wards of the members who have passed S.S.C., H.S.C., Diploma, Graduation and Post-Graduation (including professional courses such as Engg. & MBA).

(g) Staff Quarters

CIRCOT has provided housing facility to some of the staff members in the quarters located at Mahim and Ghatkopar in Mumbai and also at Nagpur. Details of the existing facilities are indicated below:

Place	Category	No. of flats
Mumbai (Mahim)	Type II	34
Mumbai (Ghatkopar)	Type III	30
Mumbai (CIRCOT Premises)	Type V	2
Nagpur	Type I	4
Nagpur	Type III	2

Type I quarters building housing 16 flats located at Mumbai (Mahim) was vacated and later demolished as it was declared to be unfit for occupation by CPWD. There is lack of accommodation for higher officials. Construction of Type IV quarters at Mahim premises by CPWD is long pending in spite of allocation of funds. Allotment of 8 Type IV quarters at Antop Hill and two type V quarters at Ghatkopar CGS colonies under surplus pool from the Estate office, Mumbai has helped to ease the situation to some extent.

(h) New Office Building

Basement and ground plus two floors of Yashwantrao Chavan Bhavan annexe have been constructed and occupied during the review period. Construction of four more floors would be undertaken after sanction of funds.

3.9 HRD Efforts

Training the employees in any organization is an investment to help them and therefore the organisation to perform better by updating their skills and to make them understand their roles. It also works as an motivational tool. Even senior level officers and scientists need a refresher from time to time, to update and to invigorate their skills as well as to motivate them to do the best in the organisation. Details of trainings and foreign deputations are given in *Annexure IV* and it is seen that efforts have been made to get all categories of employees trained in the fields relevant for them. It is however seen from the list of deputations that foreign exposure in advanced areas is lacking and half of the deputations are for imparting training to African countries under cotton TAP and not for updating of skills. As majority of scientists at the

institute today are young, they would benefit from exposure and training at advanced centres of knowledge world over.

3.10 Education

To promote research and teaching in the sphere of cotton science and technology, the Institute has signed MoUs with a number of educational institutions like VJTI, SNDT and ICT in Mumbai; DBSKKV, Dapoli and UAS, Dharwad. This enables not only in carrying out joint research work but also creates an opportunity to pursue postgraduate & doctoral degree programmes. In addition, to promote the quality of post graduate research and training in cutting edge areas, the Institute facilitates students from NARS and other organizations to access specialized guidance and facilities as per the ICAR guidelines. The University of Mumbai has also accorded permanent recognition to ICAR-CIRCOT for guiding students leading to **M.Sc. (by research)** in subjects: Physics, Bio-physics, Microbiology, Physical Chemistry and Organic Chemistry and **Ph.D** in Physics and Microbiology.

The Institute scientists are also recognized as co-guides for Post-Graduation and Ph.D by Institute of Chemical Technology (ICT) Mumbai; Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli; University of Agricultural Sciences, Raichur; VJTI Mumbai and SNDT Womens' University, Mumbai.

ICAR-CIRCOT also imparts 1 to 6 months hands-on training especially in the fields of textile technology, textile chemistry, biomass utilization, microbiology and nanotechnology to Postgraduate students leading to submission of dissertation as a part of course curriculum, as per the guidelines given by ICAR.

3.11 Sports

CIRCOT is regularly participating in ICAR annual Inter-Institute Zonal Sports Meet. CIRCOT's contingent is usually of 40-60 staff members who include both men and women. During the five year period under review, CIRCOT won 16 gold and 21 silver medals in events like Athletics, Chess, Carrom, Table tennis, Badminton, Kabbadi and Volleyball at the West zone tournaments. It is encouraging to note that ladies have taken the lead in many of the events. Participation in annual sports meet has served to strengthen the spirit of friendship and camaraderie among the employees. QRT feels that the practice must continue with the same vigor.

Chapter 4

Programmes and Projects

4.1 Core Area and Projects

Institute research programmes are divided into five core areas. A list of the various institutional and externally funded projects undertaken at the institute under each core area appears below:

Core Area I: Pre-Ginning and Ginning

S.No	Name of the Project	Duration
1.	Engineering Interventions for improving Energy Efficiency in Bale Presses	May 2010 – March 2013
2.	Design and Development of Pollution Abatement System for Collection of Flying Dusts from Ginning and Pressing Halls	October 2011 - September 2013
3.	Evaluation of Engineering and Economic Performance of High Capacity Rotary Knife Roller Gin for Indian Cottons and Optimization of Machine and Process Parameters for Efficient Ginning	October 2012 - September 2015
4.	Investigation of Forces Acting on Different Components of Double Roller (DR) Gins under Different Working Conditions	January 2015 – December 2017
5.	Design and Development of Single Locking Cotton Feeder for Double Roller Gin for Enhancing Ginning Efficiency	April 2016- March 2018
Externally funded projects		
6.	Development of Cotton Picking Machinery for Small Scale Cotton Production Systems (TMC MM1.4)	April 2013 – March 2017

Core Area II: Mechanical Processing, Technical Textiles and Composites

S.No	Name of the Project	Duration
1.	Standardization of Compression Molding Machine Parameters for Natural Fibre Reinforced Composites for use in Construction Purposes as Wood Substitutes	October 2012 - March 2013
2.	Studies on Preparation of Composites from Fibrous Waste Material	November 2013 – October 2015
3.	Development of Innovative Fibre Blends and Finishes for Improved Functionality of Cotton Textiles (Flagship project)	April 2012 - March 2017
4.	Development of High Performance Cotton Textiles by Electro Spraying / Spinning Technique	October 2012 - September 2015
5.	Improvement in coconut fibre compatibility for production of superior quality fibre reinforced composites	November 2012 - September 2015
6.	Development of Activated Carbon from Cotton Stalk for Use in Protective Textiles	April 2016- March 2018
7.	Development of Durable Antimicrobial Cotton Textile through Fibre Blending Process	April 2016- March 2018
Externally funded projects		
8.	A Value Chain for Coconut Fibre and its By-products: Manufacture of Diversified Products of Higher value and Better Marketability to enhance the Economic Returns of Farmers (NAIP)	December 2008 - March 2013
9.	Design and Development of Rubber Dams for Watersheds (NAIP)	January 2008 - March 2014
10.	Biodegradable Electro spun Fibre Mat for Use in Packaging of Fresh Perishable Agricultural Material (NFBSFARA)	April 2013 – March 2015

11.	Electrospinning Geometry Optimization for Preparation of Core-sheath Nanofibers and Conversion of Nanofibers into Yarns (DST)	March 2012 - March 2014
12.	Jute Based Bio Composite for Industry (NFBSFARA)	April 2012 - March 2015

Core Area III: Characterisation – Cotton and Other Natural Fibres, Yarns and Textiles

S.No	Name of the Project	Duration
1.	Evaluation of the Quality of Cotton Samples under the All India Co-ordinated Cotton Improvement Project / Quality Assessment and Performance Improvement of Indian Cottons	(1924 - Continuing)/ April 2012-March 2017
2.	Evaluation of Quality of Standard Varieties of Indian Cotton	(1926 - Continuing) April 2012- March 2017
3.	Design and Development of Portable Moisture Instrument for Cotton using Customized Sensor Designed for Fixed Volume and Uniform Packing Density	October 2010 - September 2012
4.	Design and Development of RFID Bale Tagging and Software System for Centralised Bale Trading and Tracking Application	October 2011 - September 2013
5.	Development of Objective Fabric Handle Model for Indian Market	April 2012 - March 2015
6.	Design and Development of Lint Opener for Preparation of Samples for Micronaire Testing	April 2015-March 2017
7.	Survey on the Contamination Status in Indian Cotton	May 2014-April 2016
8.	Design and Development of Field Level Banana (Musa spp.) Pseudostem Fiber Extraction Machines	April 2011 - March 2014

Externally funded projects		
9.	A Value Chain for Cotton Fibres, Seed, Stalks: An Innovation for Higher Economic Returns to Farmers and Allied Stake Holders (NAIP)	December 2007 - December 2012
10.	A Value Chain on Banana Pseudostem for Fibres and other Value Added Products (NAIP)	June 2008 - March 2014

Core Area IV: Chemical and Biochemical Processing and Biomass & By-Product Utilisation

S.No	Name of the Project	Duration
1.	Surface Modification of Cotton Textiles using Nano Technology to Impart Super Hydrophobicity	October 2010 – September 2012
2.	Nano-finishing of Cotton Textile to Impart Flame Retardance and U.V. Protective Functionalities	October 2010 - March 2013
3.	Utilization of Tender Coconut Husk for Dyeing of Natural Fibre Fabric	April 2011 - March 2013
4.	Use of Plant Extracts for Dyeing and Imparting Ultraviolet Protective and Antibacterial Properties to Cotton Textiles	April 2012 - March 2014
5.	Improving Interfacial Interaction of Nanocellulose with Commodity Polymers to Enhance their Performance	April 2012 - March 2014
6.	Fire Retardant Finishing of Cotton Fabric using Herbal Extract	October 2012 - September 2014
7.	Regeneration of Discarded Polymerized Frying Oil and its Utilization	October 2012 - September 2015
8.	Low Temperature Technology for Preparation of Absorbent Cotton for Decentralized Sector	November 2013 – October 2015
9.	Multifunctional Durable Finishing of Apparel Grade Cotton Fabrics with Nano ZnO	November, 2013 – March, 2016

10.	Development of Innovative Dyeing and Finishing Process for Cotton Garments	April 2015-March 2018
11.	Advanced Technology to Predict Dye Recipe for Non-metameric Colour Matching in Textile	April 2015-March 2017
12.	Development of Suitable Solvent Extraction Process for Obtaining Low Gossypol Cottonseed Meal for Non Ruminant Feed and Food Applications	April 2016- March 2018
13.	An Accelerated Process for Preparation of Bioenriched Compost from Cotton Plant Residues	April 2011 - March 2013
Externally funded projects		
14.	Development of Gossypol-free Lysine-rich Cottonseed cake by Solid State Fermentation (NFBSFARA)	June 2012 - May 2014
15.	Improvement in Cotton Quality by Plasma Nanotechnology: An Eco-friendly Approach (NFBSFARA)	June 2011 - May 31, 2014
16.	Agro Techniques for High Density Planting System and Surgical Cotton Varieties (TMC MM1.7)	June 2013 – March 2017
17.	Preparation of Specialty Grade Pulp from Cotton Linters for Production of Security Paper (ICAR- Extra Mural)	February 2016- March 2018
18.	Cellulose Based Nano Composite Film for Application in Packaging (CRP Nanotechnology)	January 2015- March 2017
19.	Preparation of Nano-Lignocellulose and its Incorporation in Polymer Composites for Improved Performance (CRP Natural Fibres)	April 2015-March 2020
20.	Eco-friendly method for the preparation of absorbent/surgical cotton from non-spinnable cotton (CRP Natural Fibres)	April 2015-March 2020
21.	Sustainable Green Technology for Dyeing of Cotton Textile (CRP Natural Fibres)	April 2015-March 2020
22.	Utilisation of Ligno- cellulosic Fibre based Biomass as Renewable Energy for Rural and Industrial Application (CRP Natural Fibres)	April 2015-March 2020

Core Area V: Technology Marketing

S.No	Name of the Project	Duration
1.	Impact Assessment of CIRCOT Bajaj Cotton Pre-cleaner	October 2012 – September 2014
2.	Popularization of CIRCOT Technologies on Compost and Oyster Mushroom Production using Cotton Stalks among the Cotton Growing Farmers of Vidarbha Region	April 2016-March 2017
3.	Application of Nano Cellulose in Cement Concrete, Rubber Composites, Pulp and Paper for Enhancement of Functional and Mechanical Properties	April 2016-March 2017
4.	Assessment of Factors Influencing Adoption of Scientific Cottonseed Processing in India	April 2016-May 2018
Externally funded projects		
5.	Zonal Technology Management and Business Planning & Development Unit at CIRCOT, Mumbai (NAIP)	November 2008 - June 2014
6.	Technical Assistance Programme to Strengthen Cotton Value Chain in Cotton 4 Countries (Benin, Burkina Faso, Chad & Mali) and Malawi, Nigeria and Uganda in Africa (Min of External Affairs, GOI)	January 2012-September 2016
7.	Agri Business Incubation Centre at ICAR – CIRCOT, Mumbai (NAIF)	January 2016 - March 2020

4.2 Balance between Basic, Strategic & Applied Researches

CIRCOT has had the history of carrying out basic studies on cotton, right from the days of its inception, when the technology of diversified utilisation of cotton fibre was still at its infancy in the country. Fibre morphology, chemical components, fibre quality variations between seeds, between fibres on the same seed, strength of attachment between fibre & seed, inter-specific property variations etc., have been the subjects of detailed study. While in early decades, such studies were aided by primitive techniques and machines, in later years they were studied more thoroughly using state-of-the-art equipments like X-ray diffractometer, electron microscopy,

sophisticated chemical analysis apparatus etc. The wealth of data generated over the decades has led to a clear understanding of cotton fibre and its behaviour, thereby providing the foundation for applied researches in later years.

With the change in names of research divisions from basic sciences like physics, chemistry, microbiology etc., into function-oriented designations like MPD, QEID, CBPD etc. in 1997 and through directions received from headquarters, Scientists started showing preference to undertake applied research problems. Over the last 20 years, there has been a notable shift as exemplified by projects in domains such as development of blended textiles, by-product utilization, eco-friendly textile processing, nanotechnology applications in textile and other allied fields, ginning and allied machinery designs, etc.

During the review period, CIRCOT Scientists have forayed into fields like nano and plasma technology and electro-spinning and their applications in textile and allied fields and funding from NFBSFARA of ICAR has helped in undertaking basic research studies. QRT observes that focused efforts on basic research are needed to create a foundation for future applied research.

Chapter 5

Major Achievements of Research

5.1 Core Area I: Pre-Ginning and Ginning

- It was found that about 90% fine dusts are emitted from the ginning point of double roller (DR) gins and hence an enclosure system was designed and developed which arrested around 80% of the total dust generating from this point.
- Single locking cotton feeder was designed with three different mechanisms. 1) Saw band cylinders with twin regulator and apron 2) Spike cylinders and feed roller 3) Combination of spike cylinders and feed roller with saw band cylinders and apron. Prototypes of single locking cotton feeder with these three designs were fabricated.
- The optimum settings for DR gin for efficient ginning were worked out and these were found to be 8% moisture in cotton, 1.2 mm clearance, 1/3rd of the staple length for cut off and 85 mm as fixed knife position. These resulted in maximum lint productivity of 84 kg/h.
- It was found that long and extra-long staple cotton can be effectively ginned on commercial rotary knife gin without any adverse effect on fibre and yarn quality at optimum conditions of roller speed in the range of 200-225 rpm, rotary knife speed of 400-450 rpm, feeder roller speed of 18-20 rpm and a pressure of 80 bar between the roller and the rotary knife.
- About 10% decrease in cost of operation for up packing and conventional presses was found as compared to down packing type presses with capacity of 15 and 25 bales/hr.
- An onboard cleaner based on sling off action was developed for on-field cleaning of machine stripped cotton for reducing its trash content. The developed cleaner was integrated with the cotton stripper developed in collaboration with ICAR-CICR, ICAR-CIRCOT and Mahindra & Mahindra
- A bale tracking method was developed by attaching a unique RFID tag with one of the twelve cotton bales straps during the packing operation. Software was developed with features to record the Mandatory Parameters like Pressmark No, Year of manufacture, Lot Number, Bale Number and Weight and Optional Quality Parameters like Grade, Variety, Fibre Length, Micronaire, % UR, Trash and Moisture.

5.2 Core Area II: Mechanical Processing, Technical Textiles and Composites

- Composition of fully bio- degradable Cotton and PLA blend was optimised to have good moisture management property suitable for sportswear applications.
- Blending cotton with bamboo viscose improved the softness and drape of the cotton-rich blend.
- Nonwoven materials were produced using cotton and Superabsorbent fibres (SAF) using low melt polyester as the binding material.
- Cotton fibre was blended with antimicrobial polyester fibre of 1.2 denier and 38 mm length to produce durable antimicrobial property in yarn.
- A multi-sheath feeder attachment to Raspador machine was designed and developed for improving the output of fibres extracted from banana pseudostem sheaths.
- A pedal driven machine named as CIRCOT - Phoenix Charkha was developed for spinning banana pseudo-stem fibres and other coarse long-staple fibres at the cottage level. This charkha can produce fairly fine yarn with sufficient uniformity from natural fibres which are otherwise difficult to spin.
- Finest coconut fibres obtained by coconut fibre segregating machine developed at the institute were used to make cotton covered Jute-coconut composite yarns with good mechanical properties.
- An improved design of adhesive activated reinforcing fabrics for fabrication of high performance rubber composites suitable for rubber dam was developed. It was then shaped into a suitable waterproof and wrinkle-free dam as per the required size of the check dam. A low-cost inflation–deflation mechanism along with a suitable installation method was also developed.
- Under the sponsorship of DST, New Delhi and in collaboration with IITM, Chennai and a private company, M/s. Physics Instruments Co., Chennai, a novel collector system for the electro-spinning process for production of nanofiber based yarns has been developed. The friction spinning collector for the electro-spinning setup was designed and fabricated.
- A multi-phase electro-spinning system setup has been fabricated with multi-axial arrangements with different nozzle geometry, angle adjustments and automated linear motion stages and multiple parallel needles to increase the productivity. Prepared electro-spun fibre mat was used as substrate for production of colorimetric sensor for monitoring the ripening of packed mangoes.

- By using jute sliver as core and polypropylene sliver as sheath material, friction spun yarns were produced using the DREF- 3000 spinning machine with three different Jute/PP core: sheath ratios
- The core spinning technique was used for combining the jute yarns and PLA fibres together, followed by preparation of the plain woven matrix of the yarn and then, the composites were prepared by thermo-moulding processing.

5.3 Core Area III: Characterization – Cotton and Other Natural Fibres, Yarns & Textiles

- Under the AICRP, the breeding material from cotton breeders of various states is systematically screened every year for fibre quality, yield and pest resistance. Promising genotypes are subjected to further trials. The Institute evaluates fibre quality of several thousand samples required to be screened prior to identifying a variety, which is superior to an existing one. CIRCOT has been successful in ensuring that better yielding varieties meeting the desired quality requirements alone are released for commercial cultivation. Total number of cotton samples received, tested and reported to the respective Cotton Breeders and the Project Co-ordinator at AICRP headquarters, Coimbatore under AICRP over the years is listed below.

Year	2012-13	2013-14	2014-15	2015-16	2016-17
No. of sample	3686	2328	3469	3755	2825

- As HVI mode is used internationally, this mode has now been adopted by the institute from 2015-16 onwards and accordingly new provisional quality norms in this mode have been developed.

During the review period, following varieties / hybrids of cotton have been released for commercial cultivation under AICRP.

Year	Varieties / Hybrids of cotton (Area/ Zone has been given in brackets)
2012 – 13	NACH 12, Anand Desi Cotton 1, H 1300, Phule Anmol (RAC 024), Phule Dhanwantary (Rharb 02-1)
2013 – 14	RG 542
2014 – 15	NACH 18
2015 – 16	Bt Cotton genotypes released for North Zone 2016 RS 2013, PAU 1, F 1861
2016-17	--

- During the period under report, 59 samples of 26 released standard cotton varieties from cotton breeders were received for verification of fibre quality parameters. Analysis revealed that these varieties are maintaining their release time values except for HD123 for 2.5% span length.
- A new device was developed in partnership mode with M/s Precision Tooling Engineers, Nagpur for opening of cotton lint samples for micronaire testing.
- Prototype of portable moisture meter for measuring the moisture of cotton using customized sensors for fixed volume and uniform packing density was developed. Disc type, cup type and probe type of moisture sensors were developed to measure the moisture content of seed cotton, lint and bale.
- Indian Cottons were designated as the most contaminated in descriptions by the International Textile Manufacturers Federation (ITMF), Zurich, Switzerland. A survey on the contamination of Indian Cottons, using the developed questionnaire, was undertaken in around 50 spinning mills from different zones. The overall contamination status of the cotton was graded as insignificant to moderately contaminated with less than 10% of the surveyed mills reporting severe contamination.

5.4 Core Area IV: Chemical, Biochemical Processing and Biomass & By-Product Utilisation

- An energy efficient technology for preparation of absorbent cotton was developed using enzymes. The developed process is eco-friendly with savings in energy, time and water along with minimum physical and chemical changes in the fibre.
- Many desi cotton cultures suitable for absorbent cotton applications were identified.
- Three naturally brown linted *arboreum* cotton cultures having good fibre and colour stability properties developed by joint CICR- CIRCOT team were registered with germplasm registration committee of ICAR.
- Very simple and effective method for producing durable antibacterial and UV protective finish to cotton fabrics by synthesizing nano-ZnO directly on cotton fabric was developed.
- Durable UV protection properties were imparted to cotton fabric by application of synthesized titania nano sol.
- An encapsulation process has been developed for mosquito repellent finishing using citronella oil for application on cotton. Application of microcapsules was done using multi layer coating technique to increase the durability of the finish.

- Aqueous extract of the tender coconut husk was used for the dyeing cotton. Simultaneously mordanted and dyed cotton fabrics displayed best shades.
- Treatment of cotton fabrics with aqueous extract of tannin rich substances such as Harda (*Terminalia chebula*) or Beheda (*Terminalia bellerica*) fruits, pomegranate rinds and flowers and then fixing the tannin materials by alum improved the UV protection of the fabric from poor (UPF 5) to excellent (50+).
- Different sizes of plasma reactors, such as 6 X 7 cm², 6 X 11 cm², 6 X 15 cm², 15 X 15 cm², and 15 X 20 cm² with and without cooling system were designed and fabricated. After plasma treatments, water absorbency significantly increased in various textile substrates.
- An eco-friendly natural flame retardant finish has been prepared from the banana pseudostem sap for textile application. Treated fabric showed good FR property, as its LOI improved to 1.6 times of the untreated control. It however was not wash durable
- To address the issue of non-metameric colour matching in textiles a database was prepared by dyeing the cotton fabrics with various concentrations of reactive dyes through which dye recipe can be calculated to match any shade.
- To improve the interfacial interaction between nanocellulose and nonpolar polymer matrices in composites for high mechanical properties, the surface of cellulose nanocrystals was successfully modified to impart hydrophobic properties.
- The polymerized used cottonseed oil was purified using a combination of adsorbents such as silica gel, activated charcoal and aluminum oxide through column chromatography. The quality parameters of purified oil improved significantly in single pass.
- A novel process was developed for gossypol reduction and nutritive quality enrichment in Cottonseed cake using solid state fermentation. The free gossypol, bound gossypol, crude protein, crude fibre and lysine contents in initial and fermented CSC were (2200, 360 mg/kg), (2100, 770 mg/100g), (20, 33.5 %), (35, 25%) and (0.4, 0.8 %) respectively. The gossypol level in the fermented cake meets the standards as prescribed by food and drug administration and protein advisory group, USA. The feed conversion ratio was found to be effective up to 40 % replacement of soybean meal with fermented CSC in the diet of both broilers and layers.
- Mixture of acetone with water was found effective in removing both free as well as total gossypol and in lab trials, 70% reduction in total gossypol and 97% reduction in free gossypol content of powdered cottonseed kernels was observed and the

extracted residue could meet the BIS criteria in this respect for edible cottonseed flour.

- A methodology was formulated for preparation of activated carbon from cotton stalks using phosphoric acid soaking method followed by thermal degradation. The yield of activated carbon was found to range from 49% to 92%.
- A rapid microbial composting process was developed for preparation of bio-enriched compost from cotton stalks. Good quality compost was prepared after 45 and 60 days from wet and dry cotton stalks respectively.

5.5 Core Area V: Technology Marketing

- ZTM & BPD unit-CIRCOT commercialized thirty (32) technologies, generated revenue of more than Rs. 1 crore, supported over one hundred and twenty (129) entrepreneurs and incubated 15 budding entrepreneurs, organised 30 events for entrepreneurship development, facilitated twenty nine (29) consultancy agreements and filed fifty two (59) patents.
- The exemplary performance of ZTM & BPD unit-CIRCOT was duly recognized by ICAR and the unit was bestowed with Best performing NAIP Business Planning and Development unit for the Technology Commercialization award at the Agri-tech Investors meet 2013 held in New Delhi.
- ABI centre of CIRCOT has admitted six startup/entrepreneurs for incubation, with one graduated incubatee; developed and commercialized five new product innovations; conducted eleven training programs and eight conferences/seminars/workshops for canvassing institute technologies among stakeholders and entrepreneurs.
- Technical Assistance Programme (TAP) for development of cotton sector in African countries was implemented as per Second Africa-India Forum Summit (AIFS). The Cotton TAP was conducted by CIRCOT was aimed at providing development support for the cotton sector in the C-4 countries (Benin, Burkina Faso, Mali and Chad), Nigeria, Uganda and Malawi. The country-specific problems related to processing and value addition prevailing to a great extent in these countries were understood and measures to mitigate them were being implemented under this programme. ICAR-CIRCOT, one of the implementing agency of the Cotton Technical Assistance Programme (TAP) for Africa.

5.6 Extramural project

- Specialty grade pulp was produced using different natural fibres. Among all the fibres, flax fibre emerged as the best fibre in terms of double fold even after bleaching and its bursting strength was found to be higher than the standard requirement and very close to banana fibre which has highest bursting strength.

5.7 CRP-Nano

- Starch-nanocomposite films using nanocellulose fillers was developed. This can hold oil after thermal sealing, without any leaking or deformation. The pH based sensor in the starch nanocomposite film for visible detection of fish spoilage in packaging was demonstrated using the pH indicators (methyl red / bromo cresol green) and trimethylamine as a representative odour chemical for fish spoilage.

5.7 CRP on Natural Fibres

- Pellets prepared from 3 mm cotton stalk chips, 8% cashew nut shells and 0.07% starch as binder resulted in lowest ash content (less than 6%), highest calorific value (about 4200 kcal/kg), lustrous surface finish, improved durability and bulk density of cotton stalk pellets. Explored the possibility for use of cotton stalk briquettes for burning of dead bodies. Developed pellet testing facility at GTC for measuring durability index, fines, bulk density, etc.
- About 61% increase was noticed for impact strength due to addition of fibrillated coconut fibres in epoxy composites.
- New enzyme developed for scouring of cotton fibre is more economic than existing pectinase. The same enzyme can also be used for scouring of any cotton material like woven fabric, knitted fabric or any other form before dyeing or printing.
- A process to use sea water for dyeing of cotton using reactive dyes with low salt has been developed. Salt free dyeing process for cotton with reactive dyes using organic chemical has also been developed.

Chapter 6

Linkages

ICAR-CIRCOT, a renowned research institute in India is carrying out basic and applied research in post-harvest technologies relating mainly to cotton and its byproducts. It has undertaken research in areas of nanotechnology, technical textiles, composites, ginning, textile processing and finishing, by-product utilisation etc. Over the years, the institute has successfully completed many multi-disciplinary collaborative research projects and in the process has developed extensive and strong linkages and collaborations with many other research organizations- agricultural universities, academic institutions, industries and private organizations both nationally and internationally.

Participation/Presentation of papers by Scientists and Technical Officers in national/international conferences/seminars, and publication of original research papers in national and international journals enables the transfer of expertise and information to the user groups. Scientists of the institute are also active members in many advisory panels of other textile research institutions like ATIRA, BTRA, SITRA and also in the various committees of CAI, CCI, etc., besides being invited to deliver lectures and to participate in research programmes of Institutions such as VJTI, ICT, DKTE.

ICAR-CIRCOT is also well known for its testing services. It has been accredited by the National Accreditation Board for Testing and Calibration of Laboratories (NABL), since 1999 and is now an ISO 9001 certified institute. The Institute has expertise and facilities for conducting more than 160 tests on different textile materials and cotton by-products, which are utilized by many textiles mills, government departments, research and academic institutions and the private sector.

The Institute continues to carry out commercial testing, consultancy projects and partnership MoU's with other research institutes, academic institutions, private companies, entrepreneurs, NGO's, start-ups etc. and in the process establishing fruitful and effective linkages with the varied agencies. ICAR-CIRCOT has linkages with NIRJAFT, CIFT, ICT, VJTI, Mumbai University colleges, DKTE, MGIRI, JDIET, Hindustan Unilever, Aditya Birla group, NIFT, WIPRO Enterprises, Birla Institute of Science and Technology, Intertek, IPCA Laboratories, Johnson and Johnson, Bajaj Steel Industries, Anjaneya Agro Tech, Grasim Industries, Pidilite Industries, Croda India, ITC, Lafarge India, Precision Tooling Engineers, Co. (P), Trytex machines, Kadri Mills, GREYY (A start-up firm), Bloom Textiles etc.

Institute has now widened its training activities and in addition to ginning and quality evaluation, subjects like nanotechnology, microscopy, cottonseed utilization, and absorbent cotton technology are also covered wherein participants from industry,

research institutions and academia from across the nation participate and interact with staff.

ICAR-CIRCOT continues to be associated with the Bureau of Indian Standards, and contributes a great deal to the development and standardisation of textile test methods. Many CIRCOT scientists have been chairman/members of different sectional committees of the BIS and have been instrumental in the preparation of several standards for textile testing

The institute through conduct of the above activities has been able to establish strong linkages with its many stakeholders who have always entrusted the institute with multi-fold research, analysis and consultancies. A majority of them have maintained their liaison with the institute over the years, which is a testimony to the fact that they are satisfied with the services offered.

A new development during the period has been the establishment of direct connection with farmers and educating them of the technologies developed by ICAR-CIRCOT through activities under Mera Gaon Mera Gaurav project initiated by GOI. Groups of scientists visit adopted villages in the Wardha district of Maharashtra and interact with farmers and help them in bettering their crops and produce. Similar activities were also conducted under the Tribal Sub-Project (TSP) scheme of GOI, where awareness and demonstration programmes in respect of farmer related technologies of the institute were conducted for farmers from villages in an around Coimbatore, Dharwad, Narayangaon (M.S.), Sirsa etc. There have also been many visits of farmers' groups to the HQ and GTC, Nagpur under ATMA programme.

A major activity involving many stakeholders internationally was the Cotton Technology Assistance Programme (Cotton TAP) to strengthen Cotton Value Chain in C-4 and other African countries. ICAR-CIRCOT, CICR, the IL&FS and the Directorate of Cotton Development were involved in this project. Successful linkages and collaborations have been established with agencies in countries such as Uganda, Malawi, Benin, Nigeria etc in addition to already existing international linkages with ICAC, CFC, UNDP, UMES, USA, CRI, Egypt etc.

A summary chart of the various linkages and collaborations is presented in Figure 6.1.

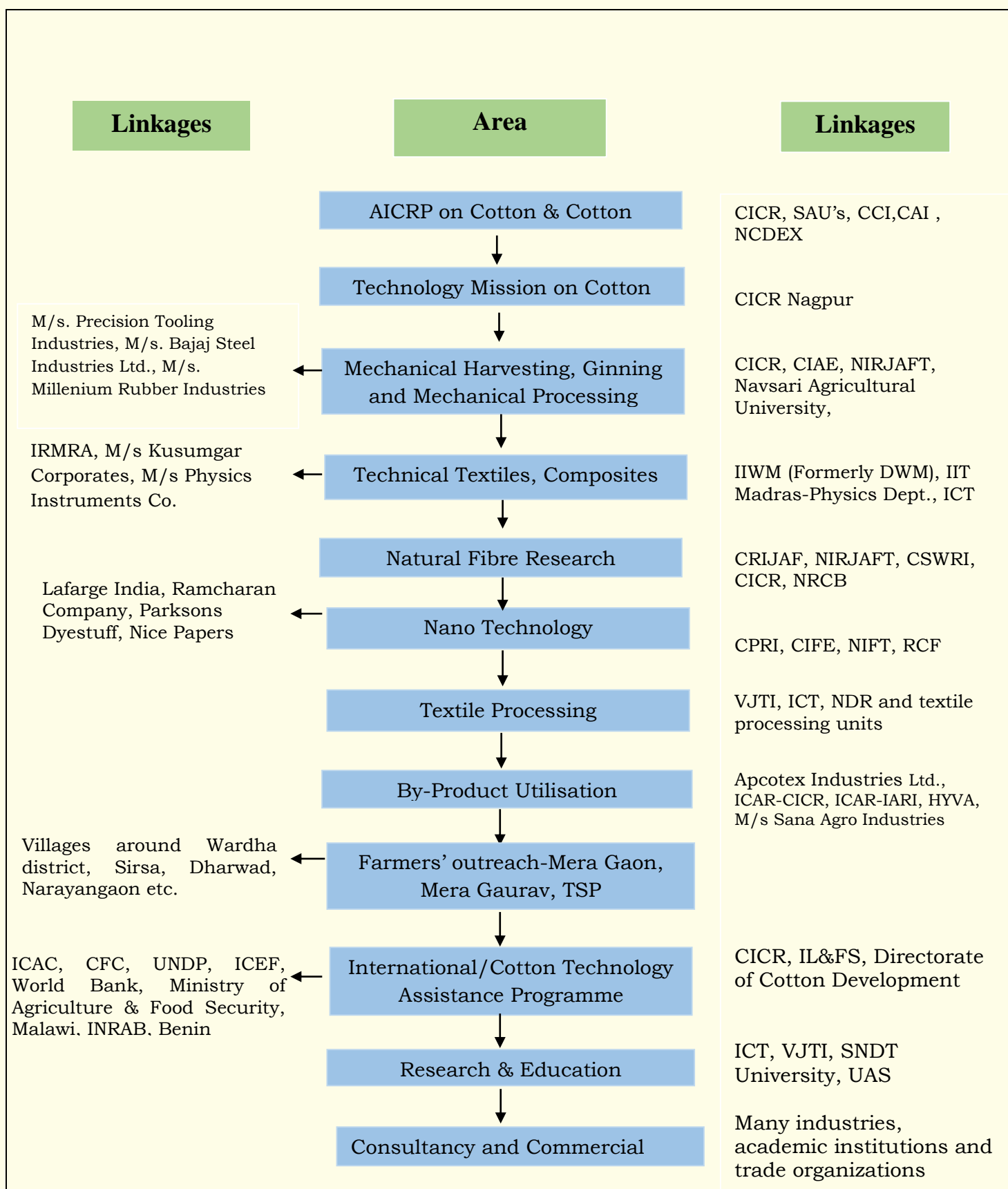


Figure 6.1 Schematic representation of various linkages of ICAR-CIRCOT

Chapter 7

Constraints

The QRT team noticed the following constraints at the Institute and its Regional Units:

1. Human Resource shortage

Presently, the positions of all four Head of the Division are vacant which is directly hampering the implementation of scientific programmes of the institute.

It is observed that 42% of the scientific staff positions were vacant on 31st March, 2012 which has increased to 48% on 31st March, 2017. Also the vacancies in technical cadre which performs the important function of assisting scientists in conduct of research and testing work have increased from 16.7% at the start of the review period to 39% of the total technical staff positions at the end of the review period. Strength of the technical staff is expected to reduce further in next 4-5 years in view of many retirements which would seriously affect the working of the institute. Much of the vacancies in technical staff are due to centralization of recruitment by ASRB at Delhi. Powers to recruit non- scientific staff which were earlier with Directors of the Institute may be restored in order to have timely recruitment.

As per the data available, almost 38% posts i.e. over 100 posts against the total sanctioned posts of 267 are vacant under different categories and that is further going to increase due to the retirement of staff in near future. This is hampering the working of the institute adversely.

2. International exposure

Scientists need exposure to international advances and cutting edge technologies to improve their skills. However it is observed from the budget details that no funds are provided for international HRD and most of the deputations (listed in Annexure V) were for imparting training to African countries. Scientists need to be deputed to UK, USA and other developed countries to improve their skills and to expose them to international advances and should be encouraged by providing opportunities and necessary funds in the budget allocation.

3. Provision of Instruments and Machinery

One of the mandates of CIRCOT is to provide technological support for improvement of the quality of Indian cottons and to act as referral laboratory for testing of textiles/ cotton fibres. Many of the instruments both at CIRCOT Headquarters and Regional Units are very old and have become obsolete as per current technology standards and need to be replaced on priority. Besides Research and Quality testing of samples, these

instruments are the promising source for the generation of revenue and hence it is necessary to replace them by new ones for which sufficient funds need to be allocated in the budget.

In addition to this, sufficient funds to update the labs to buy new machinery and equipments needs to be provided.

4. Infrastructure

CIRCOT at headquarters is having four buildings through which all the operations and most of the activities are performed. Research and development activities are expanding and more space is needed for laboratories and training activities. Present space may be effectively utilized by suitably increasing the height of the buildings within the local municipal norms and sufficient funds may be provided for the same. Additional space may also be acquired in nearby localities.

Ginning Training Centre at Nagpur is doing excellent work by providing a number of trainings even at International level with the current existing limited facilities. Facilities and infrastructure there needs to be expanded, strengthened and updated as it is only one of its kind centre in the country and all over the world. Special separate funds shall be provided to this activity on priority.

Regional quality evaluation unit of Sirsa is doing very well in research and extension activities and is housed in regional centre of CICR with very limited space. It needs one separate block and enhanced manpower to further expand research, training, extension and testing activities. CICR is ready to provide the space which was inspected by QRT team during the visit. Separate funds would be needed for construction.

5. Staff Quarters

Housing problem is acute in Mumbai. People have to travel long distances. Quarters availability for scientists and higher staff though eased to some extent due to allotment of some surplus pool quarters to institute from Estate office, Mumbai, is still not adequate. Availability of quarters for lower staff has also reduced drastically after demolition of dilapidated Type I Quarters. Long pending sanctioned construction of Type IV building should be completed at the earliest and construction of more quarters for other categories of staff should also be taken up.

6. Revision of BIS Standards

Indian cotton is handpicked and therefore contains much lower trash than machine picked cotton. Still Indian cotton is labeled as trashy by various international organizations such as ITMF and is sold at a discount. It was observed that the Standard specification of lint cotton bales prescribed by BIS, India allows a trash content of 4-5%. QRT members observed that the handpicked seed cotton is very clean with a trash level of about 2% and therefore the limit for trash level should be suitably revised to promote cleaner cotton bales and creation of a brand value for Indian cottons.

BIS standards for cottonseed and other cotton by-products may be formulated/ revised.

7. Library Funds

Access to foreign journals and other literature is essential to keep up to date information about developments in world relating to sectors under CIRCOT mandate but during the review period CIRCOT has drastically curtailed the expenses on subscription of these items. In view of the essentiality of access to latest research literature, the allocation of funds to library should be appropriately increased.

Chapter 8

Brief Achievements and Overall Assessment

Evaluation of CIRCOT on various parameters

Sr. No.	Parameter	Achievement				
1.	Number of New Externally funded projects came during the period (Annexure – VI)	14				
2.	Number of New machinery and process/technologies developed during 2012 -17 (Annexure – VI)	2012-13	2013-14	2014-15	2015-16	2016-17
		12	12	13	11	12
3.	Number of New Technologies (developed during this period) licensed (Annexure – VI)	13				
4.	Number of New Technologies developed and commercialized during the period. (Annexure – VI)	14*				
5.	Number of patents filed and granted during the period (Annexure – VII)	Filed			Granted	
		16			6	
6.	Number of research papers published in refereed journals (citations and h-index of the institutes)	Total	NAAS Rated		Citations	
		124	118		948	
7.	Number of trainings conducted and Number of participants (Annexure – VIII)	No. of trainings			Participants	
		National		100	1214	
		International		7	183	
8.	Number of National and International Awards received by scientists and institute	38				
9.	No of Media coverage (print and digital media separate)	Print			Digital Media	
		60			--	

*includes calibration cotton

i. Evaluation of public perception of the institute

CIRCOT is held in high esteem by its stake holders such as cotton trade and industry as well as researchers and public working on cotton. This was arrived at by looking at the feedback received from the parties availing its testing facilities, feedback from trainees attending its various training programmes and interaction with stakeholders during various interactive meets at Mumbai and regional units.

CIRCOT test results are considered very authentic and in spite of higher charges, parties get samples tested here. Students and researchers from many textile institutes and colleges and sister ICAR institutes avail of the testing facilities and guidance. Renowned companies have come forward to ask consultancy from it. Feedback from trainees participating in numerous training programmes shows full satisfaction about the training content and its conduct. CIRCOT calibration cottons are in use by most HVI users in mills. These are promoted by HVI manufacturers also and repeat orders are received.

ii. Evaluation of the working environment of the institutes and scheme (by sampling of file/papers movements and time delay, by talking to individual scientists, admin and other staff etc)

Working environment in general at the institute is good. Time taken in file/ papers movement is variable. Some papers such as those related to loan/ withdrawal from GPF account get cleared in 1-3 days. Advances such as TA/ CB advances are also granted within 2-3 days to one week. However settling of the advances takes more time and that may vary depending upon the completeness of papers also. Payment of TA and Honorarium bills of QRT chairman and members into their accounts (due to cashless policy of the institute) has taken 2 weeks to two months after submission.

iii. Impact assessment and economic gain due to the institutes/scheme.

Impact assessment/Economic gains due to institute activities are summarized below-

Technology

- Increment in the earnings of Ginning industry through reduction of trash content leading to bale value improvement to the tune of Rs 2500 crores
- Economic impact by way of foreign exchange earnings through export of ginning machinery worth Rs. 100 crores
- The calibration cotton, Standard Reference Material for calibration of fibre testing instruments, developed by the institute is an import substitute to USDA calibration

cotton. Around 2526 containers of the calibration cotton worth Rs. 15.20 lakhs were sold during the last five years.

- The institute established nano cellulose Pilot Plant facility based on the energy efficient process developed by the institute which is first in Asia and is in line with Make in India initiative. It has attracted 5 Research consultancy projects and 11 industrial linkages.

Impact to Farmers

- Commercial utilization of the cotton stalks (as briquettes and pellets) especially as source of renewable energy can fetch additional remuneration to the cotton farmers by sale of Chipped cotton stalks @ Rs 3000 per hectare.
- On-farm enterprise development through composting of the cotton stalks and by venturing into mushroom cultivation using cotton stalks
- Around 30 enterprises on Briquetting and Pelleting based on Cotton stalks are running successfully in Vidharbha region with about Rs. 120 Crore per annum turn-over.
- By linking the price to ginning outturn and the objectively measured quality parameters, Farmers in the Cotton Value Chain project area were able to fetch better prices: 3-4% increase in ginning outturn fetched up to Rs.300/Qtl. Premium to farmers

Skill Development

- Capacity building both in India and Abroad (Africa).
- More than 1300 personnel were trained and around 50000 farmers/stakeholders benefited directly from Awareness and demonstration programmes during review period.
- Capacity building in the ginning sector resulted in the benefit to the tune of Rs. 150 crore per annum through Improvement in efficiency, Reduction in processing cost and Improvement in bale value
- “Regional knowledge cluster cum training centre on Post-harvest and ginning Technology” was established at Benin, Africa under Cotton TAP programme

Impact on environment and sustainability

- Promotion of the Accelerated composting process of cotton stalks among farmers has resulted in improvement of soil health and sustainability of the production process.
- Utilization of cotton stalks for various purposes has resulted in reduced greenhouse gas emission due to their burning.

- Development of Eco-friendly wet processing methods for cotton textiles has resulted in lesser use of water and chemicals.

Others:

- 118 research articles were published in NAAS rated journals with 948 citations
- 16 technologies were commercialized, 5 incubatees were admitted to the Agri-Business Incubation (ABI) Centre and 26 MoU's were signed and 6 patents were granted to the institute.
- Two new start-ups established based on the institute technology
 - ✓ M/s. Sana Agro Pvt. Ltd., Raichur: Production of the Degossypolized cottonseed cake for use as poultry feed and fish feed.
 - ✓ M/s. Greyy Pvt. Ltd, Navi Mumbai : Development of Natural fibre based active wears
- Institute generated Rs.4.98 crore revenue through technology transfer activities, skill development programmes, research consultancy and commercial testing services; which is about 29.8% of the Plan budget allocation.

Overall Assessment

S.No	Performance indicators	Achievements/Remarks
1	Research projects undertaken; Institutional : Externally funded	38 : 24 (14 new)
2	Number of technologies; Generated : Commercialised	13 : 14
3	Number of patents; Applied : Granted	16 :6
4	Publications; JA : CP : Book Chapter : Training manuals : Leaflets :Others	124: 103 :18 :36 : 16
5	Awards and Recognition	38
6	Number of Trainings conducted: National : International	100 : 07
7	Education; Ph.D. awarded : Ph.D. on-going	02 :05
8	HRD; International Deputations : National Training Programmes attended by Institute staff	12 (including 4 for training) 60
9	Industry linkages – Stakeholders	43
10	Regional Units management	Nagpur and Sirsa units good, rest need improvement.
11	Research Division Management	Good
12	Seminars/Conferences/Workshops organised	24
13	Library and computer facilities	Good. More funds needed for Library
14	Financial management: Budget utilisation	99.82% (very good)
15	Revenue generation	Rs 498 lakh (very good)
16	Administration: Recruitments/work culture/discipline	Good
17	Grievance management	Satisfactory
18	Meetings organised; IRC/RAC/IMC/IJSC:	11/5/5/10
19	Infrastructure development and maintenance	Very Good
20	General: Social-cultural-sports activities	Very good
Overall Assessment of Institute Performance: VERY GOOD		

Chapter 9

Way Forward

9.1 Recommendations

1. Ginning Training Centre of CIRCOT

- 1) In view of lack of ginning training facilities in the world, efforts should be undertaken to upgrade Ginning Training Centre into International Ginning Training Centre (IGTC). Vacant land available in the premises of GTC, can be used for construction of Training & research block and amenities for the trainees. Ginning training available in USA is very costly; hence there is ample scope to provide similar type of training to Asian and African countries at a much lower cost. Centre already has the experience of training African participants.
- 2) Centre needs to be strengthened with more scientific and technical manpower.
- 3) Mechanical harvesting of cotton is the need of the hour due to labour shortage and high cost. So, suitable low cost mechanical harvester could be developed with the help of CIAE, Bhopal and CICR, Nagpur. Indigenous pre and post-cleaning machinery needs to be designed and developed to reduce trash content in mechanically harvested cotton.
- 4) Ginning Training Centre may be upgraded to a regional station of CIRCOT.
- 5) Extension activities on cotton by-products utilisation need to be strengthened by educating young farmers.

2. Reorganisation of Institute

It is observed that Core area III- characterisation of fibres is a prerequisite for Core area II- Textile manufacturing activities. Therefore the two Core areas can be clubbed together and Quality Evaluation and Improvement Division addressing to Core area III can be merged with Mechanical Processing Division addressing Core area II and the merged Division can be named as Fibre Science and Textile Manufacture Division.

Thus there would be following Divisions:

- 1) Division of Fibre Science and Textile Manufacture
- 2) Division of Chemical and Biochemical Processing
- 3) Division of Technology Transfer
- 4) Regional Centre of CIRCOT/ IGTC Nagpur

It is also recommended that discipline wise list of scientific staff for each Division/ centre should be in place. As majority of cotton produced is utilised for textile

purposes, scientific manpower at the institute should be in tune with this primary application.

3. Providing Adequate Manpower

There is severe shortage of human capital at the institute with about 38% posts lying vacant. Maximum crunch is seen in respect of scientists where 42% vacancies at the end of previous plan period have increased to 48%. Vacancies in technical cadre is also acquiring serious proportion with 39% vacancies. With many senior technical personnel due to retire in coming 4-5 years, research, testing and training functions of the institute would be badly affected. All four Head of Division posts are also vacant. This needs urgent attention and steps should be taken to fill the vacant positions.

4. Upgradation of Laboratories

Many of the sophisticated equipment required for day to day working of the institute are more than 10-15 year old with some being even more than 20 years old. These need frequent maintenance and it is also difficult to get the spare parts. These could not be upgraded due to resource crunch. There is a need for providing sufficient funds for their upgradation to latest models as well as procurement of new state of the art equipment and machineries to enable cutting edge research and reliable test results. This is very much needed if the institute has to maintain its referral laboratory status in cotton fibre/ textile testing.

5. Regional Quality Evaluation Units

QRT observed that the five regional units at Coimbatore, Sirsa, Guntur, Dharwad and Surat need to be upgraded in respect of infrastructure, facilities and staff. Specific recommendations in respect of each unit are listed below-

Coimbatore Unit:

- Centre may be strengthened with scientific and technical man power to develop liaison with textile mills.
- A workshop may be conducted at Coimbatore on calibration cotton to popularize CIRCOT calibration cotton among textile mills, in Tamil Nadu.
- Facilities may be developed to test comfort parameters as many textile mills are located in the vicinity of Quality Evaluation unit of CIRCOT.

Guntur Unit:

- The centre may be strengthened with Technical man power.
- New HVI machine may be provided to the unit. This will help to strengthen the bond with the stake holders and increase in revenue generation.
- Awareness workshop on CIRCOT technologies like calibration cotton and scientific processing of cotton seed should be conducted at the unit for their popularization and benefit of stakeholders (cotton ginner, textile mills, delinting units and oil mills).

Sirsa Unit:

- The centre may be strengthened with scientific and technical man power to develop liaison with ginning mills, in Northern Cotton Zone.
- New HVI machine may be provided to the Regional Quality Evaluation Unit so that CIRCOT's Revenue generation can be increased. This will strengthen the relation with the stake holders.
- Demonstrations on cotton stalks composting technology were undertaken by the centre under Tribal Sub-Plan (TSP). Many progressive farmers in the area are now interested in the technology and need microbial consortium for adoption of technology. Facility for production of microbial consortium is therefore required at the centre.
- For promoting cotton stalk utilisation, a chipping machine may be provided for demonstration purpose. Cotton stalk chips could be used by brick kilns and for mini power generation plants (7-10 mw).

Surat Unit:

- Centre needs to be strengthened with Technical manpower.
- New HVI machine may be provided to the Regional Unit.
- Awareness workshop may be arranged to strengthen ties with all stakeholders in Gujarat.

Dharwad Unit:

- Centre needs to be strengthened with more number of technicians.
- Proper space should be provided to the unit by the university as presently allocated space is not sufficient for taking up the testing activities.
- New HVI machine may be provided, this will help in increasing CIRCOT's Revenue generation.

- CIRCOT technologies could be popularized among stake holders in Karnataka State.

9.2 Research Suggestions

1. All technologies developed by the institute over the years should be compiled and reviewed to find out their present day relevance and if relevant, their drawbacks and shortcomings can be examined and improved upon.
2. Mechanization of cotton harvesting is need of the hour due to labour shortage for picking. Therefore work undertaken on cleaning machinery for mechanically harvested cotton undertaken under TMC programme should be continued.
3. Work should be initiated to develop/ improve BIS standards for cotton bales, ginning machinery and also cotton byproducts
4. Efforts should be made for improving the efficiency of ginning machines
5. Effect of insect infestation on fibre properties of cotton may be investigated and package of practices in ginneries for management of such infested cotton may also be worked out.
6. There is a general perception that Indian cottons are weaker. A comparative study on strength characteristics of Indian and foreign cottons may be undertaken.
7. Institute has done good work by conducting a survey to bring out the real status of trash content in Indian cottons in view of the ITMF presenting Indian cottons as trashy. Institute should work with other stake holders for establishing the brand value of Indian cottons in view of the much cleaner hand picked cotton.
8. Development of green composites as an alternative to glass-reinforced plastics may be taken up.
9. Cotton has limited application in technical textiles. Besides surgical cotton, development of cotton wovens and nonwovens for use in filtration and medical textiles should be explored.
10. Development of multifunctional cotton-based smart textile materials can also be attempted
11. Work on eco-friendly textile processing and dyeing techniques including the use of natural substances and enzymes should be continued and efforts should be made to transfer such technologies to the unorganized cottage and small scale units.
12. Research work on reducing the effluent load, effluent treatment strategies and its reuse should be taken up in view of the current zero liquid discharge norms introduced for textile wet processing industries.

13. Lot of good work has been carried out on nanotechnology. Care should also be taken to study toxicological and environmental safety aspects of nano materials as well as treated textiles.
14. Much effort has been directed towards the utilisation of cotton stalks but cottonseed which forms the major part of seed cotton produced has not received desired attention. As it is now a major edible oil source and also a source of linters, hulls and protein rich meal, constraints in its proper utilisation should be identified. Efforts should be undertaken to find out proper cottonseed processing techniques which result in best utilisation of this valuable resource.
15. Presence of Gossypol pigment hinders utilisation of cottonseed meal for non ruminant/ human feed. Efforts to reduce gossypol by various means should be continued. Cottonseed is processed by different methods across the country. Effect of various processing operations on its nutritive value should be undertaken.
16. Development of an efficient cotton stalk uprooting and chipping machine should be undertaken as chipping is a prerequisite for any cotton stalk utilization activity
17. Cotton stalks are rich in minerals, therefore their on farm usage for composting/ mushroom growing should be promoted as it that can reduce cost of cultivation by reducing fertilizer requirement

ANNEXURE I

Action taken on the recommendations of Previous QRT report (2007-2012)

Sr. No.	Recommendation of last QRT	Action Taken
1.	<p>In recent past there has been rising demand for training from overseas especially Afro-Asian regions, where Indian ginning technology is being increasingly accepted. This demands expansion of the facilities for training in ginning and other related technologies at Nagpur. International Ginning Training Centre (IGTC) shall be established by upgrading present facilities to global standards, which includes acquiring additional land, additional state of the art instrumentation, laboratory, administrative building, international hostel, scientists' home, accommodation for staff and adequate transport vehicles. The new institution should be provided with well-trained scientific and technical human resources.</p>	<p>Action suggested by the Council: The Director may submit a comprehensive proposal to Council for upgradation of existing Ginning Training Centre to International Ginning Training Centre. As the activities of Nagpur centre will be upgraded in terms of Technology Transfer and Industrial Extension, the Technology Transfer Division (TTD) may be shifted from CIRCOT, Mumbai to Nagpur.</p> <p>Action taken by the Institute: Upgradation of the existing Ginning Training Centre (GTC) Nagpur to International Ginning Training Centre (IGTC) was included in the CIRCOT XII Plan SFC with a financial outlay of Rs. 10 crore. A committee constituted for site selection also visited Nagpur in the month of January 2015. However funds were not released. Now, a fresh proposal to upgrade GTC into a Regional Station without any additional manpower and financial burden has been included in the SFC document for 2017-20</p>

2.	<p>Considering the present pace of development in textiles, there is a need for modern, high precision and high capacity instruments with larger space availability at main campus and other regional centres. Additional space and instrumentation be acquired and all laboratories upgraded to match with international standards.</p>	<p>Action suggested by the Council: The Director may keep appropriate provision for up-gradation of the laboratories during 12th FYP.</p> <p>Action taken by the Institute: Provision was made in the XII plan for purchase of new / replacement instruments. Approval was accorded for Rs 11.82 crore for purchase of HVI, twin screw extruder, finish durability analyzer etc. However many instruments were not procured, since only limited fund was released by the Council.</p> <p>A new annex building (G+2 with basement) has been constructed at a total cost of Rs. 3.27 crore, which has added to the space availability in the Institute by 717.57 sq.m.</p>
3.	<p>CIRCOT has six regional units across the country, some of them operating with highly inadequate space and facilities. Regional units presently functioning with constraints should have own space for laboratories, storage and office with state-of-the-art instruments for cotton testing and spinning. The regional units at Coimbatore and Guntur need immediate intervention.</p>	<p>Action suggested by the Council: The Director may initiate appropriate action to strengthen the regional units at Coimbatore and Guntur.</p> <p>Action taken by the Institute: At Guntur, appropriate space for laboratory, office and storage has been provided by the ANGRAU. A proposal to upgrade the Coimbatore unit to a Regional Station has been included in the SFC document for 2017-20 (without any additional manpower and financial burden) to</p>

		capitalize on the locational advantage for technology development & dissemination.
4.	CIRCOT main campus at Matunga, Mumbai has limited space available for expansion of present and future activities. Additional space for horizontal and vertical expansion needs to be provided at headquarters. There is acute shortage of staff quarters, laboratories, training hostel, guest house and other amenities. Availability of space along with budgetary provisions be ensured through appropriate administrative initiatives.	<p>Action suggested by the Council: The Director may keep appropriate provision of horizontal and vertical expansion along with budgetary estimate during 12th FYP.</p> <p>Action taken by the Institute: Provision of Rs 1.58 crore was made during the 12th FYP for a new office building. Yashwantrao Chavan Annex building (G+2 with basement) has been constructed and is in use since 2016. This houses Technology Transfer Division (TTD) and Test House on ground floor; Agri Business Incubation Centre (ABI), Priority Setting, Monitoring and Evaluation Cell (PME) on first floor and Guest House on second floor. Construction of Type IV staff quarters (stilt + 4 floors with 8 quarters), with a budget of Rs. 3.08 crores was approved in the XII Plan and an amount of Rs 102.96 lakhs released by the Council was deposited with CPWD. Construction has however not progressed due to various issues</p>
5.	CIRCOT has 42 % vacancy in scientific positions as on March 31, 2012. It is recommended that vacancies be filled as early as	<p>Action suggested by the Council: Action has been initiated by the Council to fill vacant scientific positions. The provision of</p>

	possible. In case there are constraints in filling the positions, the Institute may be allowed to fill up the positions on contractual basis against the vacant positions till the regular appointments are made.	contractual appointment is being considered under 12 th FYP. Action taken by the Institute: All scientific (44%) and four Head of the Division vacancies have been intimated to the Council and the same is being followed up.
6.	CIRCOT generates technologies through a scientific process which includes proposals in the form of RPF-I and concludes with RPF-III. At this stage there is no window for further movement of technology towards adoption. As the researcher concerned is well acquainted with development process, he/she could be best candidate for taking this knowledge to users. It is recommended that a new format which could be designated as RPF-IV be included in the process to take forward the technologies recommended in RPF-III. Technology Transfer Division of the institute will act as a facilitator.	Action suggested by the Council: Appropriate necessary action has been initiated in the Council for implementation of the above recommendation. Action taken by the Institute: New research project proposal (RPP) forms have been introduced by the Council and the RPP-IV form takes care of further movement of technology towards adoption. The new system has been implemented at the Institute.
7.	CIRCOT has generated a good number of viable technologies. However, some of them have not entered the commercial space. There is need to create an intermediate structure like incubation centre for facilitating	Action suggested by the Council: The Director may take necessary action. Action taken by the Institute: During the report period, this work was initially looked after by the BPD at the institute and various

	<p>refinement of the commercially viable technologies jointly by the researcher and the entrepreneur. CIRCOT should set up an incubation centre.</p>	<p>technologies have been transferred by it. The following are the some of the technologies transferred by the institute to the stake holders</p> <ul style="list-style-type: none"> ➤ Development & fabrication of Miniature Spinning Machines ➤ Design and Development of Small ginning machines ➤ Development and commercial supply of the new DR ginning machine (hinged blade assembly) and self-grooving rubber roller ➤ Pedal Driven Banana Spinning System (CIRCOT-Phoenix Charkha) ➤ Production of Textile Reinforced Rubber Composite Sheets ➤ Cotton Lint Opener ➤ Design and Manufacturing of Pre-cleaner, Double Roller Gin, Baling Presses and Feeding Systems <p>Agri business Incubator has now been established at the institute and is in operation since Jan 2016. Six incubates were incubated/being incubated on following technologies</p> <ul style="list-style-type: none"> ➤ Microbial method for degossypolization of cottonseed meal ➤ Antibacterial treatment of Textile materials ➤ Nanocellulose application in Textile-Yarn Spinning ➤ Development of Cotton Reinforced Rubber Baton
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		<p>➤ Development of cotton and cotton blend and application of functional finishes to impart antibacterial and moisture management properties</p> <p>➤ Development of thermal and bath blankets using cotton and biodegradable polyester</p> <p>During 2012-2017 period institute has generated Rs 4.10 crore which is 24.6 % of institute budget as revenue by carrying out testing, consultancy, transferring technology etc. Institute has carried out many consultancies in the areas like ginning machineries, Kawabata analysis of textiles, Scanning electron microscopic analysis of different materials and earned good amount of revenue.</p>
8.	<p>There are small traditional cottage industries in textile processing and dyeing. There is need for scientific up-gradation of these units to be economically viable. Technologies generated at CIRCOT be transferred to these units through appropriate linkage mechanisms.</p>	<p>Action suggested by the Council: The appropriate action may be initiated by the Transfer of Technology Division of the Institute.</p> <p>Action taken by the Institute: Regular workshops and trainings are conducted for sharing the information about various technologies suitable for traditional textile processors. Technologies developed in natural dyeing were shared with traditional weavers and dyers during the National Workshop on 'Natural Dyes and Textile Industry' at Hyderabad during June</p>

		15-16, 2013. Institute also participated in International Natural Dye Workshop (IWND, 2014) at Hyderabad during March 5-7, 2014. Training cum workshop on dyeing with natural dyes was organized at KVK Narayangaon for tribal men and women on March 27, 2014.
9.	Particle Board Demonstration Unit established at Nagpur centre needs to be made fully operational by upgrading and up-scaling for round- the-year production through development of suitable ancillary mechanisms for collection, transportation and utilization of cotton stalks. The possibility of outsourcing by developing suitable mechanisms with operators must be explored.	<p>Action suggested by the Council: The Director, CIRCOT may take necessary action and work out modalities for implementation of the above recommendation.</p> <p>Action taken by the Institute: The Particle board Pilot plant is being operated during training (including training of African Nationals) and EDP Programmes to create awareness and nurture budding entrepreneurs on this technology. Boards prepared from this pilot plant are sold in outside market. Particle board blocks for transporting hydraulic cylinders to different places were also made in pilot plant as a consultancy project to M/s. HYVA India Ltd. However due to shortage of staff and other considerations, it was not found feasible to have round the year operation.</p>
10.	Cotton by-products like seed, oil, meal, linter, hull, cotton stalk etc. have potential for conversion into	<p>Action suggested by the Council: The Director, CIRCOT may work out suitable programme / projects in</p>

	value-added products. R&D activity on cotton by-product utilisation should be scaled up.	<p>consultation with RAC to implement it.</p> <p>Action taken by the Institute:</p> <p>Institutional as well as externally funded projects on by product utilization have been undertaken during the reporting period. Pilot plant facility to make nanocellulose from cotton linters has been established. Fermentation technology for degossypolisation of cottonseed meal to make it suitable for non-ruminant feed has been developed and transferred. Utilisation of cotton stalks for making compost, briquettes, and pellets has been explored. Institute has bagged an extra mural funded project entitled “<i>Preparation of specialty grade pulp from cotton linters by blending with pulps from other cellulosic materials for high end applications</i>” in competitive mode and developed the technology for the production of currency grade paper. Institute is currently liaising with Security Paper Mill, GOI for up-scaling this technology.</p>
11.	CIRCOT’s stakeholders include farmers, plant breeders, ginners, traders, spinners, manufacturers, by-product utilisation units, process houses and government & non-government agencies. Feedbacks from stakeholders	<p>Action suggested by the Council:</p> <p>The Director, CIRCOT may take necessary action in consultation with Council for implementation of the recommendation.</p>

	<p>greatly help in formulating research agenda and priorities. CIRCOT should organise stakeholders' meet every year preferably in July-September.</p>	<p>Action taken by the Institute:</p> <p>Details of various stakeholders meets with the farmers, ginners and plant breeders arranged by the Institute during 2012-17 are:</p> <ul style="list-style-type: none"> ❖ Farmers and Cotton Ginners Awareness Meet on “Modernization in Ginning and Advantages of Bale Tagging with Fibre Properties” at Sirsa on 20.04.2012. ❖ EDP for Technologies on Biomass Utilization (Focus: Particle Board and Nanocellulose) during March 11-13, 2013 at CIRCOT, Mumbai ❖ One day pre-commercialization workshop on “Flexi Check Dam, popularly known as rubber dam made of Textile-Rubber Composite for Watershed Application” organized by ZTM-BPD unit, CIRCOT, Mumbai, on May 30, 2013. ❖ Technology Mela has been organized every year during the month of February- March since 2016 where farmers and other stakeholders participate. Besides, the scope of training programmes has been broadened and many stakeholders participate in these training programmes.
12	<p>CIRCOT primarily working with cotton fibre needs to expand its mandate with inclusion of other</p>	<p>Action suggested by the Council:</p> <p>Since the allied fibres are in the mandate of NIRJAFT, Kolkata, there</p>

	<p>natural fibres, as the potential for natural fibres is not fully explored. There is a large scope for making composites and blended products with cotton to meet the emerging needs of the consumers.</p>	<p>should be complementarities between the two fibre institutes (NIRJAFT and CIRCOT) for implementation of any programme on allied fibre.</p> <p>Action taken by the Institute: To promote utilization of other natural fibres, R&D work on natural fibres was undertaken. CIRCOT is mainly working on blending and processing of natural fibres, which is complementary to the work of NIRJAFT. Following projects were undertaken during the year 2013-14:</p> <ul style="list-style-type: none"> ➤ Improvement in coconut fibre compatibility for production of superior quality fibre reinforced composites ➤ Jute Based Bio Composite for Industry (Funded by ICAR-NFBSFRA) <p>In 2016, as per the Council's direction, "other natural fibres" was excluded from CIRCOT mandate.</p> <p>CIRCOT is the lead center for the implementation of CRP on Natural Fibres launched in April 2015. Two projects namely 'Utilization of ligno-cellulosic fibre based biomass as renewable energy for rural and industrial application' and 'Preparation of nano lignocellulose</p>
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		and its incorporation in polymer composites for improved performance' are being carried out under the CRP on Natural Fibres.
13.	Technical textile is an emerging area where a large number of functional materials can be developed. Possibility of using fibrous materials for conversion into value-added products should be explored. CIRCOT should initiate R&D activity in this area.	<p>Action suggested by the Council: The Director, CIRCOT may work out suitable R&D programmes in consultation with RAC to implement it.</p> <p>Action taken by the Institute: Technical textiles were given due priority in the XII plan and following projects were undertaken-</p> <ul style="list-style-type: none"> ➤ Biodegradable Electro spun Fibre Mat for Use in Packaging of Fresh Perishable Agricultural Material (Funded by ICAR-NFBSFRA) ➤ Jute Based Bio Composite for Industry (Funded by ICAR-NFBSFRA) ➤ Electrospinning Geometry Optimization for Preparation of Core-sheath Nanofibers and Conversion of Nanofibers into Yarns (Funded by DST) ➤ Improvement in coconut fibre compatibility for production of superior quality fibre reinforced composites ➤ Development of Protective Textile against Snake Bite for Farmers
14.	CIRCOT should work hand-in-hand with global partners in strategic areas of cotton	<p>Action suggested by the Council: The Director, CIRCOT may initiate</p>

	processing to keep pace with fast changing textile technology by developing collaborative arrangements with international agencies.	<p>necessary action in consultation with Council /DARE.</p> <p>Action taken by the Institute: As part of the cotton TAP project, CIRCOT has provided technical assistance to African countries- Benin, Burkina Faso, Chad ,Mali, Uganda, Nigeria and Malawi in post-harvest processing of cotton and by-products utilization. Regional knowledge cluster cum training centre has been established at Bohicon, Benin.</p>
15.	CIRCOT has generated and commercialized several technologies in cotton textiles. There is need for showcasing these technologies for wider adoption. Technology museums should be established at the main campus and regional units.	<p>Action suggested by the Council: The Director, CIRCOT may formulate a suitable proposal and keep provision in the 12th FYP for consideration of the Council.</p> <p>Action taken by the Institute: The Exhibition cum visitors' room facility has been created in August 2014 at CIRCOT, Mumbai to showcase the research achievements and exhibit the products developed by the Institute for the benefit of visiting dignitaries and other guests. Technologies related to Ginning are showcased at GTC, Nagpur where pilot plants on modern ginning, scientific processing of cottonseed and particle board from cotton stalks have also been established. Currently other regional units viz. Coimbatore, Guntur, Dharwad,</p>

		Surat and Sirsa have space crunch and hence separate museums are not possible there.
16.	CIRCOT has standardized and commercialized calibration cotton. However, the quantity and quality aspects need further research and development to match with Calibration Cotton of international standing. Facilities for production of CIRCOT Calibration Cotton be upgraded, expanded and possibility of outsourcing explored with full control of CIRCOT expertise.	<p>Action suggested by the Council: The Director, CIRCOT may initiate necessary action for its implementation.</p> <p>Action taken by the Institute: Adequate quantity of calibration cotton covering the wide range of short, medium, long and extra-long cotton has been provided by the Institute to completely meet the industries' demand. Rs. 15.88 lakh revenue was generated through its sale during 2012-17. Customers are satisfied with quality and services provided by the Institute. Outsourcing of manufacturing has been discussed in institute meetings, however the proposal was kept pending as being a reference material, quality control during production is crucial.</p>
17.	Material handling technology, cleaners for mechanically picked cotton, high production & energy efficient double roller gin, efficient dust & waste fibre collection systems etc. be brought within the R&D ambit of CIRCOT.	<p>Action suggested by the Council: The Director, CIRCOT may take appropriate action in consultation with RAC.</p> <p>Action taken by the Institute: R&D projects have been undertaken in the said area with good success. The following are some of the achievements-</p>

		<ul style="list-style-type: none"> i. Stick removal machine to remove the large sized vegetative trash components from mechanically picked cotton. ii. A saw band cleaner to remove fine trash, burrs etc. from mechanically picked seed cotton. iii. An On-board Cleaner based on sling off action for on-field cleaning of machine stripped cotton. <p>The following projects were undertaken on double roller gin, efficient dust & waste fibre collection systems-</p> <ul style="list-style-type: none"> i. Pollution Abatement System for Collection of Flying Dusts from Ginning and Pressing Halls ii. Investigation of Forces Acting on Different Components of Double Roller (DR) Gins under Different Working Conditions iii. Single Locking Cotton Feeder for Double Roller Gin for Enhancing Ginning Efficiency
18.	R & D in plasma and nano technologies needs special focus and attention.	<p>Action suggested by the Council: The Director, CIRCOT may identify specific area of research related to plasma and nano technology and develop action plan for its implementation.</p> <p>Action taken by the Institute: Research programmes related to plasma and nano technologies are being implemented at the Institute</p>

		<p>and many technologies have been developed under these niche research areas-</p> <ul style="list-style-type: none"> ➤ A state of the art pilot plant facility on energy efficient nanocellulose production of 10 kg per day capacity has been established with financial support from NAIP. ➤ Plasma generation and characterization facility has been established under the project funded by NFBSFARA. ➤ Waterless hydrophobic finishing process using atmospheric plasma process has been developed ➤ Antibacterial bed sheets using nanotechnology have been developed.
19.	Collaborative research on cutting-edge technologies such as e-learning, digitization, bale tagging through bar coding or radio frequency identification system may be initiated.	<p>Action suggested by the Council: The Director, CIRCOT may identify specific area of research related to above issues along with collaborative institutes and develop action plan for implementation.</p> <p>Action taken by the Institute: An on-line RFID bale tagging system along with Gin ERP was developed in the institute to track the quality of the cotton and track the movement of cotton from farmers, ginner, traders by the spinners. The technology was commercialized to</p>

		<p>M/s SSPS, Hyderabad. ICAR-CIRCOT along with M/S. SSPS had a series of meeting with the ginners and office of Textile commissioner for its successful implementation in the ginning industry. The RFID bale tagging system has been identified as one of the component for implementation under the second phase of Technology Mission on Cotton under Mini Mission IV.</p>
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ANNEXURE II

Details of meetings and visits of QRT to ICAR-CIRCOT & regional units

Meetings	Date	QRT Meetings/ Visits to Institute/ Regional Units	Participants
The First Meeting	June 28, 2017	Planning Meeting of QRT at CIRCOT, Mumbai	Dr. N. C. Patel , Chairman QRT Dr. S. N. Jha , ADG (PE), ICAR Dr. P. G. Patil , Director, CIRCOT Dr. G. R. Anap , Member QRT Dr. N. J. Thakor , Member QRT Dr. V. D. Gotmare , Member QRT Dr. M. K. Sharma , Member QRT Dr. Sujata Saxena , Member –Secretary QRT HoD's, SAO and AFAO of CIRCOT
The Second Meeting	July 25, 2017	i) Visit to Ginning Training Centre of CIRCOT, Nagpur	Dr. N. C. Patel , Chairman QRT Dr. G. R. Anap , Member QRT Dr. N. J. Thakor , Member QRT Dr. V. D. Gotmare , Member QRT Dr. M. K. Sharma , Member QRT Dr. Sujata Saxena , Member –Secretary QRT Dr. S.K. Shukla , Officer In-charge, GTC Dr. V. Mageshwaran , Scientist, GTC Er. Varsha Satankar , Scientist, GTC Technical and Other staff of GTC
		ii) Stakeholders' meet	Mr. J.P. Mahajan , GM, MSCCGMF Ltd. Nagpur Dr. M. S. Kairon , Ex Director, CICR , Nagpur Mr. G. H. Wairale , Ex General Manager, MSCCGMF Ltd. Nagpur Mr. S. Joshi , Manager (Ginning) Gimatex Pvt. Ltd., Hinganghat Mr. Sunil Jaiswal , Cotton Trader, Nagpur Mr. Rahul Bharatwal , Vice President CIS testing lab., Nagpur Mr. Bhupesh Pathak , Ankur Seeds Pvt., Ltd., Nagpur Mr. M. T. Varghese , Grace Enterprises Pvt., Ltd., Nagpur

			Mr. Akshay Sagole , Nagpur Fuels, Nagpur Smt. Vandana Wagh , Ginning Entrepreneur Mr. S. Kshirsagar , Vidarbha Sales, Nagpur A group of forty farmers from Buldhana and Jalna District in Maharashtra
The Third Meeting	August 29- 30, 2017	Visit to Quality Evaluation Unit of CIRCOT at Coimbatore and stakeholders' meet	Dr. N. C. Patel , Chairman QRT Dr. P. G. Patil , Director, CIRCOT Dr. N. J. Thakor , Member QRT Dr. V. D. Gotmare , Member QRT Dr. Sujata Saxena , Member –Secretary QRT Dr. A. H. Prakash , Project Coordinator, AICCIP & Head, CICR- RS, Coimbatore Dr. S. Venkatakrishnan , CTO & unit In-charge Sh. S. Mukundan , ACTO Sh. S. Bhaskar , ACTO Dr. M. Kumar , Professor & Head (Cotton), TNAU, Coimbatore Dr. Jacob Anamalai , Principal Scientist & Head, CIAE-RC, Coimbatore Dr. Senthil kumar , Senior Scientist, CIAE-RC, Coimbatore Mrs. M. Asha Rani , SIMA- CDRA, Coimbatore Mr. K. Muthusamy , SIMA- CDRA, Coimbatore Mr. Sivaprakash S. , Zonal manager sales, Premier Evolvics, Pvt. Ltd. Coimbatore Mr. K. Ashok Kumar , Sr manager R&D, MAG solvics Pvt. Ltd. Coimbatore Mr. V. Ramnathan , Sales manager, Statex Electronics, Coimbatore Mr. R. N. Subramanian , M/s Trytex Ltd., Coimbatore Mr. P. N. Saravanan , Salem Kanda textiles, Salem
The Fourth Meeting	October 7, 2017	Visit to Quality Evaluation Unit of CIRCOT at Sirsa and stakeholders' meet	Dr. N. C. Patel , Chairman QRT Dr. G. R. Anap , Member QRT Dr. N. J. Thakor , Member QRT Dr. V. D. Gotmare , Member QRT Dr. Sujata Saxena , Member – Secretary QRT

			<p>Dr. D. Monga, In-charge, CICR-RS, Sirsa</p> <p>Dr. Hamid Hasan, ACTO & Unit In-charge</p> <p>Dr. Jal Singh, STO</p> <p>Shri Gurcharan Singh, Shri Ganapati Cotton and Ginning Mills, Sirsa</p> <p>Shri Gurdeep Singh, Farmer</p> <p>Shri Malik Saheb, Farmer</p> <p>Shri Gurnam Chandra, Farmer</p> <p>Shri Gopiram, Farmer</p> <p>Shri Raja Ram, Farmer</p> <p>Shri Ved Prakash Arya, Managing Director, Shakti Vardhak Hybrid Seeds Pvt. Ltd.</p> <p>Shri Raj Bahadur, Shakti Vardhak Hybrid Seeds Pvt. Ltd., Hisar</p> <p>Shri K. S. Miranis, Scientist, Cotton Research Station, CCSHAU, Sirsa</p>
The Fifth Meeting	November 20- 21, 2017	i) Interactive meeting of Institutional and Industrial Stakeholders with QRT at CIRCOT, Mumbai	<p>Dr. N. C. Patel, Chairman QRT</p> <p>Dr. P. G. Patil, Director, CIRCOT</p> <p>Dr. G. R. Anap, Member QRT</p> <p>Dr. N. J. Thakor, Member QRT</p> <p>Dr. V. D. Gotmare, Member QRT</p> <p>Dr. Sujata Saxena, Member –Secretary QRT</p> <p>Er. A. K. Bharimalla, Head I/c, Technology Transfer division,</p> <p>Dr. P.K. Mandhyan, Head I/c, Quality Evaluation & Improvement Division,</p> <p>Dr. A.S.M. Raja, nodal officer for CRP on natural fibres</p> <p>Mr. V. G. Arude, I/c, PME cell</p> <p>Dr. C. Sundaramoorthy, nodal officer, PME cell</p> <p>Dr. P.S. Deshmukh, Senior Scientist</p> <p>Dr. Manoj Kumar, Scientist</p> <p>Mr. Sunil Kumar, SAO</p> <p>Mr. S. V. Kasabe, AFAO</p> <p>Mr. Pankaj D. Mepani, Sr. Vice President, M/s DD Cotton Pvt. Ltd., Mumbai</p> <p>Mr. J. C. Kulkarni, Manager-Sales, M/s Uster Technologies (India) Pvt. Ltd., Ahmedabad</p> <p>Dr. P.S. Patel, Director, M/s Carver Technologies (India) Pvt. Ltd., Mumbai</p>

			Mr. Sanjay L. Gajul , Technical Marketing Manager, SA Pharmachem, Mumbai Mr. Mustafa Motiwala , Partner, M/s BioDyes Pvt. Ltd., Sawantwadi (M.S.)
		ii) Meeting with Staff of CIRCOT, Mumbai	Dr. P. G. Patil , Director, ICAR-CIRCOT Heads of Divisions, SAO, AFAO, scientific and technical staff
	November 21, 2017	Meeting with staff and various committee of CIRCOT, Mumbai	Administrative and supporting staff, Representatives of Institute Joint Council, Women's Complaints committee etc.
The Sixth Meeting	November 22, 2017	Visit to Quality Evaluation Unit of CIRCOT at Guntur and stakeholders' meet	Dr. N. C. Patel , Chairman QRT Dr. G. R. Anap , Member QRT Dr. N. J. Thakor , Member QRT Dr. V. D. Gotmare , Member QRT Dr. M. K. Sharma , Member QRT Dr. Sujata Saxena , Member –Secretary QRT Shri K. Thiagarajan , ACTO & I/C CIRCOT, QEU, Guntur Dr. S. Ratna Kumari , Principal Scientist & Head, Cotton Section, RARS, Guntur Dr. Y. Satish , Senior Scientist, Breeding, RARS, Guntur Shri PVS Sankar , Director, AP cotton Association Shri P. Suresh , Regional Manager, Rasi Seeds (P) Ltd. Shri V. Rajsekharan , Regional Manager, Monsanto, India Pvt. Ltd. Shri M. Vinaya Kumar , Technical Manager, Monsanto, India Pvt. Ltd.
The Seventh Meeting	February 15, 2018	Visit of QRT to Regional cotton Research Station, Viramgam of AAU	Dr. N. C. Patel , Chairman QRT Dr. G. R. Anap , Member QRT Dr. V. D. Gotmare , Member QRT Dr. Sujata Saxena , Member –Secretary QRT Dr. T. T. Patel , Associate Research Scientist and Centre I/c,
	February 16, 2018	Visit to Visit to Quality Evaluation Unit of CIRCOT located at Main Cotton Research	Dr. N. C. Patel , Chairman QRT Dr. C. J. Dangariya , Hon'ble Vice Chancellor, Navsari Agricultural University, Navsari Dr. P. G. Patil , Director, CIRCOT

		Station (MCRS), Surat of Navsari Agricultural University Surat	Dr. G. R. Anap , Member QRT Dr. V. D. Gotmare , Member QRT Dr. Sujata Saxena , Member –Secretary QRT Dr. B.G. Solanki , Research Scientist Cotton, MCRS, NAU, Surat Dr. P.K.Mandhyan , Senior Scientist & Head I/c, QEID, ICAR- CIRCOT, Mumbai Shri R.S. Prabhudesai , ACTO, ICAR- CIRCOT, Mumbai Shri G. G. Mistry , STO & I/c, QEU, Surat Shri M. B. Patel , STO, QEU, Surat Smt. Vijaylaxmi Udikeri , Technical Officer, & I/c, QEU, Dharwad
The Eighth Meeting	February 17, 2018	Meeting for preparation of QRT Report at AAU, Anand	Dr. N. C. Patel , Chairman QRT Dr. G. R. Anap , Member QRT Dr. V. D. Gotmare , Member QRT Dr. Sujata Saxena , Member –Secretary QRT
The ninth meeting	April, 11,12 & 13	Preparation of Final Report and interaction with Institute Management Committee	Dr. N. C. Patel , Chairman QRT Dr. G. R. Anap , Member QRT Dr. N. J. Thakor , Member QRT Dr. V. D. Gotmare , Member QRT Dr. M. K. Sharma , Member QRT Dr. P.G. Patil , Director, CIRCOT & Chairman, IMC Dr. S. N. Jha , ADG (PE), ICAR& Member IMC Shri Dhrupatrao Bhagwan Sable Patil , Member IMC Smt. Kranti S. Somvanshi , Member IMC Dr. S. N. Chattopadhyay , PS, NIRJAFT, Member IMC Dr. Sujata Saxena , Member –Secretary QRT Shri Sunil Kumar , SAO, CIRCOT & Member Secretary, IMC Shri S. V. Kasabe , AFAO, CIRCOT& Member IMC

ANNEXURE III

Equipment acquired during the period

2012-13	Laboratory Model Compact Ring Spinning Machine Horizontal Tensile Strength Tester for paper Temperature Controlled Orbital Shaker KV Generator Precision Balance Electronic Thickness Micrometer Turbidity Meter Digital Copier Machine
2013-14	HP Fax Machine Digital Postal Franking Machine (Model IJ 40) Canon photocopier (IR 2420) Desk Side Paper Shredder (Model PS 225) Finger Print System Laboratory IR Beaker Dyeing Machine Oven Material Handling Wheel Trolley for Cottonseed Bags Humidifier Digital Humidity Controller DR Gin with Autofeeder & accessories Rotary Vacuum Pump and Chiller Laboratory Jigger (Small width of 200MM) Samsung LED Monitor (Model S20C300DL) Deep Freezer Homogenizer (Model T 25) Funnel Shaped Collector Friction Spinning Collection Projection System with Accessories (EPSON EB 910 W 3200)

2014-15	Pilot Plant equipment for Production of Nanocellulose Multi-phase electrospinning machine High voltage setup BET analyser High speed camera Trash Separator Fluidized bed reactor with steam generator Muffle furnace (Labotech Model)
2015-16	Pelletizer Chipper Photo-Oxidation Unit GaBi LCA Software Digital moisture meter Electrolysis reactor TDS meter Adsorption Column Peristaltic pump
2016-17	Table Top Refrigerated Centrifuge Variable Frequency Drive (VFD) Vacuum Pump Oil Free Audio and Video Conference System Modular Furniture for Administration and Accounts BOD Incubator Hydro Extractor HTHP Bleaching Machine Bacteriological Shaker Incubator Table Top Refrigerated Centrifuge

ANNEXURE IV

Library books and other related assets purchased

Institute Plan Budget Library Fund

PARTICULARS	2012-13	2013-14	2014-15	2015-16	2016-17
Annual Budget(Rs.)	40 00 000	1 54 000	18 00 000	1 01 000	5 32 000
Purchase of Books Total books at HQ	2 35 190 (106 books)	31 779 (47 books)	1 69 517 (38 books)	58 892 (13 books)	45 376 (34 books)
a. English books b. Hindi books	57 49	33 14	36 2	9 4	10 24
Purchase of CD/DVD/AV			13 120 (17 DVDs)		
Subscription to Foreign Journals	21 40 675 (17 journals)	39 949 (1 journal)	14 92 062 (14 journals)	-	3 91 071 (4 journals)
Subscription to Indian Journals	32 921 (17 journals)	12 398 (5 journals)	32 426 (16 journals)	6 204 (5 journals)	4 654 (4 journals)
Purchase of Books/Journals / standards for GTC, Nagpur	9 417 (9 books)	1 614 (3 books)	6 612 (13 Books) 2 000 (1 journal)	25 949 (4 Standards)	3 116 (24 books)
Purchase of Standards	62 519 (8 ISO)	730 (2 ISO)	15 822 (7 Stds)		90 899 (6standard s)
Purchase of Journal Archives	8 76 378 (JTI + Textile Progress vol. I to yr.1996)	-	-		
Renewal of Online Database	4 32 619 (5 databases)				
Renewal of Society Membership	47 600 (TAPPI / AATCC)	57 725 (AATCC / ASTM)	70 441 (AATCC/ ASTM)	9 955 (TAPPI stds.)	
Miscellaneous expenses	1 62 681 (IBH, Mumbai)	9 805 (IBH, Mumbai)			

Non-Plan Contingency

PARTICULARS	2012-13	2013-14	2014-15	2015-16	2016-17
Non-Plan Contingency utilization in Rs.	-	2 14 427	-	-	-
Renewal of Online Database on annual basis	-	1 49 936 (World Textiles) 47 191 (Indiastat.com) 17 300 (BIS-TXD)	-	60 113 (Indiastat.com)	-

Institute Project Fund Utilization

PARTICULARS	2012-13	2013-14	2014-15	2015-16		2016-17
	CRP on NF Project: Library	-	-	CRP- PIU Library Fund	TMC (MM1.4) Contingency	CRP on NF Project: Library
Total Fund Utilization in Rs.	39 936	-	-	4 86 999	-	31 355
Renewal of Subscription to journals	-	-	-	4 76 654 (6 Foreign jrnls) 10 245 (2 Indian jrnls.)	-	-
Purchase of Books	37 960 (6 Books)	-	-	-	-	31 355 (4 Books)
Purchase of Standards	1 976 (1 ASTM)	-	-	-	-	-
Renewal of Professional Society Membership	-	-	-	-	9 666 (AATCC)	-

Plan Contingency

PARTICULARS	2012-13	2013-14	2014-15	2015-16	2016-17
Plan Contingency utilization in Rs.	-	-	2 13 975	2 14 288	31 716
Renewal of Annual Subscription to Online Databases	-	-	1 60 885 (World Textiles) 53 090 Indiastat.com	1 77 529 (World Textiles) 30 100 (BIS-TXD) 6 659 (TAPPI emerging M)	28 600 (BIS-TXD)
Miscellaneous	-	-	8 750 Binding of Journals	-	3 116 (24 books for Hindi Cell)

ANNEXURE V

Foreign Deputations during 2012 to 2017

Name	Duration	Place	Purpose
Dr. N. Shanmugam, Senior Scientist	08-07-2012 to 13-07-2012	Michigan, USA	Participation in the workshop on Technology commercialization to be held in Michigan USA
Dr. R. Guruprasad, Scientist	15-10-2012 to 28-10-2012	Egypt	Study Visit to Egypt in the Field of "Cotton Processing for Fine Quality"
Shri S.K. Shukla, Senior Scientist	15-10-2012 to 05-11-2012	Egypt	Study Visit to Egypt in the Field of "Cotton Processing for Fine Quality"
Dr. V. Mageshwaran, Senior Scientist	02-09-2013 to 30-11-2013	USA (North Carolina)	International Training on Fermentation Technology
Dr. P.G. Patil, Director	18-6-2014 to 20- 6-2014	Bangladesh	To participate & present paper in 6th ACRDN (Asian Cotton Research and Development Network) held at Dhaka (Bangladesh)
Dr.(Smt.) Sujata Saxena, Senior Scientist	23-07-2014 to 24-07-2014	France	To participate in meeting of International Consortium for Development and Evaluation of PPE for Pesticides operators and workers
Dr. P.G. Patil, Director, Er. A.K. Bharimalla, Senior Scientist, Er. V.G. Arude, Scientist	11-11-2014 to 21-11-2014	Uganda & Malawi	Implementation of Cotton Technical Assistance Programme (TAP)
Dr. P.G. Patil, Director, Er. A.K. Bharimalla, Senior Scientist & Er. V.G. Arude, Scientist	08.03.2015 to 16.03.2015	Benin	To organise in country Training Programme on Post-Harvest Management & Value Addition to Crop Residue & Selection of site for setting up of Regional Knowledge Cluster cum Training Centre on Post-Harvest & Ginning Technology

Dr. S.K. Shukla, Senior Scientist	11.10.2015 to 17.10.2015	Chad	To organise in-country Training Programme on Post-Harvest Management & Value Addition to Crop Residue under Cotton Tap
Er. A.K. Bharimalla, Senior Scientist & Er. V.G. Arude, Scientist	11.10.2015 to 18.10.2015	Chad	To organise in-country Training Programme on Post-Harvest Management & Value Addition to Crop Residue under Cotton Tap
Dr. S.K. Shukla, Senior Scientist & Er. P.S. Deshmukh, Senior Scientist	23-02-2016 to 28-02-2016	Nigeria	In-country Training Programme on Post-Harvest Management & Value Addition to Crop Residue under Cotton Tap
Dr. S.K. Shukla, Senior Scientist & Dr. C. Sundaramoorthy, Senior Scientist	14-05-2016 to 24-05-2016	Burkina Faso & Benin	“In-country Training Programme (Burkina Faso) and Setting up of Regional Knowledge Cluster (Benin)”

ANNEXURE VI

I. New externally funded projects operating during the period

1. Electrospinning Geometry Optimization for Preparation of Core-sheath Nanofibres and Conversion of Nanofibres into Yarns
2. Jute Based Bio Composite for Industry
3. Improvement in Cotton Quality by Plasma Nanotechnology: An Eco-friendly Approach
4. Development of Gossypol-free Lysine-rich Cottonseed cake by Solid State Fermentation
5. Biodegradable Electrospun Fibre Mat for use in Packaging of Fresh Perishable Agricultural Material
6. Development of Cotton Picking machinery for Small Scale Cotton Production Systems
7. Agro Technique for High Density Planting System and Surgical Cotton varieties
8. Preparation of Specialty Grade Pulp from Cotton Linters for Production of Security Paper
9. Preparation of Nano Ligno Cellulose and its Incorporation in Polymer Composites for Improved Performance
10. Eco-friendly method of preparing absorbent/surgical cotton from non-spinnable cotton
11. Sustainable Green Technology for Dyeing of Cotton Textile
12. Cellulose based nano composite film for application in packaging
13. Agri Business Incubation Centre at ICAR – CIRCOT, Mumbai
14. Technical Assistance Programme (TAP) to Strengthen Cotton value Chain in Cotton 4 Countries (Benin, Burkina Faso, Chad & Mali) and Malawi, Nigeria and Uganda

II. Number of new machinery and process/technologies developed

2012-13

Value added products developed

1. Development of CIRCOT – Phoenix Charkha for Banana Fibres
2. Design and development of database software for cotton bale tagging and centralised on-line inventory using RFID technology

3. Testing of coconut fibre segregator
4. Preparation of coloured Turkish Towels and Napkins
5. Design and fabrication of atmospheric pressure plasma reactor
6. Development of multi-sheath feeder for banana fibre extraction machine
7. Development of cotton PLA blended yarn

Process protocol developed

1. Washing durability of nano ZnO based hydrophobic finishing of cotton fabric
2. Use of pomegranate rind for dyeing and UV protection of cotton textiles
3. Application of SiO₂ nanoparticles in combination with TiO₂ on cotton textiles for improving the UV protective functionality
4. Improvement of Interfacial Interaction between Nanocellulose and Synthetic Polymeric Materials using Compatibilizers
5. Accelerated process for preparation of compost from cotton stalks

2013-14

Value added products developed

1. Development of Cotton/PLA blended fabrics
2. Development of surface modified coir reinforced thermoplastic composites
3. Development of funnel-based electrode system for formation of yarn from electro-spun nano fibres
4. Rubber coated nylon fabric using RFL and Plasma treatment for snake bite protection fabrics.
5. Designing & fabrication of friction-spinning collector for conversion of electro spun nanofibres into yarns

Process protocol developed

1. Process technology for flame retardant finishing of textile using natural products
2. Process for dyeing of cotton fabric with tender coconut husk extract
3. Analysis of energy consumption and techno-economics of bale presses used in cotton ginneries
4. Development of a process for antibacterial finishing to cotton textiles by using electro-spraying technique
5. Plasma treatment and its effect on colouration of textile substrate
6. Process protocol for development of illustrative fabrics for fabric handle
7. Process for preparation of hydrophobic nanocellulose for application in composites

2014-15

Value added products developed

1. Doffing system and enclosure for Double Roller gin to reduce the dust emission
2. Nylon/cotton core spun yarn for rubber composites
3. Development of Cotton-rich/Bamboo viscose blended functional fabric
4. Gossypol-free lysine rich cottonseed cake as poultry meal
5. Jute Fibre Reinforced Polypropylene Composite Using Core-spun Technology

Process protocol developed

1. Process for regeneration of fried oil from cotton seed
2. Water free hydrophobic finishing of cellulosic textile using plasma Technology
3. Process for preparation of in situ nano ZnO for durable functional finishing of cotton textiles
4. Durable UV protection finishing of cotton textiles using plant extracts
5. Optimization of parameters in friction spinning collector of electro-spinning setup
6. Development of low temperature process for the preparation of absorbent cotton
7. Process Protocol for Ginning of Long Staple Cotton on Rotary Knife Roller Gin
8. Process for development of composites from newspaper based cellulosic waste

2015-16

Value added products developed

1. Multi-axial Electro-spinning setup for Production of Nano-fibre Mat
2. Development of universal flammability testing machine
3. Development of colorimetric sensor to monitor ripening of mangos
4. Cotton/PLA/Viscose tri-blended yarns and fabrics for improved functionality
5. Development of On-board-pre-cleaner for mechanically harvested cotton

Process protocol developed

1. Process for production of elctrospun fibre mat from cellulose acetate
2. Process for preparation of Zinc Oxide based hybrid nano particles.
3. Protocol for production of Nanocellulose on pilot scale
4. Low salt dyeing process for cotton using saline water
5. Process Protocol for Ginning of Machine Picked Cotton
6. Salt free dyeing process through cationization of cotton fabric

2016-17

Value added products developed

1. Preparation of Activated Carbon from Cotton Stalks
2. Lint opener for preparation of cotton samples for quality testing

Process protocol developed

1. Development of antibacterial finish to cotton- bamboo viscose blended fabrics
2. Surface modification of Nylon fabric and its optimisation for improved adhesion in rubber composite
3. Database for non-metameric computer colour matching of cotton textiles
4. Logistics of harvesting, collection, chipping and transportation of cotton stalks for preparation of briquettes and pellets
5. Improving the strength of kraft paper by using micro fibrillated cellulose as furnish additive
6. Report on contamination status of Indian Cottons
7. Optimising the microbial process for preparation of absorbent cotton for efficacy and uniformity
8. Microencapsulated herbal formulation for mosquito repellent finish
9. Development of Single Locking Cotton feeder for Double Roller Gin
10. Surface modification process for banana fibres for use in composite making

III. No. of New Technologies (developed during this period) licensed

1. Pedal Driven Banana Fibre Spinning system, "CIRCOT-Phoenix Charkha"
2. Design and Development of new Double Roller Ginning Machine with Self Grooving Rubber Roller
3. ICAR Flexi-Check Dam
4. Double Roller Ginning Machines with Hinged Knife, Leaf Spring Pressure Mechanism and reciprocating finger type seed metering device
5. Microbial method for degossypolization of cottonseed meal
6. Antibacterial treatment of Textile materials
7. Gin Cotton Lint Opener
8. Development of cotton and cotton blend and application of functional finishes to impart antibacterial and moisture management properties
9. Energy from cotton stalks – supply chain
10. Accelerated Process for Composting of Cotton Stalk
11. Absorbent cotton production
12. CIRCOT LLC Baton
13. Nanocellulose Production Technology

IV. No. of New Technologies developed and commercialised during the period

1. Pedal Driven Banana Fibre Spinning system, “CIRCOT-Phoenix Charkha”
2. Design and Development of new Double Roller Ginning Machine with Self Grooving Rubber Roller
3. ICAR Flexi-Check Dam
4. Double Roller Ginning Machines with Hinged Knife, Leaf Spring Pressure Mechanism and reciprocating finger type seed metering device
5. Microbial method for degossypolization of cottonseed meal
6. Antibacterial treatment of Textile materials
7. Cotton Lint Opener
8. Development of cotton and cotton blend and application of functional finishes to impart antibacterial and moisture management properties
9. Energy from cotton stalks – supply chain
10. Accelerated Process for Composting of Cotton Stalk
11. Absorbent cotton production
12. CIRCOT LLC Baton
13. Nanocellulose Production Technology
14. CIRCOT Calibration Cotton

ANNEXURE VII

Number of patents filed and granted during the period

Patents filed

Sr. No.	Patent filing No.	Title	Date of filing
1.	1553/MUM/2012	Pretreatment of Cottonseeds with Microbial Consortium for Energy Efficient Removal of Linters	22-05-2012
2.	1554/MUM/2012	Pedal Driven Banana Fibre Spinning System	22-05-2012
3.	3464/MUM/2012	Banana Psudostem Fibre Drawing Machine	07-12-2012
4.	3465/MUM/2012	Banana Pseudostem Fibre Carding Machine	07-12-2012
5.	3466/MUM/2012	Cellulosic Materials Incorporating Nano Zinc Oxide and Method to Manufacture the Same	07-12-2012
6.	3467/mum/2012	Banana Pseudostem Fibre Ring Spinning Machine	07-12-2012
7.	3468/MUM/2012	Cotton Textile Incorporating Titanium Dioxide Nano particles and Method to Manufacture the Same	07-12-2012
8.	3469/MUM/2012	Method of Dyeing and Protective Finishing of Cotton Textiles Using Vegetable Extract	07-12-2012
9.	362/MUM/2013	Optical scanner based fabric pilling measurement system	07-02-2013
10.	295/MUM/2015	Electrospinning apparatus with friction spinning collector for production of core-sheath nano yarns	29-01-2015
11.	1477/Mum/2014	A novel process for gossypol reduction and nutritive quality improvement in cottonseed cake for its use in non-ruminants feed	28-04-2014
12.	1509/MUM/2014	RFL (Resorcinol Formaldehyde Latex)-Free process for textile based rubber composite	30-04-2014
13.	1723/MUM/2014	Composite made from waste paper and the method of producing the same	23-05-2014

14.	PCT/IB2012/0532 68	A novel organic fertilizer of banana pseudo stem	01-12-2013
15.	4957/MUM/2015	Bi-axial Electrospinning setup for production of Nanofibre mat	30-12-2015
16.	201621000249	Process of Natural Fiber reinforced Thermoplastic Composite Material Production by Fiber Wrapping method and the product of the same cases	05-01-2016

Patents Granted

Sr. No.	Title	Patent No.	Date of grant
1.	Development and use of Rubber Disc with soft rubber layers as material for self -grooving roller in roller ginning machines	266213	15-04-2015
2.	Zinc chloride pretreatment of microcrystalline for preparation of nanocellulose by homogenization process	266707	27-05-2015
3.	A Process for Preparation of Cellulose Nanoparticles using the Fungus, <i>Trichoderma reesei</i>	275149	24-08-2016
4.	A New Enzymatic Process for the Preparation of Absorbent Cotton from Non Spinnable Short Staple Cotton	273512	13-06-2016
5.	Bio-enrichment of Cattle feed for Better Digestibility	276257	07-10-2016
6.	A Method for the Production of Cellulose Powder from Crop Residues	276255	07-10-2016

ANNEXURE VIII

List of Trainings conducted with number of participants

Sr. No.	Place	Description	Duration (Days)	No. of Participants
1.	CIRCOT, Mumbai	Quality Evaluation of Textile Fibres	3	42
2.	CIRCOT, Mumbai	Quality Evaluation of Textile Fibres	3	
3.	GTC, Nagpur	Training on Ginning Technology and Quality Evaluation of Cotton fibres	5	
4.	GTC, Nagpur	Training on Ginning Technology and Quality Evaluation of Cotton fibres	3	36
5.	CIRCOT, Mumbai	Training on Ginning Technology and Quality Evaluation of Cotton fibres	5	42
6.	CIRCOT, Mumbai	Quality Evaluation of Cotton	5	
7.	GTC, Nagpur	Training on Ginning Technology and Quality Evaluation of Cotton fibres	5	150
8.	GTC, Nagpur	Training on Ginning Technology and Quality Evaluation of Cotton fibres	5	
9.	CIRCOT, Mumbai	Quality Evaluation of Cotton	5	
10.	GTC, Nagpur	Training on Ginning Technology and Quality Evaluation of Cotton fibres	5	
11.	GTC, Nagpur	Training on Ginning Technology and Quality Evaluation of Cotton fibres	13	
12.	GTC, Nagpur	Training on Ginning Technology and Quality Evaluation of Cotton fibres	5	
13.	GTC, Nagpur	Training on Ginning Technology and Quality Evaluation of Cotton fibres	5	
14.	GTC, Nagpur	Training on Ginning Technology and Quality Evaluation of Cotton fibres	8	11
15.	GTC, Nagpur	Training on Ginning Technology and Quality Evaluation of Cotton fibres	5	19
16.	CIRCOT, Mumbai	Quality Evaluation of Cotton	5	8

17.	GTC, Nagpur	Ginning Technology and Quality Evaluation of Cotton fibres	6	10
18.	GTC, Nagpur	Training under ATMA scheme (Ginning)	0	36
19.	CIRCOT, Mumbai	Basics of Nanotechnology and their Applications	5	3
20.	GTC, Nagpur	Cotton Ginning Technology	6	6
21.	CIRCOT, Mumbai	Quality Evaluation of Textile Fibres	5	3
22.	GTC, Nagpur	Cotton Ginning Technology	5	6
23.	GTC, Nagpur	Ginning	5	21
24.	GTC, Nagpur	Ginning	5	37
25.	GTC, Nagpur	Cotton Ginning Technology	5	5
26.	CIRCOT, Mumbai	Entrepreneurship development programme on absorbent cotton technology	2	18
27.	GTC, Nagpur	Cotton Ginning Technology	2	39
28.	GTC, Nagpur	Cotton Ginning Technology	4	3
29.	GTC, Nagpur	Cotton Ginning Technology	5	30
30.	CIRCOT, Mumbai	Extraction and application of Natural Dyes	1	29
31.	GTC, Nagpur	Cotton Ginning Technology	5	5
32.	GTC, Nagpur	Cotton, Ginning and By-product utilisation	4	30
33.	GTC, Nagpur	“Developments in Cotton Ginning Technology” for unemployed youth	4	14
34.	CIRCOT, Mumbai	Basics of Nanotechnology and its Applications	5	14
35.	GTC, Nagpur	Double Roller Ginning Technology and Cotton Quality Evaluation	5	70
36.	GTC, Nagpur	Double Roller Ginning Technology and Cotton Quality Evaluation	6	5
37.	CIRCOT, Mumbai	Quality Evaluation of Cotton	5	10

38.	GTC, Nagpur	Cotton Ginning and Quality Evaluation	6	2
39.	CIRCOT, Mumbai	Quality Evaluation of Cotton	5	6
40.	GTC, Nagpur	Instrumental and Manual Cotton Classing	6	5
41.	GTC, Nagpur	Cotton Processing, Classing and Marketing	6	12
42.	CIRCOT, Mumbai	Quality Evaluation of Cotton	5	21
43.	CIRCOT, Mumbai	ICAR Short Course on Application of Electrospun Nanofibres in Crop Health & Post-harvest Technology	10	16
44.	GTC, Nagpur	Double Roller Ginning Technology	6	12
45.	GTC, Nagpur	Double Roller Ginning Technology and Cotton Quality Evaluation	6	8
46.	GTC, Nagpur	Double Roller Ginning Technology and Cotton Quality Evaluation	6	5
47.	CIRCOT, Mumbai	Basics of Nanotechnology and its Applications	5	12
48.	CIRCOT, Mumbai	Cotton Spinning	5	5
49.	CIRCOT, Mumbai	Advances in Microscopy	3	10
50.	GTC, Nagpur	Farmer's Training Programme on "Improvement in Cotton Quality and Value Addition"	5	23
51.	CIRCOT, Mumbai	Quality Evaluation of Cotton	5	7
52.	CIRCOT, Mumbai	Chemical Characterisation of Textile Material and Auxiliaries	5	13
53.	CIRCOT, Mumbai	Advances in Textile Characterisations	5	9
54.	GTC, Nagpur	Double Roller Ginning Technology and Cotton Quality Evaluation	6	7
55.	GTC, Nagpur	Double Roller Ginning Technology and Cotton Quality Evaluation	6	15
56.	CIRCOT, Mumbai	Quality Evaluation of Cotton	5	7

57.	CIRCOT, Mumbai	Quality Evaluation of Cotton	5	3
58.	GTC, Nagpur	Recent Advances in Cotton Ginning, Quality Evaluation and By-products Utilisation	6	6
59.	CIRCOT, Mumbai	Quality Evaluation of Cotton	5	14
60.	CIRCOT, Mumbai	Quality Evaluation of Cotton	5	17
61.	GTC, Nagpur	Double Roller Ginning Technology and Cotton Quality Evaluation	6	5
62.	CIRCOT, Mumbai	Quality Evaluation of Cotton for Cotton Breeders / Scientists	3	24
63.	CIRCOT, Mumbai	Quality Evaluation of Cotton	5	19
64.	CIRCOT, Mumbai	Absorbent Cotton Technology	2	10
65.	GTC, Nagpur	Double Roller Ginning Technology and Cotton Quality Evaluation	5	14
66.	CIRCOT, Mumbai	ICAR Course on Fermentation Technology for Value -addition to Cotton By-products and Biomass	10	11
67.	CIRCOT, Mumbai	Advances in Applications of Nanotechnology	5	17
68.	CIRCOT, Mumbai	Quality Evaluatio of Cotton	3	15
69.	CIRCOT, Mumbai	Quality Evaluatio of Cotton	5	18
70.	CIRCOT, Mumbai	Quality Evaluatio of Cotton	5	14
71.	GTC, Nagpur	Double Roller Ginning Technology and Cotton Quality Evaluation	5	17
72.	CIRCOT, Mumbai	Quality Evaluatio of Cotton	5	15
73.	CIRCOT, Mumbai	Spectroscopic and Chromatographic Techniques for Material Characterisation	4	16
74.	CIRCOT, Mumbai	Fibre Identification, Yarn making and Dyeing of Textiles	1	12
75.	GTC, Nagpur	Double Roller Ginning Technology and Cotton Quality Evaluation	6	4

76.	GTC, Nagpur	Double Roller Ginning Technology and Cotton Quality Evaluation	6	4
77.	CIRCOT, Mumbai	Electrospinning Techniques and their Applications	3	12
78.	CIRCOT, Mumbai	Quality Evaluation of Cotton	5	8
79.	GTC, Nagpur	Double Roller Ginning Technology and Cotton Quality Evaluation	6	10
80.	CIRCOT, Mumbai	Value addition to Cottonseed	4	8
81.	CIRCOT, Mumbai	ICAR Short Course on Synthesis and Characterisation of Nanomaterials for Agricultural Applications	10	20
82.	CIRCOT, Mumbai	Quality Evaluation of Cotton	5	3
83.	CIRCOT, Mumbai	Fibre and Yarn Quality Management in Spinning	3	11
84.	CIRCOT, Mumbai	Basic Statistical Techniques for Textile Research	3	11
85.	CIRCOT, Mumbai	Absorbent Cotton Technology	3	10
86.	CIRCOT, Mumbai	Characterisation of Materials Using X-Ray Diffractometer (XRD)	3	11
87.	CIRCOT, Mumbai	Advances in Microscopy	3	10
88.	GTC, Nagpur	Double Roller Ginning Technology and Cotton Quality Evaluation	6	4
89.	GTC, Nagpur	Preparation of Compost and Cultivation of Oyster Mushroom using Cotton Stalks	1	22
90.	CIRCOT, Mumbai	Advances in Application of Nanotechnology	5	12
91.	CIRCOT, Mumbai	Quality Evaluation of Cotton	5	6

International Training Programmes Conducted

Sr. No.	Place	Description	Duration (Days)	No. of Participants
1.	GTC, Nagpur and CIRCOT, Mumbai	Two week Training -cum-Exposure Programme on "Post-harvest Management of Cotton and Value Addition to Crop Residues" under Technical Assistance Programme (TAP) for African countries- Benin, Burkina Faso, Chad, Malawi, Nigeria, & Uganda,	15	31
2.	Cotton Development Organization (CDO), Kampala, Uganda	Cotton TAP for Africa: In Country Training Programme on "Post-harvest Management of Cotton and Value Addition to Cottonseed and Crop Residues"	5	25
3.	Bvumbwe Agricultural Research Station, Blantyre, Malawi	Cotton TAP for Africa: In Country Training Programme on "Post-harvest Management of Cotton and Value Addition to Cottonseed and Crop Residues"	3	21
4.	Bohicon, Benin	Post-harvest Management of Cotton and Value addition to cottonseed and crop residues	5	25
5.	Moundou, Chad, Africa	In-Country training programme on post-harvest management and value addition to crop residues (under Cotton TAP)	4	20
6.	Zaria, Kaduna State, Nigeria	In-Country training programme on post-harvest management and value addition to crop residues (under Cotton TAP)	6	43

Sr. No.	Place	Description	Duration (Days)	No. of Participants
7.	Ouagadougou, Burkina Faso	In-country Training Programme on "Post- harvest Management of Cotton and Value-addition to crop residues"	2	17

ANNEXURE IX

Abbreviations

ABI	: Agri-Business Incubator
ACTO	: Assistant Chief Technical Officer
ADG	: Additional Director General
AFAO	: Assistant Finance & Accounts Officer
AFIS	: Advanced Fibre Information System
AICCP	: All India Coordinated Cotton Improvement Project
AICRP	: All India Coordinated Research Project
AKMU	: Agricultural Knowledge Management Unit
ANGRAU	: Acharya N G Ranga Agricultural University
ATMA	: Agricultural Technology Management agency
ATR	: Action Taken Report
BIS	: Bureau of Indian Standards
BPD	: Business Planning and Development
CAI	: Cotton Association of India
CBPD	: Chemical & Biochemical Processing Division
CCI	: Cotton Corporation of India
CCSHAU	: Chaudhary Charan Singh Haryana Agricultural University, Hisar
CDRA	: Cotton Development & Research Association
CEWF	: CIRCOT Employee Welfare Fund
CFC	: Common Fund for Commodities
CIAE	: Central Institute of Agricultural Engineering
CICR	: Central Institute for Cotton Research
CIFE	: Central Institute of Fisheries Education
CIFT	: Central Institute of Fisheries Technology
CIRCOT	: Central Institute for Research on Cotton Technology
CPRI	: Central Potato Research Institute
CPWD	: Central Public Works Department
CRIJAF	: Central Research Institute for Jute and Allied Fibres
CRP	: Consortia Research Platform
CSWRI	: Central Sheep and Wool Research Institute
CTO	: Chief Technical Officer
CTRL	: Cotton Technological Research Laboratory
DARE	: Department of Agricultural Research and Education
DDG	: Deputy Director General
DR	: Double Roller
DST	: Department of Science & Technology
EMR	: Extra Mural Research
GeM	: Government e-Marketplace
GOI	: Government of India
GTC	: Ginning Training Centre
HOD	: Head of Division
HQ	: Head Quarters
HVI	: High Volume Instrument
IARI	: Indian Agricultural Research Institute
ICAC	: International Cotton Advisory Committee
ICAR	: Indian Council of Agricultural Research
ICCC	: Indian Central Cotton Committee
ICEF	: Indo Canada Environment Fund
ICT	: Institute of Chemical Technology
IGTC	: International Ginning Training Centre
IIWM	: Indian Institute of Water Management
IJSC	: Institute Joint Staff Council
IL&FS	: Infrastructure Leasing and Finance Services
IMC	: Institute Management Committee

INRAB	: Institut National des Recherches Agricoles du Bénin
IRC	: Institute Research Council
IRMRA	: Indian Rubber Manufacturers Research Association
ISO	: International Organization for Standardization
ITMU	: Institute Technology Management Unit
JDIET	: Jawaharlal Darda Institute of Engineering and Technology
KAB II	: Krishi Anusandhan Bhavan II
LOI	: Limiting Oxygen Index
MANTRA	: Manmade Textile Research Association
MCRS	: Main Cotton Research Station
MGIRI	: Mahatma Gandhi Institute for Rural Industrialisation
MGMG	: Mera Gaon Mera Gaurav
MIS-FMS	: Management Information System- Financial Management System
MoU	: Memorandum of Understanding
MPD	: Mechanical Processing Division
NAAS	: National Academy of Agricultural Sciences
NABL	: National Accreditation Board for Testing & Calibration of Laboratories
NAIF	: National Agricultural Incubation Fund
NAIP	: National Agricultural Innovation Project
NCDEX	: National Commodities and Derivatives Exchange Limited
NDR	: Natural Dye Resources
NFBSFARA	: National Fund for Basic Strategic and Frontier Research in Agriculture
NIFT	: National Institute of Fashion Technology
NIRJAFT	: National Institute of Research on Jute and Allied Fibre Technology
NRCB	: National Research Centre on Banana
PLA	: Poly Lactic Acid
PME	: Prioritization, Monitoring and Evaluation
QEID	: Quality Evaluation and Improvement Division
QEU	: Quality Evaluation Unit
QRT	: Quinquennial Review Team
R&D	: Research and Development
RAC	: Research Advisory Committee
RCF	: Rashtriya Chemicals & Fertilizers
RFID	: Radio-Frequency Identification
SAO	: Senior Administrative Officer
SAU	: State Agricultural University
SEM	: Scanning Electron Microscope
SFC	: Standing Finance Committee
SIMA	: Southern India Mills Association
TAP	: Technology Assistance Programme
TMC	: Technology Mission on Cotton
TO	: Technical Officer
TSP	: Tribal Sub- Plan
TTD	: Technology Transfer Division
UAS	: University of Agricultural Sciences
UNDP	: United Nations Development Programme
USDA	: United States Department of Agriculture
VJTI	: Veermata Jijabai Technological Institute
ZTMC	: Zonal Technology Management Centre

Glimpses of Visits



Planning meeting at ICAR-CIRCOT, Mumbai



QRT visiting ICAR-CIRCOT's nanocellulose pilot plant



QRT visiting ICAR-CIRCOT's facilities



**QRT at ICAR-CIRCOT's Visitors cum
Exhibition room**



QRT at GTC, Nagpur



Interacting with stakeholders at GTC, Nagpur



QRT at CIRCOT QEU Coimbatore



Meeting with stakeholders at Coimbatore



Interacting with stakeholders at QEU, Sirsa



Visiting cotton fields - Regional station of CICR, Sirsa



Meeting with stakeholders at ICAR-CIRCOT, Mumbai



QRT inspecting the lab at QEU, Guntur



QRT at QEU, Surat of CIRCOT



QRT visiting cotton ginning industry at Viramgam, Gujarat



Interactive meet with CIRCOT IMC



QRT with members of CIRCOT IMC



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