



COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

CSIR RESEARCH AND DEVELOPMENT

# STRATEGIC PLAN



MINISTRY OF FOREIGN AFFAIRS OF DENMARK  
**DANIDA** | International  
Development Cooperation



DECEMBER, 2014



## ACKNOWLEDGEMENT

We hereby acknowledge the support of the Council for Technical and Vocational Education Training (COTVET) and the World Bank for providing sponsorship for the preparation and publishing of the CSIR Research and Development Strategic Plan.

The Director-General of the CSIR, Dr. Abdulai Baba Salifu led in the development of the plan. Dr. Naaminong Karbo, the Director of Animal Research Institute and Dr. George O. Essegbey, the Director of the Science and Technology Policy Research Institute (STEPRI) facilitated the preparation and the consultations on the plan. Dr. (Mrs) Wilhemina Quaye was a member of the team that drafted the plan.

The rich inputs from the Directors of the CSIR Institutes and other functionaries were critical in the finalization of the plan and are hereby gratefully acknowledged. Contributions from Association of Ghana Industries (AGI) and other private sector players are highly appreciated.



*The DG, Directors, along with supporting Research Staff of CSIR in the drafting and validation of the CSIR R&D Strategic Plan-15th October, 2014*



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## LIST OF ABBREVIATIONS AND ACRONYMS

AGI	- Association of Ghana Industries
ARI	- Animal Research Institute
BRRl	- Building Road Research Institute
CCID	- Corporate Commercialisation and Information Directorate
CIDA	- Canadian International Development Agency
COTVET	- Council for Technical and Vocational Education and Training
CRI	- Crops Research Institute
CSIR	- Council for Scientific and Industrial Research
DAAD	- German Academic Exchange Service
DANIDA	- Danish International Development Agency
EMPRETEC	- Entrepreneurs and Technology
EPA	- Environmental Protection Agency
EU	- European Union
FORIG	- Forestry Research Institute of Ghana
FRI	- Food Research Institute
GCCI	- Ghana Chamber of Commerce and Industry
GIZ	- German Federal Enterprise for International Cooperation
GNAFF	- Ghana National Association of Farmers and Fishermen
IDRC	- International Development Research Centre
IIR	- Institute of Industrial Research
INSTI	- Institute for Scientific and Technological Information
ISP	- Internet Service Providers
JICA	- Japan International Cooperation Agency
MESTI	- Ministry of Environment, Science, Technology and Innovation
MOTI	- Ministry of Trade & Industry
NBSSI	- National Board for Small Scale Industries
NGO	- Non-Governmental Organization
NRC	- National Research Council
OPRI	- Oil Palm Research Institute
PGRRI	- Plant Genetic Resources Research Institute
PMF	- Performance Management Framework
PPP	- Public-Private Partnership
R&D	- Research and Development
RSSP	- Rice Sector Support Project
SARI	- Savanna Agricultural Research Institute
SRI	- Soil Research Institute
STEPRI	- Science and Technology Policy Research Institute
STI	- Science, Technology and Innovation
SWOT	- Strengths, Weaknesses, Opportunities and Threats
TDTC	- Technology Development and Transfer Centre
UNDP	- United Nations Development Programme
UNESCO	- United Nations Educational, Scientific and Cultural Organization
USAID	- United States Agency for International Development
WAAPP	- West Africa Agricultural Productivity Programme
WRI	- Water Research Institute

## Chapter 1

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### 1.0 Introduction

#### 1.1 Background

The establishment of the National Research Council (NRC) in 1958 illustrates the early recognition of Science, Technology and Innovation (STI) as the driver of Ghana's national development. It institutionalised Research and Development as an important source of enhancing socio-economic activities in the country. After the dissolution of the NRC, the Council for Scientific and Industrial Research (CSIR) was established in 1968 to consolidate the functions that ensure STI impact on national development. The re-establishment law of 1996 crystallises the vision of the CSIR in the modern context and with the functions spelt out in sub-section 2 of Act 521, including:

- To pursue the implementation of government policies on scientific research and development;
- To advise the Minister on scientific and technological advances likely to be of importance to national development;
- To encourage co-ordinated employment of scientific research for the management, utilisation and conservation of the natural resources of the Republic in the interest of development;
- To encourage in the national interest scientific and industrial research of importance for the development of agriculture, health, medicine, environment, technology and any other service sectors and to this end to encourage close linkages with the productive sectors of the economy;
- To exercise control over the research institutes, centres, units and projects of the Council;
- To institute a system of contract research to ensure that research being carried out in the Council is relevant and cost effective;
- To encourage and promote the commercialisation of research results.

The clear statement made for "commercialisation of research results" in the 1996 law re-establishing the CSIR has defined the direction of R&D generally for all the constituent institutes, centres and units. The R&D activities are not

ends in themselves but are means to the ends of commercialisation. In the broad sense, the research institutes are to carry out what in current jargon has become known as “demand-driven” research. However, the focus on commercialisation only brings into the spotlight, a pervasive and chronic problem in the national research system – the problem of the gap between the research system and the user ends of the outputs of research. This fundamental problem is addressed in this Five (5) year CSIR R&D Strategic Plan, which takes effect between 2015 and 2019.

The CSIR R&D Strategic Plan is organized into six main chapters. Chapter 1 introduces the plan with the background, statement of the problem and the goals and objectives. Chapter 2 is on R&D and technology transfer. It does a SWOT analysis of the CSIR and outlines the implications for strategies. The Chapter 3 elaborates on the strategic areas for R&D and technology transfer. Chapter 4 expands on the strategic areas and details the strategic actions. Chapter 5 focuses on the CSIR-TDTC project implementation and the strategies to entrench the project activities in the institutes. The concluding Chapter 6 summarises the highlights of the way forward for the strategic plan.

## **1.2 The problem statement – the gap between research and industry**

Generally, there is a real gap between the Ghana’s research system and the private sector. Research and Development (R&D) outputs or innovations in diverse forms see little uptake in the private sector. Yet the innovations are often what the private sector needs to address their business challenges and enhance productivity for socio-economic development.

What is urgently needed is a structured mechanism to bridge the CSIR research system with the private sector to ensure the flow of innovation. Such a bridge will also help the CSIR to engage with the private sector in the conceptualization and the generation of the innovations to enhance transfer and application in the private sector. Entrepreneurs also need to be sensitized to the value and applicability of CSIR technologies since there is also the problem of limited knowledge of the opportunities available in the CSIR with respect to innovations. Where sensitization or training is done in a structured framework, there is a very high feasibility of successful technology transfer and commercialization of the innovations.

Furthermore, a critical factor accounting for the research-industry gap is the lack of appropriate start-up capital for initiating the process of commercialization and dealing with the risk of investing in new technologies. Funding is a major challenge for the private sector. The private sector will therefore be better encouraged should there be funding opportunities for the uptake of R&D innovations in business.

### 1.3 The Conceptual Framework

Against the background of the problems statement, a conceptual framework is proposed. We conduct Research and Development (R&D) in partnership with the private sector, producing technologies or innovations that feed into industry or get adopted for use (See Figure 1).

Figure 1 illustrates the various phases of research, technology development and transfer. There is the conceptualization phase with the formulation of

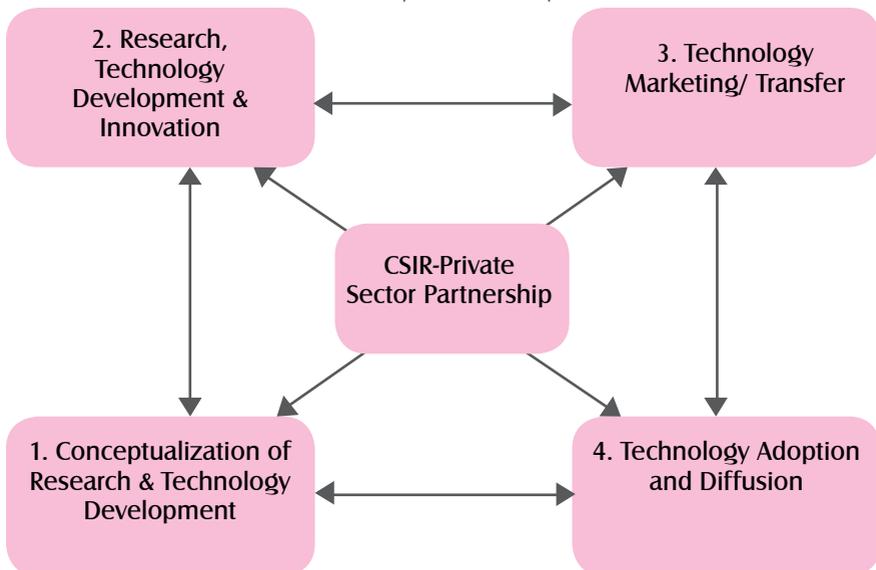


Figure 1: Conceptual Model of CSIR Research, Technology Development and Transfer

proposal and research design. The research, technology development and innovation follow. The next phase is technology marketing and transfer.

Then there is technology adoption and diffusion. In the new paradigm, all the four phases will be done in partnership with the private sector. Besides, each phase is interactive with the next with feedback making the research, technology development and innovation an integrated system.

It means the TDTC and the Commercialization Directorate of CSIR should facilitate the generation of funds for the CSIR through commercialisation of internally developed technologies and innovations. We expect increase in commercialisation and the internal generation of funds through expanded demand for the technologies or products and the direct transfers through licensing, co-ownership of the business, etc.

#### **1.4 Vision, Mission and Objectives of the CSIR**

The CSIR R&D Strategic Plan states the vision of the organisation as follows:

The vision of the CSIR is to become a globally recognized scientific organization that uses the transforming power of STI for socio-economic development.

The vision of the CSIR is to use the transforming power of Science, Technology and Innovation (STI) for socio-economic development. In this regard, the CSIR with its constituent research institutes pursue a range of activities in Research and Development (R&D).

The mission of the CSIR is to become a scientific organization that promotes accelerated national socio-economic development through research, technology transfer, innovation and training in partnership with the private and public sectors.

Objectives of the CSIR are mainly to:

1. Develop demand-driven technologies for wealth generation;
2. Innovate for sustainable mobilization and management of funds;
3. Make STI more client-responsive;
4. Generate adequate resources to sustain the CSIR; and
5. Develop competent human resource base for R&D activities for socio-economic development.

The value proposition is providing STI to transform businesses. CSIR ensures access to quality-driven innovative technologies to achieve competitiveness. This involves the following:

- **Partnership with private sector:** It is at the heart of the CSIR technology development and transfer. Clients are mainly smallholders and medium enterprises. However, we are also open to dealing with the large scale enterprises;
- **Enhancing the value of indigenous knowledge and technology:** Value addition to indigenous technologies and products; joint development and or co-ownership with the private sector;
- **Quality assurance:** What distinguishes CSIR products from others on the market is the quality of products, technology or service. Quality assurance will be the hallmark of CSIR operations;
- **Cost-effectiveness or value for money:** Ensure the efficiency and efficacy of the production systems developed by the CSIR in order to optimise on profit. Whatever the business operation, in partnership with CSIR there is value for money;
- **Commitment to client service:** CSIR workers of all grades are totally committed to the mission of demand-driven R&D and technology transfer at all times; and
- **Environmental friendliness:** CSIR technologies are environmentally friendly and climate-smart.

## Chapter 2

### 2.0 SWOT ANALYSIS OF THE CSIR

This chapter gives an overview of the CSIR organizational framework, the Research and Development programmes and technology transfer. It analyses the strengths, weaknesses, opportunities and threats of the CSIR and highlights the key issues for strategies.

#### 2.1 The CSIR organizational framework

The CSIR operates under the Ministry of Environment, Science, Technology and Innovation (MESTI) with thirteen research institutes. There is a Director-General, with a Deputy Director-General, Directors of the Institutes and Corporate Directors. See Appendix 1 for organizational framework and list of institutes.

#### 2.2 The CSIR R&D Programmes

There are several R&D programmes going on in the 13 research institutes coming under the broad thematic areas of the following

- Agriculture, agribusiness and food security;
- Industry and services;
- Built environment and environmental sustainability;
- Technology in society.

##### 2.2.1 Agriculture, Agribusiness and Food Security

The thematic areas of agriculture, agribusiness and food security embrace research institutes which have functions bearing on the important national challenge of food security, self-sufficiency and contributing to creating the raw material base for agro-industrialization. For example, the CSIR-Crops Research Institute has a broad research mandate covering all food and industrial crops. The crops researched on are Grains (maize,

rice, cowpea, soyabean, groundnut and bambara groundnut), Horticultural Crops (tropical fruits banana, citrus, pineapple, cashew, avocado, pawpaw and mango), Vegetables (pepper, garden eggs, tomato, onions and leafy vegetables) and Root and Tubers (cassava, yam, cocoyam, sweet potato and taro) as well as industrial crops (rubber, sugar cane, tobacco and bast fibres).

The research programmes of CSIR-CRI include the broad areas of the following:

- Biotechnology;
- Legume and Cereals Improvement;
- Root and Tuber Crops Improvement;
- Resource and Crop Management;
- Plant Health;
- Seed Technology, Post-harvest and Food Science;
- Socio-economics; and
- Biometrics.

The CSIR - Animal Research Institute (ARI) is mandated to develop and transfer technologies aimed at promoting sustainable animal agriculture, improved livestock production and productivity to reduce poverty and enhance commercial animal production while improving natural resources management. The Institute is also to stimulate, through R&D, accelerated production and consumption of animal protein. It is involved in studying access and adoption of improved technologies transferred to its clients in Ghana. The institute offers advisory services and training to small, medium and large-scale farmers in Ghana, as well as advice to Government of Ghana on policies concerning the animal industry. The core competences are diverse and research programmes are in the following areas:

- Diagnostics & control of animal and zoonotic diseases;
- Parasite and vector control;
- Food safety, and
- Vaccine development for livestock and poultry (e.g. anthrax, coccidiosis).
- Breed improvement in poultry, grasscutter, guinea fowl, cattle, goat, sheep and pigs;
- Feed resources & feeding systems development;
- Livestock waste management.
- Production systems improvement – cattle, sheep;

- Feed resources & feeding systems improvement; and
- Genetic resources management/conservation.

The Soil Research Institute (CSIR-SRI) is also an agricultural research institute with core mandate in all aspects of soil. CSIR-SRI conducts research to generate information and technologies for effective planning, utilisation and management of the soil resources of Ghana. The current programmes are:

- Fertilizer development;
- Promoting enabling health policy environment;
- Biochar use in agro-ecosystems;
- Production of biofuels;
- Agricultural climate change mitigation;
- Development of improved infrastructure and technologies for rice production
- Soil map digitization; and
- Nitrogen fixation for small holder farmers.

The Savanna Agricultural Research Institute (CSIR-SARI) is another important agriculture-based scientific institution with the key focus on research in the north of Ghana. Its research is extensive and includes broadly the improvement of crops suitable for the agro-ecological regions of the savanna. The crops being improved include rice, sorghum, maize, yam, cassava, yam, potato varieties, vegetables, cotton, etc.

Another agricultural research institute is the Oil Palm Research Institute (CSIR-OPRI). Over the years, it has contributed tremendously to the improvement of Ghana's oil palm germplasm and it is still committed to the development of the crop, its farming systems, extension of knowledge to the industry players, among other things.

It is not only in crop and livestock agriculture that the institutes research in. There is also aquaculture. The Water Research Institute carries out agriculture-related research in the specific area of aquaculture. The research programmes include:

- Research and technology transfer in aquaculture and sustainable management
- Supply improved brood stock and feed from local ingredients
- Breed improved Akosombo strain of Nile Tilapia (*Oreochromis niloticus*)

## 2.2.2 Industry and Services

The Industry and Services thematic area embrace research primarily for industries and enterprises of all scales. For example, the CSIR-IIR is mandated to conduct research to assist in poverty reduction through the creation of opportunities for generating and increasing incomes within the SMEs; contribute towards food security, generate foreign exchange earnings and apply cost-effective industrial technologies that are both environmentally friendly and commercially viable. The mission of the CSIR-IIR is to drive national development and global competitiveness in industry through scientific and technological research. This will be achieved by developing relevant cutting-edge technologies and materials, and offer services that can attract local and international applications. The R&D activities cover among others:

- designing and developing science resources software for school;
- implementation of digital library services; and
- training on scientific and engineering software as well as maintenance of data network.
- Renewable Energy (Build capacity on renewable energy:- provide electricity through solar photovoltaic system to deprived communities);
- Bio-sanitation systems construction and promotion; and
- Research into Development of composite materials using plastic waste and saw dust.
- Design and Fabrication of small scale agro-industrial machinery targeting the local agro processing industry;
- Kiln and Incinerator construction.

The Food Research Institute (FRI) is mandated to conduct market-oriented applied research, provide technical services and products to the food industry, assist in poverty alleviation through the creation of opportunities for income generation and contribute to food security and foreign exchange earnings. There are research activities on-going under (i) Grains and Legume Products, (ii) Roots and Tuber Products, (iii) Meat, Fish, Poultry and Dairy Products and (iv) Fruit and Vegetable Products. In line with these, there are a number of collaborative research projects such as:

- Rice Sector Support Project (RSSP) funded by Agence Francais De Development (AFD)
- Rice post-harvest handling, marketing and the development of new

rice-based products- AfricaRice funded by CIDA

- African Food Tradition Revisited by Research (AFTER) Project: EU-Funded
- Africa Rising Project funded by USAID
- Cassava: Adding Value for Africa (C:AVA) Project –Ghana funded by BMFG
- Gains from losses of Root and Tuber crops (GRATTITUDE) Project: EU-Funded
- Cassava Growth Markets: EU-Funded
- West Africa Agricultural Productivity Programme (WAAPP) funded by the World Bank
- Improving Food Security by Reducing Post-Harvest Losses in the Fisheries Sector: EU-Funded

### **2.2.3 Built Environment and Environmental Sustainability**

The Built Environment and Environmental Sustainability reflect one of the important mandates of the CSIR – applying scientific knowledge and innovation for sustainable development. For example, the CSIR-BRRI is mandated to provide research and development processes, products and services to the building and road sectors for the socio-economic development of Ghana. The institute has programmes in development of alternative building materials from local sources. Research programmes are aimed at:

- Development of innovative designs to ensure cost-effectiveness in shelter construction;
- Technological properties of lesser-used timber species;
- Road construction material specifications to suit the local environment;
- Basic data for road planning and design;
- Construction of effective drainage structures using alternative local materials such as timber bridges; and
- Assessment and Management of Geological Hazards - Landslides and other Mass Movements, Slope Stability Analysis, Earthquake, etc.

Along the theme of sustainable environmental management, the Forestry Research Institute of Ghana (CSIR-FORIG) makes important contribution to the development and management of forestry resources. CSIR-FORIG is mandated to conduct forest and forest products research for social,

economic and environmental benefits of society. The research programmes include the following:

- Efficient processing and utilisation of timber, wood residues and promotion of Lesser Used Species (LUS), plantation timber and small diameter logs;
- Sustainable domestic and international trade in forest resources, including NTFPs; and
- Bio-energy, including development of traditional sources of energy and its efficient utilisation.
- Policy, legislation and institutional framework of natural resources management
- Rural livelihoods, benefit sharing and poverty reduction; and
- Biodiversity conservation and management;
- Landscape restoration and rehabilitation of degraded lands;
- Mechanisms for harnessing environmental services, mitigation and adaptation to climate change; and
- Ecosystem health and vitality, and improving stream flow and soil productivity.

In the water sector, the Water Research Institute (CSIR-WRI) is an important scientific institute. The CSIR-WRI conducts research into water and related resources through the generation and provision of scientific information, strategies and services towards the rational development, utilization and management of water resources especially in the agriculture, environment, health, industry, energy, transportation, education and tourism sectors. The research programmes under the various divisions of the institute include:

- Assessment of Surface Water Resources for Water Supply to Communities, Farms, Companies, etc.
- Characterization of Stream Flow of Major Rivers and Lakes
- Agricultural/ Irrigation Water Management
- Assessment & monitoring groundwater resources
- Hydrogeological mapping
- Monitor pollution in inland, coastal and marine waters & recommend pollution control strategies
- Identification and managements of invasive plants and other flora & fauna

- Environmental & water pollution assessment and develop control strategies
- Microbiological assessment, monitoring and management of portable and waste water & samples
- Preventive and control strategies for water borne diseases and other infectious and non- communicable diseases

#### **2.2.4 Technology and Society**

The Technology and Society thematic area of programmes embrace two main institutes namely the Science and Technology Policy Research Institute (STEPRI) and the Institute for National Scientific and Technological Information (INSTI). The former carries out programmes to enhance the application of STI for socio-economic development in all sectors of the economy. The latter carries out programmes to promote scientific and technological information in the populace.

### **2.3 The SWOT Analysis of the CSIR**

Given the diversity of competence and accumulation of scientific knowledge, technology and innovation in the broad thematic areas, there is need to understand the potency and deficiencies of the CSIR to underpin the corporate R&D strategy. In this regard, the analysis of the strengths, weaknesses, opportunities of the threats is summarized in Table 1.

*Table 1: Conceptual Model of CSIR Research, Technology Development and Transfer*

<b>STRENGTHS</b>	<ul style="list-style-type: none"><li>• Highly qualified human resource and technological skills</li><li>• Scientific and Industrial Research in all the important sectors of the Ghanaian economy (food, agriculture, livestock, health, medicine, environment, housing, Transport/Roads, industry, energy and other service sectors</li><li>• The strong geographical presence in all the agro-ecological zones</li><li>• Availability of R&amp;D infrastructure and facilities</li><li>• Existence of facilities for agribusiness incubation</li><li>• Internationally accredited laboratories</li><li>• Institutionalization of commercialisation of developed technologies</li><li>• CSIR Intellectual Property Right office and policy place</li><li>• Availability of marketable technologies and success stories with the private sector, for example in the food industry</li><li>• The existence of Public-Private Partnership (PPP) framework</li><li>• Business incubation opportunities</li></ul>
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**WEAKNESSES**

- Inadequate entrepreneurial skills or business mind-sets among CSIR employees
- Inadequate state of the art equipment
- Limited institutional capacity to commercialise research outputs on a commercial scale
- Inadequate clarity in the commercialization concept
- High cost of operation-expense ratio
- Weak research-industry linkage; low interaction between researchers and entrepreneurs
- Poor visibility of some CSIR-Institutes
- Inadequate techno-economic evaluation of technologies developed
- Lack of motivation for technology transfer to the private sector
- Lack of institutional system to track technological needs of the private sector
- Limited piloting of the technologies
- Weak monitoring and evaluation systems of R&D
- Poor coordination between CSIR institutes
- The existence of expertise that are not relevant for the job specification within the CSIR institutes

**OPPORTUNITIES**

- High demand for technological and innovative products and services
- Networking opportunities with researchers in-country and at the global levels as well as the existence of the industry associations and groupings provide networking opportunities;
- Taking advantage of the global CSIR brand name
- Senior scientists retained to mentor the early career researchers
- Readily availability of well-trained graduates
- Institutionalization of Incentive and Award schemes for technology transfer and commercialization activities
- Capacity building opportunities
- Growing services sector of the Ghanaian economy
- Existence and operations of financial institution such as the banks, Venture Capital Trust Fund, COTVET funding opportunities for scaling ups, Stanford-SEED project
- The goodwill and support of donor agencies for national development programmes including R&D e.g. DANIDA, WORLD BANK, GTZ, USAID,
- Opportunities exist for CSIR to set up industries

<b>THREATS</b>	<ul style="list-style-type: none"> <li>• Competition from foreign technologies and innovations as well as competition from Universities and NGO's</li> <li>• Encroachment on CSIR lands</li> <li>• Technological advances in developed countries rendering CSIR technologies obsolete</li> <li>• The unfriendly business climate in Ghana with e.g. high interest rates on loans, high cost of utilities, inflation etc.,</li> <li>• Dwindling government investment in R&amp;D</li> <li>• Potentially high attrition rate</li> <li>• Weak industrial sector which cannot invest much into Research and Development activities</li> <li>• Governments discretionary powers/interference could be at CSIR disadvantage given that CSIR is a national organisation</li> <li>• Unfavourable government policies towards local R&amp;D institutions</li> </ul>
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## 2.4 PESTEL Assessment

In addition to the SWOT Analysis, the concept of PESTEL is used to identify the Political, Economic, Social, Technological, Environmental and Legal factors that may impact negatively on CSIR Research and Development efforts particularly, on the transfer of technologies and innovations to the private sector indicated in Table 2.

<b>Political and Economic Factors</b>	<ul style="list-style-type: none"> <li>• Changing Governments and Policies (Elections in 2016)</li> <li>• Taxation and tariff policies affecting importation of chemicals</li> <li>• ST&amp;I not a priority area of government</li> <li>• Insufficient knowledge of S&amp;T among the legislature</li> <li>• Government importation of S&amp;T solutions from overseas</li> <li>• Weak inter-sectorial linkages and private sector coordination</li> </ul>
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<b>Political and Economic Factors</b>	<ul style="list-style-type: none"> <li>• Depreciation of the cedi as against major trading currencies</li> <li>• Lack of national research fund</li> <li>• Lack of industrial pro-activeness</li> <li>• Inability to project the business aspect of ST&amp;I</li> </ul>
<b>Social Factors</b>	<ul style="list-style-type: none"> <li>• Cultural, demographic and population changes</li> <li>• Wide spread of superstitious belief's about ST&amp;I in society</li> <li>• Poor advertisement of ST&amp;I from the media domain</li> <li>• Changing consumer tastes and preferences for foreign technological products and services</li> </ul>
<b>Technological Factors</b>	<ul style="list-style-type: none"> <li>• Effect of digital communication developments</li> <li>• Inadequate local ST&amp;I capacities to compete favourably with foreign ones</li> <li>• Inadequate support for sustaining innovation potentials</li> <li>• Inadequate technological awareness</li> </ul>
<b>Environmental</b>	<ul style="list-style-type: none"> <li>• Changes in the climatic conditions e.g., rainfall and temperature</li> <li>• Improper utilisation of the environment as a resource for agricultural purposes</li> <li>• Continuous increase in illegal mining activities</li> <li>• Changes in the business environment</li> </ul>
<b>Legal Factors</b>	<ul style="list-style-type: none"> <li>• Weak legal structures controlling the movements of biological materials within and outside the country</li> <li>• The lack of enforcement of laws</li> <li>• Inability to compete favourably for some projects due to corporate nature and subverted status</li> <li>• Product Quality and Safety Laws</li> <li>• Regulations by Food and Drugs Authority and Ecological control regulations by EPA</li> </ul>

## 2.5 Key strategic thematic areas

What emerges from the SWOT and PESTEL analysis is the fact that there are important strengths that CSIR can leverage on for demand-driven research and technology development. Furthermore, there are opportunities in the country and beyond that augur well for such efforts. The socio-political and institutional factors analysed in the PESTEL also point to the opportunities coming with the challenges in the national context. Thus, the R&D strategy will be based on the identified strengths and aimed at taking advantage of the opportunities detailed. On the whole, the thrust of the strategy will be holistic and cross-cutting. Specifically, the strategy will focus on the strategic areas in Box 1.

*Box 1: Strategic Areas for enhanced R & D and Technology Transfer*

- Institutional strengthening – the principles and concept
- Human resources management and development
- Development and improvement infrastructure
- Strengthening research and development
- Enhancing commercialization
- Marketing and branding

## Chapter 3

### 3.0 ENHANCED STRATEGIES FOR R&D AND TECHNOLOGY TRANSFER

The development of this chapter is informed by the contextual issues raised in the previous chapters where the existing situation of research and development and technology transfer in the Council has been analyzed in the SWOT. The strengths of the CSIR are very evident. There are opportunities in the R&D environment for technology transfer and commercialization. It naturally follows that any strategic plan seeking to take advantage of the strengths and opportunities, minimize weaknesses and address threats be rooted in the key strategic thematic areas identified previously. This chapter elaborates on each of the strategic thematic areas illustrated in Fig.2.

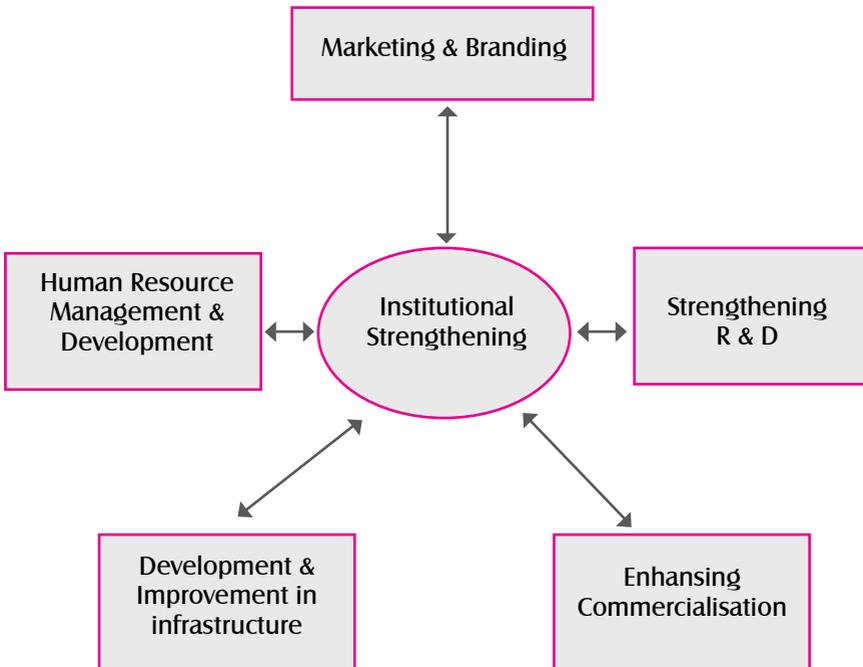


Figure 2 Strategies for R&D technology development and transfer

### 3.1 Institutional Strengthening

This area focuses on a retooling of the research system of the CSIR with particular emphasis on the policies, rules and regulations, attitudes, the philosophy, structures and function including their value proposition. Transparency and trust building among staff of the institution as well as with stakeholders and other actors is crucial. The CSIR will need to put in place the mechanisms including systems and procedures of good practices to readily and effectively be attractive to industry players as well as the individual smallholder farmers as users of technology for innovation. In simple terms, there should be organizational change. It is anticipated that with the change, many more new and old actors and partnerships will come up in the interaction and will require proper coordination, harmonization and integration of functions within and without the CSIR in order to achieve the desired objectives.

The institutional strengthening provides for the enabling environment for technology generation and dissemination for markets with innovation outcomes. Policies on technology testing, packaging and release frameworks and mechanisms similar to varietal releases need to be put in place by the Council. Aspects of organizational change management should be undertaken aimed at shaping rules and regulations for the better. The right culture and attitude of staff will be addressed through regular sensitization for behavioral change, team building, coaching and mentoring. It is generally known that change is also about people and this explains why it is strategic in the plan to also give attention to the management of the human resources in the CSIR for the purpose.

### 3.2 Human Resources Management and Development

The CSIR will operate a three-component and integrated unit focusing on R & D, Graduate School and Commercialization. The human resources of the R & D and technology transfer unit will need to respond more compactly to the new market demands for quality assurance and competitiveness. The strategic plan therefore identifies the human resource requirements in terms of quality and quantity to occupy the relevant areas of basic and applied cutting-edge research responding to the current and future

demands of industry. The plan aims at engaging expertise with minimum qualification of PhD for prosecuting the core research agenda of the Council.

This will require offering opportunity for training to convert M.Sc. holders currently in the system to the required level of expertise (PhD). Such training opportunities will be extended to the technical support staff in the unit to enhance a holistic development and use of the human resources. A gender sensitive human resource management and development plan will be put in place to match with the relevant R & D programme areas of the CSIR reflecting government policies and market place demands for such products in Ghana and the West Africa sub-region.

It may therefore be rewarding for human resource sustainability to plan effectively for young professionals in the system through deliberate effort of identification, recruitment and mentoring. The existing policy of retaining some principal scientists after 60 years of age on contract is a key strategy of this plan to tap on the many years of experience and connections to the benefit of the organization. The plan will take stock of all programmes and projects, the leadership for effective coordination and engagement of the teams of scientists with value for money outcomes.

The human resource development plan will put a level of emphasis on assisting scientists and technical staff to a regular participation in local and international workshops, conferences and other platforms in order to build on networking capital for the benefit of the organization. The orientation of R & D actors in the CSIR on research-industry relationships will also be crucial to facilitate the effective setting up of the research agenda, implementation and adequate packaging and communication of the products. In this regard, business acumen of staff is critical. The capacity of CSIR Staff will be built through short course and training in technology transfer, dissemination, marketing and forming partnerships with the private sector players.

### 3.3 Development and Improvement of Infrastructure

Laboratory audit for quality assurance in the CSIR was conducted in 2009 and will have to be revisited in order to bring about improvements in the status of equipment. State-of-the-art equipment will be needed in our laboratories to confer valid and credible results on products for industry players as well as contribute reliable data bases and knowledge to the scientific community locally and internationally. Deliberate efforts will be made to raise the status of such laboratories to class 2-3 ISO standards. This could be achieved through networks and partnerships with private sector actors.

Training opportunities will be provided locally and abroad where applicable to technicians and scientists to constantly upgrade skills and competencies to deliver quality results. A common policy will be put in place to facilitate smooth and safe procurement and supply of laboratory reagents particularly those related to the molecular analysis not produced in the country to avoid delays. Policy measures will also be called for in the case of safe disposal of expired chemicals.

The social and economic cost of dealing with encroachment is high and effort should be made to prevent further encroachment on CSIR lands. This calls for very proactive means to protect the remaining lands by seriously lobbying government to intervene. Lands could also be protected through facilitation for public-private-partnership arrangement with interested investors.

Travel for scientists abroad on duty for research meetings, conferences, workshops, etc. should be free and unimpeded in view of short notices. Governments should be lobbied to engage foreign countries for example the EU-CAAST-NET programme. In-country travels for research work particularly in rural areas will require durable cross-country vehicles. Programmes and projects should be encouraged to budget adequately to purchase such means of transport to facilitate project delivery.

### 3.4 Strengthening Research and Development

CSIR will identify and delineate its market segments for targeting with the relevant and demand-driven research and development products. This is likely to positively inform critical areas and the depth of investments to strengthen R & D. There is the need to strategize for research of public goods nature as well as that responding direct to commercial industry market needs. A phased inventory by institute clusters of current programmes and projects may be required for the purpose. Normal M & E approaches may be used to monitor their functioning. However, mechanisms will be put in place and capacities strengthened to tract the trajectory of the programmes and projects to distill for potential technologies, their testing, committee evaluation, packaging and proper release to markets.

With the two clients in sight CSIR may have to retool the methodological approaches and instruments for client focus and targeting in the research agenda setting, technology generation, disseminations and marketing for innovation. Participatory concepts and approaches have become common including PTD, FFS, PID, PAR, IPs, IAR4D, etc. but will require institutionalization. Existing Research-FBO dialogue frameworks and mechanisms will need to be identified and supported. Capacities of staff will be strengthened to adequately source for and engage private sector in contract research and development sustainably. Some ownership of the R&D process needs to be conferred out there in order to reap the benefits of private sector buy-in. The roll out of a strong communication strategy will be required to strengthen R & D in the CSIR.

Institutional ethics will be enforced in the design of experiments to answer research questions in the investigation process and capacities of scientists strengthened to publish their works in reputable refereed journals and also develop policy briefs to reach out to policy and decision makers. This will be done with due care not to compromise intellectual property rights mechanisms.

Incentives systems will be put in place for attraction of project funds into the CSIR as well as technologies developed by individual scientists and or team of scientists. In specific situations government and private sector should be lobbied to provide a percentage of counterparts funding to projects attracted by scientists to address project sustainability long after the project funds have dried up.

### 3.5 Enhancing Commercialization

A strategic option being embarked on by the CSIR is greater commercialization. This is crucial for the increased generation of income to adequately finance R & D investments. The need therefore is to identify and develop the strong markets locally and internationally for R & D products emerging from CSIR. Such products will be client-tailored and based on clientele needs. Needs assessment survey of industry players should be conducted and matched with available and potential technological solutions for best fit at the market place. New market-oriented research programmes could also be designed out of this activity for implementation with the objective that emerging technological solution will be taken straight by industry and piloted with committed adoption outcomes.

This will however, require proper positioning to effectively engage the private sector to leverage their finance capital investments in R & D as well as jointly take advantage of enabling government policy environments through lobbying and strong advocacy. The organization of technology fairs, exhibitions and breakfast meetings with business community and high level policy decision makers will be most encouraged. By a participation in similar international fairs with CSIR products could prove equally rewarding for the enhancement of greater commercialization. It may therefore be appropriate to regularly strengthen staff capacities to professionally discharge such duties creditable and profitably.

Integrated systems packaging of CSIR technological solutions addressing problems of rural communities holistically could easily find favours with governments, NGOs and donor partners leading to contractual engagements thereby attracting needed financial capital inflow for the quality services. The local government system needs to be targeted deliberately aimed at delivering the benefits of R & D to rural communities in the various District Assemblies at cheaper cost.

### 3.6 Marketing and Branding

The CSIR has been around for nearly five decades and appears to have a brand name. The need now is to make a profitable presence in the market place locally and internationally. The internal linkage mechanisms between the Center and all CSIR commercialization organs will have to be identified and strengthened for the purpose. Once products and services have been identified and properly catalogued the basket of goods should be sent through a competitive cost and pricing system to gain space at the market place. This should be informed by adequate market needs assessments. Staff skills and competencies will need to be sharpened to undertake the task cost effectively. The use of IT and web-based systems will be explored for marketing products as well as branding the products and services. Niche markets with CSIR products will have to be created and branded as such.

## Chapter 4

### 4.0 THE STRATEGIC ACTIONS

#### 4.1 The Strategic Actions

The ultimate aim of the strategic plan is to create a system for technology transfer that effectively transfers technology to the end-users and is sustainable and profitable. It is a huge challenge but is surmountable provided more efforts can be channeled into making R&D activities demand-driven. The highlights of the strategic actions to achieve this aim are presented in Table 3 below:

Table 3: CSIR-Strategic Actions, Outputs and Timeframe

STRATEGIC AREA	STRATEGIC ACTIONS	OUTPUTS	M&E INDICATORS	PARTNERS	TIME FRAME
Institutional strengthening – the principles, concepts and practice	<ul style="list-style-type: none"> <li>-Organize participatory workshops, meetings on institutional changes and strengthening</li> <li>-Review existing institutional policies, regulations and guidelines</li> <li>-Operationalize the revised policies, regulations and guidelines</li> <li>-Initiate appropriate change management system for CSIR.</li> </ul>	<ul style="list-style-type: none"> <li>-Proceedings/ reports/ minutes</li> <li>-Institutional policies, regulations and guidelines revised or formulated</li> <li>-Improvement in CSIR operations</li> <li>-Change in attitude of staff</li> </ul>	<ul style="list-style-type: none"> <li>-No. of staff participants</li> <li>-No. of meetings/ workshops/ etc.</li> <li>-No. of policies, etc. revised</li> <li>- Level of re- presentation</li> </ul>	<ul style="list-style-type: none"> <li>GIZ</li> <li>DANIDA</li> <li>USAID</li> <li>IDRC</li> <li>DFID</li> <li>JICA</li> </ul>	5 years
Human Resources management and development	<ul style="list-style-type: none"> <li>- Staff audit and rationalization</li> <li>- Develop staff training programme</li> <li>-Implement programme</li> <li>-Evaluate the programme</li> </ul>	<ul style="list-style-type: none"> <li>- Reports</li> <li>-Staff in appropriate positions</li> <li>-Trained human resource in key specialities</li> <li>-Evaluation report</li> </ul>	<ul style="list-style-type: none"> <li>-No. of staff rationalised</li> <li>- No of trained human resource at M.Phil and Ph.D.</li> </ul>	<ul style="list-style-type: none"> <li>USAID</li> <li>DAAD</li> <li>NUFFIC</li> <li>JICA</li> <li>AGRA</li> <li>UNDP</li> <li>GETFUND</li> <li>UNESCO</li> </ul>	5 years

STRATEGIC AREA	STRATEGIC ACTIONS	OUTPUTS	M&E INDICATORS	PARTNERS	TIME FRAME
Development and improvement of infrastructure	<ul style="list-style-type: none"> <li>-Develop a CSIR infrastructural development plan;</li> <li>-Identify funding source-innovative way</li> <li>- Implement plan with provision of equipment and logistics</li> <li>- Seminars and workshops on maintenance of infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>-Infrastructural development plan</li> <li>-Funds availability</li> <li>-Equipment and logistics</li> <li>-Proceedings of workshops</li> </ul>	<ul style="list-style-type: none"> <li>-Report on Infrastructural development plan</li> <li>-Amount of funds</li> <li>- No. of equipment/ logistics provided</li> <li>-No of proceedings</li> <li>-No. of reports of workshops organized</li> </ul>	<ul style="list-style-type: none"> <li>USAID</li> <li>JICA</li> <li>S.KOREA</li> <li>WORLD BANK</li> <li>FRENCH GOVERNMENT</li> <li>DANIDA</li> <li>MCA</li> </ul>	5 years
Strengthening research and development	<ul style="list-style-type: none"> <li>-Priority settings</li> <li>-Develop CSIR R&amp;D Strategic Plan;</li> <li>-Establish CSIR-private sector platform for partnerships</li> <li>-Organise consultative programmes for change management</li> <li>-Identify specific research priorities for each institute of CSIR</li> <li>-Develop a program to incentivize development of innovations for private sector adoption</li> </ul>	<ul style="list-style-type: none"> <li>-Demand-driven technologies</li> <li>-CSIR R&amp;D Strategic Plan</li> <li>-Platform established</li> <li>-Proceedings/ reports</li> <li>-Institutes' research priorities</li> <li>-Incentive program</li> </ul>	<ul style="list-style-type: none"> <li>-No of technologies and services developed/ transferred</li> <li>-CSIR R&amp;D Strategic Plan</li> <li>-No of private sector partnerships established</li> <li>-Reports of Consultative Meetings</li> <li>-Incentive packages disbursed</li> </ul>	<ul style="list-style-type: none"> <li>GNAFF</li> <li>DAS</li> <li>NGOs</li> <li>DPs</li> </ul>	3 years
Enhancing commercialization	<ul style="list-style-type: none"> <li>-Fine-tune technologies for the market</li> <li>-Develop partnerships with private sector;</li> <li>-Mainstream CSIR-TDTC's operations</li> <li>-Create opportunities (provision of start-up support) for spin-off companies to be established</li> </ul>	<ul style="list-style-type: none"> <li>-Piloting of technologies/ Innovations</li> <li>-Partnerships with private sector developed</li> <li>-CSIR-TDTC's operations mainstreamed</li> <li>-Piloting of technologies/ Innovations</li> </ul>	<ul style="list-style-type: none"> <li>- No. of technologies fine-tuned for the market</li> <li>-No. of partnerships with private sector</li> <li>-No of incubation companies established</li> </ul>	<ul style="list-style-type: none"> <li>EMPRETEC</li> <li>AGI</li> <li>NBSSI</li> <li>DAs</li> <li>MOTI</li> </ul>	3 years

STRATEGIC AREA	STRATEGIC ACTIONS	OUTPUTS	M&E INDICATORS	PARTNERS	TIME FRAME
Marketing and branding	<p>-Increase visibility of competences and products</p> <p>-Develop communication and marketing strategy for CSIR</p> <p>-Establish CSIR as a brand with high visibility</p> <p>-Improve on CSIR presence on Internet and social media.</p>	<p>-Weekly advertisement of CSIR products and services</p> <p>-CSIR communication and marketing strategy developed</p> <p>-CSIR brand is very visible</p> <p>-CSIR website becoming very interactive</p>	<p>-Sales and uptake of CSIR products and services</p> <p>-No. of CSIR participation in radio, television and newspaper stories.</p> <p>-No. of visits to CSIR website per week.</p>	Media houses, ISP	3 years

## 4.2 The Monitoring and Evaluation and Learning System

The summary in Table 2 only details the key strategic actions, which have some indicators for evaluating progress. However, there is need for a Monitoring, Evaluation and Learning system that determines the success of the implementation of the R&D Strategy. Each of the strategic actions will constitute a basis for an elaborate proposal to solicit funding and will have more specific indicators. Some of the key indicators to use as evaluation tools are:

- *Number of technologies or Innovations transferred to private sector firms;*
- *Number of collaboration/partnerships formed with the private sector;*
- *Amount of Revenue generated through technologies or innovations transferred;*
- *Number of interactive business meeting organized with entrepreneurs;*
- *Number of Technology fairs and other sensitization activities organized on CSIR Products/Services;*
- *Number of training workshops organized for Staff/training courses on technology transfer issues attended by staff;*
- *Number of Technologies or Innovations profiled; and*
- *Frequency of needs assessment survey of industry players conducted and matched with available and potential technological solutions for best fit at the market place.*
- *Change in CSIR policy content*
- *Staff attitude and behaviour change*

The M&E will ensure that Annual Progress Reports are produced. There will be mid-term review of implementation and at the end of the term.

## Chapter 5

# 5.0 STRATEGIC IMPLEMENTATION AND THE PARTNERS

### 5.1 The Transformation

The Innovation System concept underscores the important roles of all critical actors in the innovation process. From the scientist to the entrepreneur there are important relationships that have to be nurtured to ensure the success of the innovation process. It goes back to the conceptual framework outlined in Chapter 1.

CSIR intends a radical transformation of its commercialization and technology transfer system to reflect the authenticity of a system that generates relevant technologies and transfers same to the points of application and usage in the economy and society. Consequently, there is need for collaboration with the relevant partners including the private sector (which have already been highlighted), the development partners and the non-governmental organisations.

### 5.2 The CSIR-Technology Development and Transfer Centre

Nevertheless, the strategic implementation of the CSIR R&D Strategic Plan is the establishment of the CSIR-Technology Development and Transfer Centre (CSIR-TDTC). This is a project funded under the auspices of MESTI, which is a response to a call for proposals from research institutes, universities and polytechnics for market-oriented programmes under Component 2 of the Skills Development Fund (SDF). The Council for Technical and Vocational Education and Training (COTVET) operates the funds coming from the World Bank. A total of \$500,000 has been earmarked as grant for operationalizing the CSIR-TDTC.

The CSIR-TDTC which operates directly under the office of the Director-General (Appendix 2) will translate the vision of the CSIR R&D Strategic Plan into reality. The CSIR-TDTC is a unique set up given the broad orientation towards identifying specific technologies for systemic development and

transfer. Unlike the Commercial Directorate of the CSIR which coordinates the purely commercial activities of the research institutes, the TDTC fosters the development of strategic partnerships with key business entities and entrepreneurs.

The TDTC has broad linkages with all the research institutes and corporate directorates. It has in particular, an established special role in the Science and Technology Policy Research Institute (STEPRI), to implement the TDTC project and drive its agenda. STEPRI therefore is addressing the challenge of the strategic implementation of the overall CSIR strategic concept. The challenge however remains how to entrench the TDTC's operations in the CSIR and mainstream its activities in line with the content of the strategic plan elaborated herein.

### **5.3 Strategic Objectives of the CSIR-TDTC:**

Based on the conceptual model of the CSIR Research, Technology Development and Transfer, the strategic objective of the CSIR-TDTC is stated as follows:

“The strategic objective of CSIR-TDTC to improve the capacities and incentives of the CSIR selected research institutes to develop, adapt and diffuse technologies to private sector enterprises on a demand-driven basis.”

The CSIR-TDTC mission is to:

- Engage the private sector in partnerships for technology development, appropriation and transfer from the CSIR to industry;
- Encourage CSIR Research Scientists to respond effectively to the technology demands from the private sector through incentive schemes; and
- Create a system or platform for intensive research-industry interaction
- Facilitate commercialisation in the CSIR.

Technology transfer is the process of transitioning technologies from the research laboratory to the marketplace. This may involve handing over intellectual property rights to the private sector completely, entering into partnerships with the private sector or development of technical skills among entrepreneurs for technology applications. Technology development and transfer is driven by either supply push or demand pull

factors. Under the CSIR-TDTC, technology will be considered transferred when an outcome of a research activity by CSIR institute that has been tried and tested is adopted by a private sector player/enterprise. For a technology or innovation to be counted as transferred the following conditions must be met.

The said technology:

- Must be developed or modified by scientists in CSIR;
- Technology must be adopted and or licensed;
- Must add/increase commercial value to an end product/service;
- The technology should be in use by the private sector;

The CSIR-TDTC will ensure that technologies developed by the various CSIR institutes are demand-driven, marketable and packaged in acceptable forms for effective up-take by the private sector entrepreneurs. Marketable technologies developed by CSIR Institutes will be continuously profiled and well-documented for the private sector consumption. Technology profiles will serve as investment decision tools for would-be adopters of the CSIR-developed technologies.

The technology profiling will detail description of each marketable technology that has been developed by CSIR institutes participating in the TDTC project. The detailed technology description consists of innovation characteristics, how the technology works, resources required for the adoption and utilization of this innovation, dissemination strategies, end-users or targeted clients, opportunities and challenges associated with the use of the technology.

The CSIR Research and Development system is conceptualized as a production and demand system where development of research ideas and innovation cannot take place without critical demand for uptake of research outputs. Thus, the importance of market research and validation for critical management decision making within the CSIR organization is critical. The CSIR-TDTC will encourage capacity building of marketing personnel under the existing commercialization system to handle technology marketing issues.

There are some imperfections associated with technologies transfer efforts by the CSIR such as lack of effective institutional arrangement,

ineffective communication mechanisms and insufficient interaction with industry players at the research planning stages. But there are equally strengths that can be capitalized to better position CSIR to take advantage of external opportunities for effective technology transfer. These have been elaborated on in the previous chapters.

## 5.4 The Monitoring and Evaluation and Learning System

Table 4 presents the Performance Management Framework (PMF) that will serve as a guide to assess the performance of CSIR-TDTC activities.

Table 4: PERFORMANCE MEASUREMENT FRAMEWORK (PMF)

Indicators	Target by 2020	Strategies	Responsibility
Number of technologies or Innovations transferred to private sector firms	At least 20 CSIR technologies transferred	<ul style="list-style-type: none"> <li>Organise business interactions with industry/AGI/Potential Clients</li> <li>Promotional activities/organise</li> <li>Social marketing activities</li> <li>Focal Persons well-resourced to coordinate technology transfer activities</li> <li>Set institutional target</li> <li>Annual Report by CSIR Institutes to TDTC</li> </ul>	<ul style="list-style-type: none"> <li>CSIR Corporate</li> <li>CSIR-TDTC</li> <li>Corporate Commercialisation and Information Directorate (CCID)</li> </ul>
Number of collaboration/partnerships formed with the private sector	At least 20 research-private sector partnerships established	<ul style="list-style-type: none"> <li>Conduct Needs Assessment Survey of industry players</li> <li>Match available and potential technological solutions for best fit at the market place</li> <li>Encourage researchers to seek research grants and consultancies for technology transfer to the private sector</li> <li>Sign MOU/Contractual Agreements between CSIR-TDTC and private sectors</li> <li>Focal Persons well-resourced to coordinate technology transfer activities</li> <li>Annual Report by CSIR Institutes to TDTC</li> </ul>	<ul style="list-style-type: none"> <li>CSIR-TDTC</li> <li>CSIR Corporate</li> <li>Corporate Commercialisation and Information Directorate (CCID)</li> </ul>

Indicators	Target by 2020	Strategies	Responsibility
Amount of Revenue generated through technologies or innovations Transferred	At least 5% increase in annual revenues from technology transfer and commercialisation activities	Set institutional target  Compare achievement with target and give constant feedback to CSIR-Institutes	CSIR-TDTC  CSIR Corporate  Corporate Commercialisation and Information Directorate  CSIR-Institutes
Number of interactive business meeting organized with entrepreneurs	Organize at least two business seminars yearly  Organise at least one Technology fair yearly	Create platform for intensive research-industry interactions.  CSIR Directors make presentations on technologies developed  Get feedback on industry technological needs	CSIR-TDTC  CSIR Corporate  CSIR-Institute Directors
Number of training workshops organized for Staff/training courses on technology transfer issues attended by staff	At least 100 research staff trained	Training on marketing activities and roles in attracting, building, and maintaining customer/client relations  Assist staff to develop favourable customer/client orientation  Organize training on Intellectual Property Issues	CSIR-TDTC  CSIR Corporate
Number of Technologies or Innovations profiled	At least 20 New technologies Profiled	Technology profile document updated yearly  characteristics of the technology, the market value and registration or patent reference	CSIR-TDTC  CSIR Corporate  Corporate  Focal Persons at CSIR-Institutes

Tracking progress using the PMF tool will help identify challenges and opportunities for improvement. The PMF formulates strategies that need to be implemented for successful technology development and transfer to the private sector. There will be Monitoring and Evaluation (M&E) to ensure that Annual Progress Reports are produced and there will be mid-term review of implementation and at the end of the term.

## 5.5 Potential Strategic Partners

The main need for a CSIR Strategic Plan is to ensure that, demand-driven or market-oriented R&D continues after the lifespan of the CSIR-TDTC Project. It is therefore very vital that the sources of funding to sustain the potentially mainstreamed activities outlined in the strategic plan be identified. The strategic actions offer opportunity for identifiable organizations to partner with the CSIR. The sources of funding will be the internally generated funds, the development partners support and the private sector investment in the commercialisation of the CSIR technologies.

Already the CSIR institutes generate funds internally through various commercial activities. However, the implementation of the CSIR-TDTC should ensure an enhancement in the internal generation of funds. This should enable greater commercialization with adoption of various models of technology transfer including the formation of spin-off enterprises.

The development partners such as the World Bank, DANIDA, CIDA, DfID, USAID, Bioresources International, GIS and others are important strategic partners. The formulation of project proposals specific to their operations and based on the strategic actions will enable some of the current activities under the CSIR-TDTC to continue and new one to be started in line with the strategic plan.

The private sector also holds the key to the effective implementation of the CSIR R&D Strategic Plan. This is a plan that pivots on the partnership with the private sector. The extent of collaboration with the private sector bodies such as the Association of Ghana Industries (AGI) and the Ghana Chamber of Commerce and Industry (GCCI) will go a long way in crystallizing the vision of the plan. Agro-food industries such as Nestle Ghana Limited, ELSA Foods, Ebenuts Limited, Dodo Foods, BAMAF Industries, Neat Foods

Ghana, Nkulenu, entrepreneurs in the hospitality industry, Samba Foods Limited and West Africa Fisheries are potential partners as well. With research into crops, potential partners include Seed Dealers and NGOs like ADRA, World Vision and TechnoServe. Accra Brewery and Guinness Ghana Limited could be potential partners of CSIR-Crops Research Institute. Regarding Building and Road Research, potential partners are Ghana High Way Authority, Institute of Surveys and Building and Road Contractors. Others are Ghana Real Estate Development Authority (GREDA) and Volta River Estates. Pharmaceutical Industries are potential partners of CSIR-Plant Genetic Resources Research Institute.

The banks and financial institutions by their investment activities can contribute to the realization of the vision. Appendix 3 shows revenue projections for products and services for the institutes and the corporate CSIR as assessed by a team of consultants working on the CSIR Business Plan (CSIR, 2014). The revenue projections are only indicative of the business potentials available in the CSIR institutes, which the private sector can take advantage of.

## Chapter 6

### 6.0 THE WAY FORWARD

The CSIR R&D Strategic Plan is an instrument for a paradigm shift in the operations of the CSIR. At the core of the R&D operations is the partnership with the private sector to ensure demand-driven research. In each of the strategic thematic areas, specific actions are identified and efforts will be directed at their implementation within the timeframe of five years.

A pillar of the plan is the Monitoring and Evaluation and Learning System to not only guide the implementation of the plan but also to ensure the absorption of knowledge and the application of it in the course of the implementation. The strategic plan is therefore not cast in stone but will be reviewed mid-term and at the end of term.

Strategic partners have been identified with the CSIR-TDTC playing the lead role in institutionalizing the envisaged approach to demand-driven research and development and technology transfer. The development partners, industry associations and other identifiable organizations have opportunity to partner with the CSIR. There will be the need to develop programmes and projects based on the strategic actions outlined in the plan for the mobilization of funds. The implementation of the CSIR Strategic Plan is expected to ensure wealth creation, the expansion of job opportunities and sustainable development for Ghana as a nation taking account of the areas highlighted below:

#### Things in the Plan to Attract Investors

1. Ability to provide raw materials and to identify industrial challenges
2. Capacity to develop tailor-made technologies and Innovations
3. Highly qualified human capital
4. Ability to reduce operational cost
5. Training of the private sector
6. Quality Assurance of products and innovations
7. Internationally Accredited Laboratories and state of the art Equipment
8. Re-branding of CSIR

#### Mechanisms for Research-Industry engagement and interactions

1. Symposia, Technology fairs & Exhibitions,
2. Farmers day & Farmer Field School, Innovative Platforms
3. Attend AGI sector meetings
4. Business Seminars
5. Attach Research Scientists to Industries
6. Documentaries and Talk Shows
7. Varietal release shows
8. Functioning CSIR-TDTC website

## REFERENCES

CSIR (2006) *Strategic Plan*, CSIR, Accra

CSIR (2010) *CSIR Handbook*, CSIR, Accra

Government of Ghana (1996) *CSIR Establishment Act*, 521

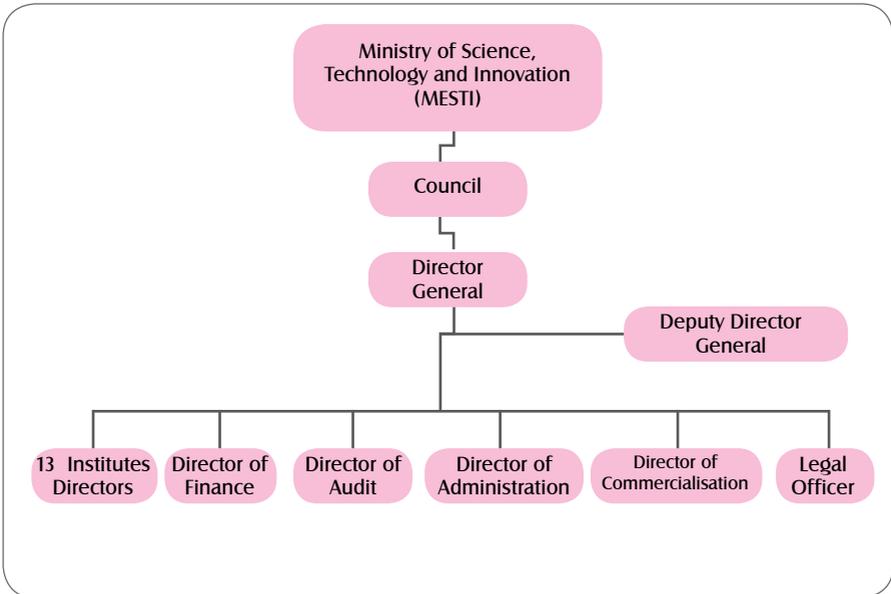
COTVET-CSIR (2013) TDTC Project Proposal, CSIR, Accra.

CSIR (2014) CSIR Business Plan for 2015-2019, CSIR, Accra

# APPENDICES

## Appendix 1: Organizational Framework of the CSIR

The CSIR-Management Structure



The 13 CSIR Institutes are:

1. CSIR-Animal Research Institute, Accra;
2. CSIR-Building and Road Research Institute, Kumasi;
3. CSIR-Crops Research Institute, Kumasi;
4. CSIR-Food Research Institute, Accra;
5. CSIR-Forestry Research Institute of Ghana, Kumasi;
6. CSIR-Institute of Industrial Research, Accra;
7. CSIR-Institute for Scientific and Technological Information, Accra
8. CSIR-Oil Palm Research Institute, Kusi-Kade;
9. CSIR-Plant Genetic Resources Institute, Bunso;
10. CSIR-Savanna Agricultural Research Institute, Tamale;
11. CSIR-Science and Technology Policy Research Institute, Accra;
12. CSIR - Soil Research Institute, Kwadaso, Kumasi; and
13. CSIR -Water Research Institute, Accra

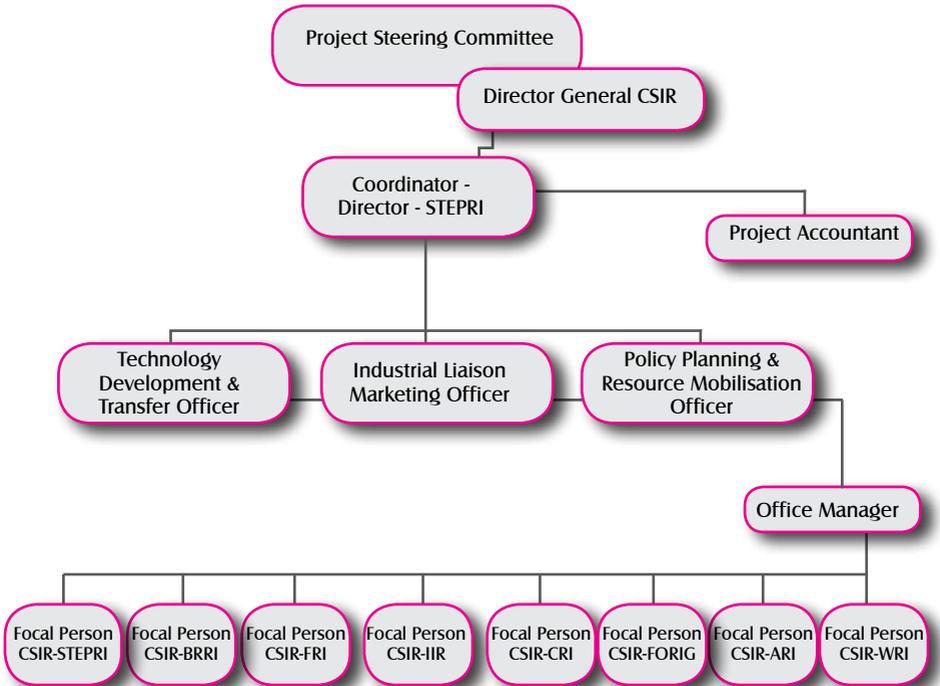
## Council

The Council which is answerable to the Minister of Environment, Science, Technology and Innovation (MESTI) is made up of a Chairman and 20 members. The CSIR Act requires that 40% of the membership of its Governing Council should be drawn from the private sector. The current Council membership is as follows:

- Chairman, and representatives of:
- Ministry of Food and Agriculture
- Ministry of Health
- Ministry of Trade and Industry
- Ministry of Environment, Science, Technology and Innovation
- Ministry of Education
- Universities
- Ghana Chamber of Mines
- Association of Ghana Industries
- Ghana National Chamber of Commerce and Industry
- Institution of Engineers
- Ghana Academy of Arts and Sciences
- National Development Planning Commission
- CSIR Directors
- Senior Staff Association of CSIR
- The Director-General
- Three reputable Scientists
- Two private individuals

The functions of the various organs illustrated in the organogram are spelt out in Act 521 of 1996 and the CSIR Handbook.

## Appendix 2: Organogram for Technology Development and Transfer Centre



The details of the roles of the key offices in the organogram are spelt out in the project document.

### Appendix 3: Revenue Projections from Products and Services (GHC)

CSIR-INSTITUTE	2015	2016	2017	2018	2019
CSIR-ARI	17,149,778	19,642,316	15,724,790	20,004,785	23,327,153
CSIR-BRRI	18,216,994	21,550,026	16,242,424	19,772,207	24,106,598
CSIR-CRI	30,712,613	36,428,195	24,400,422	30,899,971	38,234,252
CSIR-FRI	8,470,785	10,495,538	8,218,881	13,854,217	24,986,453
CSIR-FORIG	12,356,129	15,337,470	11,352,313	14,819,233	19,359,117
CSIR-IIR	8,221,633	9,667,158	6,334,612	7,962,801	10,014,662
CSIR-INSTI	2,470,150	2,970,372	2,695,564	10,474,794	15,707,498
CSIR-OPRI	9,630,468	10,812,274	3,255,371	3,941,216	4,772,966
CSIR-PGRI	7,835,550	9,378,321	6,497,886	9,126,337	13,349,539
CSIR-SARI	13,537,969	15,880,572	13,429,156	16,525,777	20,487,060
CSIR-SRI	7,392,804	9,210,233	6,905,459	11,160,115	19,214,724
CSIR-STEPRI	4,127,514	4,693,300	3,518,286	4,095,372	4,773,474
CSIR-WRI	12,515,000	15,193,497	12,619,277	16,523,077	21,826,424
CSIR-CORPORATE	1,493,146	2,156,668	3,211,613	5,343,140	8,173,421

Source: CSIR-Business Plan for 2015-2019 developed in March 2014

