

# Supporting Green Growth and Knowledge Economy through Research, Innovation and Technology for Sustainable Development

Title: The History of TIRDO and Industrialization in Tanzania up to 2018.

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## Abstract

This paper examines different areas which are the prerequisites of industrialization. It focuses on the issues of research and innovation as imperatives in industrialization from historical point of view, the paper utilizes the case study of Tanzania Industrial Research and Development (TIRDO) as a research institution established for the purpose of advancing industrialization in Tanzania. The paper focuses on the circumstances which prompted the establishment of the institution and the purpose for which it was established. The functions and roles of the institution have been reviewed and dissected from the historical point of view. The successes, challenges and future prospects have been discussed in line with industrialization. Methodologically the paper has been designed from historical exploratory design utilizing a case study strategy. The approach engaged in this paper is that of qualitative nature utilizing both primary and secondary historical sources to gather information through in depth interviews, oral histories, observation and intensive archival documentary review. Research instruments such as interview guides and checklists were designed to facilitate smooth collection of the required data. Most of the secondary data were generated from libraries at SAUT, MWECAU, UDSM, National Library DSM, Mwanza Regional Library and Kilimanjaro Regional Library. The findings revealed that TIRDO was created with very strong ambitions to advance industrialization in Tanzania. However, the functions of which were marred by lack of commitment and unnecessary bureaucratic bottlenecks. Budgetary problems and structural organizational inconsistencies crumbled the smooth functioning of the institution.

**Key Words:** Industrialization, Innovation, TIRDO, Research, Local industries

## Introduction

The search for new knowledge based on human experience is as old as human society itself. In all countries, Tanzania inclusive, there has been some form of this search for many years. It all depends on the society to organize its search into a well thought out, a well planned, and a purposeful one, which is aiming at conquering problems within its environment in order to ensure a future healthier, more productive and worth living-in environment. This is a continuous move, and each move gravitates around previous experiences and observations. This is termed as organized research, a purposeful search for a new knowledge based upon past

experience.<sup>28</sup> This paper discusses the position of TIRDO as a research institution to advance science and technology to support the process of industrialization in Tanzania as well as to achieve sustainable economic development.<sup>29</sup>

Conceptually and historically countries have all over the world achieved industrial development and successful sustainable economic development through investing in research and innovation. The research centers and institutions are established and well financed to cater for these research activities. Since the area of research is a sensitive undertaking the political will of those in power was very important because it was all about national and human security issue. The political economy of research and innovation is therefore not ideologically free. The colonialists for example did not engage in researches which were to develop their colonies. Instead the research centers were mainly to improve their economies such as raw material research based (crops, minerals and animal researches). It therefore goes without saying that all developing countries were to make research as one of their priority if they were to achieve industrial progress and sustainable development.

Tanzania has had some kind of organized scientific research for years. This was done by a number of isolated research centers owned by the government and the East African Common Services Organization (later East African Community). There had been achievements in creating and establishing research centers and later the opening of the University of Dar es Salaam in 1961. The university starting with a Law Faculty and later other faculties including agriculture, science, medicine and engineering were put in place.

Series of other research centers and institutions continued being established. A number of technology supporting institutions are already in place, these include: Tanzania Industrial Research and Development Organization (TIRDO) 1979, Tanzania Bureau of Statistics (TBS), Centre for the Development and Transfer of Technology (CDTT), Tanzania Industrial Studies and Consulting Organization (TISCO) Institute for Production Innovation (IPI), National Construction Council (NCC), Building Research Unit (BRU), National Radiation Commission (NRC), Small Industries Development Organization (SIDO), and others.<sup>30</sup>

### **Research and Innovation Under Colonialism**

Serve for Indigenous Knowledge research under precolonial era, Tanzania has had some organized scientific research in the past years. It all began with the advent of the German colonialists (*Deutsch-Ostafrika*) who established a research center at Amani in Tanga in 1902

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<sup>28</sup> R. Mazengo, Scientific Research in Tanzania, in Gabriel Ruhumbika, (ed.) *Towards Ujamaa: Twenty years of TANU Leadership*, East African Literature Bureau, Dar es Salaam, 1974:147

<sup>29</sup> TIRDO, Research Policy and Guidelines, June 2004

<sup>30</sup> Benedict C. Mukama and Charles S. Yongolo, Tanzania Commission for Science and Technology (COSTECH), Development of S & S System and Experience of Tanzania on S&T Data Collection, 2005

where they established the Usambara *Kulturstation*.<sup>31</sup> This center started up as an agricultural and biological center and came to be known as Amani Biological-Agricultural institute.<sup>32</sup> The institute later expanded enormously into the areas of research in the following years. "The Amani Institute soon became a 'tropical scientific institute superior to anything in the British colonies and protectorates and comparable with Pusa in India or the Dutch establishment at Buitenzorg in Java."<sup>33</sup> In early years practical research concentrated on plants most relevant for European agriculture, mainly coffee, rubber, tea, and sisal. The results were popularized in two journals of the institute (*Berichte über Land- und Forstwirtschaft in Deutsch-Ostafrika and Der Pflanser*) in courses and seminars organized for planters and officials.<sup>34</sup> The Germans had a number of other research centers in the colony notably in the northern parts of Tanganyika.

"Although Amani was the most famous of Germany's colonial research stations, representing a 2-million-mark investment, it was only one of several German agricultural stations in the northern region. Another, named Kwai farm and located in the nearby West Usambaras, preceded Amani as the colony's chief center for agricultural and livestock experiments. Kwai lacked Amani's international reputation, but it one the less held a prominent place in the minds of the Africans who lived in its shadow."<sup>35</sup> Other research centers were Kibong'oto in Moshi charged with research on agriculture and cattle and cattle diseases in the fastest growing white settlement. Experimental farm and cotton school was established at Mpanganya in 1904 as a training and propaganda station for African cotton farmers.<sup>36</sup> More experimental stations for agriculture were established in the districts of Tabora, Lindi and Mrogoro which concentrated on cotton.<sup>37</sup> The Germans built other facilities, including schools and hospitals, in different parts of the country while ruling the colony (1891–1918). One of their biggest colonial achievements was in scientific research at the institutes they established in German East Africa, especially at Amani.

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<sup>31</sup> Juhani Koponen, *Development for Exploitation;: German Colonial Policies in Mainland Tanzania, 1884-1914*, 1994:252

<sup>32</sup> Henderson, W.O.; "German East Africa 1884 – 1918," in Vincent Harlow, E.M. Chilver, Alison Smith, eds., *History of East Africa, II*, London: Oxford University Press, 1965:134

<sup>33</sup> Report of the East Africa Commission, *Cmd. 2387 (1925)*, p. 86.

<sup>34</sup> Koponen, op. cit. p. 252

<sup>35</sup> Conte, Christopher-Allan; "Imperial Science, Tropical Ecology, and Indigenous History: Tropical Research Stations in Northeastern German East Africa, 1896 to Present," in Gregory Blue, Martin Bunton and Ralph Croizier, eds., *Colonialism and the Modern World: Selected Studies*, New York: M. E. Sharpe, Inc., 2002

<sup>36</sup> Koponen op.cit. p.423

<sup>37</sup> Ibid. p.424

After the Germans lost the First World War the German East Africa colony went to the British and was named Tanganyika Territory in 1920. The British took over as a League of Nations Mandate, after the German Empire lost World War I. The Amani Research Station was renamed the East African Agricultural Research Institute.<sup>38</sup> From about 1927 to 1948 Amani Institute was transferred to Muguga near Nairobi, the station made impressive record of very productive research especially soil science and agronomy and plant breeding of crops such as cassava, maize and groundnuts. Many scientific papers were produced though they hardly reached the farmer.

After the Second World War many agricultural research stations were established. The main aim was to find solution to problems facing export crops so as to increase their production. Therefore the Sisal Research Station was set at Mlingano near Tanga, in 1934, the Coffee Research station was established at Lyamungo near Moshi in 1934, the Empire Cotton Growing Corporation posted scientific staff to Ukiriguru near Mwanza to develop cotton crop in 1939, and the Overseas Food Corporation had a strong scientific wing.<sup>39</sup> Tations ike Tengeru was established to undertake research on food crops. The Mpwapwa Research Station was established near Dodoma to undertake research on animal husbandry whose programmes were not included in Amani prgramms. Although the Amani Research Institute became world-famous during German colonial rule as a scientific research centre,<sup>40</sup> it retained its international reputation after the British received control of the colony they named Tanganyika.<sup>41</sup>

Other areas of research were added to the institute in 1960. During World War I, the Amani Research Institute reinforced its international reputation in research when scientists at the centre developed various products. They included medicine and chemical products, from local material to meet war needs and those of the German settlers at a time when the colony was cut off from the rest of the world and could not import anything. "Considerable ingenuity was shown in producing in the colony manufactured goods and medical supplies normally imported from Europe. Quinine was made at the Amani Institute and at Mpwapwa....Dye-stuffs were made from native barks. In the first eighteen months of the war the Amani Agricultural Research Institute 'prepared for use from its own products 16 varieties of foodstuffs and liquors, 11 varieties of spices, 12 varieties of medicines and medicaments, 5 varieties of rubber products, 2 of soap, oils and candles, 3 of materials used in making boats, and 10 miscellaneous substances. Many of these were prepared in comparatively large quantities, e.g.15,200 bottles of whisky and other alcoholic liquors, 10,252 lb. of chocolate and cocoa, 2,652 parcels of toothpowder, 10,000 pieces of soap, 300 bottles of castor oil'<sup>42</sup>

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<sup>38</sup> Mazengo, op.cit. p.149

<sup>39</sup> Mazengo, op. cit. p.149

<sup>40</sup> Conte, Christopher-Allan; *Highland Sanctuary: Environmental History in Tanzania's Usambara Mountains*, Athens, Ohio: Ohio University Press, 2004:13

<sup>41</sup> Mwakikagile, Godfrey *Life in Tanganyika in The Fifties*; Dar es Salaam, Tanzania: New Africa Press, 2010, p. 164

<sup>42</sup> *Report of the East Africa Commission*, Cmd. 2387 (1925), p. 86....Owing to the blockade, overseas trade came to an end....The long drawn-out conflict inflicted serious damage on the colony." Cf. W.O. Henderson, "The

After the British took over, they were "impressed both with Amani's international reputation and the quality of research conducted there...and continued operating it as a research institute under the British postwar government. Amani therefore continued to function as an important center of botanical research and became a flash point for arguments over the value of pure versus applied research in Britain's East African colonies."<sup>43</sup> The institute also became famous for its research in malaria during British colonial rule and was transformed in 1949 into the East African Malaria Unit. The research centre served not only Tanganyika but also Kenya, Uganda, Zanzibar and British Somaliland in the prevention and control of malaria and other vector-borne diseases. It became the East African Malaria Institute in 1951 and was renamed the East African Institute of Malaria and Vector Borne Diseases in 1954. In the present day it maintains a high reputation in research, as the Amani Medical Research Centre, in the Tanga Region of Tanzania.

After British colonial rule ended, the institute continued to play an important role as a research centre in Tanzania. In 1977, it was renamed Amani Medical Research Centre of the National Institute for Medical Research, covering a wide range of areas in medical research.

### Scientific and Technological Initiatives in Tanzania

In 1961 Tanganyika got her independence from Britain.<sup>44</sup> In 1964, independent Tanganyika united with Zanzibar to form the United Republic of Tanzania.<sup>45</sup> At independence Tanzania inherited colonial economic structure which had kept its umbilical code intact with the metropolitan economy. The subsequent development plans took on board the colonial structure hence industrial research was not a priority. The East African governors of [Uganda](#), [Kenya](#) and [Tanganyika](#) established several regional boards to help coordinate the war effort proposals for the future management of the inter-territorial services in East Africa which resulted into the establishment of East Africa (High Commission) Order in Council 1947.<sup>46</sup> The East African Common Services Organization research facility continued to offer services to the nation.<sup>47</sup> However, things started changing with the collapse of EAC in 1977. Tanzania had to make a decision on how industrial research should be conducted. It was out of this situation the idea to establish TIRDO was conceived. Other East African countries came up with similar initiatives, Kenya Industrial Research and Development Institute (TIRDI) in Kenya and Uganda Industrial Research Institute (UIRI) in Uganda.

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war economy of German East Africa, 1914 - 1917," *Economic History Review*, xiii, 1943. Ref. Henderson, 1965, pp. 160 – 161; Henderson, 1943, pp. 104 – 110.

<sup>43</sup> Conte, 2002, op. cit. p. 246; Conte, 2004, op. cit.p. 13.

<sup>44</sup> Tanganyika Independence Act 1961, and The Tanganyika (Constitution) Order in Council, 1961

<sup>45</sup> An Act to ratify the Articles of Union between the Republic of Tanganyika and the People's Republic of Zanzibar

<sup>46</sup> East Africa (High Commission) Order in Council 1947,

<sup>47</sup> The East African Common Services Organization Ordinance, 1961. Cf. Benedict C. Mukama Charles S.Yongolo, Development of S & T System and Experience of Tanzania on S&T Data Collection, Tanzania Commission for Science and Technology

### **Tanzania Industrial Research and Development Organization (TIRDO)**

The history of TIRDO started when it was established as a public sector institution to support the industrial sector through the Act of Parliament of the United Republic of Tanzania No. 5 of 1979.<sup>48</sup> Its establishment was conceived as a means to support the process of industrialization in Tanzania as well as achieve sustainable economic development. As a body corporate which have perpetual succession and an official seal; can sue and being sued; capable of holding, purchasing or acquiring any movable or immovable property and of disposing of any of its property.

This act granted TIRDO broad mandate to initiate and undertake applied research, to evaluate and to disseminate the findings related to the strengthening and improving the performance and technological base of manufacturing industry.<sup>49</sup> As well as offering technical services related to solving problems and constraints in industries.

### **What Prompted the Establishment of TIRDO**

From the time of the Arusha Declaration 1967 the government of Tanzania considered the weak technological research and development base as the stumbling block towards industrialization. To alleviate this problem the government considered to set up centers of excellence in research and development.<sup>50</sup> One of these institutions was TIRDO which commenced its operations in 1979. However, global demands for science and technology were the effects of decisions, recommendations and reports of a number of major inter-governmental or non-governmental conferences such as those associated with meetings organized within the framework of the World Conference on Science. A brief list of various critical UNESCO regional initiatives done to promote Science and Technology included the First United Nations Conference on the Application of Science and Technology (UNCAST) for the benefit of the less developed world that was held in Geneva in 1963 in which Tanganyika participated.

UNESCO sponsored the International Conference on the Organization of Research and Training in relation to the study of Conservation and Utilization of Natural Resources that was held in Lagos, Nigeria – August 6, 1964. In 1974 the First Conference of Ministers responsible for Science and Technology in Africa (CASTAFRICA I) was held in Dakar, Senegal. As a follow up to

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<sup>48</sup> The Tanzania Industrial Research and Development Organization ACT 1979

<sup>49</sup> The Act *ibid.* Article no. 4

<sup>50</sup> Bartelt Bongenaar and Adam Szirmai (1999), Development and Diffusion of Technology The Case of TIRDO, in Adam Szirmai and Paul Lapperre, (eds), *The Industrial Experience of Tanzania*, Palgrave Macmillan, p. 171

the 1963 Geneva Conference; the Second United Nations Conference on the Application of Science and Technology for Development (UNCASTD) was held in Vienna, Austria in 1979.<sup>51</sup>

On the African continent the Organisation of African Unity (OAU) rekindled the UNESCO initiative by a series of meetings in Monrovia and Lagos whose final act was the promulgation of the joint 1980 declaration of the “*Lagos Plan of Action for the Economic Development of Africa: 1980-2000.*” The Contents of the Lagos Declaration was a sure indication of the seriousness of the political willingness to utilize science and technology in all its forms as a vehicle for development; of which chapter V is on Science and Technology. The declaration called for three major actions for effective application of science namely: formulation of national science and technology policies that will contain essential elements contained in the UNESCO call of 1963. It was the UNESCO call that gave birth to OAU declaration. The establishment of national science and technology systems comprising of ministries and councils for effective for administration and implementation of the national science and technology policies and commitment of funding of research and development activities in science and technology to a minimum of 1% GDP (set up previously by UNESCO) in 1980 rising to 3% GDP (as seen in most development countries) by the year 2000.

National initiatives as a result of the United Nations Conference on science and development, UNCTD, Vienna 1979 and the statements on science and technology issues in OAU Lagos Plan of Action; Tanzania had taken the following measures for stimulating science and technology for development. Measures included the establishment of the Tanzania National Scientific Research Council in October 10, 1968.<sup>52</sup> The Council was inaugurated on June 25, 1972 marking the first step towards the establishment of the national coordinating mechanism for research activities in Tanzania. Later, following the collapse of the East African Community, a structural problem arose of how to co-ordinate research activities in Tanzania. As a measure of necessity, all the research institutions that were under the defunct East African Community were placed under the management of their sectoral ministries to create a conducive environment for the establishment of an effective national co-coordinating mechanism.<sup>53</sup> The Act No. 17 was passed to amend the Tanzania National Scientific Council Act of 1968.

The 1985 National Science and Technology Policy spelled out national goals and objectives generally and by sector. In addition, it enunciated specific statements for attainment. The policy’s specific aspirations included, among others, a section on a national system for co-coordinating research and development institutions as a way of monitoring research activities in the country. This was followed by the establishment of COSTECH through the Act of Parliament No.7 of 1986 and the establishment of the Ministry of Science, Technology and Higher Education in November 1990. The Ministry’s involvement in research and development matters was through one of its departments responsible for Science and Technology. COSTECH on the other hand, with its wide range of Science and Technology responsibilities, reported to the Ministry.

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<sup>51</sup> Benedict C. Mukama and Charles S. Yongolo, op.cit

<sup>52</sup> Parliament Act No. 51, Tanzania National Scientific Research Council in October 10, 1968

<sup>53</sup>Act No. 17 on November 30, 1977,

In implementation of the Lagos Plan of Action in 1984 the Government of Tanzania formulated the National Science and Technology Policy document that was subsequently approved and published the policy in 1985. Due to the changing socio-economic factors for development a new Science and Technology Policy was drafted, delivered to Cabinet for approval late in 1995 and subsequently made public in April 1996.

Establishment of COSTECH led to all research and development institutions became affiliated to COSTECH. This meant that the Commission's role of co-coordinating and monitoring research in Tanzania involved a very wide range of research activities ranging from medicine to social sciences and to engineering. Committees for each priority sector in the country were given the responsibility of advising COSTECH on policy issues related to its sector and recommend allocation of research funds and manpower development in connection with the Sector's contribution to production.

The 1985 Policy on Science and Technology advocated for ministerial cabinet status of Science and Technology in order to arguably draw the attention of the Central government. Consequently this ministry was established in November 1990 with one directorate dedicated to science and technology. In line with this spirit several governing policies on research and development were passed which apparently became the guideline for research and innovation at TIRDO. These policies included National Research and Development Policy 2010, National Science, Technology and Innovation Policy of 2010, Sustainable Industrial Development Policy of 1996-2010, Five year Development Plan of 2011-2016, National Development Vision of 2025 and Integrated Industrial Development Strategy (IIDS) 2025 - Master Plan of 2011.

### **Functions and Roles of TIRDO**

According to the law which formed this public organization it was envisaged that the core functions of TIRDO should be but not limited to the following:<sup>54</sup> To conduct research, development and technical services on industrial processes and products, while utilizing local materials in partnership with industries. To carry out research in various aspects of local and foreign industrial techniques and technologies and evaluate their suitability for adaptation and alternative use in local industrial production. To provide and promote facilities for the training of local personnel for carrying out scientific and industrial research. To monitor and coordinate applied research carried out within Tanzania or elsewhere on behalf of or for the benefit of the government of Tanzania and to value the findings of the research. To establish the system of registration of and to register the findings of applied research carried out within Tanzania and to promote practical application of those findings in industrial production. To establish and operate a system of documentation and dissemination of information on any aspect of applied research carried out by or on behalf of the organization. To provide to the government and or organizations engaged in industrial production technical and advisory services and advice and guidance on technical matters necessary for the furtherance of, or relating to industrial activity. To advise the government and firms or organizations engaged in industrial production on the adaptation of technology in industrial production. To provide to the government and firms or organizations involved in industrial production advice and assistance relating to the provision of technical facilities in industrial enterprises and processes, so as to improve performances of

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<sup>54</sup> The TIRDO Act op. cit.



industrial pollution. To advise the Government and Firms engaged in industrial production on the adoption and adaptation of technologies in industrial production. To provide an advisory technical service relating to the establishment of systems for the control and regulation of industrial processes to the firms engaged in industrial production so as to improve performance and to avert or minimize the sources of industrial pollution. These were among the important functions TIRDO was charged to perform in order to accelerate industrialization according to the law which established it.

### **Industrialization and TIDO Activities**

At independence the industrial sector in Tanganyika remained tied to the colonial structure hence research and innovation was also externally connected to the industries. The 1967 Arusha Declaration and its subsequent nationalization of industries created a big public sector of industrial enterprises.<sup>55</sup> Nationalized industries included Bata Shoes, East African Breweries, textiles, skin and hides, Tanganyika Packers, British American Tobacco, and Metal Box, banking industry, export-import businesses, mills and food manufacturing firms.<sup>56</sup> The demand of the Three Year Development Plan (TYDP) between 1961 and 1964 followed by the First Five Year Plan (FFYP) between 1964 and 1969<sup>57</sup>, the Five Year Development Plan of 1981 – 1986 and the Basic Industrial Strategy (BIS) 1975-1995 increased the industrial sector in Tanzania.<sup>58</sup> The TIRDO Industrial Information/Industrial Extension Department began operation in September 1981. Industrial information was provided to industries in the areas of engineering, textiles, foods, fibres, chemical processes, mining and metallurgical processing, ceramics, energy and instrumentation.<sup>59</sup> Sixty-one information requests were received in 1983. Five industries (glass, edible oils, soap, salt, and farm implements) were using the TIRDO Information Service on a recurring trial basis with the possibility of future subscription service.<sup>60</sup>

The TIRDO Industrial Extension Service, during the period 31 September 1981 to 15 March 1983, had contacted 160 industries, technical institutions and industry associations. These visits identified 115 technical problems confronting the productive sector. Twenty four industries have indicated problems of production, process design or modification, or analysis and testing, which TIRDO may be able to solve. The TIRDO Engineering Energy Audit/Conservation Unit

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<sup>55</sup> The National Industries Licensing and Registration Act of 1967

<sup>56</sup> Dias, Clarence (1970) "Tanzanian Nationalizations: 1967-1970," *Cornell International Law Journal*: Vol. 4: Iss. 1, Article 4. Available at: <http://scholarship.law.cornell.edu/cilj/vol4/iss1/4>

<sup>57</sup> Samuel Wangwe, Donald Mmari, Jehovanes Aikaeli, Neema Rutatina, Thadeus Mboghoina, and Abel Kinyondo; The performance of the manufacturing sector in Tanzania Challenges and the way forward, World Institute for Development Economics Research, 2014: 5

<sup>58</sup> Ibid. pg. 6

<sup>59</sup> UNIDO: Technical Report: Evaluation of the Project Performance and Problems of Implementation, 1983:1

<sup>60</sup> Ibid. p.viii

began to function in December 1982, upon completion of training of two TIRDO staff members and acquisition of necessary equipment.

The working of TIRDO was constraint by some events essentially aggravated by the global economic crisis of that decade late 1970s to mid 1980s. First of all TIRDO was unable to accomplish its construction plan due to lack of financial ability. Some of its laboratories and office blocks were not completed until to date. Equipment for the completed buildings was not available.<sup>61</sup> This made it difficult to perform most of its applied researches or TIRDO had to establish ad hoc arrangements to use laboratories and equipment in other parastatal institutions. Scarcity of financial resources constrained the recruitment of competent and sufficient manpower for the purpose of their research agenda and priorities.

In the second half of 1980s the Tanzanian economy in general and industrial sector in particular was at crossroads. Structural Adjustment Programmes (SAPs) were adopted though with deep pains “the double edged sword” solution as President Mwinyi put it.<sup>62</sup> With the *rukasa* policy advocated by President Mwinyi which allowed importation of manufactured goods from outside Tanzania, the entire industrial sector suffered the most. The advent of neo-liberal policies and globalization in 1990s dealt a death blow to the industrial sector. TIRDO amid this situation was in very precarious condition as most of the public industries were privatized.<sup>63</sup> The rest of the industries were closed. It was out of this situation TIRDO considered it wise to review its research and innovation strategies coming up with the Research Policy and Guidelines of June 2004. The policy contained strategies for sustaining research and consultancy to sustain both private and public manufacturing sector resulting in national development.<sup>64</sup>

Improving the available technical capacity at TIRDO was another aspect considered in the new research policy. The technical capacity at TIRDO was built on Physical Laboratories and Pilot Plants for Applied Research, Technology Development, and Industrial Advisory Technical Support Services. The laboratories include Food and Microbiology Laboratory which is the only Accredited Laboratory at TIRDO since 2009 through the South African National Accreditation Systems (SANAS) Efforts are underway to accredit three (3) more laboratories which include: Environment and Occupational Safety Laboratory, Agro Technology and Industrial Chemistry Laboratory, and Materials Testing Laboratory/Non destructive testing Laboratory (NDT) and The Food and Microbiology Laboratory The aspect of human resource capacity was also taken into consideration in order to be effective in research. Currently TIRDO has 80 workers of which 45 are Scientists, Engineers and Technicians and the rest consists of Administrative personnel. The number is analyzed as follows; PhDs (9) (3 undertaking PhD studies) MScs (23) and Technicians (10). There is need of support for capacity building in terms of Equipment maintenance and calibration, Accreditation of Laboratories Purchase of specialized Equipment in the fields of Environment Monitoring Specialized Skills Development in the areas of Non Destructive Testing

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<sup>61</sup> Ibid. cf. Dr. Msabila interviewed November 2018

<sup>62</sup> President Ali Hassan Mwinyi Speech 1986

<sup>63</sup> Public Corporation Act, 1992, which was made into a law (and amended in 1993, 1999, and 2001)

<sup>64</sup> TIRDO, Research Policy and Guidelines, June 2004

(NDT) on Concrete Structures Specialized Training on Equipment Utilization. Industrial research department boasts of Agro Processing and Industrial Chemistry, Environmental Technology and Occupational Safety, Food Processing and Bio-Technology

### **Priority Areas of Research for Collaboration from 1990s**

Agro processing technologies, gas and petrochemical technologies, textile and leather technologies coal, iron and steel technologies, natural and medicinal products technologies, nanotechnologies (water and energy) and biotechnologies. Ongoing technical services to industry and establishments offered by TIRDO include; physical , chemical and microbiological testing of foods and water quality (metals and non metals), fuels, determination of calorific values. Environmental monitoring of air quality, waste water streams, sound levels, lighting levels, flue gas and particulate matter. Energy audit to industry , government buildings, institutions, and establishments. Non destructive testing on gas and oil pipelines, buildings and metal structures.

The role of TIRDO as local technology service provider was a mediator between MNEs and the local innovation system (IS), in Tanzania. The two collaboration projects between two MNCs subsidiaries in Tanzania, Tanzanian Cigarette Company (TCC) and Coca Cola Kwanza Ltd, and the Tanzanian Industrial Research and Development Organization (TIRDO), paying specific attention to how learning takes place between the MNEs and the local technology service provider on the one hand and, on the other, to how this knowledge is transformed, transferred and applied by local users.<sup>65</sup>

### **TIRDO Contribution to the Industrialization Process<sup>66</sup>**

In the field of industrial development the following services were offered by TIRDO; the industrial technical audit and advisory services, industrial feasibility studies, product development and testing, monitoring and evaluation of industrial projects. In the field of oil and gas sector the following were made available by TIRDO; professional welder's qualification and non-destructive testing of oil and gas pipelines and tanks and industrial pressure vessel and process equipment.

In the field of coal sector the following services were offered by TIRDO were laboratory and pilot plant for coal quality assessment and coal utilization technologies development. In the field of Iron and Steel Sector the following services were offered by TIRDO; Metallurgical services in development of spongy iron and, iron and steel products quality assessment. In the field of Cleaner Production in Industries the following services were offered by TIRDO Environmental services for waste minimization, improved occupational safety and maximized productivity. In the field of ICT and Electronics Sector the following services were offered by TIRDO Cyber Security Training and technical assistances to industries, Maintenance of electronic, scientific equipment through instrumentation unit. In the field of Leather and Textile Sector the following

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<sup>66</sup> Dr. Msabila, interviewed at TIRDO premises 2018

services were offered by TIRDO Quality assurance and technical services in the textile and leather industries and, leather waste recycling.<sup>67</sup>

### **TIRDO Communication System**

In the field of communication TIRDO communicates with the government formally through circular orders and letters. Other formal communication systems of email, telephone are used to communicate with the Government. Any information during communication must be in written form for formalization. TIRDO communicates with its Customers through the formal communication system which involves institutional email, letters, telephone, fax and face to face (physical visit) is used to communicate with the customers. Internal communication system is done through TIRDO participation in exhibitions, trade fair, Mass communication in radio, newspapers and television

### **Cooperation with Stakeholders<sup>68</sup>**

To advise the Government and Firms engaged in industrial production on the adoption and adaptation of technologies in industrial production. To provide an advisory technical service relating to the establishment of systems for the control and regulation of industrial processes to the firms engaged in industrial production so as to improve performance and to avert or minimize the sources of industrial pollution. eg. Researching on the standard/quality of local technology for better improvement

### **Ongoing Industrial Support Services**

TIRDO has embarked on providing support services to numerous industries. The recipients were prisons and PPF integrated leather factory feasibility study and Simiyu cotton based industries feasibility study. Due diligence to a pipe manufacturing factory Morogoro, canvas factory technical audit and revival, Cassava zero waste project, Industrial energy audit Analytical services in coal, chemistry and food, Industrial environmental audits and environmental and social impact assessment (ESIA)

### **Technologies Developed and Transferred by TIRDO**

TIRDO has been able to invent and develop some technologies including a solar drier (semi cabinet) the drying technologies for vegetables and fish products, orange juice extractor, essential oil distillation unit, cassava processing machines and palm oil processing machine

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<sup>67</sup> TIRDO, Industrial Support Services Provided by TIRDO, Presentation Made Before Public Relations Society of Tanzania (PRST), Dar es Salaam Tanzania May, 2018

<sup>68</sup> Prof Mkumbukwa Mtambo, Director General TIRDO interviewed November, 2018

developed for medium scale pilot plants for small and medium enterprises.<sup>69</sup> Other technologies developed and transferred include production of particle boards using cashew nut shell liquid glue, traceability systems in coffee, tea, fish and cashew nut industries and GS 1 company in Tanzania, bio control methods for prevention of ochratoxin A in coffee processing. A patent has been secured for Cashew Nut Shell Liquid (CNSL) – Tannin Wood Adhesive for chipboards particleboards in 2004.<sup>70</sup>

### **Successes and Challenges faced by TIRDO from 1979 to 2018**

The Act gave TIRDO the mandate to undertake applied research to strengthen and improving the performance and technological base of manufacturing industry. And to offer technical services related to solving problems and constraints in industry. Therefore the success of TIRDO will be evaluated by the relevance of its research done on problems in the industrial sector and by the speed and success in offering solutions to the problems of the industries. TIRDO was to formulate research policy which would have accommodated the prevailing research and development needs of industry and the existing globalized environment. The established work plans and priorities should take into account the available manpower resources, financial resources and the existing infrastructure.<sup>71</sup>

### **Foreign Bodies of Knowledge in the Tanzanian Economy**

Due to the presence of Multinational Enterprises (MNEs) in the local system, some of the knowledge that is flowing in the system constitutes a foreign body of knowledge. Through the increasing internationalization of production and Foreign Direct Investment (FDI), this body of knowledge forms a solid part of the local system. Additionally, inward FDI links domestic actors to economic units outside the national ones. The extent of cross-border knowledge exchange varies from system to system. Innovation systems connect domestic and foreign bodies of knowledge,<sup>72</sup> and this is generally the case in Less Developed Countries (LDCs) where the foreign knowledge base is particularly important. For local institutes, such as TIRDO, this is the context in which they are operating. MNEs constitute bodies of leading knowledge in the wider local

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<sup>69</sup> Dr. Msabila, interviewed January 2019

<sup>70</sup> TIRDO Records in custody of Dr. Msabila

<sup>71</sup> TIRDO, Research Policy and Guidelines, 2004 p. 3

<sup>72</sup> Rajneesh Narula, [Multinational Investment and Economic Structure: Globalization and Competitiveness](#), Routledge, 2002,

context.<sup>73</sup> Effective knowledge sharing: the Tanzanian Industrial Research and Development Organization as mediator between the foreign and local sector.<sup>74</sup>

The domestic knowledge base is further developed by the technology and knowledge transferred from the foreign sources. However, the domestic system needs to be in a position to internalize the input of the foreign knowledge sources. This ability to develop adequate capabilities to absorb the knowledge output of the collaboration with MNEs is one important challenge. With regards to macro implications for the SI, there need to be appropriate conditions not only within technology service providers, but also within the whole economy and society, i.e. social capabilities need to be present. Another challenge is related to the general gaps in the systems that exist in LDCs. Even if LDCs can learn from MNEs, due to increased cross-border activities, there is the problem of internalizing the input and the question of relevance of the input.

Regarding the rather basic problems that many companies in Tanzania are facing, concepts such as those conveyed to TIRDO through the collaboration with both Coca-Cola are of secondary priority. The local firms have to struggle with problems as for example low level of human and physical resources. Consequently, issues like improving the working environment are not prioritized. The input of ideas resulting from the collaboration with MNEs is therefore only productive and with potential for wider application where the ideas can be transferred to different contexts. This means, not directly from the foreign firm to a local one, but rather finding a form for application in another context.

Forms of interaction between a foreign affiliate, as representative for the private, foreign industries, and TIRDO a local technological service provider. It is investigated how knowledge of importance for economic development is shared and diffused between various actors in the economy with TIRDO being the key translator between the foreign and the local actors.

### Challenges

The domestic industry in Tanzania is still characterized by an inadequate base of technology and research and development activities, due to an unfavourable environment for the research and development activities. It has also been argued that domestic industries are not sufficiently informed about the existing research and development institutions and their potential for solving technical problems.

The weak technological research and development base prompted the Tanzanian government to establish sector-based centres of excellence. This has been done because a broader institutional framework is needed to support the development of the private sector. Research and

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<sup>73</sup> A. Szogs and L. Wilson. 2006, Effective Knowledge Sharing: the Tanzanian Industrial Research and Development Organization as Mediator between the Foreign and Local Sector

<sup>74</sup> Knowledge Management for Development Journal KM4D Journal 2(1): 92-104, [www.km4dev.org/journal](http://www.km4dev.org/journal)

development in Tanzania is primarily carried out by governmental institutions.<sup>75</sup> It has been shown that if the research and development capacity of the country is de-linked from the private sector, it will contribute only little or nothing to technological upgrading at the firm level.<sup>76</sup> The main task of the industrial support organizations is to provide services, including technological advice to industry, and to help them with innovative work on their products and processes.

The role that science and technology play in the development process has not been recognized by many industrial firms, demonstrated by lack of commitment to more innovative undertakings. Even with a few that are aware, there are other barriers including financial resources, inadequate human skills and weak information system.

There is absence of strong private sectors that appreciates in research and development contribution, and the same lacks willingness to adopt local innovations in technological services. Inadequate labour force with industrial experience which is compounded by inadequate educational system which does not consider the Tanzania industrial development policy. Improper utilization of natural resources, for example high quality coal is used in cement industry instead of iron and steel industry as energy sources. The other issue is lay in inadequate awareness to industrialists in sustainable industrial systems such as energy efficiency. More important is the Inadequate budgetary resources for research and development.

In view of the low level of industrial development in Tanzania, the economic situation and the needs and problems of the productive sector, the main functional activities of TIRDO have been largely limited to providing technical services of a problem-solving nature. Even with use of other laboratory facilities, TIRDO is unable to undertake other than limited applied research. TIRDO is providing the kind of assistance (information, energy audits, instrument repair, chemical analysis,) which the productive sector requires.<sup>77</sup>

### **Future Prospects and Outlook of TIRDO**

As an institution for research and innovation for industrial development in Tanzania TIRDO has been focusing on improving its future prospects and outlook for the national development. To support environment for research and technology development and formulate policies to support research and development, innovation and entrepreneurship. Tanzania has the political will to ensure that research and development is the National Agenda. TIRDO looks forward for accreditation of all laboratories so as to acquire international recognition of services. TIRDO is making effort to have the establishment of more laboratories in Government strategic areas such as leather and textile, metallurgy and energy technologies. Establish and strengthen collaboration with industry, academia and other research and development institutions locally and internationally.

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<sup>75</sup> Bartelt Bongenaar and Adam Szirmai (1999), Development and Diffusion of Technology The Case of TIRDO, in Adam Szirmai and Paul Lapperre, (eds), *The Industrial Experience of Tanzania*, Palgrave Macmillan, p.172

<sup>76</sup> (UNCTAD 2001)

<sup>77</sup> UNIDO, op.cit. p. 11

### Conclusion:

The industrialization campaign under the banner of *nchi ya Magufuli itakuwa ya viwanda* was supposed to take into account the role of TIRDO as a research and development organization. In the 1940's and 1950's a full 20% of United States of America's economic growth stemmed from research and development.<sup>78</sup> However, Tanzania just like all other developing countries has its manufacturing sector very weak. This is partly explained from the effects of colonial experience which concentrated on production of primary raw material products. For the colonial state to harness research and innovation in colonies would have been tantamount to committing economic suicide. This is exactly what happened in Tanzania under both German and British rule. The effort to establish self reliant economy as per Arusha Declaration and the establishment of TIRDO for the purpose of harnessing research and innovation in the manufacturing sector was a positive step towards strengthening of the local manufacturing sector.

The performance of TIRDO however, was not encouraging just like other public sectors created by Tanzania government. The poor performance of TIRDO according to this paper is attributed to a number of factors. The legal framework provided by the Act did not provide mechanism to the organization to enforce the exercise of its mandate to the manufacturing sector. Again the law did not provide a framework for the organization to be accountable in case of misdeeds. Placing TIRDO under the ministry though with its independent governing board crippled its power in decision making and above all in raising and managing its funds. The TIRDO budget being appended to the ministry budget rendered TIRDO unable to get what it needed at the right time. The status of public institution accorded to TIRDO made less autonomous from the shackles of government authoritative mighty. When public institutions started shaking amid economic crisis TIRDO was not spared.

The government treated TIRDO under the normal operation of other government organs. However, TIRDO as a research institution required extra care because it was sensitive to the manufacturing sector in terms of disseminating knowledge, research findings, consultancies and innovative services. This exercise is expensive and required vast investment in terms of human resources, financial resources, time resources and friendly infrastructure. Failure to care and fulfill these necessary demands for TIRDO rendered it weak to perform its noble mandate of advancing the industrial sector.

### Recommendations

Government which is committed to advance industrialization as the campaign of president indicates should have taken initiatives to appreciate the role of research and development in the envisaged industrial development by giving TIRDO a central position. The initiative could be in the form of increased budgetary allocation for research and development in niche sectors of the economy. Currently there is no money made available for research activities at TIRDO. Government is urged to put in place a strategy for capacity building by allowing TIRDO to employ researchers and the supporting staff. Currently TIRDO has to ask permission from the ministry of to employ workers. There should be a staff development programme so as to develop the existing staff to the levels of MSCs and PhDs. Completion of the physical infrastructures

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<sup>78</sup> F. K. A. Allotey, Science, Technology and Development, The University of Michigan



construction which was planned from the time of TIRDO's inception is another area to be addressed to. There are many laboratories missing including incubation centers, food processing, chemistry, metallurgy, textiles and biotechnology. The laboratories must be furnished with the necessary equipment for the applied researches to be conducted at the TIRDO premises.

A legal framework should have been put in place for industrialists compelling them to embrace technical services offered by TIRDO for improving productivity and product quality. Besides, TIRDO complains that its mandate as provided in the Act establishing it has been taken by COSTECH and Tanzania Bureau of Standards (TBS). This anomaly needs to be adjusted by removing the existing duplication existing in these parastatal organizations. Public Relations Society of Tanzania (PRST) needs to play its advocacy role during this process of industrialization

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