

**THE ROLE OF TECHNICAL SCIENTIFIC RESEARCH EDUCATION IN  
SUSTAINABLE DEVELOPMENT AND CONSERVATION IN THE  
REPUBLIC OF THE SUDAN**

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**ABSTRACT**

In this paper, the review is vital for the development of scientific and technological research also highlights the efforts made sporadic in this area. And try to put some solutions and recommendations that help the advancement of scientific research to resolve issues in the Sudanese society as the quantity and quality. Despite the obstacles, the movement of scientific research did not stop completely, because a number of researchers still believe in the inevitability of continued scientific research to benefit the maximum of what is available (and the efforts of individual) to attain the objectives of development, prosperity and keep pace with scientific development. The reality, which must be viewed seriously and considering it is that scientific research has become a pedestal only to build a modern state in today's world, and became the backbone for all plans developed nations and even developing countries. And enter the world in the era of World Trade Organisation (WTO) and intellectual property Guanyin and the demands of globalisation for the next century that followed, we will find ourselves irrelevant desert plant that the blood on our present situation did not change ourselves. It must employ scientific research to address the backlog of cases over the years such as the issue of poverty and human capacity development and exploitation of natural resources of the country and the fight against desertification and settling of scientific technologies for the stability of the pastoral communities, and others. The ramifications in the fields of science and technological abounded to the point where it became impossible to take in all its aspects and its subsidiaries and became to be the selection of research needed by the various communities and the selection of educational curricula have efficacious in both the vertical (specialised) or horizontal (destruction). These thoughts came together and a hint of shame and sometimes pour sometimes without reference to party or institution. It is about frameworks general extrapolated to infer and devise solutions and

treatments. I hope those who care about the subject of research and funding in the current international situation, which stripped the developing nations of the features that I found of Southeast Asia and other developing her country's tradition of innovations and products to developed countries.

**Keywords:** Sudan, education, technical scientific research, sustainable development.

## 1. INTRODUCTION

A booming economy, high population, land-locked locations, vast area, remote separated and poorly accessible rural areas, large reserves of oil, excellent sunshine, large mining sector and cattle farming on a large-scale, are factors which are most influential to the total water scene in Africa. It is expected that the pace of implementation of water infrastructure will increase and the quality of work will improve in addition to building the capacity of the private and district staff in contracting procedures [1]. The financial accountability is also easier and more transparent. 'Global Change' consists of the linked and interacting phenomena of rapid, modern and widespread change in land cover and land use; atmospheric composition; climate; biological diversity; economic organisation; population size; distribution and consumption patterns; and trade patterns. Together these factors pose a great challenge to human development. Global change research is a large, interdisciplinary and worldwide effort to find solutions to these challenges, in order that human development may be sustained and equitable. Africa is particularly vulnerable to many of the negative consequences of global change. Every aspect of the water, energy, health, and agriculture and biodiversity agenda is impacted in some significant way.

Many hundreds of Africa-based researchers are already engaged full- or part-time on global change research. In addition, there are similar numbers of researchers based outside Africa, focused on global change research relating to Africa. A rich set of overlapping networks links global change researchers in Africa to each other and to the global community. These networks should form the basis of future coordination efforts. There are key constraints to the development of a larger, more productive and better distributed (both in terms of countries and topics) [2]. Global change research community in Africa is the lack of adequate dedicated, accessible and

stable funding sources to support this research area. Secondary constraints of insufficient highly skilled human resources, and in-continent access to certain technologies, could be resolved within a decade if funding were available. Specific recommendations include:

- Strengthen the existing networks rather than creating completely new sets, supplementing them where necessary. An overarching structure that caters for human sciences with a more development focus as well as for biophysical sciences with a longer-term focus is suggested.
- Establish centres of excellence in aspects of global change research in south, east, central, west and North Africa, using existing concentrations of researchers in most cases.
- Focus international collaborative research campaigns on large, complex key uncertainty areas in Africa, including (for example, and among others) the processes and model characterisation of tropical and subtropical rainfall; climate land-surface feedbacks; hydrological cycle impacts in the presence of elevated CO<sub>2</sub>; impacts and adaptation of biodiversity; responses to changes in vector-borne diseases and the emergence of novel diseases.
- Increase the availability of small to medium sized competitive research grants for African researchers in global change.

### **1.1 BACKGROUND**

Sudan deals with science and technology since a long time, especially in the most important aspects of research and development. It did not identify specific policies or plans for science, technology and scientific research in Sudan in the post-independence period in spite of direct interest and activity, which is done by scientists and experts such as the Sudanese Arquette Conference for the overall development [3]. The first composition of structural and institutional framework for science technology and scientific research establishment of the National Council for Research in 1970 as a government responsible for policy, planning and programming has been included under his five boards specialising in agricultural research and scientific and technological research, medical research, renewable energy research and the economic and social research. And be under the umbrella of some national committees in the environment, population

and genetic engineering. It also established some of the centres and units to conduct scientific research in disciplines that are not available to universities and other research centres and the most important dimension of the Remote Sensing Centre and the Centre for Documentation and Information.

The new world order and the globalisation agenda of the twenty-first century are controlled by the revolution and the Sultan of information and amazing and successive developments in science communications, electronics, biotechnology, genetic engineering and computer science. All these challenges require the use of scientific research in order to survive competition and does not have a will of its strength does not have a decision in his or her liberty in all its dimensions. I have the latest scientific advances by the end of the twentieth century new phenomena, including the authority of informatics and the authority of the international media and social change and systems in a sophisticated modern technology, production and management. It is more complicated systems using modern technologies and the accelerated globalisation of information and knowledge become the methods of scientific research of the basics and requirements of sustainable development of any country seeks to true independence. Because the people have the information and improve their use will have an advantage in the selection of appropriate technologies and in reducing the cost of production and raising rates and competition in foreign markets and meet the challenges of globalisation in all fields [4].

All of this, the experience accumulated around us and our needs of actual and our well-defined should be our starting point to develop a strategy applied scientific research to which we aspire, otherwise we will apply to us the rule which says ((those who seek not what we want, and who want not what we need, which we need can not access it)). This paper dealt with the subject of scientific research in the Sudan, also highlights the efforts made sporadic in this area. And try to put some proposals and recommendations that help the advancement of scientific research in order to achieve its objectives and even going in the right direction, which can achieve sustainable development and in line with the requirements of globalisation.

The National Research Council in 1981 the first plan for science and technology and scientific research in the form of a programme known as ((the programme of building a science of modern)) in between 1981 and 1990 included the sub-programmes to exploit science and

technology and to encourage scientific research and building science cities. In 1989 established the Ministry of Higher Education and Scientific Research and became a ministry responsible for setting policies of science and technology, scientific research and has developed a new management structure of the National Centre for Research and issued law in 1991 with the aim of the Centre to conduct scientific and applied research. And entrusted the National Centre for Research to conduct scientific and applied research for economic and social development within the framework of state policy and under its auspices, and in coordination and integration with the institutions of scientific research in Sudan menu such as:

- (1) Centre for research and industrial consultancy.
- (2) Agricultural research corporation (and forests).
- (3) The research of livestock.
- (4) The geological and mining research.

## **1.2 ENTRANCE**

At a time when the pace of the Western world strides in the field of scientific research until they reached the maximum range in recent years, the country has been developing, including Sudan in the early stages, its features are not clear yet. It may be appropriate to begin the article for reasons including:

- One can take a closer look and comprehensive review in this area during the past decades.
- Second defend economic, social and technical, which is moving towards wider horizons the better and the worst.
- Third - tech machines, which jumped from steam to nuclear reactors and equipment to lightning satellites.
- Fourth globalisation and the consequence of openness are difficult to control it. That is why the world's post-year 2000 will be governed, including the decisions taken today, and decisions taken by the views at the top of the state bodies in the development of policies, strategies and plans. Those decisions should be taken along the lines of solid

base of knowledge and skill. Knowledge and skill that needed to research and application, research and application need for political and professional experience and knowledge and practice.

Modern scientific research began in Sudan and establishing a laboratory chemical in the second year of this century (Welcome Chemical Laboratory) and cotton research stations, followed by several research centres, all linked to areas of scientific and technological and related ministries and various government departments. After independence, turned institutions and scientific schools and the College of Gordon to form the University of Khartoum and obtained scientific research has attached great importance especially after the increase in graduates from the University of Khartoum and open the opportunity for many of them to engage in scientific research, this was a breakthrough for the development of scientific research in various levels and the response to a number of issues and try to address the problems associated with its evolution [5].

Scientific research in Sudan: The scientific research in the broad meaning is to harness science and technology for the benefit of society. We have met all platforms scientific (meetings, seminars, conferences, workshops, etc.), whether regional or global, which discussed the major challenges that science and technology has become the way real disposable in today's world to achieve economic and social development and that the difference between the developed and underdeveloped countries is due primarily to the difference between them in the scientific and technical capabilities. No way for these countries to achieve economic and social development only through science and technology and scientific research. Among the most important factor in increasing production and development is the scientific and technological progress and the ratio of the strong relationship between economic and social development and scientific and technological progress. Known to Sudan to deal with scientific research with the beginning of this century has been established plant (Welcome) in 1902 to take control of Epidemiology and parasites. In 1904 established the first station of the Agricultural Research. And established the Kitchener Medical School 1924 and then the School of Veterinary and Agriculture in 1938 and the interests of geology. The objective of this research in the colonial era to provide simple needs in the fields of agricultural, health and mining, but linked, in particular raw materials and make it suitable for export was also associated with imported goods in order to make it fit with local

needs. Expansion of scientific research in the fields of agriculture and veterinary medicine, forestry and fish thanks to these colleges and professors to become a stand-alone there is a College of Graduate Studies at the University of Khartoum. About the history of scientific research in Sudan: Scientific research aims to find solutions to the problems facing the human to follow the scientific methods of the Organisation based on a systematic consideration of sound. This concept began scientific research in the modern sense Sudan with the beginning of this century, and the research efforts, individually and in limited areas of improved goods and raw materials as well as in some of the veterinary services and quality control. The unit veterinary quarantines the first nucleus for scientific research in Sudan, where the user defined the British administration in 1900 in the interest of military veterinary time and paid attention to study some common diseases in the bovine animal plague and prevention.

In 1902 established a laboratory (Welcome), where the active and clear in the fight against diseases and insects harmful to humans and animals and plants, has contributed to the lab to discover some of the endemic diseases, especially schistosomiasis in Sudan. In 1904 established a separate unit for agricultural research included in 1912 to the benefit of knowledge of Sudan and had been cooperating closely with the lab (Welcome) and in 1919 turned into agricultural research to the Department of Agriculture and confined their efforts in the period to monitor the quality of the crops and protect them from pests. In 1934 opened the Kitchener Medical School and later joined to the rest of the sections of Gordon Memorial College to form the (Khartoum University College in 1951). The 1938 milestone in the history of scientific research in Sudan, where was established the School of Veterinary Medicine and School of Agriculture and have evolved later to the colleges of Agricultural Sciences and Veterinary Science and the graduates of those schools are leading the Sudanese first in the field of scientific research in agriculture, veterinary science and was almost a kidney impact in enriching scientific research in Sudan qualified cadres and the development of curricula and research methods [6]. Not only research activity in Sudan on the human and veterinary medicine and agriculture, but efforts have been made in multiple areas of research in science and engineering in different branches in industry, food, construction, geology, mining and areas of economics, sociology and the humanities, etc. The owner of those official efforts by non-governmental scientific associations in various fields and made some magazines and scientific journals limited distribution and the country began to

hear about conferences, seminars and scientific seminars. The independence of Sudan at the beginning of 1956 witnessed the beginning of a new stage in quality and quantity of scientific research and approaches and decisions of the College of Khartoum university marked the birth of the University of Khartoum, which recognised the nuances of scientific world and provide for scientific research potential of the largest and expanded opportunities for government missions and non-governmental organisations to universities and colleges outside the country, which shares in the country to provide scientific expertise in the various branches of modern knowledge. The spread scientific research centres, especially in agriculture and livestock in various parts of the country to reach areas of production and animal communities and expanded the work of general survey of the potential of the country and its natural resources. A closer cooperation between Sudan and the friendly countries and bodies and international organisations are very important.

## **2. STRUCTURE MANAGEMENT AND COORDINATION OF SCIENCE AND TECHNOLOGY AND SCIENTIFIC RESEARCH**

The country continued her scientific during the period that followed independence until the 1970 year of transition the great scientific where a National Research Council as an independent sponsor scientific research in the country under the care directly to the president and the president of the National Council for Research in the rank of minister and participate in meetings of the Council of Ministers and led the National Council Research march to scientific research by universities. Sudan announced in early 1982 that the era of the eighties would be the start-up phase in building a modern science. In 1991 the centre was established the National Centre for Research (NCR) as a substitute for independent, multidisciplinary research and development concern in the field of applied developmental and under the auspices of the Ministry of Higher Education and Scientific Research [7].

### **2.1 SECTOR OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH**

This sector is supervised by the terms of the development of policies, strategies and plans, National Council for Higher Education and Scientific Research under the auspices of head of state and is chaired by the Minister of Higher Education and Scientific Research, representing



the universities and the National Centre for Research heads of their boards and Directives members in addition to the membership of institutions of higher education colleges and private Ahli. Established the National Council for Higher Education and Scientific Research of the Research Committee as one of its standing committees and entrusted with the task of coordination between universities, higher institutes and the National Centre for Research.

## **2.2 RESEARCH AND DEVELOPMENT SECTOR MINISTRIES**

This sector consists of institutions for research and development to follow the federal ministries. The largest of these institutions, the Agricultural Research Organisation, which consists of agricultural research centres and the Food Research and affiliated with the Ministry of Agriculture and Natural Resources, in the same form belongs to the Livestock Research of the Ministry of Livestock, and Medical Laboratory of the Ministry of Health, the Centre for Research and Industrial Consultancy to the Ministry of Industry, Research Institute of Hydraulic to the Ministry of Irrigation, and the Institute of Geological research of the Ministry of Energy and Mining.

## **2.3 THE SUPREME COUNCIL FOR ENVIRONMENT AND NATURAL RESOURCES**

Established under the chairmanship of the president of the Republic and the membership of the Minister of Agriculture and Livestock Minister and the Ministers of Higher Education and Scientific Research, health, industry, irrigation and finance. The Board shall leave policies that are interested in the environment, natural resources and the coordination between governmental and private institutions in their respective fields. Based on the above are policy development and coordination and evaluation in the field of science and technology at the moment on several levels in different sectors. The National Council for Higher Education and Scientific Research, policy development and coordination between universities and the National Centre for Research on science and technology through the Standing Committee on Research. The policy development and coordination between national research institutions are at the level of the Supreme Council for Environment and Natural Resources and the Federal Cabinet.

## **2.4 QUALIFIED PERSONNEL IN THE FIELD OF SCIENCE AND TECHNOLOGY AND SCIENTIFIC RESEARCH**

Classified as developing nations when compared to the rest of the world it is lagging behind scientifically percentage of scientists is very low, and also spending in science and technology does not affect the rate of 1% of GNP set by UNESCO as a minimum for the development of science and technology. There are many indications and are known to help assess the degree of development of science and technology, including:

- Number of qualified cadres in the field of research and development in every million people.
- Percentage of expenditure on research and development of the gross national product.
- Number of scientific personnel and technical ability in the thousands in every million people, it is the duty of developing countries to develop research and development in the structures of local scientific even expanding the scientific base and are used and increase their effectiveness and strive for the developed countries and benefit from the model of scientific as most of the scientific personnel and technical assistance to these developed countries working in industry in the area of quality control and production development. In the field of research and development, the labour force and high-trained staff are a great wealth for the success of the application of science and technology in moving the wheel of development. According to UNESCO standards require developing countries with a per capita GNP between U.S \$500-1000 to 6000 specialised scientific and engineer in every million people that 10% of whom specialise in the field of scientific research and development. Also need this number of qualified personnel to a large number of intermediate cadres of technicians and skilled workers.

## **2.5 SUDAN TRENDS IN SCIENCE AND TECHNOLOGY AND SCIENTIFIC RESEARCH**

Sudan are evaluating the effectiveness of teachers and researchers in universities and research institutions in the light of the results of their research and their experience in addition to their

participation and contribution in the productive sectors, including industrial, agricultural and services sector. Also, as the correlation of universities and research institutions of these sectors is one of the important indicators in determining the level of scientific, technical and can be measured by the number of contracts related to research and development in the public or private sector and also offers advice and other technical services for the benefit of society.

### **2.5.1 SCOPE OF PROCEDURE**

Sudan has taken in recent years a number of positive steps towards supporting science and technology and its applications in the field of formal commitment and policies are the following steps:

- A comprehensive national strategy included an approved plan for development of science and technology and its applications. This is the first formal commitment in the modern history of Sudan.
- To create the National Centre for Research in 1991 as an independent, multidisciplinary research and development concerned and aimed to strengthen the scientific capacity in the field of applied and developmental.
- Formation of the Supreme Council for Environment and Natural Resources in order to support, coordination and balance environmental and sustainable development.
- Horizontal and vertical expansion in the training of scientific personnel and professional establishment of regional universities and specialised institutes and increase the proportion of the number of students of higher education. As the expansion of education above college and branched specialties.
- Restructuring of the agricultural research for independence and support staff and financial resources and linking them to the application farm in the major agricultural enterprises. And take advantage of technological packages for the establishment of crops and increasing the vegetable production, and were separated bodies dealing with livestock research and development in livestock enormous.

- And encourage scientific publishing and media support scientific publications and programmes at different levels of information in audio-visual media tools and governmental interest in public awareness in science and technology.
- Establishment of the council to develop the manufacture of Sudan under the auspices of Centre for Research and Industrial Consultancy, Ministry of Industry.

### **2.5.2 OUTSIDE**

Sudan has been a great interest in regional and international cooperation in science and technology and to provide what is available has the potential of scientific and material assistance to the brotherly and friendly countries as Sudan committed themselves to the agreements and protocols, regional and global within this framework:

- Sudan signed in 1992 the Vienna Convention and Montreal Protocol on Substances that Deplete the Ozone Layer.
- Sudan signed in 1992 the Convention on International Centre for Biotechnology and Genetic Engineering and established a national focal point of the National Centre for Research.
- Sudan has signed conventions on biodiversity and global climate during the International Conference of the United Nations Environment and Development in Rio de Janeiro in 1992.
- Sudan adopts many of the activities of the Federation of Arab Scientific Research Councils.
- Sudan participated actively in the programmes of regional and international organisations.

There is still a need for greater effort in different sectors to create an enabling environment adapted to the increased production of science and technology and its applications to bring about growth and development through:

- An interest in developing the capacities of institutes and research units in universities and scientific centres to provide the funding and training opportunities within and

- outside Sudan and supplement laboratory equipment, libraries and documentation centres and information.
- Care for the environment and the provision of scientific supplies necessary for researchers and technicians, professionals and motivate them to stability in Sudan and to increase their production and technological research and to encourage and honour of or excelled in them.
  - Involvement of scientists and modern technology (Altqanyen) priorities in the formulation and application of science and technology on scientific grounds.
  - Working to upgrade the basic science curriculum in higher education with interest in teaching mathematics and modern science such as genetic engineering and computer science.
  - Work on doubling the number of researchers, engineers and technicians with stimulate outstanding students to join the institutes of education and training and in the training of the intermediate.
  - To find the appropriate formulas for linking scientific research areas of consulting, production and so on:

A/ insurance needs of the citizens in the basic food, clothing, medicine and energy through productive projects attractive to investors so as to ensure self-sufficiency.

B/ self-production complexes typical for rural development and balanced regional cities and to alleviate the bottlenecks. These complexes will provide opportunities for the transfer of research results to the fields and factories.

C/ vertical development is done through modernisation of management and means of production and services in various sectors and the use of computer data and takes advantage of genetic engineering and the introduction of sprinkler and drip irrigation and other inputs from modern technology.

D/ double centres and computer networks and arrived in the commercial and political centres in Sudan, computer information networks that are created National Council of the computer.

E/ establishment of laboratories and high technology and advanced to the development and consolidation of technological rules to advancing development, such as microelectronics

laboratories and laboratories of biotechnology and genetic engineering laboratories and information and solar power, atomic energy and science of the desert and remote sensing and medical science.

F/ and/or attract scientists and professional staff, technical and technological requirements and provide better service and equipment specific to the progressive work and a better working environment.

G/ qualification and training and improving production in order to focus on human development.

It is clear that universities set up distributed to various states of Sudan and the following must be considered:

- (1) Confirm the identity of the nation and establish it through the curriculum which are approved by the university and applied.
- (2) Conduct scientific and applied research related to the different needs of society and renewable energy in order to service and upgrade.
- (3) Interest in desert ecology, medicine, land and industry in the context of interest in the development of Sudan in general.
- (4) Attention to issues of human development, thought and religious values.
- (5) Concern for the environment of Sudan in general and the state concerned, especially the environment and the rehabilitation staff is able to upgrade and resolve jurisdictional issues relating to the environment.
- (6) Technical innovation and employment to serve the Sudanese community, in collaboration with universities and institutions of higher education and scientific research, and the other country.
- (7) Interaction with the citizen understanding of rural problems and recognition of his knowledge and experience, and work with him to develop according to his needs and values.
- (8) To prepare students and give them the vacation of science.

From here it is clear that scientific research theory and practice-oriented and is the mainstay of development plans in the country, the first stage of each development project, or

a step forward in the world today based mainly on new technologies. However, the concept of scientific research and unfortunately may like a large mixing in Sudan since the prevailing concept of scientific research is the work leading to the new discoveries and inventions of the things that were not known before. And this became the prevailing sense of politicians, planners and executives, as well as ordinary citizens, resulting in the full dimension of scientific research on the movement planning in the country, and do all the development projects both big and small, without that preceded or followed by scientific research. As in the side of development projects across all the previous era, we have witnessed the collapse of a large number of agricultural projects, especially those established by the private-sector, for simple reasons for the disqualification of soil or poverty, or lack of validity of the climate, or after the area of marketing, or certain types of insects in the region concerned and others. In the industry it is even worse and more bitter, and the whole Sudanese society is still bemoans the textile project Kadow, and a project for manufacturing fertilisers, and the project of producing yeast and others. Even the existing plants, it works because the specifications of low cards do not match temperature in Sudan [8].

### **3. THE GOALS OF SCIENTIFIC RESEARCH IN HIGHER EDUCATION INSTITUTIONS**

Derived from Sudanese old universities reputation and fame and reputation locally, regionally and globally from academic and research excellence. Prestigious universities have sought to regulate scientific research to devote our specialised departments dealing with the affairs of scientific research under the direct supervision of the Departments of University. It is the most important functions of the Department of Scientific Research is the supervision, coordination, and funding for outstanding scientific research. To hide the that the cross-fertilisation between scientific research centres, which is the main tributaries of research activity in universities has become an absolute necessity in the pursuit of excellence and integrated work for scientific research, basic and applied universities, as both are complementary to one another because of the organic unity that exists between higher education and scientific research, education includes research activities in all its aspects and specialisations, and comes through the provision of scientific research results in basic and

applied. But is not limited scientific research on science and technology, but knocking all areas of social sciences and human and economic, etc. Since the homes are prestigious universities has particular expertise harnessed their potential and efficiency of research faculty members to conduct applied research of the character, which contribute to achieving development goals, by linking research and the urgent need for the development of society and help solve problems that impede development [9].

### **3.1 AREAS OF SCIENTIFIC RESEARCH INSTITUTIONS OF HIGHER EDUCATION**

The link between higher education institutions are preoccupied with the country necessitated the commitment engagement in all areas of research available, which greatly helped in securing the rise reflected an integrated development and prosperity and the prosperity and development of comprehensive and the most important areas of research:

1. Medical research and health.
2. Research and industrial engineering.
3. Research livestock and wildlife.
4. Agricultural researches.
5. Research forestry and natural resources.
6. Research geological and earth sciences and mining.
7. Water research.
8. Energy research and renewable energy.
9. Economic research and development.
10. Research for strategic studies.
11. Research sovereign, political and judicial.
12. Research, educational, social and intellectual.
13. Security research.

Tasks of scientific research centers specialised in:



- (1) There are centers of radiation of modern technologies such as remote sensing, biotechnology and space science, renewable energies and others.
- (2) There are centers of training for staff in all institutions in order to settle these technologies in the country.
- (3) To be advisers to the state of the scientific studies necessary preceded any development project in order to avoid confusion and loss, and planning random.
- (4) To ensure that resettlement technologies in the global agriculture, industry and animal husbandry, and others.
- (5) That the necessary studies in order to achieve international standards in all national products and national wealth in order to be competitive globally.
- (6) That works to detect the exploitation of natural resources existing in the country, such as plants medical and natural fertilisers and pesticides, plant, solar and others.
- (7) To spread the spirit of innovation and invention and disclosure, and encourages and seeks to achieve scientific leadership.
- (8) To establish research projects of integrated human development and fighting poverty.

### **3.2 PROBLEMS OF EVALUATING SCIENTIFIC RESEARCH**

Scientific research in Sudan is concentrated in three or four ministries which are the Ministry of Higher Education and Scientific Research and led by the National Centre for Research and Universities, Ministry of Agriculture and Natural Resources Development and the Agricultural Research Corporation, and the Ministry of Livestock and the Body Livestock Research, Ministry of Industry and the Centre for Research and Industrial Consultancy. In addition to the small units in some other ministries such as the geological research, and the National Department of Energy, and General Management of Forests [10].

- An escalating costs of research materials necessary laboratory and field and logistical.
- Migration researchers outside the country and sometimes internal, non-research sites to get an income guarantee.
- Lack of funding for general research, a very small proportion of national income.

- Imbalance ratios between scientific research and technical assistant in all disciplines.
- Social and economic conditions that adversely affect the researcher and the lack of appropriate financial incentives and lack of access to opportunities to participate in conferences and meetings of global and regional.
- Quality of research and its incompatibility with the application directly.
- Coordination between producers of research and its users.
- Failure to provide supplies to apply the results of scientific research in terms of management and human resources, and financing frameworks.
- Busy bodies in the productivity boost production, and incentives and lucrative bonuses.
- Weak contribution of 10 research organisations in solving the actual bottlenecks in production lines, including punishment of confidence between the parties.
- 11 non-priority-setting researches properly respond to urgent cases and with tangible economic returns.
- Poor management of scientific research.

#### **4. DIFFICULTIES THAT HINDER THE COURSE OF THE DEVELOPMENT OF RESEARCH AND DEVELOPMENT SYSTEM**

The following difficulties are discussed:

##### **4.1 COORDINATION IN THE DEVELOPMENT OF RESEARCH AND DEVELOPMENT PROGRAMMES**

Lack of coordination in the development of research and development policies and development between the national plan and research programmes in universities, research centres and lack of familiarity with the problems and needs of the industrial sector and agriculture and due to the lack of authority, which sponsors scientific research and then entrusted with the accounting research directions.

##### **4.2 COORDINATION BETWEEN UNIVERSITIES AND RESEARCH CENTRES**

Not to encourage researchers in universities on the use of laboratories, research centres and the results of previous research affiliate, no facilities and special benefits for the exchange of information and experience between them but no interaction is limited to each and everyone in his own world.

#### **4.3 COORDINATION BETWEEN THE PRODUCTIVE SECTOR AND THE SERVICE, AND SCIENTIFIC RESEARCH**

Solve the problems of the factories away from the centres of scientific research, whether in universities or research institutions and often the solution will cut the import of new or foreign assistance. The results of the research not concern the productive sector to lack of confidence and accommodating the extent of its success and realistic cost.

#### **4.4 INTERNAL DIFFICULTIES IN RESEARCH INSTITUTIONS**

There are several internal constraints impeding research institutions to interact with the productive and service sectors, such as not qualified for the Latest Altqanyen in sufficient numbers to carry out maintenance and operations research under the supervision of senior staff. These intermediate cadres need to be a comprehensive training and there is a lack of familiarity with the needs of these sectors and how to market services to them. There is no sense of the role of media failure and the absence of a mechanism to activate the association and coordination and integration between research institutions and sectors of the recipient.

#### **4.5 FINANCING OF RESEARCH AND DEVELOPMENT**

The agreement in the research and development is one of the direct indicators to assess the scientific status of any country; there is a high correlation between investment in research and development and economic growth. Developed countries maintain the progress and prosperity through the availability of credits in the field of research and development, while developing countries in contrast to the belief that the interest in investment in science and technology does not come benefits urgent. In the time that developed countries spend high percentages (between 2 to 3 %) of their gross national product in research and development, we find that the majority

of developing countries does not exceed more than 2%-3% and 0.2%-0.5% of their gross national product in research and development [11].

#### **4.6 HUMAN RESOURCE**

The human element is a powerful tool in bringing about economic and social development through the use of other factors of production, and the human at the same time the target development. Dealing with human development as the development of population characteristics, abilities and organically linked with the overall development of a society where rights and the means or purpose. The population of Sudan, about thirty million people (Statistics 1996) and estimated population growth rate of about 8.2% per year and notes that the increase of population in urban areas of 5.7% per year, while increasing the rural population rate of 5.1% per annum and is due mainly to migration from the countryside to cities. It is also noted that a high proportion of the population under the age of 15 years (it follows that the existence of the proportion of approved high) and the population density is about 10 inhabitants per square kilometer and up in agricultural areas populated to 390 and there is variation in the distribution of population between different states [12].

The number of economically active population by about 48% of the total population and contribute to kidney for males by about 60% and women by about 4.6%, which is very low and worthy of review and processing and the contribution of women in rural areas is higher than in urban areas and areas rich in the top of the poor. By the urbanisation process and continuous improvement of health services, the youngest age bracket increases for the composition of the population. The estimated labour force (15-64 years) at about 54% of the total economically active population who are estimated to be about 5.8 million of whom 1.2 million urban and 4.6 million rural. One of the problems that must be addressed, increase-mounting losses in the various stages of education, has the unemployment rate in 1993 about 17% while it was 5.10% in 1983. And to promote population characteristics and development of human resources and development skills of the workforce to raise the efficiency of production to achieve the development goals desired, while maintaining the stability, entitled to the problems of population and workforce awareness and mobilisation and organisation, guidance and information to improve the characteristics of population while maintaining the highest rates of population

growth commensurate with the geographical expanse and objectives strategic addition to the employment potential of the population and higher rates of growth while preserving natural resources and ensure the continuation of its bid for ways to raise awareness and promote the means of production and legislation [13]. The workforce may be seeking to address issues of illiteracy and reduction of waste education and technical training and vocational skills development and linked to appropriate technologies and the local environment and the needs of the labour market. Vary the contribution of each of these systems in GDP and in the importance of economic and living conditions depend Sudanese economy heavily on irrigated agriculture and rain-fed agriculture mechanism and the two together contribute about 80% of food production (maize) and estimated its contribution of about 50% of the value of agricultural exports has recently contributions to the growing livestock and gum Arabic in the Outbox [14]. Successive governments have continued to exercise parental role in this sector in terms of providing the requirements of foreign exchange for inputs and operational requirements and the obstacles that have emerged have accompanied the influential sector in its overall performance [15].

## **5. STRATEGIC OBJECTIVES BASED ON THREE AXES**

Three procedures required accessing the completeness of the goals of the observed and the strategy includes three main components:

1. Formulation of objectives.
2. Planning work programmes to reach the objectives.
3. Ensure that the capabilities required.

Management strategy must be seen as an ongoing process and it does relate to the goals and plans, and monitor the risks and restraints, and support aids, and the decline of priorities, and believe in possibilities, and the sequence of implementation, and the results. Even a strategy of scientific research does must believe:

1. Maturity of the strategy and the plans.
2. Safety priorities.

3. Integrated management process (technically, administratively and financially).
4. The stability of scientific research institutions structurally and functionally.

Types of research can be summed up as follows:

1. Research strategy.
2. Applied research.
3. Technical research (field technology) research.
4. Research methods (methodology matters).

### **5.1 STAGES OF DEVELOPMENT OF THE CAPACITY OF RESEARCH INSTITUTIONS**

Studies agree that there are three key stages to reach this goal and every stage of which needs to periodic review in order to achieve its goal. And these stages can be summarised as follows:

1. at the consensus of opinion.
2. Building capacities.
3. Reinforcement of structural and functional (consolidation).

### **5.2 SCIENTIFIC RESEARCHES AND THE CHALLENGE OF CIVILISATION**

Believes much of the so-called third world (including Sudan) that the transfer of technology in its final form represents an ideal solution to the problems of poverty and underdevelopment are experiencing, and an indispensable tool in narrowing the differences of civilisation between them and the developed countries, the owner of this technology and then adopt to monitor huge amounts of their income low in order to achieve this goal at a time are neglected these countries. Scientific research, both basic and applied largely ignored and clearly foreshadows his meager allocations upon the absence of a plan and conscious of actual research priorities, methods, and operates intellectual capacity through both scientific researches mentioned it affects each in other in a constant cycle of movement and interaction, leading to community-building and face the problems of scientific solutions which take into account the specificity of the community and the

uniqueness of its components. One manifestation of lack of attention to scientific research as well as the weakness of the preparation of national human resources trained and capable of understanding the techniques of the times and working with them for its development or at least bear in mind in order to achieve optimal use of them, reduces mistakes, and vanished with its negative effects on social and cultural life [16-25].

Technicians, technology, information revolution, the Internet are all echoes of the scientific research and development has reached the world for hundreds of years in research and experience. And for the world technology, we find that pre-empt access to knowledge that ensure comfort and superiority to others, especially to maintain national security. We find that some developed countries have given the efforts of the scientific and intellectual interest in each of their children and ridiculed their all kinds of support. And others learned the importance of the human mind to migrate minds and marshalled for the service of science and technology even possessed the world. It has become clear that the intellectual capital, which came by the information revolution, is a source of wealth, a new capital.

Scientific research is the examination and investigation of the fact that the orderly and systematic follow scientific methods. Since we are in the era of globalisation and privatisation has received the importance of scientific research in the definition of globalisation as the entry because of the evolution of the information revolution and technology in the process of the development of civilisation. Development is the activation of natural resources and the human-centered human mind in its search for how to use and activated. And development stage does not come only by the accumulation of quantitative and qualitative research and ongoing efforts. Relationship is still scientific research institutional development the subject of controversy, this despite that the relationship between them cannot be separated. Developmental planning is putting the priorities and needs of the scientific research programme while feeding the proper research institutions planning information and the correct data, which would work to increase production and reduce costs and make the upcoming changes. It is sad to know that the development of research is an investment in itself, where studies showed that the average rate of return of scientific research than 1000% of expenditure on it. Although this ratio is differ according to different states in Sudan, but just the opposite [26].

## **6. CONCEPTUAL FRAMEWORK**

### **6.1 FIRST, THE CULTURAL FABRIC OF SOCIAL CONSIDERATIONS**

Begin to say that the experiences of forty years of development efforts that shows growing modern industry is not subject to the elements of traditional production, which also says the comprehensive national strategy for only a tenuous link does not carry an abundance of raw materials and energy resources or human density flows or foreign aid. Growing modern industry depends on cultural fabric of social, a product of more than a political, social, cultural spiritual and the fruits of social mobilisation. Court, unity and national vision inclusive and effective, is the result of the victory on the crises of national and confusion, and waste and conflict, which is the result of finding programmes that cruel to national priorities and resource allocation and the provisions of the settings and promotion of manpower.

### **6.2 SECOND, MACRO-ECONOMIC POLICIES**

The growing modern industry requires the provision of appropriate macro-economic environment, which manufactured and rooted macro-economic policies effects directly and indirectly. That macroeconomic policy is appropriate to require Shell industrial development programmes and obstruction of public and industrial performance, and industrial investment.

### **6.3 THIRD, NATIONAL CONSTITUTIONAL CHANGES**

It is necessary to fit the industrial development policies and regulations of the Department of Industrial Development with the political and constitutional changes and major social changes that are organised home. Hijacking on the meanings and values of autonomy (the terms of reference state and the competence of local government) is exceeded on the principles of democratic governance and the principles of decentralisation and basic services. Needs to be a better means of economic management and capacity-building performance in the climate market economies, and then fit with the dramatic changes in the global economic climate.

### **6.4 FOURTH, CHANGES IN ECONOMIC LIFE AND THE GLOBAL WAVE OF GLOBALISATION**



Characterised by a climate of international economic life depletion constraints of official international aid organisations and to link international inferior pressures and constraints. And the national industry will face new challenges in the post-General Agreement on Tariffs and Trade (GATT), not only the challenges of competition in foreign markets but in the challenges against competitors in the market within the national itself. There is no way an expression of that cruel to reach high levels of economic efficiency and quality, support and development. The advantages are of natural systems, the relative economic efficiency and high quality industrial dynamic, and that the keys to the future are a science and technology, information technology and knowledge-based industry. Otherwise the industry will not get from agricultural products and edenic but rates of subsistence and go value-added and employment opportunities and employment and gain skills to employers industries. The industry is oil refining and electricity production and transfer of mineral ores and agricultural products to high-value multi-purpose. At this stage of our economic development, it is necessary to link the agricultural development to industrial development and a tight linkage to the full coordination between the arbitrator agricultural programmes and industrial programmes. The world is at the stage of knowledge-based economy and information technology in the pattern and type of industrial products and a stunning development in the patterns of industrial goods, the traditional and the transition to industrial products, new goods and products to the intellectual capacity (Brain Power Products) this economy is based on the miracle of conversion brainpower to material products [27].

Economy of the future requires a workforce with high skills and superior capabilities of mind and fullness of the spirit of innovation and initiative. Economy of the future requires a new culture and new modes of behaviour and affiliation unwavering to the values of harmony and unity and team spirit and requires a firm relationship between membership, production and the forces of science and knowledge and powers of the soul and technology. We have to deal with the changes of contemporary systems, the division of labour (Division of Labour) in the international economy and the resettlement of large groups of industries to train industrial industries like truck, automotive, industrial equipment, steel mills, fertiliser and cement and traditional textiles and leather tanning, etc.

## **6.5 FIFTH, SCHOOLS (MZHABIYAT) INDUSTRIAL DEVELOPMENT**

We should beware of liquid industrial development strategy in any Mzhabiyat or schools of thought or any rules M\_khash theory (Cook Book Rule) and be careful of the transfer and application of the theoretical basis and ignore the real situation in the country and the actual conditions. And the development of the necessary tools to address the actual situations of national industry and solve problems based or expected in the national industry.

### **6.6 SIXTH, CONGENITAL NATURAL ECONOMIC**

On the natural moral economic technical homeland outline of a strategy of industrial development in the country, the strategy for the development of real resources of the country and to protect and enrich the education advantages enjoyed by the country's crops and wealth dynamic industrial technology and the highest levels of economic value added and economic efficiency and innovation. And a summary of the matter is that the foundation stone of the industrial strategy is the treatment of industrial processes or manufacturing of materials and primary resources of the country (such as availability of cotton, oil seeds, leather, corn, vegetables and fruit) that requires the full coordination and harmonisation of agricultural and industrial policies. Should adopt a strategy of industrial development to address the real ills and build on the diagnosis and deep analysis, realistic and critical ills following:

- (1) Small industrial processes (shallow), and low added value.
- (2) Greater reliance on wills inputs.
- (3) Imbalance and the weakness of the front and rear linkages with other sectors of the economy.
- (4) Imbalance and the weakness of the interdependence of the industrial sector still rolling.
- (5) Lack of productive diversification, and low use of industrial by-products.
- (6) The inability to integrate in the global market.

## **7. INTERNATIONAL AGREEMENTS**

(1) United Nations Convention to combat desertification, particularly in Africa, signed in 1995 one hundred and five countries and thus become legally binding. Whale Convention forty articles and four annexes and the aim is to combat desertification and mitigate the effects of drought.

(2) World Federation for the Conservation of Nature and the headquarters of the Union in Gland, Switzerland and the Union's regional and continental offices and national site in 35 in various parts of the world, the number of member states 133 and the number of government institutions and NGOs. Must be accompanied by training local management based on the use of this technology, and this must be a programmer to choose the local people sperm delivery of the project they must participate in the process of technology selection, design, construction and delivery and to participate in a simple run under the supervision of experts.

(3) The need to comply with base balance between the sources of energy, environment and promote cooperation in the field of renewable energy and focus on the applications of biomass energy for rural development and the expansion of interest in them. And dissemination and promotion of solar technologies for the introduction of new technologies is not harmful to the environment.

(4) The rationalisation of consumption of firewood and coal, and thus to preserve the wealth of forest and environmental impacts, and optimum utilisation of agricultural residues and animal heat and raise the value.

(5) Awareness of the importance of native landscaping, and encourage farming planted forests and shelter belts and the introduction of fast-growing tree species and improve care of trees and forest management and the fight against destructive factors unjust random, and the rationalisation of consumption and improved household stoves next to improve manufacturing techniques.

(6) The need for organisational units and lead the process of preserving the environment and achieve the objectives of development of natural resources in the cooperation and coordination.

(7) There is a need for fundamental change in energy systems to bring them into line with sustainable development. And the need to change dictated by social and economic issues, environmental and security situation in the account with the following:

(A) To promote universal access to modern energy.

(B) Building local capacity.

(C) Establishment and maintenance of fair rules of the game (by removing the permanent subsidies and make energy prices reflect the external costs (such as social and environmental costs)).

(D) To single out the roles of stakeholders (environmentalists, consumers, current and potential, etc.) not belonging to the private-sector [28-39].

(E) The entry of the regular formation of the new generation of technologies that are used to cleaner fossil fuels, and renewable sources and efficiency improvements.

### **7.1 STRATEGIC OBJECTIVES FOR THE ENVIRONMENT IN SUDAN**

1. Preservation of the environment and development and prevent disasters.
2. Stop environmental degradation and reconstruction.
3. To maintain the balance and stability of environmental components (systems ecology).
4. Development agencies working in the environmental field.
5. To develop relations with other countries and international institutions and organisations in the environmental field.
6. Development of the balance of wildlife and exploitation in accordance with sustainable development.

### **7.2 POLICY**

1. To follow a sound approach in the rational exploitation of natural resources.
2. Achieve sustainable development in pace with global efforts to protect the environment and natural resources.
3. Status of a comprehensive plan for scientific research in the fields of the environment.
4. Issuance of environmental legislation for each collector and the fundamental principles of public policy for the protection of the environment.
5. Reconstruction of the southern Sudan environment affected by the war and reconstruction of areas affected by drought and environmental degradation in coordination with the relevant authorities.
6. Sudan to fulfill commitments to international conventions and organisations in the area.
7. Attention to cadres and the creation of specialised training at home and abroad.

8. To encourage the voluntary associations and organisations in the environmental field.
9. Allocation of new natural reserves and the promotion of new projects zoos states.
10. Include the environment in the curriculum.
11. Rational exploitation of resources, the environment and promotion of environmental awareness to all levels of coordination.
12. To provide potential accommodation and complementary services of transport and communication.

### **7.3 HIGHER EDUCATION IN AGRICULTURE**

1. An expansion of a higher agricultural education system to include all food production from farm to market.
2. Preparation of higher agricultural education programmes on the basis of teaching, research and extension.
3. Re-structure of the curriculum so as to provide knowledge, skills and information technology including the use of computer and sustainable resources.
4. Creating and strengthening links between universities (Colleges of Agriculture and Veterinary, etc.), and national research centres.
5. Provision of training opportunities to raise the capabilities and efficiency of the faculty members through seminars, meetings and programmes.
6. Support cooperation and distribution of information among educational institutions and other devices.
7. Attention to sustainability of institutions of higher education because they suffer from a continued decline in funding and the erosion and degradation of the environment research and the inability to keep the faculty members in their positions.
8. Consideration of the establishment of centres of excellence for postgraduate studies in some Arab countries.

The main objectives of agriculture as set out in comprehensive national strategy on:

- (1) Food security.
- (2) Sustainable agricultural development.
- (3) Of the increase and diversity in crop and animal production.
- (4) Raising the efficiency of resource use.
- (5) Increasing productivity by using modern technologies to focus on small farmers and investment by the private-sector and the interest in the role of women in development.
- (6) Integrated rural development and balanced.

The proportion of researchers working in the field of agricultural engineering:

Agricultural Research 9.26%

University of Khartoum 6.34%

University of Gezira 5.15%

Sudan University 5.11%

Sesame Centres 5.11%

Organisational structures have remained constant with the change of project objectives and farming systems and policy changes are being reviewed in the structures and I think that there is a need for closer monitoring of the implementation of the new agricultural policy which requires re-formulation of structures.

- (1) High cost of funding and limitations on the financing requirements of production and post-harvest operations, including marketing.
- (2) Rising tax burden on the irrigated sector, particularly on cotton with the ease of what happened remains an urgent need for further easing the tax burden on agriculture.
- (3) The escalation of production costs due to inflation.
- (4) The escalation of the cost of administrative expenses.

## 8. CONCLUSION AND RECOMMENDATIONS

The attention to scientific research has become the duty of the state-public and private-sector and it is difficult to enter the twenty-first century, the century of globalisation and planetary who became illiteracy is computer illiterate without proficiency in scientific research and technology development resources and technology. And developing countries face many problems in the transfer of technology or in the tradition of industry after the World Trade Organisation and to ensure intellectual property rights related to Trade Related Issue of Intellectual Property Right (TRIPR) and the Court of tendencies and not but to rely on themselves or the establishment of centres for joint research with the developing to be produced from an original effort, the thought of her children and technology adapted to the level of development. Of the richest on the discretion of the state of the importance of research and serious political commitment towards the creation of a climate and create a mechanism to develop, update and adopt a policy, e.g., a sound and priorities are on a scientific basis and adequate funding. Because the research is the ways to provide scientific information systematically to develop programmes and activities effects on sectors where it is applied research results and therefore on society and the state. After it is vital that we come to be vital for the development of technological and scientific research can be its recommendation as follows:

1. Development of strategic planning for the scientific research according to the desired available and can be leading, and setting priorities. Favourites including development issues and serve the community, and detailed analysis of the research carried out and the periodic review.
2. Coordination between the centres of scientific research in the education sector and government and private agencies in the country.
3. Research unit and the private-sector through the Sudanese Employers Union and coordination with the relevant authorities.
4. Coordination and integration, communication, and cooperation between scientific research bodies, universities, consulting, production locally, regionally and globally.
5. Financing of scientific research (laboratories, and field logistic), input of scientific research, scientific instruments, certain, references, magazines, specialised libraries, scientific publishing, and attending conferences.

6. To identify a percentage of national income for scientific research and the involvement of the private sector and the Federation of employers in financing scientific research, and the imposition of fees on all productive sectors for the benefit of scientific research.
7. Support the translation and localisation to keep abreast of developments in scientific research.
8. Benefit from the results of scientific research in the development and promotion of production and services, industry and trade, according to development plans.
9. Focus on scientific research on rural development and regional balanced and sustainable.
10. Commitment of government and private agencies to provide information and data to researchers and establish a database in all science disciplines and double centres and computer networks.
11. Public awareness of the importance of scientific research in the dissemination of knowledge and the evolution of reality through the media of audio-visual and print media.
12. Improve the situation and living conditions of researchers and stop the migration of research centres, universities and others.

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