CHEMICAL EDUCATION AND NATION BUILDING

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Abstract

The paper portrays chemical education as a veritable instrument for nation building. It examines the role of chemical knowledge in the chemical industrialization of Nigeria which is doped will make her *a* user of its raw materials; an exporter nation; an earner of more foreign exchange; and self-reliant. It will open up employment opportunities for Nigerians and improve the socio-economic well-being of her citizens. The resultant benefits will greatly contribute to nation building. A chemical industry is a stimulant for the growth of other manufacturing industries. Since the chemical industry depends heavily on chemical education, the chemistry curriculum which should be reviewed periodically, should be designed to produce personnel that are adequately trained and appropriately oriented to the demands of chemical education for nation building.

Introduction

Some of the important goals of chemical education include: the propagation of the teaching and learning of chemistry; awareness of the role of chemistry and its relevance to nation bnilding; fostering scientific literacy through acquisition and utilization of chemical knowledge. Commenting on the nature, scope and place of chemistry in national development Ikoku (1984) asserted that:

> ... chemistry, by its very definition, is preoccupied with the molecular transformations, which matter manifests. Ipso facto, chemistry embraces not only the processes occurring in the chemical industry per se, but indeed in oilier industries such as iron and steel, non-ferrous metals, petroleum, food, paper and pulp, glass, electronic equipment and so on. It must be observed, (hat the expansive discipline, with its versatile interrelationship with the vital sections of the economy, its indispensability for the pursuit and successful execution of other professions and other dominant role in the important exercise of improving the quality of life of all the citizens, still has to be fully recruited to the task of . national development.

Bankole (1983) corroborated this view when he stated that:

> ... It is hard to find any part of industry, which today is not influenced by chemistry, and the chemical industry. Chemical science truly represents a basis, or at least a supporting discipline, for many other fields just as the chemical industry represents a basis or a supporting industry for many other manufacturing industries.

Against the above background, the place of chemistry education in nation building can hardly be over emphasized. It is important to point out that nation building connotes national development. Elucidating the meaning of development as it affects a nation. Aghadinuno (1997) opined that; Development is a socio-economic term. H is a kind of socio-cultural change in which new ideas are introduced into a social system in order to produce higher per capita incomes and higher standards of living through modern science and technology and improved social organization. Development includes improvements in the material welfare of the people as well as the eradication of mass poverty and its correlates of illiteracy, diseases and short life-expectancy. Development has several dimensions of the capability of satisfying the needs for food, health, potable water, shelter, clothing, education.

defence/security, communication energy and leisure. Any society that satisfies these needs to a extent in her citizens is considered developed.

Thus, it can be said that chemistry is a vital instrument for socio-economic development. Chemistry is an expansive discipline. It embraces processes occurring not only in chemical industries. but other industries as well. Chemistry is a gateway to many professions role of chemical education in nation

building. In order to appreciate the crucial role chemical education prays in nation building, it is important to examine some areas in our national economy where chemistry finds application. **Agriculture:** Chemical principles and products have been utilized to control pests and weeds and in fertilizer production for increased food production. They are also used in managing domestic animals for economic production of meal, milk, eggs, etc. (Aniodoh. 20(1!). Chemistry is ;i vital inslnmienl for the socio-economic development of a nation.

Healthcare: Drugs, which are products of chemistry abound and are used for various purposes including prevention and treatment of various diseases. Proserpine, a Yohimbe alkaloid, for example, has important clinical use in the treatment of high blood pressure (hypertension) and also as a tranquillizer for the emotionally disturbed. Ergot alkaloids are used chemically to induce contraction of the uterus in the last stages of pregnancy. Morphine and some of its related compounds are well known pain relievers (Aniodoh, 2001). It is often said that health is wealth. Good health is essential for nation building. Education: Chemical education fosters scientific literacy. Chemical knowledge and the application of chemical principles and products are important in problem solving. Scientifically literate citizens are an asset to a nation. A chemically literate citizen knows the dangers associated with drugs and how to use them without occasioning harm.

Potable Water supply: Water is chemically treated to kill germs, thus rendering it lit for human consumption and other domestic uses. Water, air and food are vital for human life and development.

Clothing: Some textile fibres used as clothing are obtained b> modifying natural fibres of agricultural origin such as viscose rayon and cellulose acetate from cellulose. Other fibres such as nylons, terylenes and acrylic fibres are all chemical synthetic derivatives from petroleum sources and are used as clothing.

Energy Supply: Coa! is fuel and a source of energy. Fuel derived from petroleum is used to power automobiles, aeroplanes and ships. Gaseous fuel such as butane is used as cooking gas. Kerosene, a derivative of petroleum, is a household name and is used in heating, cooking and lighting,

Role of Chemical Education in Chemical Industrialization

Perhaps, one of the areas where chemical education plays its most important.roles in nation building is in the area of chemical industrialization. Some renowned Nigerian chemists/academics. Bankoic (1983) and Ikoku (1984) bad advocated chemical industrialization ofNigeria as a sure way to national development. In buttressing his case, Bankole (1983) bad this to say:

> ...chemical industry represents a basis or supporting industry for many oilier **manufacturing** industries. The chemical industry rapidly gives rise to new developments that quickly become separate industries in their own right. Thus, industries concerned with the manufactured or processing of plastics, man-made fibres, pharmaceuticals, artificial rubbers, soaps, and detergents, dyes and pigments, fertilizers, etc. are offshoots of the general chemical industry which can today be referred to in their own rights as industries.

In a survey conducted in the Department of Chemistry. University of Ibad'an to ascertain the chemicals and raw materials used in Nigeria's industries, their sources and quality, and what by-products resulted from those industries and how they were disposed, etc. it was discovered that, "our industries consume quite a lot of chemicals and that these are mainly imported from abroad[1]". He presented a dismal picture. Table 1, which gave the ratio of imported to total raw materials used in various industries of the chemical sector.

Table 1. Industries and the Ratio of'their Imported/Total **Raw Materials**

S/N.	Industries Group	Imported Raw Material/ Total Raw Materials
I.	Manufacture of carpets and rugs	0.936
2.	Basic; Industrial chemicals	0.814
3.	Paints	0.678
4.	Drugs and medicines	0.841
5.	Soaps, perfumes, cosmetics and other cleaning preparations	0.613
6.	Other chemical products	0.839

7.	*t*yres and tubes	0.813
8.	Plastic products	0.806

Source: adapted from Appendix 12.6 oft he fourth Development Plan pp. ! 76-177 in Bankole, T.O. (1983). Inaugural Lecture, University of Ibadan, p.2.

In lamenting lack of utilization of Nigeria's abundant mineral raw materials. Bankoie (1983) said:

> While the technology and perhaps the machinery are imported, it would be more comforting if they were much less dependent on imported raw materials, especially in a country endowed with the necessary mineral ores and resources as our country is.

Need For chemical Industrialization of Nigeria

Ikoku (1984) listed and discussed the following six points to support his advocacy for a chemical industry in Nigeria.

1. The chemical industry provides other industries with raw materials.
2. Nigeria currently imports virtually all the chemicals she uses. Local manufacture will ensure not only colossal savings in foreign exchange but also more reliable supply of other (consumer) goods.
3. The chemical industry will result in increase range and volume of exports. Since petroleum is a major resource base for a chemical industry, it is advisable to increased our local oil refining capacity and deploy the refining products in chemical and allied industries. Some of the products of such industries could be sold for foreign exchange and efficient utilization of our crude oil insulates us from the vagaries of the world oil market and the predictable consequences of the resolve of the countries that currently buy our oil to switch to alternative energy sources.
4. The nation's projected petrochemical industry will not take off without a thriving indigenous chemical industry. Although petrochemical production makes use of petroleum and natural gas, other chemicals needed for production come from the chemical industry.
5. The chemical industry is indispensable for developing a self-reliant national defence system.. Bullets, explosives, grenades, mortars, rockets, bombs and other weapons, all concentrates of
chemical energy, are of chemical origin.
6. The presence of a chemical industry will have a markedly positive effect on chemical education and research. Since the chemical industry depends heavily on chemical know-how, the chemical
industry will spur research as well as set in motion an enrichment and re-orientation of chemistry curricula at the tertiary and secondary educational tiers that will make the teaching of chemistry more relevant to societal needs and the nation's production goals. Combined efforts of the chemistry
industry, educational institutions and research establishments can go a long way in enhancing the socio-economic development of a nation.

Constraints to Chemical Education and Chemical Industrialization of Nigeria

Some constraints, which readily come to mind regarding dissemination of chemical knowledge, include poor chemistry teaching, inadequate chemistry laboratories, obsolete chemistry curriculum, lack of awareness of the role of chemical education in nation building and apparent lack of interest by government in science.

1. Poor Chemistry Teaching: A survey of chemistry teaching in most of our secondary and tertiary institutions shows that not much meaningful teaching and learning of chemistry is taking place. In most cases the chalk and talk method takes place leading to poor acquisition of chemical knowledge. There is little recourse to teaching resources, which would stimulate and make learning more meaningful. Poor chemistry leaching may be attributed to lack of qualified chemistry teachers, poorly remunerated qualified chemistry teachers and lack of adequate
teaching and learning resources.

2. Inadequate Chemistry Laboratories: Akpata (1997) identified lack of adequate and functional laboratories as one of the problems facing chemistry education in "Nigeria. He observed that most of the secondary schools in this country that offer chemistry as a subject do not have functional laboratories. The schools located in the rural areas with a larger population are worse of because most of them do not have a building called laboratory. Teaching chemistry without practical makes it abstract and this portrays the subject as being difficult and consequently kills the interest of the students in the subject. In tertiary institutions where laboratory buildings may be available, equipment and chemicals are totally absent. Akpata's observations are in accord with what ue see today in our institutions of learning.

3. Obsolete Chemistry Curriculum: Every curriculum changes with time. It changes in response to the present day realities of the society-the learner's needs and societal demands. The continued use of chemistry curricula drawn many years ago is unacceptable if chemistry is to perform its much-needed role in nation building.

4. Lack of Awareness of the Role of Chemistry Education in Nation Building: Not many Nigerians,even students, know the enormous role chemical education plays in various occupations and the upliftment of the socio-economic of the socio-economic development of the nation. This lack of awareness is an impediment to enrolment in chemistry education; low acquisition and application of chemical knowledge and lack of knowledge of chemical potentials in industries

5. Apparent Lack of Interest by Government: Little fund is devoted to the teaching of science and technology by the Nigerian government contrary to the provisions of the National Policy on Education (NPE) (1981) Section *5* paragraph 39 which states as follows:

   i. A greater proportion of educational expenditure will be devoted to science and technology; and

   ii. Universities and other levels of the education system will be required to pay greater attention to the development of scientific orientation. To this end, more Colleges of" Technology and Polytechnics will be opened in a bid to improve technological and science education.

The ratio of Science to Liberal Arts Student in our Universities has been fixed at 60:40 during the Third National Development Plan period.

It is common knowledge that most of the provisions listed above are not being met. Although we now have more Colleges of Technology and Polytechnics, how well they are funded is another matter. The 60:40 admission ratio of Science/Liberal Arts students is not adhered to in admission to our Universities and no one seems to care. This apparent lack of interest by government is affecting the advancement of science and technology and rapid industrialization of Nigeria.

Bankole (1983) listed high rate of population growth, size of local market, type of labour available, choice of products, choice of process and raising the capital as problems militating against chemical industrialization in developing countries.

Strategies for Enhancing Chemical Education and Chemical Industrialization for Nation Building

The need for sound chemical education For nation building can hardly be over emphasized. The following strategies are suggested for enhancing chemical education and hence chemical industrialization of Nigeria.

1. Chemistry Laboratories should be adequately equipped with chemicals and reagents and well qualified personnel teachers, technologists and laboratory assistants should be recruited to man them. Such personnel should be adequately remunerated and motivated by government by sponsoring them to seminars/workshops to update their knowledge and skills.

2. There is need for more meaningful teaching and learning of chemistry in our schools. Making a case for chemistry teaching that is relevant to real life, Ikoku (1984) observed that:

   Since the secondary schools produce the "raw materials" for the tertiary

institutions, and considering the fact that industries (chemical and others) employ a large number of secondary school leavers, the chemistry syllabi! and, more importantly, the teaching of chemistry in the secondary schools should be made more relevant to real life and pupils should be made more aware of the role of the chemical industry in national development.

3. The chemistry curriculum should be reviewed periodically to meet both the learners" needs and societal demands. Ikoku (1984) pointed out that, the chemistry curricula at the various
educational tiers should reflect an awareness of perceived role of chemistry in the national economy and should be designed to produce personnel that are not only adequately trained but appropriately oriented.
4. Awareness programmes should be mounted by government on the importance of chemical education and its relevance in industrialization for upliftment of the socio-economic well-being of the Nigerian society.
5. Government should match policies with action by ensuring proper funding of science and technology and insisting that the 60:40 ratio of Science/Liberal Arts Students in our Universities is maintained.
6. The Nigerian government should give serious thought to setting up indigenous chemical industries to absorb our abundant raw materials and natural resources and thereby stimulate the growth of other industries. Chemical industrialization of Nigeria will fetch the country more foreign exchange; make her self-reliant and improve the socio-economic well-being of her citizens. It will provide employment opportunities for Nigerians.

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Summary and Conclusion

Chemistry has been presented as a vital instrument for the socio-economic development of a nation and an expansive discipline that embraces processes occurring not only in chemical industries, but other industries as well. Chemical science truly represents a basis, or at least a supporting discipline, for many other fields.

Chemical industrialization of Nigeria has been advocated as a means of achieving national development. Many benefits accrue from the establishment of an indigenous chemical industry in the country. One, chemical industry provides other industries with raw materials. Two, it is the quickest

means to industrialization based on local resources. Three, il will fetch the country much needed foreign exchange. Four, Nigeria will become more of exporter or goods and services than a dumping ground for foreign goods. Five, the chemical industry is important in developing a self-reliant national defence system. Six, establishment of a chemical industry has synergistic effect on chemical education. While the chemical industry draws its manpower needs from the Universities, stimulates research and sets in motion an enrichment and re-orientation of the chemistry curricula both at the secondary and tertiary educational tiers, the educational tiers send their pupils to the chemical industry for Students Industrial Workshop Experiences (SIWES) to enable them obtain out-of classroom experiences which enrich chemistry teaching and give pupils a perspective of chemistry that enhances classroom instruction.

The need for recruitment of well qualified personnel, provision of adequate laboratories, periodic review of chemistry curriculum; creation of awareness of the potential of chemical education for national development has been made. The need, also, has been made for government to show more interest in the advancement of science and technology. Nigerian leaders should give serious thought to Ikokif s plea that, "If Nigeria is to achieve its declared objective of becoming a dynamic, virile, self-reliant, modern nation, it must ensure the fullest possible recruitment of chemistry to the task of national development" (Ikoku. 1984).

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