

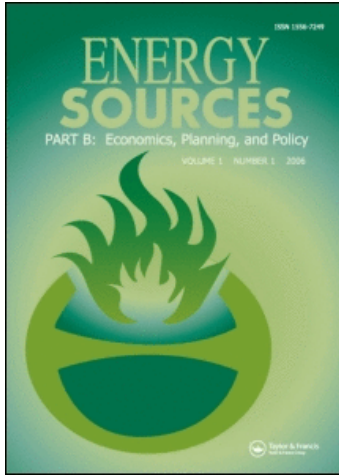
This article was downloaded by: [Oguejiofor, G. C.]

On: 24 August 2010

Access details: Access Details: [subscription number 917259383]

Publisher Taylor & Francis

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Energy Sources, Part B: Economics, Planning, and Policy

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t716100766>

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Online publication date: 30 November 2009

To cite this Article Oguejiofor, G. C.(2010) 'Using Total Quality Management as a Tool for Re-engineering Coal Production in Nigerian Coal Corporation: An Energy Industry Case Study', Energy Sources, Part B: Economics, Planning, and Policy, 5: 1, 29 – 40

To link to this Article: DOI: 10.1080/15567240701621174

URL: <http://dx.doi.org/10.1080/15567240701621174>

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Using Total Quality Management as a Tool for Re-engineering Coal Production in Nigerian Coal Corporation: An Energy Industry Case Study

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Abstract *An attempt aimed at entrenching the total quality management paradigm into the Nigerian Coal Corporation is made to ensure that the re-introduction of coal into the Nigerian energy mix is sustainable and maintainable. To this end, the following issues crucial to this report are examined and discussed, as the full text of this article would show. The review of the Nigerian coal production profile from 1916 to 1998 displayed two spectacular regimes, namely: The growing production period (1916–1959) and the diminishing production regime (1972–1998). The highlights of the Minerals and Mines Act 2006 which revealed the incentives that would be beneficial to the investors, host communities, subsistent miners, government and environmental-protection enthusiast. The discussion about the Nigerian Electricity Regulatory Commission awards of licenses to the independent private power companies showed that the Nigerian Electricity Regulatory Commission was yet to be guided by the Federal government policy of diversification and promotion of viable non-oil resources like coal. The brief excursion into the problems of the Nigerian Coal Corporation exposed the technical and administrative problems of the Nigerian Coal Corporation that are required to be tackled by total quality management paradigm. The discussion of the basics of the total quality management paradigm and culture showed how to tackle the Nigerian Coal Corporation problems through the enthronement of the total quality management principles.*

Keywords diversification, entrenching, paradigm, re-engineering, subsistent miners, total quality management

1. Introduction

Coal production started from Enugu coal mines in 1916. Coal was the primary source of energy in Nigeria from 1916 up to 1972. During that period (1916–1972), the industrial customers who depended on the coal for their operations were:

- The Nigerian Railway Corporation,
- The then Electricity Corporation of Nigeria (ECN) which used coal for power generation in Ijora and Oji thermal power stations,

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- The Nigerian Cement Company Limited (Nigercem) Nkalagu, and
- The Marine Department.

However, 1972 was the turning point for coal as the following events were witnessed:

- The 1972 Indigenization Decree which resulted in the withdrawal of foreign multinational mining corporations and expatriate professionals from Nigeria.
- The dominance and outpacing of coal by crude oil in the early 1970s and the subsequent policy of the military and political classes to switch over to the usage of petroleum products. Examples were the dieselization of the Nigerian Railway Corporation and the conversion of the Ijora thermal power station to gas-fired plant.

The result of these phenomena was summarized by Iwu (1998) that the annual contribution of coal to the national energy mix had, therefore, declined from 50% in the 1960s to about 0.4% in the 1990s. The end result was the collapse of the Nigerian Coal Corporation (NCC) and the overdependence on oil and gas for energy.

However, Nigeria's reinvigorated drive for economic development and massive industrialization has recently compelled her to seriously tackle the problem of energy generation and supply to private customers and industrial users. To this end, the Federal Government of Nigeria (FGN) has come up decisively with:

- The establishment of a regulatory body, the Nigerian Electricity Regulatory Commission (NERC), and
- The enactment of the Minerals and Mines Act 2006, in line with the policy of diversification and promotion of the viable non-oil sector (Minerals and Mines Act, 2006).

In this regard, the special assistant to the Minister of Solid Minerals Development on Privatization and Deregulation, Mr Demola Gbadegesin (2006), said in the *Guardian* that the direct foreign investment expected in the coal sector was ₦11.2 trillion (US\$86.2 billion at 2006 average exchange rate of ₦130 per US\$1).

The breakdown showed that the investors for the Okpara Coal Mine in Enugu would stake in ₦4.2 billion (US\$32.3 million) for immediate surface mining and ₦140 million (US\$1.2 million) for briquette production. Underground mining at Okpara will witness an investment of ₦1.4 trillion (US\$10.8 billion); export activities and the establishment of an independent power plant (IPP) will receive ₦1.4 billion (US\$10.8 million) and ₦1.7 billion (US\$13.1 million) direct investment.

At the Ogboyoga Coal Mine in Kogi state, the bidding companies would invest ₦7.15 trillion (US\$55 billion) in surface mining, briquette, underground mining, export activities, and the establishment of an IPP in the next five years (Gbadegesin, 2006).

In view of this development, reviving the NCC to meet the requirements of the direct foreign investments has become crucial. This would entail entrenching the philosophy and culture of total quality management (TQM) in the NCC to ensure continuous improvement in coal production and robust returns on investment.

To this end, this article is broken up into the following objects of discussion: Review of the profile of coal production in Nigeria; highlights of the Minerals and Mines Act 2006; discussion about the NERC awards of licenses to private investors; brief excursion into the problems of the (NCC); discussion about the basics of TQM paradigm and culture; and a conclusion to this article.

2. Profile of Coal Production in Nigeria

The coal industry was the oldest industry set up in Nigeria, dating back to 1916 when commercial coal production started in the Enugu coal mines. The review of the profile of coal production in Nigeria may not be appreciated without first of all taking a look at the Nigerian coal reserves (Table 1).

A large coal reserve, probably in excess of 1,000 million tonnes, is also believed to occur within the Mamu formation at depths of over 600 m in Amansiodo area of Enugu State (Famuboni, 1996).

The Lafia-Obi coal deposit is the only coking coal so far discovered in Nigeria, which has the potential of saving Nigeria about US\$200 million per annum required to import coking coal for Ajaokuta Steel Plant. An estimated coking coal requirement of about 1.2 million tonnes per annum is required in the first stage of the steel plant operation.

Figure 1 shows the profile of coal production from 1916 to 1966 when the Nigerian civil war broke out. Coal production, as shown in Figure 1, showed a rising profile from 24,511 metric tonnes (mt) in 1916 to 905,397 metric tonnes (mt) in 1959. Subsequently, production fell to 730,183 metric tonnes in 1966, the pre-war year. The Nigerian-Biafran Civil war period from 1967 to 1970 resulted in an abrupt decline to zero production. However, these annual levels of coal production from 1916 to 1965-1966 sustained the Nigerian economy in the pre-petroleum era.

Figure 2 shows the trend of coal production from the end of the civil war in 1970 to 1998.

After the civil war, coal production peaked at 323,001 mt in 1972; thereafter, coal production suffered a decline in fortunes owing to:

- The emergence of petroleum on Nigeria's economic scene, which witnessed the switch over to petroleum products by the customers and users of coal. Example: the Nigerian Railway Corporation
- The 1972 Indigenization Decree, which forced foreign companies and expatriates out of the solid minerals sector of the economy

Table 1
Coal reserves in Nigeria (million tonnes)

State	Location	Indicated (in-situ)	Inferred	Overall
Enugu State	Enugu	54	200	254
	Ezimo	56	60	116
	Inyi	20	Unknown	20
Benue State	Orukpa	57	75	132
	Okaba	73	250	323
	Ogboyoga	107	320	427
Delta State	Asaba (lignite)	250	Unknown	250
Plateau State	Lafia-Obi (Coking coal)	22	Unknown	22
		639	905	1,544

Source: Ugwu, 1996.

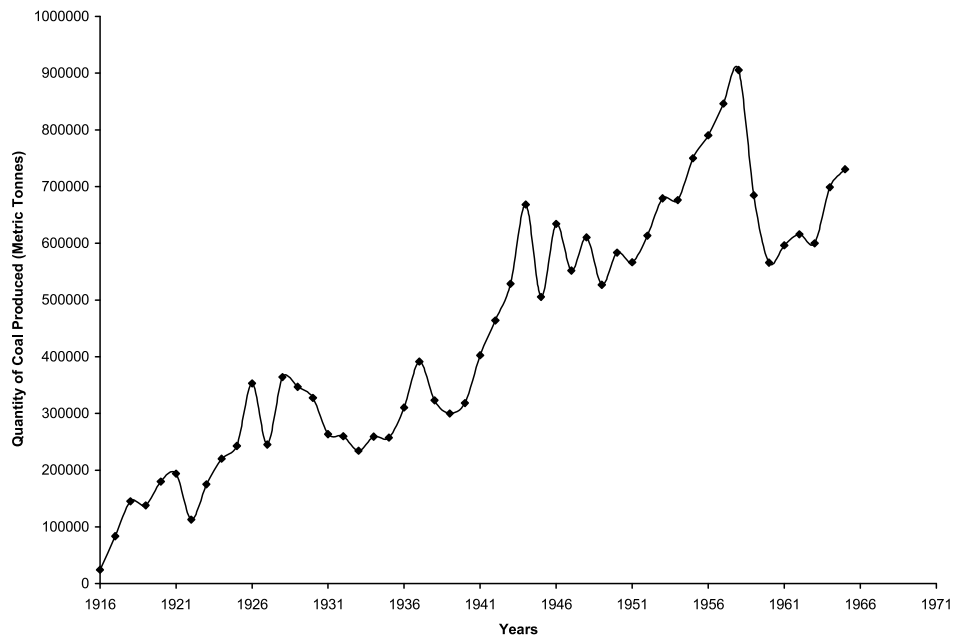


Figure 1. Graph of the profile of coal production from 1916 to 1966–1967. (Source: Ugwu, 1996.)



Figure 2. Graph showing the trend of coal production from 1970–1971 through 1998. (Source: Ugwu, 1996; FOS, 1991, 1996, 2001.)

- Besides the emergence of petroleum and the indigenization decree of 1972, after the civil war the military and political leaders neglected and relegated to the background the coal industry, apparently in continuation of hostility to the South East Nigeria. Example: the modernization of the coal industry was elusive in the face of obsolescence of equipment and personnel and the coal-powered Oji River power plant was neglected and written off in 1990s.

Interestingly, the present Federal Government through her agencies, such as the Federal Ministry of Solid Minerals Development, seemed eager to rectify the dwindling fortunes of coal as the next section will show.

3. Highlights of the Minerals and Mines Act 2006

Recently, the President signed into law the new Mineral and Mines Act 2006, passed by the House of Senate. The report about the bill showed that prior to the drafting of the bill, extensive international and local consultations and studies were carried out to ensure that the bill (now law) is globally competitive and comparable to similar laws in other mineral-producing countries such as Tanzania, Chile, Geneva, Malaysia, and Indonesia. Some of the salient aspects of the Minerals and Mines Act 2006 (Binniyat, 2007) include:

- The establishment of an autonomous cadastre which will function as one-step agency for processing of mineral titles.
- Mineral resources and environmental management committees will be established in all states.
- All investors will be expected to sign community development agreements (CDAs) with host communities.
- The agreement will include provisions for environmental impact assessment, rehabilitation programs, and an environmental protection fund.
- An acknowledgment and recognition of the role of artesian and small scale miners who will be encouraged to join registered co-operatives.
- The Act supports a competitive fiscal regime which includes incentives for investors, such as tax holidays and import tax exemptions, which are already in place.

At this point, it is necessary to elaborate on the incentives that complement the Minerals and Mines Act 2006. These incentives are contained in Act No. 63 of 1992 and are listed by the Nigerian Export Processing Zones Authority, NEPZA (2006) as follows:

- Complete tax holidays from all Federal, State, and Local government taxes, rates, custom duties, and levies
- One-step approvals for all permits, operating licenses, and incorporation papers
- Duty-free, tax-free import of raw materials and component for goods destined for re-export
- Duty-free introduction of capital goods, consumer goods, machinery, equipment, and furniture
- Permission to sell 100% of manufactured, assembled, or imported goods into the domestic Nigerian market
- When selling into the domestic market, the amount of import duty on goods manufactured in the Free Zone is calculated only on the basis of the value of the raw materials, or components used in assembly, not on the finished products.
- 100% foreign ownership of investments

- 100% repatriation of capital, profits, and dividends
- Waiver on all import and export licenses
- Waiver on all expatriate quotes for companies operating in the zones
- Prohibition from strikes and lockouts
- Rent-free land during the first 6 months of operation

However, the new Minerals and Mines Act 2006 is very crucial to coal-mines development and investment. This is because it may be likened to the repudiation of the 1972 Indigenization Decree, which exited foreign multinational mining companies and expatriate professionals, and resulted in the depressed fortunes for coal and other solid minerals for over three decades.

Also, the new Act legalized and encouraged subsistent mining activities, probably because subsistent mining is one of the oldest traditional professions in Nigeria, ranking second to subsistent agriculture.

In light of the Minerals and Mines Act 2006, this article will discuss in the next section the awards of licenses to private investors by the Nigerian Electricity Regulatory Commission (NERC).

4. NERC Awards of Licenses to Private Investors

With regards to the objective of the Federal Government to privatize the public utility company, the Power Holding Company of Nigeria (PHCN) mandated the NERC to issue licenses to private investors in the power sector. Table 2 displays the eight private investors awarded operational licenses in power generation by the NERC.

Apart from Mabon Power Limited, other licensees in Table 2 will use oil/gas for their independent private power (IPP) generation schemes. This is indicative of Nigeria's continued overdependence on oil/gas resources. Nigeria has abundant coal reserves of high grade to the magnitude of over 1.5 billion tonnes as Table 1 shows. The British Colonial Government had demonstrated that the Enugu Coal could supply electricity to the defunct Eastern Nigeria, by her establishment in 1956 of the Oji River thermal power plant, which was shutdown because of age by the Federal Government in 1990. It is expected that the awards of licenses to private investors by the NERC would have been guided by the Federal Government policy of diversification and promotion of viable non-oil sector, such as the coal resources in the licensing of independent power generation companies.

Table 2
Power generation licensees

S/No.	Licensee	Location	Capacity, MW	Date issued
1	Ethiopia Energy Limited	Ogorode, Delta State	2,800	August 2006
2	Farm Electricity Supply Limited	Otta, Ogun State	150	August 2006
3	ICS Power Limited	Alaoji, Abia State	624	August 2006
4	Supertek Nigerian Limited	Akwete, Abia State	1,000	August 2006
5	Ewekoro Power Limited	Ewekoro, Ogun State	12.5	December 2006
6	Ikorodu, Industrial Power Limited	Ikorodu, Lagos State	39.0	December 2006
7	Geometric Power Limited	Aba, Abia State	140.0	December 2006
8	Mabon Power Limited	Dadin Kowa, Gombe State	39.0	December 2006

Source: Vanguard, 2007.

The Federal Government spent US\$7.5 billion in seven years (1999–2006) on fuel imports subsidy. Also, this is the outcome of overdependence on gas and oil products, since some of the fuel imports were used in industrial plants for firing boilers and electricity generating sets/appliances. The diversification by NERC to alternative energy sources like coal will no doubt reduce the overdependence on oil/gas and its associated monetary costs and subsidies.

However, the diversification to coal resources may have some attendant problems and challenges caused by over three decades of neglect and relegation. The next section will examine briefly the problems of the coal industry under the auspices of the Nigerian Coal Corporation (NCC).

5. Brief Excursion into the Problems of the NCC

The NCC is the British Colonial establishment. According to Ugwu (1996), the 1949 industrial dispute which led to the killing by shooting of 21 miners, resulted in the ordinance enacted in 1950 establishing the NCC; the responsibilities then and today, have been to prospect and mine the coal resources of Nigeria.

When actual mining started in 1916 at the foot of Udi Hills along the Enugu escarpment, the coal industry was a section of the Marine Department. This was because coal was supplied to the British Navy for its boats and to the Nigerian Railways for the steam locomotive engines. Ugwu (1996) writes that in 1937 the coal industry got off the Marine Department and went in with the Nigerian Railways which then consumed more coal than any other customer.

The NCC, created by the ordinance enactment of 1950, still exists today. The brief excursion into the problems of the NCC will be made because the NCC is the core organization on which the TQM philosophy and culture are proposed for entrenchment.

After the Nigerian civil war in 1970, came the emergence of commercial-quantity petroleum, the 1972 indigenization decree, and the gradual abandonment of coal by the Federal Government. All of these occurrences bedeviled the NCC, as the Corporation experienced over the years the following problems Ugwu (1996):

- Lack of capital base/inadequate investment
- Power supply dilemma
- Procurement of requisite mining materials (95% foreign)
- Failed mechanization, outdated infrastructural facilities
- In addition to these technical problems are administrative challenges such as outdated personnel, who were neglected and relegated to rot away. However, these identified problems will be explained below.

5.1. Capitalization

All mining ventures, coal mining inclusive, are highly capital intensive. According to Ugwu (1996), over the years and across the various development plan periods, remittances have never been beyond 15% of the estimates. Examples in the third national plan (1975-1980), the capital loan grants received by the NCC from the Federal Government were ₦4.50 million, ₦10.0 million, ₦17.0 million, ₦14.5 million, ₦9.3 million, and ₦25.24 million, respectively (Ugwu, 1996). None of these grants exceeded 15% of the estimates. Therefore, Ugwu (1996) concludes that the coal industry needs to operate from a much firmer capital platform.

5.2. Power Supply and Mine Floods

Regarding power supply dilemma, Ugwu (1996) reports that power failure and fluctuating frequencies cause the industry enormous losses in coal production. The underground mines get flooded submerging the installations. Voltage fluctuations damage the electric motors of many appliances in use. There are stand-by giant generators where the running costs add a lot to operating problems. The Enugu mines power consumption is in excess of 6 MW (Mega watts).

5.3. Mining Materials and Kits

Ugwu (1996) reports that about 95% of the mining materials and equipment are imported. This import dependence is a major constraint in the production program. The funds are low and even when available there is a considerable time lag between placing orders and deliveries, resulting in lost production time. Besides, a good number of machinery is too old to keep running profitably. The bulldozers, scrapers, excavators, and drill rigs guzzle a lot of the maintenance money consequent on their ages.

5.4. Failed Mechanization, Outdated Infrastructural Facilities

The plan to mechanize the Enugu coal mines resulted in the contract between the Federal Government and the Polish company (Kopex). Ugwu (1996) writes that in order to establish full mechanization of long wall operations, Kopex introduced the Polish KK-1318 equipment. Also, Ugwu (1996) concludes that equipment failure was the main undoing of the Kopex attempt; the armored conveyor chain system, corroded pans and gear heads, the powered supports with hydraulic pumps, chocks and rams broke down too frequently. The advance rate of the KK-1318 equipment was too poor to cope with increasing roof pressure.

5.5. Outdated Personnel

The withdrawal of the expatriate professionals from mining businesses in the face of the 1972 indigenization decree, enhanced the isolation of the staff of the NCC from the outside mining world. This led to the decay of both the technical and administrative personnel, who had during the civil war period suffered isolation by abandoning the mines for the safety of their lives.

The corporate objective of the NCC is certainly increased production—produce more, sell more, and make profits (Ugwu, 1996). One, therefore, wonders how this objective could be accomplished by the corporation that is being challenged by the above explained problems. This is why the next section will review the basics of TQM as the suggested solution to problems revealed above.

6. Basics of the TQM Paradigm and Culture

In this article, total quality management (TQM) is the proposed/suggested solution to the technical and administrative problems besieging the NCC. To this end, the TQM tenets will be explored and discussed under the following subtitles: Overview of TQM Paradigm and Culture; Guideposts for Entrenching TQM into NCC; Approaches to TQM Entrenchment into NCC; and Recommendations.

6.1. Overview of TQM Paradigm and Culture

Williams (1994) defines TQM as an organization's management philosophy to attain customer satisfaction through a comprehensive program of tools, techniques, and training. The TQM tools referred to in the definition above are defined by Williams (1994) as the devices used in TQM to identify and correct problems with quality; they commonly include graphs, charts, and diagrams. While TQM techniques refer to the methods used to integrate TQM tools into an organization, the traditional techniques include team building and empowerment skills (Williams, 1994). Also, TQM training according to Williams (1994) is the instructional and communications process that improves the worker's ability to understand and use these tools and techniques. Thus, this review reveals that tools, techniques, training, and customer's satisfaction are the driving forces of TQM. However, Williams (1994) opined that tools, techniques, and training alone do not drive TQM, it takes a commitment from the entire organization to neither stand still nor stagnate in mediocrity. Therefore, this review has established five TQM drivers that would prove to be crucial factors required to revive the NCC and subsequently turn around the ailing fortunes and vanishing coal output of the Nigerian coal industry; and they are: tools, techniques, training, customers' needs, and commitment from all and sundry.

Ewurum (2001) writes that TQM is ongoing, predicated on the belief that however good a system may be, improvement potential is always there. This is similar to the statement by Williams (1994) that TQM requires continuity of quality that begins with the design or concept of the product or service and is carried through to servicing after delivery. Also, Ewurum (2001) writes that TQM is claimed to work horizontally across functions and departments involving all employees top to bottom, and extending backwards and forwards to include the supply chain and the customer chain. Thus, this kind of management concept that involves/includes continuous improvement, all employees' participation, and suppliers/customers' contributions in corporate management would prove to be the likely cure for the ailing NCC.

Culture is the cumulative perception of how an organization operates and how employees treat each other, vendors, and customers (Williams, 1994). TQM culture may be said to be made up of taboos, rules, and procedures that are people focused, with the view to ensuring quality and quality improvements. To this end, the TQM culture, being envisaged for the NCC, will include the taboos, rules, procedures, guidelines, or methods that define how people will accomplish quality and continuous quality improvement in both coal product and coal production in Nigeria. As culture is dynamic, so will be the TQM culture for the NCC.

Ewurum (2001) defines paradigm as the thoughts and behavioral patterns that characterize a body of knowledge. These thoughts and behaviors are usually rooted in the industrial culture. Therefore, the TQM paradigm reflects the TQM thoughts and behaviors as rooted in a modern and promising coal corporation/industry. There is need for a shift to the TQM paradigm in the NCC because the existing colonial paradigm is currently inadequate to cope with the requirements of modern competitive enterprises. Definitely, declining outputs in coal production in Nigeria have links to:

- The influence of British colonial management culture whereby the management has the top-bottom structure, which is less-people focused, with the bottom having virtually no inputs in the management decision making process of the NCC.
- Obsolete mining equipment and methods caused by the indigenization decree and the Federal Government's abysmal neglect for over three decades by way of poor funding.

- Outdated personnel resulting from lack of training development and foreign exposure; and of course poor remuneration.

Therefore, in order to revamp the NCC, there is the need for paradigm shift from the British Colonial Government's management culture to TQM paradigm.

Given these submissions, the ailing NCC requires the entrenchment of the TQM paradigm and culture that will ensure the continuity of coal quality from the point of its revival or re-design, to the point where coal product or its derivatives (coal chemicals) or its services (like electric power) are delivered to the end users and beyond.

6.2. *Guideposts for Entrenching TQM into NCC*

To accomplish the entrenchment of TQM into the NCC, the three factors listed and explained below are considered to be the guideposts:

- Integration
- Continuous improvement
- Customer focus

6.2.1. *Integration.* TQM attempts to accomplish integration through the enhancement of communication and tearing (breaking) down of the compartmentalization that is usually associated with creating infighting among competing departments. Also, TQM tries to achieve integration by ensuring employees' participation in management's decision-making process and by applying the concept of the inverted pyramid, which means bottom-top management principle. The NCC inherited the British colonial management culture, the inefficiency of the Nigerian public sector, and the dictatorial tendencies of the Nigerian military class, all of which must be shaded off to avoid infighting and ensure the unity/integration that would make TQM work in the NCC.

6.2.2. *Continuous improvement.* Continuous improvement is predicated on the belief that TQM is ongoing and that however good a system may be, improvement potential is always there (Ewurum, 2001). Continuous improvement is the product of Research and Development (R&D) and is realized in the forms of innovation and possibly technology improvisation and adaptation. The NCC, under the envisaged TQM, will require a viable R&D and a promising personnel that will be creative in innovations and technology adaptations needed for continuous improvement, so as to ensure customers' satisfaction in coal output and quality.

6.2.3. *Customer focus.* In the context of TQM, a customer is defined by McGeorge and Palmer (1997) as anyone who has the benefit of the work, activity, or actions of another. Customers are classified as internal customers who are customers of processes and are within the organization; external customers who are customers of processes and are outside the organization; and end users who receive and pay for the final product/service.

The customer focus intended for the reviving of the NCC should dictate/ensure that management at all levels and other integral members of the NCC should develop an unshaken commitment to, and obsession for the external customers, internal customers, and end users of the coal product, coal derivatives, and coal services.

6.3. *Approaches to Entrenching TQM into NCC*

Some of the approaches to TQM implementation available in management literature are:

- Tagushi methods
- Failure mode and effects analysis
- Statistical process control
- Just-in-time approach
- Juran's approach
- Dewing's approach
- Crosby's approach

Each of these approaches has its own uniqueness, applicability, or suitability. This may explain why Ewurum (2001) writes that: "there is no 'one best way' to implement TQM. A high technical company with many engineers, for example, may find Juran's approach far more appealing than the idealistic approach promoted by Deming. Further, a firm with a history of organizational development will find Crosby's organizational stage model culturally more comfortable. Whereas, an organization that has general quality culture could adopt elements of Crosby and Deming approaches which have strong awareness-building focus."

6.4. *TQM Approach Recommended for NCC*

With regard to the above citation, a situational approach is recommended for the resuscitation of the ailing NCC. This situational approach involves the careful weighing and matching the unique organizational environment in the NCC with a customized TQM program. To prepare a customized TQM program for the NCC, the factors to be taken into account include the size and age of NCC, the corporate values and culture of NCC, and, of course, the business area of NCC.

Also, the paradigm shift necessary to switch or change NCC to TQM management should be implemented. It entails implementing the four-state process that ensures that the TQM goal is realized and Ewurum (2001) lists them as follows:

- Establishing the need for the change
- Gaining and sustaining commitment
- Implementation

Review

To ensure the effective and efficient management of change or paradigm shift for NCC, no member and no level of management of the NCC should be left out; for Ewurum (2001) states that any effort spent in dealing with ossification is energy wisely spent.

7. Conclusion

As a support to the energy sector reform that will ensure compliance with the national policy of diversification to non-oil resources, there is the crucial need to entrench the TQM culture and paradigm into the NCC. The TQM culture and paradigm would prove to be promising tools and methods for the realization of:

1. Re-engineering of coal production operations for the purpose of taking care of the obsolescence in mining equipment, machinery, and facilities.

2. Retooling and empowering of personnel with regard to updating the skills, expertise, and competence of staff, so as to ensure continuous creative innovations and improvement in coal production, coal product, and coal services.
3. Re-creating new market models as a way of improving the old/existing models.

The results envisaged from these would be robust returns on investments made in the coal industry. Therefore, the Federal Government of Nigeria (FGN) should institutionalize TQM in the NCC, to encourage coal resource in taking and occupying its proper place and role in the Nigerian energy mix.

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