

Sustainable Aircraft Maintenance Hangar: Imperative to the Nigerian Aviation Industry.

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ABSTRACT

This paper describes the fundamental issues relating to the development of Sustainable Aircraft Maintenance Hangar (SAMH) and its imperative to the Nigerian aviation industry. Air transport industry in Nigeria has witnessed evolve, operate and collapse syndrome since the 1980's as a result of unfavorable business conditions despite the impressive global contributions of air transport to economic development. Air transport business is highly challenging and involves complex and capital intensive operations. Major operational hubs in the world have well developed Maintenance, Repair and Overhaul (MRO) facilities and the technical expertise to carry out major checks on aircraft. Nigeria has about 350 aircraft that are ferried overseas for major repairs resulting in ridiculous capital flights. If Nigeria is to embark on SAMH, various cost drivers such as aircraft characteristic, aircraft utilisation, economics of scale, fleet age, fleet composition, maintenance input costs, maintenance philosophy, maintenance planning, maintenance programme design, market positioning, network design, operational practices, and productivity amongst others would need careful considerations. Aviation industry in Nigeria needs proper positioning of its value chains: operate, maintain, assembly, manufacture and design. Ability to design and manufacture a commercial aircraft with 100+ carry capacity might not be feasible with the next decade, however, the sector must begin to sustainably operate, maintain and assemble in that progressive order. The newly built MH at Uyo Airport is noted as welcoming concept for others to improve upon. It is however imperative that its full and sustainable implementation would include a paradigm shift in the current maintenance framework that constraints aircraft operators to look outside the shore of Nigeria for their Heavy Maintenance checks at the detriments of Nigerian economy.

Keywords: Aircraft Maintenance Hanger; Sustainable Aircraft Maintenance Hangar, Repair and Overhaul; Nigeria; Paradigm Shift;

1. INTRODUCTION

The air transport services in Nigeria have been growing since mid 80's and early 90's with deregulation and emergence of domestic airlines. Expectedly, there has been a corresponding increase in Gross Domestic Products (GDP) [1]. The air transport industry generates and supports **6.7 million jobs** in Africa and contributes **US\$67.8 billion** to GDP - *direct, indirect and induced impacts* [2]. The contribution of air transport in Nigeria is expected to grow by 5% annually in the next 20 years [3]. Admittedly, increasing demands has enabled airlines to contribute about **USD \$0.4 billion** and **61,000 jobs** to the emerging Nigerian economy. Regrettably, despite the forecasted growth, the numbers of airlines in Nigeria depreciated to the extent that most of the early starters no longer exist! It has been reported [4] that of the thirty (30) airlines operating in the 1990's, there remain only seven (7) operating scheduled flights in 2010. Undoubtedly, inconsistent regulatory policies, deteriorating infrastructures with obsolete facilities, *negligence and managerial incompetence contributed* to the failings. Airlines negligence of industry best practices in aircraft operations and maintenances has contributed to several *aircraft crashes and folding up of the airlines* while *managerial incompetence* led to fund *misappropriations, manpower mismanagement and high indebtedness*. Specifically, the lack of Sustainable Aircraft Maintenance Hangars (SAMH) has negatively impacted on Nigerian airlines and their ability to operate sustainably in an inherently complex and dynamic global air transport industry.

The defunct Nigerian Airways Limited (NAL) once had Thirty Two (32) aircraft but was later infected with aviation viruses amongst which is the lack of SAMH! It later deteriorated, fell, buried and left unserviceable aircrafts as inheritance. Its disciples in the form of pilots, engineers and flight attendants scattered in and outside Nigeria; many of whom are now old and aged! Attempts to create indigenous airlines in Nigeria have met with similar plagues to those encountered by NAL and the evolving results have been the saddening '*evolve and collapse*' syndrome. Major operational hubs in the world have well developed airports, a well equipped Maintenance, Repair and Overhaul (MRO) facilities and the technical expertise to carry out major checks on their aircraft fleets. Therefore, the importance of MRO cannot be overlooked for aircraft owners and airline operators considering the fact that history positioned that air transport businesses "only" survives on a standard and functional maintenance environment where airworthiness of aircrafts for optimum safety is crucial business survival. Nigeria has about 350 aircraft in operations (*scheduled, charter and privately owned*) that are ferried overseas for major repairs resulting in a ridiculous capital flights. South Africa, Egypt, Morocco and Ethiopia have workable MRO facilities as well as airports that operate as hubs.

Regrettably, many of the Nigerian airlines take their aircraft to these countries; while others proceed to Europe and the US for repairs at exorbitant financial penalty. More so, the aircrafts are paced in queue for weeks before they are attended to. Given the complex facility requirements and the needed investment, it would be an uphill task for a single airline to build a SAMH in Nigeria. Historically, the approach taken to addressing the issues in relation to the establishment of sustainable aircraft maintenance framework has not lend itself to understanding the critical challenges and inherent problems confronting the industry and hence prevented the opportunity to proffer the needed solutions. This paper examines the underpinning causalities of lack of SAMH in Nigeria and its consequential relationship with economic growth, job creation and aircraft safety. It argues the importance of adopting a sustainable aircraft maintenance framework for the development of Nigerian aviation industry by proffering viable holistic-pointers and recommends the way forward to investors, airline planners and their advisers in effecting solutions to the challenges facing the establishment of SAMH in Nigeria.

2. BACKGROUND TO THE IMPORTANCE OF LOCAL MAINTENANCE FACILITY IN NIGERIA

Improved operations and record breaking performance have in a long time eluded the activities of the Nigeria aviation industry. Its air transport business has not been reliable, productive and profitable despite the intended contributions to national development [5]. The author further argued that the industry has been deprived of its competitive role with its foreign counterparts and hence remains epileptic and urgently in need of specialised intervention. The setbacks confronted by Nigerian airlines include lack of qualified and knowledgeable airline operators; low or minimal financial base; bankruptcy; aircraft accidents and incidents. The systemic failures of the airline industry can be traced to unsustainable aircraft maintenance policies resulting from ageing aircrafts, lack of appropriate maintenance personnel [6], non availability of aircraft hangars where proper 'Checks' or maintenance can be carried out, non availability of functional aircraft spare parts, non adherence to safety regulations and inappropriate maintenance culture amongst others!

The provision for maintenance facility by the Nigerian Air Force (NAF) is currently inadequate for the national needs. The demise of Okada Airline for example could be traced to the exorbitant cost of heavy maintenance tasks (amongst others!) that could have been avoided if MH were present in Nigeria. The failure of Virgin Nigeria deal might have been resolved (amongst other reasons) should there be an appropriate MH in the country. The sudden disappearance of Air Nigeria could partly be traced to the huge cost of maintenance and the non-stringent economic regulations as narrated in [7]. At some moment in the recent past, six (6) domestic airlines inclusive of Arik Air, Dana Air, First Nation, Aero, Medview, Overland and others engaged in General Aviation (GA) with about Two Hundred plus (200+) aircrafts perform their heavy checks outside Nigerian shore as a result of non-existence of MRO in Nigeria. It can be asserted that if nothing is done about the provision of sustainable maintenance framework inclusive of domesticated MH; it is very likely that other airlines might follow this unsustainable path and makes the industry less lucrative for all stakeholders. In the past, Arik Air and Aero Contractors have muted the idea of establishing an MRO facility in Nigeria for their fleets as well as those of other aircraft operators. It can however be said that the dynamic complexities of such collaboration and undefined government support amongst others has precluded the fruition of the plan.

3. DILEMMAS OF LOCAL AIRCRAFT MAINTENANCE FACILITY IN NIGERIA

In 2012, the former Director General (DG) of the Nigerian Civil Aviation Authority (NCAA) lamented that Nigerian airlines spends over US\$1.22 billion (**N200 billion**) annually on overseas checks due to lack of any major maintenance facility in the country. The author argued the need for partnership between the government and private investors to establish a local maintenance facility that could save the airlines over 50 per cent of maintenance costs and makes Nigeria a technical hub for aircraft maintenance. In practical terms, the time taken for overseas maintenance could be more than two weeks and up to months before they are attended to and in addition to the prohibitive cost of overseas maintenance. MRO costs encompass both the outgoing costs and the revenue forgone during the out-of-service time. The process of taking aircraft overseas for repairs takes a minimum of two weeks with a corresponding loss of about US\$426,830 (N70 million) for C check on Boeing 737 while Embraer 190 or Fokker 100 would have lost US\$298,780 (N49 million) during the same period - *these huge losses could be easily curtailed given the existence of MRO in Nigeria*. It is important to note that airlines leasing aircraft are normally required to make payments into one or more maintenance reserve accounts in order to provide for future maintenance expenditures – this would have been another boost to the Nigerian economy; regrettably it is an alternative forgone.

The plan to build a SAMH during the era of defunct NAL came to no fruition as the previously owned maintenance facilities (F27, 28, Boeing 737) was dashed for Airbus aircraft and maintenance personnel that were not owned – *a classic demonstration of mismatched fleet planning strategy that led to one of the causes of unrecoverable nose-diving of NAL*. Regrettably, Nigerian airspace has ever been laden with carriers that could not attract adequate funding without government's support to build a MH of the size and capacity that are required by modern airliners registered in Nigeria. It might however be viable for major players such as Arik Air, Aero Contractors, Medview Airline etc to participate on building SAMH projects but the issues of modern and licensed Aircraft Maintenance Engineers (AME) as articulated in [6] would need to be given serious considerations. Provision of enabling environment with the adequate government support would attract national and foreign investors in enabling MRO to build and operate SAMH in supporting Nigerian airlines in their pursuit for sustainable development.

Specifically, government support should enabled a long time single digit interest rate if aviation is to significantly contribute to wealth generation, create a viable employment and improve the safety standard in the Nigerian airspace. Double digits (plus 13 per cent) interest rate would encourage airlines to compromise crucial cost elements that would negatively impact on safety and sustainability of the industry. Over the years, stakeholders have been arguing for the establishment of MRO facilities where airlines could conduct ‘C and D Checks’ in Nigeria. Aircraft maintenance checks are periodic inspections that have to be performed on civil airliners after certain amount of time or usage as approved by airworthiness authority (i.e. NCAA). The checks are ‘A’, ‘B’, ‘C’ and ‘D’ as shown in Table 1 and detailed in [6]. It will be seen from Table 1 that ‘A’ and ‘B’ checks are lighter checks, while ‘C’ and ‘D’ checks are considered heavier checks. ‘C Check’ is one of the heavy checks that is more extensive than the ‘B Check’ and requires a large majority of the components to be inspected during which the aircraft is put out of service and kept in the hangar until the checks are completed. ‘D Check’ is the most comprehensive, demanding and expensive of all the checks and is usually referred to as Heavy Maintenance Visit (HMV). ‘D Check’ involves taking the entire aircraft apart for inspection and overhaul. The paints may also need to be completely removed for detailed inspection of the fuselage structural integrity. In carrying out ‘C and D Checks’, Nigerian airlines would require millions of dollars, and much more so when the check are done abroad (i.e. South Africa, Canada, Ethiopia, Turkey etc).

Table 1: Periodic Aircraft Maintenance Checks

Check	Type	Performance Interval	Required Man-Hours	Time Required	Maintenance Location	Availability
‘A’	Light	500-800 hours	20	Overnight	Airport Gate	Indigenous
‘B’	Light	4 – 6 months	150	1 – 3 days	Airport	Indigenous/ Foreign
‘C’	Heavy	15 – 21 months	6,000	1 – 2 weeks	Maintenance Hangar	Foreign
‘D’	Heavy	5 years	40,000	2 months	Maintenance Base	Foreign

Regrettably, the available Human Resources (HR) and infrastructures in Nigeria depicts that indigenous AME are only able to perform the lighter checks while heavier checks that that results in substantial financial benefits are performed abroad resulting in *capital flight with negative impact on the Nigerian pursuit for economic development*. In order to bridge the HR gap, foreign AME are being engaged by most airlines for ‘A’ and ‘B’ checks while ‘C’ and ‘D’ checks are performed abroad. It is obvious that the engagement of foreign AME and facilities will not give the desirable succession plans for sustainable transformation of the Nigerian aviation industry. It is therefore necessary for Nigerian aviation sector to seek a holistic paradigm shift that focuses on minor at the expense of the major! It is argued that current maintenance policy in Nigeria supports landlocked nations with population not greater than two (2) million! Attempts has recently been made to reestablish a true national carrier as those enjoyed in the days of NAL; however, feasibility of such would only be possible if sustainable MRO’s are indigenously created; thereby supporting thousands of jobs and minimising capital flights as a result of HMV currently undertaking outside the shores of Nigeria.

It is important to create a favourable government policy on aviation inclusive of constructive and competitive business environment where private sectors can actively participate in setting up MROs in strategic locations across Nigeria. Specifically, government intervention funds should not be for the sole beneficiary of banks and their cronies but be targeted towards the establishment of SAMH and support for MRO organisations so that the plagues that extinct NAL would be eliminated for the betterment of Nigerian aviation industry. On the policy front, there are needs to initiate planning and policy framework inclusive of its implementation strategies that would encourage the establishment of MRO for protecting the Nigerian aviation industry and its workforces. Current Nigerian aviation policy requires a paradigm shift! In its current format, it opens doors uncontrollably to foreign operators at the expense of the indigenous markets. The negotiation skills of those conducting ‘*Bilateral Agreement*’ on behalf of Nigeria are often inadequate, suspicious or grossly malicious! Nigeria need not be a platform for market abuse as it has the market potential to rival and compete with other economies elsewhere that have proactively developed their MRO. Waivers and removal of excise duties on aviation spare parts is just a mere drop in an ocean of complex aviation costing. The aspects that consume the majority of the maintenance expenses are *spare parts and labour costs* utilised for ‘C and D’ checks. In the global interest of safety and economics, most aircraft manufacturers insist that they must be conducted in an approved MRO; many of such MRO are elusive in Nigeria.

4. AIRCRAFT MAINTENANCE AND OVERHAUL COSTS

Total maintenance costs cover a whole series of separate costs, related to different aspects of maintenance and overhaul. International Civil Aviation Organisation (ICAO) groups all maintenance and overhaul expenditure into a single ‘*undivided cost*’ item while other regulatory bodies such as UK’s Civil Aviation Authority splits maintenance costs into ‘*fixed and variable costs*’; where the variable costs are those dependent on the hours flown by the aircraft. Traditionally, maintenance costs include the routine maintenance, maintenance checks carried out between flights or overnight, the more expensive periodic overhaul (‘C’) and major (‘D’) checks, cost of workshops, MH, and offices. Maintenance costs involve two major cost areas; *labour usage and spare parts (materials) consumption*.

The labour costs would involve wide-ranging usage of differing personnel directly and indirectly (*burden/overhead*). Ironically, when the maintenance work is carried out outside the station it is paramount for it to be separated from those conducted within the station. It will therefore be noted that in the case of Nigeria, where most of the maintenance activities are foreign-based (*foreign outsource*), such costs would be enormous and sometimes forbidden! In the case of those costs associated with spare parts, it should be noted that most parts of each engine and airframe have a usable life measured in terms of *block hours* or *number of flight-cycles* (landings and take-offs). On the expiry of certified life, the parts are removed and checked or replaced. Consequently and for safety reasons, spare parts consumption is high and grossly expensive for Nigerian aircraft operators that carries out its major maintenance activities outside the country by '*forced subcontracting*' or '*unprofitable outsourcing*'.

The Department of Transportation in the United States requires airlines to categorise costs into *direct maintenance on airframe*; *direct maintenance on engines*; and *maintenance burden*. The maintenance burden is the *administrative and overhead costs* associated with maintenance function but which cannot be easily attributed directly to a particular airframe or engine. It is subjective costs that are allocated arbitrarily. In other nations, airlines apportion their maintenance costs between different *aircraft types* with no standard approach and hence make comparison between airlines difficult!

The trends from 1997 to 2007 of the costs structure of ICAO member states are as shown in Table 2 and described in [8]. It can be seen that the cost of *maintenance* is categorised as *Direct Operating Costs (DOC)* and averages ten per cent (10 %) of the *Total Operating Costs (TOC)* of air transport operations within the given period. Historically, the share of maintenance in DOCs has fallen within a few percentage points either side of ten per cent (10%), but the rise in fuel costs would likely lead to dropping maintenance costs to single digits for most carriers. It is equally important to observe the cost of station and ground expenses as part of the *Indirect Operating Costs (IOC)* that averages around eleven per cent (11%) of the *TOC*. The noted two cost elements are maintenance dependent and average twenty one per cent (21%) of *TOC*. The *MRO cost per block-hour* or *MRO cost per Available Seat Mile (ASM)* or *Available Tonne Mile (ATM)* for many airlines will be factors of *aircraft utilisation*, *seating densities*, *efficiency of maintenance activities* amongst others. Globally, ICAO member states airlines are doing all they could to reduce these cost elements. However, absent of reliable data and inconclusive regulatory framework as noted in [7] has made detailed evaluation of maintenance cost of Nigerian airlines almost impossible. Regrettably, many of the operators misinterpret deregulation and liberalisation as an opportunity to operate outside the radar coverage of the regulators and hence fail to comply with standard international practices.

Table 2: Trends in Costs Structure (1997 -2007) – scheduled airlines ICAO member states

	1994 %	2000 %	2007 %
A. DIRECT OPERATING COSTS (DOC)			
1. Flight operations – total	32.8	38.0	46.5
Flight crew (including training)	(8.0)	(8.6)	(7.5)
Fuel and oil	(11.4)	(14.4)	(25.4)
Airport and en-route charges	(7.1)	(7.0)	(6.6)
Aircraft rentals, insurance, etc	(6.4)	(8.1)	(7.0)
2. Maintenance	10.0	10.6	10.3
3. Depreciation – aircraft	6.1	5.5	5.1
Total DOC	49.0	54.1	61.9
B. INDIRECT OPERATING COSTS (IOC)			
4. Station / ground expenses (<i>including depreciation of property and ground equipment</i>)	12.0	11.3	10.5
5. Passenger services (including cabin crew)	10.8	10.0	8.7
6. Ticketing, sales and promotions	15.8	12.7	8.5
7. Administration and other costs	12.4	11.8	10.4
Total IOC	51.0	45.8	38.1
C. TOTAL OPERATING COSTS (TOC)	100	100	100

Source: Doganis, 2010

It is not an underestimate to argue that Nigerian airlines spend over US\$1.22 billion annually to maintain their aircraft outside Nigeria. In unfortunate instances, the aircraft and engines do not return due to inability of the concerned airlines to resolve the huge maintenance and labour costs. Sadly, the upward spiral cost of maintenance abroad by the Nigerian airlines and the devaluing Naira has impinged negatively on their abilities to breakeven. In certain circumstances, the breakeven load factor required after maintenance is greater than 2.5 of the aircraft capacity which leaves the airline to excessively operate the aircraft beyond the recommended and regulatory practices and approved procedures hence compromise safety of the aircraft, its occupants and those of the general public.

Aircraft maintenance is significant in the contributions it makes to safety, dispatch reliability, flight completion rates, schedule integrity, and the preservation of airline residual values [9]. Nigerian aviation stakeholders should appreciate that maintenance focuses on *branding, asset management and regulatory compliance*. Hence, management objective in respect of maintenance should ensure aircraft availability in an airworthy condition when and where required in supporting performance schedule as cost-effective as possible. Given the greater reliability and maintainability built into new generation aircraft inclusive of the various cost containment strategies, global air transport industry has adopted various strategies such as *inventory management, lean methods, maintenance programme design, modern engine diagnosis tools, outsourcing, and Parts Manufacturing Approval (PMA)* to manage the cost of aircraft maintenance. Specifically, the drivers of maintenance costs includes *aircraft characteristic, aircraft utilisation, economics of scale, fleet age, fleet composition, maintenance input costs, maintenance philosophy, maintenance planning, maintenance programme design, market positioning, network design, operational practices, and productivity* [9] amongst others as adapted in Table 3! It is expected that the general public would have an entitled opinion of Table 3 and that is in order in academic settings.

Table 3: Aviation Maintenance Costs Drivers – a subjective analysis for Nigerian

S/N	Maintenance Cost Drivers	1	2	3	4	5	Current Attainment
1	Aircraft Characteristics	×	×	√	×	×	60%
2	Aircraft Utilisation	×	×	×	√	×	80%
3	Economics of Scale	×	√	×	×	×	40%
4	Fleet Age	√	×	×	×	×	20%
5	Fleet Composition	×	×	√	×	×	60%
6	Maintenance Input Costs	√	×	×	×	×	20%
7	Maintenance Philosophy	√	×	×	×	×	20%
8	Maintenance Planning	×	√	×	×	×	40%
9	Maintenance Programme Design	√	×	×	×	×	20%
10	Market Positioning	×	√	×	×	×	40%
11	Network Design	×	√	×	×	×	40%
12	Operational Practices	√	×	×	×	×	20%
13	Productivity	×	√	×	×	×	40%
Total		5	5	2	1	0	32%

A high daily aircraft utilisation increases both scheduled and unscheduled maintenance; particularly the short-haul flight as prevalent in Nigeria. It will be seen from Table 3 that Nigerian aviation scored high (80%) due to the short-haul aircraft operating lots of cycle on a daily basis. It is paramount to state that this is a good development as aircraft do not earn any revenue whilst on the ground. Hence, the more time they spend in the air, the greater the amount of output they generate over which to spread their fixed costs. Further, the more intensely a short-haul aircraft is utilised, the more daily turns it is likely to make which would negatively constraint maintenance costs. Economies of scale would occur when unit costs decline as a function of increasing output. Possible sources of scale economies in aircraft maintenance include *man-hour available* and *inventory size*. It has been reported that the unit cost advantage of a three (3) million man-hour heavy maintenance shop over that of its half capacity could be as high as twenty per cent (20%) [9]. Scale economies support the argument that sustainable MRO in the developing Nigerian economy would involve those that enable technical mergers amongst its air transport operators – regrettably, Nigeria currently scored low (40%) in the subjective analysis of this paper. Hence, a wakeup call is issued to credible stakeholders and reliable investors that support the development of SAMH in Nigeria.

The *age of an aircraft type* and the *age of particular aircraft in an airline's fleet* are the two aspect of *fleet age* worthy of consideration. Most importantly, each new aircraft generation brings with it improved *design, reliability and maintainability*. A step-change such as introduction of composite fuselage would imply airframe maintenance man-hour costs reduction well below those of aluminum airframes. Hence, MRO costs for older aircraft can be significantly higher (up to 300%) than those of the modern airliners with corresponding missions. Sadly, this is one of the areas that Nigerian air transport operators scored significantly low in this paper subjective analysis. The issue in relation to *fleet composition* amongst Nigerian airlines is critical; subjective analysis shows that Nigerian aviation scored sixty per cent (60%). Basically, having more types in a fleet and more configurations in a sub-fleet obviously increases maintenance costs. There is a need for simplicity by operating fewest possible types and standardising configurations.

Maintenance input costs must be considered from the perspective of labour costs, material costs and overhead/burden. Labour costs include the line maintenance costs and maintenance man-hour rates. Nigerian MROs should take advantage of the lower maintenance man-hour rates that currently exist in Nigeria as literature [9] states that seventy five per cent (75%) of airframe maintenance (immediate and heavy) costs are governed by the man-hour rates while only ten to fifteen per cent (10% – 15%) of engine maintenance costs are linked to direct labour. Material costs account for over fifty per cent (50%) of engine and component maintenance.

In the case of overhaul/burden, it can be said that what is true for the fleet holds true for other airlines assets inclusive of facilities. Utilisation of Hangars, bays, administration, record-keeping, quality control resources etc needs to be as high as possible to generate maximum output over which to spread fixed costs. Sadly, Nigerian airlines scored low on its maintenance philosophy in the conducted subjective analysis. Some airlines are much or less inclined to delay implementation of Service Bulletins (SBs) and deferrable Airworthiness Directives (ADs). Further, the acceptability and adherence of non-Minimum Equipment List (MEL) defects varies between airlines; some airlines like to fix defects as soon as it is practical, while others preferred to defer them; the repercussion of which could compromise safety. Existence of SAMH in Nigeria and effective regulatory framework would enable airlines to improve their maintenance philosophy in the interest of safety and economic development. Effective maintenance planning would balance two concerns: the need to maximise time between checks and the need to balance throughput and maximise utilisation at the maintenance facilities.

Operational practices followed by Nigerian airlines must be in accordance with those approved by the aircraft manufacturers and certified by the relevant aviation authorities. MROs must adhere to international best practices and procedures and must equally encourage airlines to do the same. Strict compliance to the appropriate regulatory authorities must be ensured in all their pursuits. On successive establishment of SAMH in Nigeria, three aspects of productivity must be ensured; maintenance programme design and planning, labour and inventory. Labour productivity of MRO would depend on time taken to accomplish a given tasks in relation to a stipulated standard procedures. In the case of Nigeria, there would be a need for upgraded training, world-class work practices, and gaining of the requisite experience. Hence and by implications, the demise of outsourcing (experience contractors) would still take sometimes to disappear in Nigeria. The issue in respect of inventory productivity would bear on the enormous carrying costs of inventory whether used or not! It is envisaged that successful MH in Nigeria would overcome such hurdle with time but there would be a need to consult operations management skills and the use of modern software for inventory control.

5. THE WAY FORWARD - MAINTENANCE, REPAIR AND OVERHAUL (MRO) FACILITY – UYO AIRPORT

The global MRO market is worth about US\$41 billion in 2007 [10]. Around forty per cent (40%) of it is in the North America and twenty five per cent (25%) in Europe. Notably, the fastest growth rates of MRO are in India and the Asia-Pacific region that accounts for less than twenty per cent (20%) of the market share. More than thirty per cent (>30%) of the market is devoted to engine (propulsion or power-plant) and under twenty five per cent (>25%) to line and component maintenance, fifteen per cent (15%) to airframe heavy maintenance ('C and D' checks) and about thirty per cent (30%) to modifications (Figure 1). A SAMH is a structure that houses a wide-bodied aircraft inclusive of the various sections in accordance with the manufactures guidelines and as approved by the relevant regulatory authorities for the purpose of maintaining or restoring the aircraft to an airworthy condition. It is usually managed by a high skilled and duly licensed and endorsed AMEs with an outstanding experience in the aviation industry. Section within a MH could include maintenance control, avionics, pneumatics, power plant (engine, propulsion), and airframe (structures) etc.

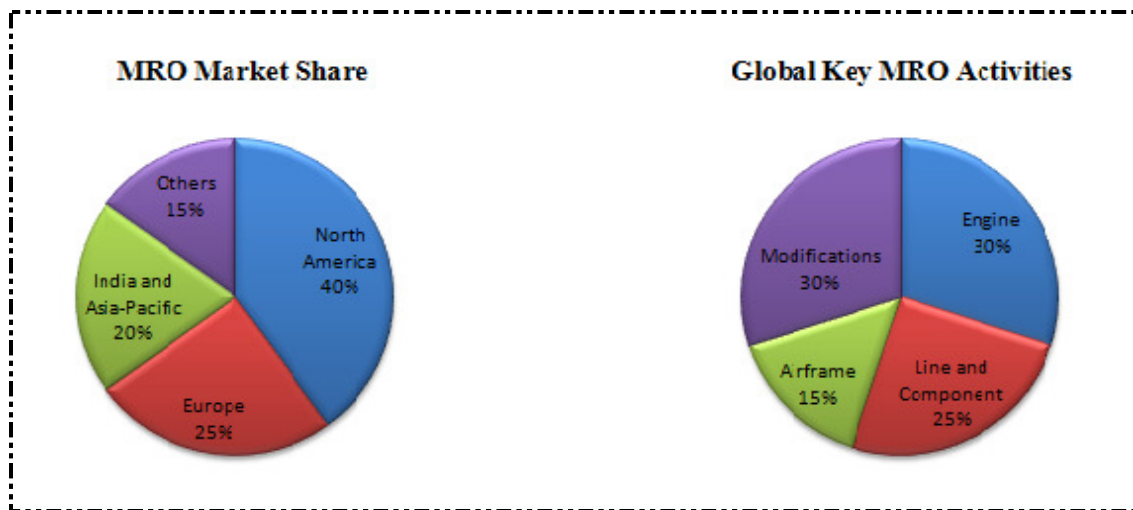


Figure 1 Global MRO market share and key activities

Traditionally, air transport operators (airlines) have been responsible for maintenance activities of its assets while the Original Equipment Manufacturers (OEMs) take responsibility for optimising the process of designing and building the aviation assets (airframe, engine, systems etc). In order to maximise asset availability, the airlines optimise its MRO operations (Figure 2). As the technical challenges increased in 1980's, airlines began to look for areas of cost reduction and opt for outsourcing. A number of airlines saw the opportunity to increase their revenue from MRO operations and established separate operational entities.

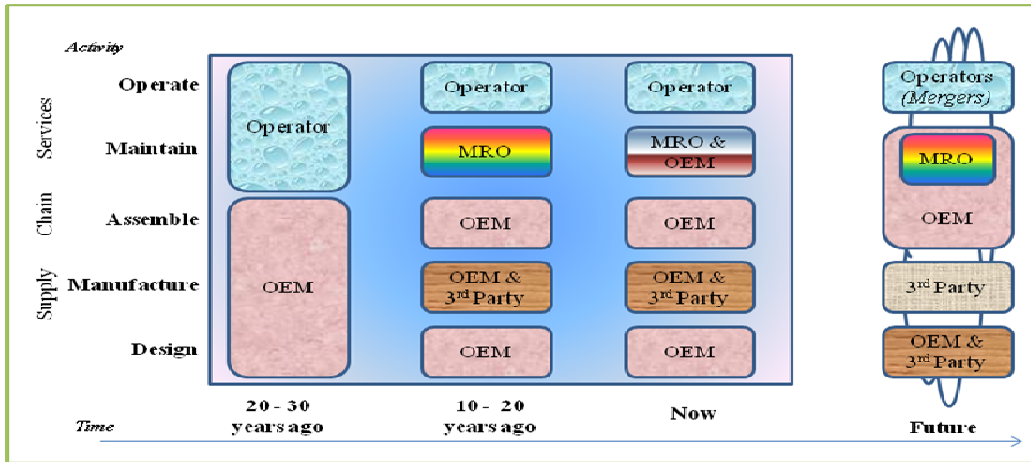


Figure 2 Supply Chain Shift and Future Trend (Source: adapted from Capgemini)

The future of the aviation industry is brighter today than ever before! Nigeria must register its presence within the value chain described in Figure 2. The sustenance of any national aviation industry would include proper positioning within the value chain: *operate, maintain, assembly, manufacture and design*. The ability to design and manufacture a commercial aircraft with carrying capacity of one hundred passengers plus (100+) in Nigeria might not be feasible within the next decade, however, Nigeria aviation sector must begin to sustainably operate, maintain and assemble in that progressive order – and the MRO facility in Uyo (Akwa Ibom State) should be seen as a viable step in the right direction (Figure 3). Once successfully completed, the facility is set to become a national presence and capable of accommodating two (2) Boeing 747-400 or six Boeings 737 in a closed and air conditioned space. However, the need for technically capable human resources that would provide high-quality maintenance services would need to be addressed. Nigerian airlines are encouraged to form a merger so as to have a cost advantage that would enable them to compete with their global counterparts.

It is suggested that the facility in Uyo and those anticipated elsewhere operating as an MRO should consider collaboration first with Original Equipment Manufacturers (OEMs) and later with 3rd Party suppliers so as to strategically upgrade the facility to an assembly plant and later collaborate with manufacturers. The major airlines, Arik Air and Aero, already have their own facilities in place, while new hangars have been built at Lagos for private and corporate jet owners, which already harbour a number of Approved Maintenance Organisations (AMOs). The need to provide a platform for who would be responsible for operating the facility would need to be dealt with and so is need to make the Hangar attractive to both domestic and foreign airlines alike.



Figure 3 Maintenance Repair and Overhaul Hangar - Uyo Airport

6. BENEFITS OF MAINTENANCE REPAIRS AND OVERHAUL FACILITIES IN NIGERIA

Building MRO facilities in Nigeria would save airlines huge revenue they expend on aircraft maintenance overseas and hence reduces capital flights. Nigeria has the largest and most modern commercial aircraft fleet in West and Central Africa but lacks an MRO facility; its airlines should build a cooperative alliance with global industry stakeholders (including viable investors) that support an indigenous and economically viable MRO facility that would address the industry needs and aspirations.

A strategic location of the MRO in the Northern and Southern parts of Nigeria could provide a commercial hub for aircraft maintenance in the West and Central Africa countries. As air safety depends on well-maintained aircraft using the right personnel; Nigeria needs SAMH facilities that will adhere to global aviation standards and recommended practices. The huge amount currently spent by the Nigerian airlines in the form of capital flights could be locally retained once functional MH facilities are in full operation. Nigeria could once again boast of the days of Nigeria Airways Limited that produces some of the best pilots, engineers and technicians and therefore complement the current remodeling, cost cutting, transformation effort etc as witnessed by the industry. Providing a standard SAMH in Nigeria would enable the nation to earn forgone foreign exchange from both domestic and foreign airlines. Specifically, Nigerian airlines would be given an opportunity to compete on a level playing ground with its international competitors and hence assess the effectiveness and efficacy of adopted styles of management that might have worked elsewhere but erroneously adopted in Nigeria.

7. CONCLUSIONS AND RECOMMENDATIONS

This paper urges the need for partnering agreement between the Federal Government of Nigeria and other stakeholders to build an effective SAMH so as to support the aviation industry and create multiple sources of wealth. Continue reliance of Nigerian aviation on foreign MRO would increase capital flight and negatively impact on the sustainability of the industry. It is prerequisite for Nigerian airlines to build a cooperative alliance by supporting an indigenous MRO facility. Strategic locations of such MROs could provide a commercial hub for aircraft maintenance amongst Africa nations. It can be asserted that if nothing is done about the provision of sustainable maintenance framework inclusive of domesticated MH; it is very likely airline business in Nigeria will continue to follow the plague of 'evolve and collapse' syndrome as evidence in the Nigerian aviation sector. Holistically, Nigerian aviation must consider the following cost drivers if it is to assure SAMH: *aircraft characteristic, aircraft utilisation, economics of scale, fleet age, fleet composition, maintenance input costs, maintenance philosophy, maintenance planning, maintenance programme design, market positioning, network design, operational practices, and productivity* amongst others!

Nigerian aviation industry needs proper positioning of its value chain: *operate, maintain, assembly, manufacture and design*. The ability to design and manufacture a commercial aircraft with 100+ carry capacity might not be feasible within the next decade, however, the sector must begin to sustainably operate, maintain and assemble in that progressive order and the MRO facility in Uyo and others anticipated elsewhere should be seen as a good starting point and an endeavour in the direct direction. A paradigm shift in Nigeria aviation industry would boost, renewed credibility, and set her on the competitive platform with the global counterparts. SAMH will build the confidence of air transport customers, while also acting as a strong economic booster for revenue generation. It is asserted that the establishment of SAMH facility in Nigeria is a prerequisite for optimising the inherent beneficial derivatives of the aviation sector.

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