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Challenges of Airlines Operations in Sub-Saharan Africa: An Empirical Investigation of the Nigerian Civil Aviation Sector

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Abstract
Purpose:*Opinions convergethat airlines in Sub-Saharan Africa are passing through perilous times. Moreover, evidences of the challenges of airlines are anecdotal, with scarce empirical investigation. Using the lens of the Theory of Constraints, we identified, measured and ranked the mitigating factors of airlines operations in Sub-Saharan Africa (adopting domestic airlines in Nigeria as subjects) in line with the tradition of empiricism.*
Methodology*- We generated 45 survey items after literature search and interviewed airline managers. We asked industry icons and gatekeepers of measurement to check for face and content validity, and collected data from a sample of 222 employees in 18 domestic airlines to conducted Exploratory Factor Analysis. Second wave of data was collected from a sample of 203 respondents, to evaluate the descriptive properties of the factors and the psychometric integrity of the data set.*
Findings *– Exploratory Factor Analysis led to the retention of 27 items, representingfive factors. Descriptive analysis reveals these challenges, as follows (in order of importance or severity):Infrastructural -, Financial -, Corporate Governance and Managerial -, Policy and Regulatory -, and Safety, Security and Environmental challenge.*
Conclusion*- We stressed that managers and policy makers need to pay the most attention to infrastructural challenge, followed by financial challenge, Corporate Governance and Managerial,and Policy and Regulatory, while safety, security and environmental challenge should not be traded-off even if it is the least challenge. We pointed out the study's limitationsand suggested generation of more items and investigations of hypothesized models on the nexus between these five factors and organizational performance, or other criterion variables.*
Keywords:*Civil aviation sector, challenges of airlines operations, exploratory factor analysis. JEL Codes: C52, L80, L93, M10*

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I. INTRODUCTION

The civil aviation industry plays a key role in the upstream and downstream sectors of the global economy. It reduces the cost of trade and facilitates tourism and the smooth operations of supply chains across continents (OECD, 2020). Aside its role in fostering the flow of goods, people, capital, technology and ideas (IATA, 2020), the airline industry is also praised for its complementarity and substitutability with other forms of transportation, thereby promoting integration and rapid development on a planetary scale.

Specifically, the industry transports more than one-thirds of the total value of goods and services. Also, for the past 10 years, the sector has enabled governments to annually generate over 111 billion as tax income. Moreover, the aviation industry contributes $3.5 trillion (4.1%) to global Gross Domestic Product (GDP) and supports 87.7 million jobs around the world (ATAG, 2020).

Following the above, scholars and governments of developing countries acknowledge the need to exploit the enormous opportunities that the airline industry offers. With air transportation, land-locked countries of Africa and South America need not link third party countries to import components and parts to drive their extractive industries, or export their goods (most of which are perishable) for increased foreign exchange earnings.

Taking Nigeria as an example, the aviation industry serves as a great catalyst of socio-economic transformation. Aviation recorded the fastest growth in the transportation sub-sector at the close of 2019, with a 0.14% GDP contribution which amounted to N198.62 billion (NBS, 2019).

Despite the enormous benefits of the airline sector - such as the promotion of trade, tourism, innovation and the creation of employment – its growth and development in Africa, and indeed Nigeria, is far behind other countries (Megersa, 2013). Al-Kwifi, Frankwick and Ahmed (2020) noted that "over 800 airports are distributed across the African continent, yet only one-tenth receive scheduled services. Apart from the few routes that link the major cities of the continent, most intra-African routes are thin and fragmented markets" (p.666).This seems to be a contradiction as the landlocked nature of most of the countries in Africa and high population of the continent offer advantage for the growth of the industry. It remains a conundrum among aviation enthusiasts that Africa is still far behind other continents and captures just 3% of the global air travel ecosystem, in spite of the fact that it is the abode of 15% of the global population and comprises 20% of the planet's landmass (IATA, 2020).

Curiously, there is also a lot of lopsidedness or difference with respect to operational performance of the industry among various African countries (Al-Kwifi, Frankwick & Ahmed, 2020). Currently, only Ethiopia, South Africa, Kenya, Egypt and Mauritius are comparatively successful in airline operations while most of the countries on the continent have airline industries struggling on the edge of failure.

Several factors have been attributed to the dismal performance of the airline industry of sub-Saharan Africa, including Nigeria. The challenges that pose threat to the survival of the airlines identified in literature are: limited market access and low level of connectivity, exorbitant fares and costs, degraded airport infrastructure (including technological infrastructure), low level of service quality, responsiveness, innovation (Sylva, 2020), unhealthy government interference and multiple taxes, inadequate access to funds, low level of air navigation assistance, poor security and safety norms, ambiguous policy, poor strategy and implementation, poor corporate governance, corruption, brain drain, weak regulatory environment (Pam, 2012), low productivity, overstaffing, competitive disadvantage, and poorly maintained and old aircraft (Xu & Dioumessy, 2019). Umoh and Sylva (2016) also echoed that domestic airlines suffer from bottlenecks such as "poor maintenance policy, insufficient funding, weak institutional ethics and low managerial and capacity planning skills. These challenges have resulted in reduction in economic activities and a negative balance sheet coupled with the inability of the industry to respond to growth opportunities" (p. 21).

Other challenges identified in literature are: powerful travel agent networks in economies that still operate in cash, unexpected last-minute booking, poor internet penetration, lack of competent and skilled employees, noise and gas pollution, climate change and natural disaster (Lawrence, 2009), and laborious bureaucratic process in obtaining Air Operating Licenses.

Although there is a quantum of literature on the challenges of the African airline industry (e.g. (Pam, 2012; Heinz & O'Connell, 2013; Ogunbodede & Odetunde, 2016), insufficient empirical studies have been conducted to determine the principal components of these challenges. Moreover, there is paucity of research that empirically investigated the relative weights of these challenges in the sector. Thus, it appears no clear policy has been formulated to address these challenges based on their relative importance or severity.

Following the gap in literature identified above, this study seeks to generate factor items that represent the challenges of the airline industry in sub-Saharan Africa, using the Nigerian civil aviation industry as the study site.

This study extents the literature on the airline industry by empirically evaluating the factors that constitute threats to the survival of the industry. The paper also reveals the factors that pose the greatest threat and those that matter least in the spectrum of challenges.

The rest of the paper follows a trajectory as given below:

1).A literature review on the airline industry in Nigeria and its challenges.

2).The methodology which involves the generation of the items (from extant literature) representing the challenges. Methodology also comprised face and content validation of the indicators as well as the establishment of the factorability of the indicators using the Exploratory Factor Analysis. Still on methodology, we conducted an analysis to compute the means and standard deviations of the principal factors in order to ascertain their levels of manifestation or importance. The last part of methodology contains the determination of reliability and validity of the factors.

3).The conclusion and recommendations.

II. LITERATURE REVIEW

2.1: Theoretical Framework

2.1.1: *The Theory of Constraints (TOC)*

The Theory of Constraints (Goldratt & Cox, 1984; Boyd & Gupta, 2004) suggests that every system has complex and interrelated activities, and is bombarded with an array of problems, or at least one constraint, which impedes its performance. An optimal usage of the constraints will, therefore, cause optimal performance outcome; whereas the maximum utilization of non-constrained resources will create excess inventory.

Watson, Blackstone and Gardiner (2007) submit that "TOC is a pragmatic and holistic approach to continuous improvement, covering disparate functionalities under a common theoretical foundation, and consists of an integrated suite of tools focused on those things that limit greater performance relative to the goal" (p.400). It is a unifying theory in operations management (Gupta & Boyd, 2008) that finds applicability in manufacturing and service sectors as well as organisations of various sizes, not-for-profits and government agencies (Watson et al., 2007; Şimşita, Günayb & Vayvay, 2014).

According to Watson et al (2007), TOC philosophy have been deployed by managers of a number of high profile companies such as "3M, Amazon, ***Boeing, Delta Airlines,*** Ford Motor Company, General Electric, General Motors, and Lucent Technologies" (p. 388),who publicly acknowledged that their organizations had significant improvements due to the adoption of TOC techniques.

Goldman (1990), and Ronen and Pass (2007) submit that managers are responsible for the identification of the constraints (weakest links) that prevent organizations from achieving their goals, and the subsequent readjustment of structures and processes to close performance gaps. A weakest link could be viewed as the most expensive or scarce resource in the organization - be it tangible or intangible.

For Büyükyılmaz and Gürkan (2009), constraints or weak links should be classified into categories for effective management. Such categories could be market demand constraints, plant/labour capacity constraints, political constraint, raw materials constraints, logistics constraint, behavioural constraints and managerial constraints. Moreover, goal incongruence, changing business cycle and customers' taste can also constitute constraints.

Specifically in the airline industry, these limiting factors include: lack of good infrastructure, unfavourable policies (Schragenheim & Dettmer, 2000), low market demand, lack of qualified personnel and competent managers, poor corporate governance, weak regulatory environment, multiple taxes, poor maintenance practice and overstaffing, amongst others (Xu & Dioumessy, 2019). Moreover, despite the fact that constraints cannot be totally eliminated from a system, a repeated practical application of the theory leads to continuous improvement and increased profitability.

The set of tools espoused by Theory of Constraints include: (i) The Five Focusing Steps, (ii) The Thinking Processes, and (iii) Throughput Accounting.

The Five Focusing Steps (5FS) of the Theory of Constraints call for managers to focus on bottlenecks for continuous improvement, through the following continuously iterative five steps: (1) Identify the system's constraint(s),(2) Develop a plan on how to exploit the system's constraint(s), (3) Organize everything else to fit into this plan by subordinating all actions to the decision made in step 2, (4) Elevate the system's constraint(s), (5) and if a constraint is broken in the previous steps, go back to the initial step to identify any new constraint that should be eliminated. Dan-Trietsch (2005) added step zero to the steps suggesting that the manager must first "select an objective function and decide how to measure it" (p. 27).

The thinking processes involve decision making activities of changing organizational processes, policies or strategies (Goldratt, 1990; Cox, Blackstone & Schleier, 2003; Gupta, Boyd & Sussman, 2004). During this process, managers develop "cause and effect" tools, root-define the causes of undesirable effects (known as UDEs) (Groop, Ketokivi, Gupta & Holmström, 2017) and then eliminate the UDEs without bringing about new ones. The basic questions that arise from the thinking processes are: (i) what needs to be changed? (ii) what should it be changed to? (iii) what actions will cause the change? (Goldratt, 2007; Watson et al, 2007).

Throughput Accounting (TA) is an accounting technique for measuring performance and aiding decision making, which aims to remedy the limitations of the traditional accounting framework. Scholars (e.g. Goldratt, 1990; Srikanth & Robertson, 1995) have argued that the traditional accounting practices encourage behaviours that are inimical to the long term profit maximizing goal of organisations. Thus, TA was advanced as a better performance measurement technique which focuses on behaviours that foster higher levels of financial performance (Lockamy & Spencer, 1998; Smith, 2000).

Managers of various organisations, including those in the aviation industry, deploy the Throughput Accounting (TA) aspect of Theory of Constraints to enable the system make money in the present and in the future, using Net Profit (NP), Return on Investment (ROI), and Cash Flow (CF) as performance measures (Goldratt, 1983). In service industries, throughput is money generated from selling the service (Siha 1999). Other performance measurements under the TOC are inventory management and operating expense (Goldratt & Cox, 1984). Thus, in order to be successful in a highly competitive environment, airlines are expected to institutionalize thinking processes geared towards profit maximization and satisfying passenger requirements - by increasing revenue generation, and reducing inventory (e.g. un-booked seat on a flight) and operating expense (Chou, Lu & Tang, 2012).

From the foregoing, the applicability of the Theory of Constraints in the aviation sector is underscored by the need for airline managers to identify the various operational activities and environmental factors that constitute bottlenecks, and device strategies to tackle each of them based on their degree of manifestation.

Furthermore, it is when managers of the airlines are aware of such constraints that decisions could be made quickly to "exploit, subordinate and elevate" the system for increased throughput, in accordance with the tenets of the Theory of Constraints. Moreover, the theory suggests that managers should understand the need to promote"very strongly an integrated, cross-functional and systems view" (Boyd & Gupta, 2004, p. 995) in order to adequately identify these constraints and reorganize the system to produce optimal operational outcomes.

2.2: *The Nigerian Airline Industry*

The Nigerian aviation industry has a chequered history spanning one hundred-odd years. The year 1920 marked the birth of the aviation industry in Nigeria as it witnessed the landing of the Royal Air Force aircraft on a polo field in Maiduguri (Ogbeidi, 2006). As at 1930, both civil and military aircrafts of Great Britain had started transporting mails and passengers to cities like Lagos, Bauch, Kano, Mina, Sokoto and Osogbo. Later on, in 1935, the British Imperial Airways started full operations in Nigeria. Shortly after this, more cities (e.g. Azare, Bauchi, Benin, Bida, Biu, Brass, Bussa, Gboko, Gusau, Katsina and Kebbi) were identified by the Air Ministry of London as viable sites for airlines operations (Federal Civil Aviation Authority, 1995). Soon after, air services that connected Lagos, Port Harcourt, Enugu, Jos, Kaduna and Kano operated up till 1946.

Nigeria and Gold Coast (present Ghana) met on May 15, 1946 and inaugurated the West Africa Airways Corporation (WAAC). On October 1, 1958, the Nigerian Government bought over the West African Airways Corporation, which was renamed West Africa Airways Corporation (Nigeria) Limited. The shares of this new company were jointly owned by the Nigerian government (51% shares), the British Overseas Airways Corporation ($16\frac{1}{3}$% shares) and Elder Dempster ($32\frac{2}{3}$% shares). On the first of May 1961, Nigeria took 100% ownership of WAAC (Nigeria) Limited and changed its name to Nigeria Airways. In 1976, the Nigerian Airports Authority (NAA) was established under Decree 45 (Ogunbodede & Odetunde, 2016).

The Nigeria Airways operated very efficiently till the early 1980s. From the late 1980s to 2003, the Nigeria Airways was inundated with several challenges which include political manipulation and over-control by government, corruption, overstaffing, inability to meet passengers' demand, flight spill-overs, flight delays, flight cancellations, difficulty in getting boarding passes, huge debt profile, poor safety record and gross mismanagement of resources.

The situation was so bad that by the time of its demise in 2003, the Nigeria Airways had only one serviceable aircraft (a crooked Boeing 737-200) for domestic flights and two aircrafts on lease for international flights. The center could not hold for Nigeria Airways, so on the 28th September 2004 the government decided to sell 49% of its 100% shares to Virgin Atlantic Airways and changed its name to Virgin Nigeria. In 2008, Virgin Atlantic sold its 49% stake in Virgin Nigeria. This led to changing the name of Virgin Nigeria to Nigerian Eagle Airlines on September 17, 2009. The newly formed Nigerian Eagle Airlines went through administrative and operational crises and changed its name to Air Nigeria on the 2nd of June, 2010 after a majority of its shares were obtained by Air Nigeria Development Limited.

Finally, Air Nigeria was declared insolvent on the 10th of September 2012 due to safety concerns and labour-management imbroglio. Currently, the ground facilities of the comatose national carrier have been annexed by Arik Air. Moreover, notwithstanding the commendable operations of airlines like Arik and Air Peace, the civil aviation sector of Nigeria is still in a pitiable state of underperformance, especially viewed against its potentials.

During the chaotic years of the Nigeria Airways in the 1980s, the government deemed it necessary to deregulate the aviation sector. As at 1995, the government had licensed up to 144 air operators (Charles & Onyiuke, 1997). In order to bring about more reforms in the sector, the government dissolved the Federal Civil Aviation Authority (FCAA), which was founded in 1989, and created three parastatals, namely: the Directorate of Safety Regulation and Monitoring (DSRAM), the Directorate of Economic Regulation and Monitoring (DERAM) and the Federal Airports Authority of Nigeria (FAAN), all under the Ministry of Aviation. The Federal Airports Authority of Nigeria (FAAN) is an amalgamation of Nigerian Airports Authority (NAA) and the air traffic services (ATS) (Ogunbodede & Odetunde, 2016). Later, in 1998, the government carried out a review of the industry based on the requirements of the International Civil Aviation Authority (ICAO). This gave rise to the formation of the Nigerian Civil Aviation Authority (NCAA) – which is the sole regulatory authority - and other bodies such as the Accident Investigation Bureau (AIB) and Nigerian Airspace Management Agency (NAMA).

The industry has five international airports (e.g.Nnamdi Azikiwe International Airport), twenty one local airports (e.g. Warri Airport) and thirteen privately owned landing strips (e.g. Azare Airstrip). Currently, there are 23 licensed active domestic airlines based on the latest updates on the Nigerian Civil Aviation Authority (NCAA) website. Counting from 1940 till date, Nigeria has recorded 81 defunct airlines (Avinngblog, 2015; Lyall, 2015).

Despite the above dismal spectacle, Nigeria is an important destination for over 28 foreign carriers and has bilateral Air services Agreements with over 78 countries. In recent times, the Nigerian domestic aviation industry has been growing steadily as regards passenger traffic. From 2008 – 2017, 139 million passengers flew through Nigeria's airports, of which 100 million (over 70%) were domestic passengers.

During the period, and even now, Terminal 2 of Murtala Mohammed Airport Lagos, Nnamdi Azikwe International Airport, Abuja, Murtala Muhammed International Airport (MMIA) Lagos and Port Harcourt International Airport were the most frequented airports in Nigeria. As at 2016, the Nigerian Aviation industry provided 245,500 jobs directly or indirectly and contributed N185 billion to the Nigerian economy with 4.7

million and 10.7 million international and domestic passengers, respectively in 2015. Without doubt, an optimally performing domestic airline industry is a condition precedent to meeting this growing demand.

2.2: *Challenges of the Nigerian Airline Industry*

Generally, the performance of the Nigerian Air transport system is sub-optimal. Uhuegho (2014) investigated the effects of economic deregulation on domestic airlines and found that most Nigerian Airlines perform poorly compared to their counterparts in other parts of the world. A review of literature shows that the challenges faced by the civil aviation industry in Nigeria could be grouped into: Infrastructural, Financial, Policy and Regulatory, Corporate Governance, Managerial, safety, security, and environmental challenges. Details of these challenges are discussed below:

Infrastructural Challenges

Infrastructural challenges of the domestic airline sector include: Poor quality of airport infrastructure, inadequate provision of power, inadequate number and small fleet sizes of aircrafts, lack of perimeter fencing of airports and poor technology.

The substandard quality of key infrastructure in Nigeria's airports poses a challenge to both the domestic and international airlines operations. For instance, many airports do not have modern landing aids such as adequate airfield lighting and Instrument Landing Systems, to allow planes land at night.Moreover, many airports in the country are deficient in basic infrastructure such as standard runway and terminal facilities (Phillips, 2015). Furthermore, the industry lacks commercial simulator facility, thus warranting airlines to spend not less than 16 million USD annually to conduct recurrent simulator training for pilots. The industry also lacks standard Maintenance Repairs and Overhaul (MRO) hanger. The absence of an MRO is also responsible for the rapid rate of deterioration of the carriers, which lifespans are cut-short to an average of 10 years. Worse still, the country has some of the oldest fleets on the planet, with more than 70% of all aircrafts above 10 years of age. This scenario translates to higher maintenance costs, increased fuel consumption, more pollution, increased downtime and low safety/reliability.

Another nagging issue that constitutes a bottleneck to the smooth operation of the airline industry is inadequate provision of power (Adebukola & Fagbemi, 2019). Government's negligence to provide reliable power via the national grid makes the airport authorities resort to alternative power (e.g. diesel powered generating sets), which is very costly and non-sustainable. The cost burden arising from this scenario is transferred to passengers in the form of increased airfares. This increase in airfare leads to sparse demand.

Another infrastructural challenge is the inadequate number and sizes of aircrafts.According to Adebukola and Fagbemi (2019), many Nigerian airlines have only few aircrafts on their fleet. Apart from the major air traffic routes, there are several others that offer reasonable traffic potential. However, due to the small number of aircraft on their fleet, most operators prefer to stick to the more populated routes thereby limiting the available options to travelers. This ultimately translates to reduced quality of service. Although market potentials exist along several under-utilized air corridors, the smallness of airlines does not permit them to explore these potential routes. Airlines may not be able to break even given the low load factors that are likely to exist on such routes. Moreover, the small fleet size of most of the carriers makes them powerless to bargain for favorable rates with fuel suppliers. Small size of carriers also constrains capacity tocompete on regional and international routes. Nigeria's domestic airlines are therefore not strong players in the international and regional markets.

The rapid rate of technological innovations and change in passengers' demand, in terms of tastes and preferences, require airports to be proactive in facilitating safe and secure trips (Wallis, 1993) with top notch experiential quality. Regrettable, Nigerian airlines are grappling with the adoption of latest technologies that will enhance their capacity to handle complex operations in a flexible manner. Thus, the transformational power of technology in the aviation sector has not been maximally harnessed. This has limited the industry's ability to improve passenger experience, aircraft communications, sharing of data among stakeholders, airport operations, baggage management and the subsequent growth in revenue. Technologies such as Virtual Modeling and Simulation, Artificial Intelligence (AI), Block Chain Technology, robotics, Internet of Things (IoT), big data and analytics, which are used for creating superior passenger experience and optimization of resource allocation and passenger flows are nowhere to be found in the airline sector of Nigeria.

Financial Challenges

Xu and Dioumessy (2019) observed that the operational cost of African carriers is higher than most carriers in other parts of the world. According to Adebukola and Fagbemi (2019), most of the materials, equipment and aircraft spares used in Nigeria are imported, and are paid for in foreign currencies. Also, a large proportion of the Maintenance, Repairs and Overhaul (MRO) activities need to be done abroad as there are no standard facilities in the country to carry them out. Consequently, both public and government airlines spend over $2 billion annually on C-check and other aircraft maintenance activities abroad. Moreover, there has been rising inflation and protracted scarcity of forex for airlines, coupled with a steady weakening of the naira against the dollar, thereby significantly increasing airlines' operational costs.

Another financial challenge airlines face is the high cost of aviation fuel (Jet A-1). In African countries, aviation fuel is about 20% more expensive, when compared with other continents (Xu & Dioumessy, 2019). Moreover, aviation fuel accounts for a shocking 40 per cent of the expenditure of airlines in Nigeria, making it difficult for them to break even (Mimi, 2008). Aside this, airlines pay up to 7% of the ticket price to travel agents (Chingosho, 2009) and are compelled to pay several charges and taxes to the government (Adebiyi, 2012). Faajir and Zidan (2016) submit that more than 30% of the airlines cannot service overhead costs, and are also unable to pay salaries on a regular basis. In addition, in spite of the dotted monetary interventions for the aviation industry implemented by the government, the available resources cannot match the growing demand of the industry. Moreover, most African governments already have huge debts, which make them reluctant to borrow fund for the development of the aviation sector.

Policy and Regulatory Challenges

Scholars (e.g. Omoleke, 2012; Pam, 2012) have pointed out that the aviation industry in African countries suffers setbacks due to lack good strategies that can address the peculiarities of the sector. Moreover, most of the policies are not properly implemented. It has been echoed that a problem facing the Aviation industry in Nigeria is Government's lack of political will to implement formulated policies (Omoleke, 2012). Also, there is misalignment between policies of ministries that oversee various aspects of the aviation industry. In several cases, supervising ministries such as Ministry of Science and technology, labour and transport send conflicting directives to the regulatory bodies, thus creating sub-optimal outcomes in the sector.

Moreover, most of the policies (e.g. taxation) enacted by the regulatory bodies stifle the growth of industry rather than accelerate it (Phillips, 2015). Also, decision making is highly centralized as the supervising ministry of aviation has a tight control over the aviation regulatory bodies. This excessive interference and overbearing control affects the speed of decision making within the sector. Omoleke (2012) observed that the agencies, commissions, corporations and other parastatals are not empowered by the supervising ministries to make discretionary decisions to increase throughput.

Furthermore, there is lack of harmony between the aviation policy of Nigeria and that of sub-regional bodies such as the Yamoussoukro Decision on air transport (Schlumberger, 2010). There is also lack of synergy between Nigeria's aviation policy and the policies of the African Civil Aviation Commission (AFCAC). This has made the sector not to optimally harvest the benefits of regional integration.

Corporate Governance Challenges

Corporate governance and managerial challenges include unbridled corruption, poor project planning skills and Human Resource Practices.

Isah (2018) opines that good Corporate Governance is a necessity in modern firms because the management and ownership are usually separate. Poor corporate governance and bad management has led to the proliferation of unethical practices and dubious activities which end up stunting the growth of the airline industry. In 1999, corrupt practices within the managerial cadre and prebendalism in supervisory bodies led to a crisis in the Nigerian Civil Aviation industry following the decline and near collapse of the Nigeria Airways (Akpoghomeh, 1999), which eventually was declared bankrupt in 2003.Transparency and accountability only exist in the theoretical realm. The system is devoid of proper checks and balances, thereby opening a floodgate of monumental financial malfeasance. In the case of prebendalism, each time there was change of administration, competent senior managers of the sector were unduly retired or fired, and replaced with kinsmen of the new czars. This resulted in the rapid depletion of human resource capital and encouraged some management staff who anticipated their unwarranted exit to loot the system to coma (Pam, 2012).

Managerial Challenges

Furthermore, in the area of project planning, airports are occasionally closed down for routine repairs and maintenance and they sometimes last longer than originally planned, with negative significant impact on all stakeholders. For example, the Port Harcourt International Airport which was closed down in August 18, 2006 for four-month maintenance, could not resume operations till December 18, 2007, making it six months of closure (Agbo, 2008).

Moreover, the industry is strangulated by unfavourable human resource practices such as neglect of training and personnel development. This has resulted in deficiency in skilled manpower. Over the years, dearth of skilled personnel (pilots and aircraft engineers) has been a major constraint to Africa's ability to meet its safety oversight functions in the aviation industry (Pam, 2013). It has been projected that seven hundred and fifteen (715) pilots and nine hundred and sixty (960) engineers are needed in Africa every year for the next twenty years. By implication, since Nigeria is 18% of Africa's population, the Nigerian aviation industry needs one hundred and twenty eight (128) pilots and one hundred and seventy two (172) aircraft engineers every year for the next twenty years(Pam, 2012). It is crystal clear that Africa or Nigeria cannot close this gap in skilled personnel in the foreseeable future without rigorously embarking in training and development as a fundamental component of human resource practices. Regrettably, there is a very few number aviation training schools in the country, and even the few that are trained end up leaving the country for greener pastures because they are uncomfortable with the reward system and are not sure of a smooth career growth. Currently a lot of specialist (high-skilled) jobs in the Nigerian aviation industry are handled by expatriates because of the shortage of competent nationals.

Finally on unfavourable human resource practices under the umbrella of managerial challenges, it has been observed that unhealthy management-labour relationship constitutes a cog in the wheel of progress of the Nigerian airline sector. There have been several complaints of poor reward system and inequity in the way local staff are treated relative to expatriates. Moreover, the provisions in employment contracts rarely capture global practices in the areas of license insurance, pension administration, conflict resolution mechanisms, medical benefits and union representation. Such conditions stifle employee job satisfaction, commitment and productivity, and in some cases, cause closure of airports due to striking labor union workers.

Safety Challenges

According to Sylva (2020, p.305), "airline operators are not only concerned with the safety of their employees and passengers, but also how their operations affect the safety of the environment and the immediate host community". There is a consensus among researchers and aviation enthusiasts that Africa scores very low in safety standards viewed against global best practices. The continent accounts for only 3% of the movement of goods and passengers, yet scores about 19% of total accidents on the planet.

Moreover, with few exceptions like Ethiopian Airlines, South African Airways, Kenya Airways, Air Mauritius, EgyptAir, Royal Air Maroc, African World Airlines in Ghana and Air Peace in Nigeria, the accident rate keeps increasing on the continent, while accident rates of other continents have been reducing or staying at the same low level. The report of IATA's industry-benchmark Operational Safety Audit in 2018 reveals that only few African airlines scored within the globally acceptable accident threshold of 1.35accidents per million flights, while the majority recorded disturbing average of 9.179 accidents per million flights.

In addition, member state report on effective implementation of state safety oversight system reveals that only Egypt, Ghana, Kenya, Madagascar, Mauritania, Rwanda, South Africa, Sudan and Togo scored up to the recommended threshold of implementation on the following areas:(i) primary aviation legislation and civil aviation regulations (LEG); (ii) civil aviation organization (CAORG); (iii) personnel licensing and training (PEL); (iv) aircraft operations (OPS); (v) airworthiness of aircraft (AIR); (vi) aircraft accident and incident investigation (AIG); (vii) air navigation services (ANS); and (viii) aerodromes and ground aids (AGA) (ICAO, 2020). Nigeria did not appear on the list because its aviation sector scored below the 75% safety implementation threshold.

Specifically, safety statistics of the industry in Nigeria reveals that there were 123 crashes between 1941 and 2013 (Aviation Safety Network, 2015). The years 2002, 2005 and 2006 recorded 154, 227 and 109 fatalities, respectively. Most of these incidences were attributed to equipment failure, flying of aircrafts that are not airworthy, negligence and human (pilot) error (Aviation Safety Network, 2015). Also, there have been reported cases of aircrafts skidding off the runway while landing because of faulty landing gear or slippery runway. There have also been emergency landings due to bad weather, as well as the falling off of emergency exit door of aircraft carrying passengers.

Other reasons attributed to poor safety climate in the industry are laxity in supervision and enforcement of traffic rules, poor maintenance culture, dearth of qualified inspectors, paltry operational budgets for the Civil Aviation organs, antiquated infrastructure, flying of old aircraft that were sold as scrap and later refurbished, poor emergency response procedures and inadequate training of technical personnel (IATA, 2019). Moreover, unethical safety practices have also been noticed in the industry. Such practices include: (i) coaxing aircraft engineers to sign certificates of release for service even when the aircrafts are unserviceable, (ii) falsification of weights by dispatchers in order to accommodate all the available load for each flight, (iii) reprimanding and penalizing pilots who want to be strict on the rules (e.g. for not compromising to fly an unsafe aircraft) (Pam, 2012). Such unethical culture sacrifices safety on the altar of short-term economic aggrandizement.

Security Challenges

Intricately interwoven with safety is the security and wellbeing of staff and passengers (Oster Jr., Strong & Zorn, 2013). Airports in Nigeria do not have functional perimeter fencing. This situation led to the damaging of the landing gear of Air France when it crashed on cows at the runway of Port Harcourt International Airport in 2015 (Agbo, 2008). There have been incessant cases of robbery along airport roads, stealing of valuables of passengers by "airport rats". Moreover, these petty thieves and urchins who find their ways to the porous airports also burgle visitors' cars to cart away their personal effects. Also, the industry is under the siege of drug traffickers as most hard drugs are airlifted from South American countries to Nigeria, to be further smuggled to Europe via the porous Nigerian airports (Nwannennaya & Abiodun, 2017; Ukwayi, Okpa & Akwaji, 2019).

Furthermore, some stowaway incidences and robbing of cargo compartment have been reported owing to the loose security architecture of the airports and compromising attitude of security staff. In the midst of these challenges, there is poor coordination and dysergy among the multiple security agencies (the Police; Customs; the National Drug Law Enforcement Agency; aviation security personnel and others) who sometimes work at cross purpose at the airports, thereby causing more security lacuna.

Currently, the global aviation industry - of which Nigeria is a player - is grappling with health security challenge occasioned by the coronavirus (COVID-19) pandemic (Maneenop & Kotcharin, 2020). Due to the high propensity of transmission of the disease, governments all over the world have restricted international movement of goods and passengers, leading to a depletion of the market value of the airline industry (Shretta, 2020). Specifically, soon after the first recorded case of COVID-19 in February, 2020, the Nigerian government shut down all the airports within the country for several months which led to huge economic loss in the sector (Siyan, Adegoriola & Agunbiade, 2020). Sirika (2020) observed that the monthly loss of N21 Billion, since the outbreak of covid-19, is traceable to the halting of activities in the industry.

Environmental Challenges

Closely related to airline safety is that of the environment and the communities around the airports (Maurice, Lavoie, Laflamme, Svanström, Romer & Anderson, 2001; Sylva, 2020). Environmental Safety challenges include the pressure from government and environmental rights groups on airlines to reduce emission of noise, toxic wastes, and greenhouse gases (CO_2 and NO_x) which deplete the ozone layer (McManners, 2016). Moreover, airport construction has significant adverse effect on the natural ecosystem, including flora, fauna and landscapes. Furthermore, the idea behind such pressure on airlines is the capacity of airlines activities in contributing to climate change and in jeopardizing the health and socio-economic wellbeing of the immediate community dwellers and other stakeholders.

Measures in mitigating the environmental impact of airline operations are been identified as: (1) adoption of environmentally friendly technologies (e.g. supersonic and urban mobility aircraft), (ii) purchase of aircrafts that are fuel efficient and have low total carbon emissions (e.g.Airbus A350 and Boeing 787), (iii) disposal of old aircrafts that have high noise levels, (iv) encouraging tree planting, and (v) using treatment plant to neutralize toxic waste (Alemayehu & Brocke, 2010). Regrettably, the airline operators are passing through economic crisis. Hence, they do not have the resources to improve environmental efficiency by carrying out these mitigating measures.

III. METHODOLOGY

3.1: Item Generation and Review

Following the recommendations of Carpenter (2018), we embarked on a qualitative process by comprehensively reviewing the literature on the challenges of the civil aviation industry in order to "generate relevant empirical items that describe" each challenge (p.33). We also contacted 2 senior staff of airlines who narrated the challenges of the industry. We then generated 52 items that represent these challenges. Two weeks later, we met 8 other senior managers in the airline industry, 2 methodologists and 5 researchers on the subject matter. These experts rated the items for appropriateness, relevance, conciseness and unambiguousness using a 5-point scale ranging from 1 = strongly disagree to 5= strongly agree.

Participants were also requested to provide their interpretation of every item, and make suggestions to effect modifications. Items that scored an average of 3.0 or below were either dropped or reworded. For instance, *modern landing aids (e.g. airfield lighting and Instrument Landing Systems); Commercial simulator facility; and Standard Maintenance Repairs and Overhaul (MRO) hanger were dropped because they were already captured by standard runway and terminal facilities.* Also, *Corruption, nepotism and unethical practices* was reworded to *Corruption and unethical practices*, while *corporate governance* was expunged because it is already described by the *Transparency and accountability* item. We arrived at 37 items at this stage.

Following two other rounds of interviews with another set of mangers and experts, additional 8 items were suggested for inclusion. The resultant 45 items were again rated for appropriateness, relevance, conciseness and unambiguousness using a 5-point scale ranging from 1 = strongly disagree to 5= strongly agree. All the items scored above 3, and so were adjudgedappropriate, relevant, concise and simple to understand (DeVellis, 2012). Moreover, the panel of experts also confirmed that these 45 items were sufficient and comprehensive in capturing the challenges of the airlines. These steps satisfied the conditions for face - and content validity (Bollen, 1989; Leedy & Ormrod, 2004; Creswell, 2005).

Table 1 shows the45 face validated itemsfor the study.

Table 1: items generated for the study.

CH_1: High operational cost	**CH_24: Lack of harmony between the aviation policy of the country and sub-regional policies**
CH_2: Inadequate provision of power	CH_25: Secure airport terminal (robbery, theft, injury and others)
CH_3: Scarcity of forex	CH_26: Provisions in employment contract
CH_4: Misalignment of policies among parastatals and ministries	CH_27: Age of fleets
CH_5: Incompetent management and poor business model	CH_28: Commission for travel agents
CH_6: Administrative and overhead costs	CH_29: Corruption and unethical practices
CH_7: Lack of perimeter fencing of airports	CH_30: Absence of competitive reward system
CH_8: Health security due to coronavirus (COVID-19) and other diseases	CH_31: Poor emergency response procedures
CH_9: Low level of implementation of safety measures	CH_32: Coordination among various security agencies at airports
CH_10: Excessive control and interference by supervising ministry	CH_33: Accident rate
CH_11: Poor Management-labour relationship	CH_34: Rising inflation
CH_12: Secure road to airport (robbery, theft, injury and others)	CH_35: Poor Airport project planning skill
CH_13: Emission of noise, toxic wastes, and greenhouse gases	CH_36: Supervision and enforcement of traffic rules
CH_14: Cost of aviation fuel (Jet A-1)	CH_37: Stowaway incidences
CH_15: Lack of Government's political will to implement formulated policies	CH_38: Weakening of the naira against the dollar
CH_16: Shortage of skilled personnel (skill gap)	CH_39: Technology and Airport Information System
CH_17: Drugs trafficking using airport as routes	CH_40: Centralization of decision making by supervising ministry
CH_18: Poor maintenance culture	CH_41: Inadequate number and small fleet sizes of aircrafts
CH_19: Standard runway and terminal facilities	CH_42: Misalignment between policies and the requirements of the sector.
CH_20: Debt burden	CH_43: Unfavourable policies
CH_21: Lack of transparency and accountability	CH_44: Poor implementation of policy.
CH_22: Inadequate training and personnel development	CH_45: Charges and taxes to the government
CH_23: Inadequate funding by government	**Note:** CH - *Challenge*

IV. RESULTS AND DISCUSSION

4.1: *Fieldwork, Data Cleaning and Demographic Report*

The generated items of the instrument were anchored on a 5-point Likert's type scale, and respondents were asked to tick the challenges in order of severity (5 = extremely sever, 4 = very sever, 3 = moderately severe, 2 = slightly sever, and 1 = not at all sever). The questionnaire was administered to members of staff with designations such as managers, supervisors, pilots, engineers, and flight attendants) in the 18 domestic airlines. We contacted three airline managers in Lagos who assisted in the distribution of the instrument via survey monkey. After 6 weeks, a total of 222 responses were retrieved for subsequent data entry and analysis. MacCallum, Widaman, Zhang and Hong (1999) submitted that a robust EFA requires at least 200 cases. Thus, the responses retrieved for this study are adequate. There was no case of missing data. Hence all the cases were analyzed to arrive at the demographic summary of the respondents, as shown in table 2.

Table 2: Demographic Characteristics of the Sample (N = 222)

Variable	Description	Percent
Gender	Male	67.6%
	Female	32.4%
Age (Years)	**Age bracket**	**Percent**
	< 26	6.3%
	26-35	25.7%
	36-45	45.1%
	>45	22.9%
Job Tenure (Years)	**Tenure Bracket**	**Percent**
	< 5	30.6%
	5-10	36.9%
	11-15	20.2%
	16-20	6.8%
	>20	5.5%

Source: IBM SPSS version 27 output.

Table 2 indicates that out of the 222 respondents, 67.6% were males, whereas 32.4% were females. Hence, the number of males is more than double that of females in Nigeria's civil aviation industry. Most women leave the industry after getting married. Moreover, 45.1% of the respondents are between 36-45 years old, whereas 25.7% are between 26-35 years, 22.9% are above 45, and 6.3% are below 26 years in age. Thus, more than three-fifths of the domestic airlines' members of staff are between 26-45 years, while about three-fifths are close to exiting the organisations. The mean age is 38.6 years (*SD* = 2.17). Nigeria is populated by youths who are ever available for the job market.

In addition, table 2 shows that 36.9% of the respondents have worked in the organisations for 5-10 years, 30.6% have worked below 5 years, 20.2% have worked between 11-15 years, 6.8% for 16-20 years and 5.5% have been working in the organisations for more than two decades. Hence, close to three-fifths of staff members have worked between 5-10 years, followed by a little less than one-thirds who worked less than 5 years. Mean number of years in the industry was 9.05 years (*SD* = 3.33). Most employees have not worked for more than 10 years, perhaps due to the massive recruitment that was done by the immediate past administration.

4.1: *Exploratory Factor Analysis*

Study 1:

We first conducted Exploratory Factor analysis (EFA) using the Principal Component Analysis (PCA) technique, in order to transform the initial input dataset into a reduced dataset while maintaining maximum amount of variance (Tabachnick & Fidell, 2007; Osborne & Costello, 2009). EFA gives the researcher the confidence that the extracted survey items are accurate, appropriate and objective measures, which can be used for inferences (Yong & Pearce, 2013). We deployed the IBM SPSS version 27 to conduct the analysis.

Moreover, the unsupervised PCA was conducted with varimax orthogonal rotation (Hinkin, 1998) to ascertain the variance-covariance or correlation structure of the sample data, and to arrive at minimal number of items. During this analysis, several criteria were used based on recommendations from gatekeepers of measurement..

For factor loadings, we used a minimum cutoff level of .50 (Tabachnick & Fidell, 2001). Such items are deleted for being practically irrelevant (Hair, Black, Babin & Anderson, 2013). In addition, we deleted any item that cross-loaded more than 0.4 on multiple factors (Field, 2013).

We also inspected the data (Howard, 2016) to ascertain critical outputs such as:

(i) The Kaiser-Mayer-Olkin's Measure of Sampling Adequacy – simply known As KMO
(ii) Eigenvalues
(iii) Bartlet's Test of Sphericity
(iv) Cronbach's alpha, and
(v) The variances explained by the individual factors.

According to Sarstedt and Mooi (2014, p. 242), the Kaiser-Meyer-Olkin's (KMO) measure of sampling adequacy "indicates whether the correlations between variables can be explained by the other variables in the dataset". Its value ranges from zero to one. KMO values less than 0.50 are unacceptable, whereas other values are rated as follows: Miserable = 0.50–0.59, Mediocre = 0.60–0.69, Middling = 0.70–0.79, Meritorious = 0.80–0.89, Marvelous = 0.90 and above (Kaiser, 1974; Malhotra & Dash, 2007).

The Bartlett's test of sphericity indicates whether sufficient correlations exist among the variables. A Bartlett's test that is significant ($p<0.5$) at 95% confidence level indicates sufficient correlations exist among the variables, which gives the researcher the confidence to continue with the factor analysis (Hair.Jr., Black, Babin, Anderson & Tatham, 2006).

The eigenvalue is a Kaiser criterion (Kaiser, 1960, 1970) which represents "the aggregated item-level variance associated with a factor" (Osborne & Banjanovic, 2016, p.13). A factor that scores eigenvalue less than 1.0 is treated as a redundant factor (Fabrigar & Wegener, 2012).

Cronbach's alpha (Cronbach, 1951) is a widely used estimate of internal consistency of survey indicators. It measures "the proportion of variance that is systematic or consistent in a set of survey responses" (Vaske, Beaman & Sponarski, 2016, p. 3). We observed an alpha cut-off value of 0.7 in harmony with the recommendation of Nunnally (1979).

The results of the EFA for the items reflecting the challenges of the civil aviation industry are presented in Table 3.

Table 3: Results of EFA for Challenges Airlines (*N* = 222)

Latent Variables and their Items	Factors				
	1	2	3	4	5
Infrastructure (Factor 1)					
CH_19: Standard runway and terminal facilities	0.809				

CH_27: Age of fleets	0.761				
CH_39: Technology and Airport Information System	0.757				
CH_41: Inadequate number and small fleet sizes of aircrafts	0.740				
CH_2: Inadequate provision of power	0.652				
CH_7: Lack of perimeter fencing of airports	0.644				
Financial Challenges (Factor 2)					
CH_1: High operational cost		0.794			
CH_45: Charges and taxes to the government		0.790			
CH_3: Scarcity of forex		0.710			
CH_20: Debt burden		0.681			
CH_23: Inadequate funding by government		0.668			
Policy and Regulatory Challenges (Factor 3)					
CH_44: Poor implementation of policy.			0.788		
CH_10: Excessive control and interference by supervising ministry			0.771		
CH_42: Misalignment between policies and the requirements of the sector.			0.748		
CH_24: Lack of harmony between the aviation policy of the country and sub-regional policies			0.693		
Corporate Governance and Managerial Challenges (Factor 4)					
CH_21: Lack of transparency and accountability.				0.795	
CH_5: Incompetent management and poor business model				0.773	
CH_22: Inadequate training and personnel development				0.668	
CH_11: Poor Management-labour relationship				0.659	
CH_30: Absence of competitive reward system				0.628	
Safety, Security and Environmental Challenges (Factor 5)					
CH_9: Low level of implementation of safety measures					0.871
CH_31: Poor emergency response procedures					0.868
CH_12: Secure road to airport (robbery, theft, injury and others)					0.862
CH_25: Secure airport terminal (robbery, theft, injury and others)					0.802
CH_32: Coordination among various security agencies at airports					0.779
CH_8: Health security due to coronavirus (COVID-19) and other diseases					0.682
CH_13: Emission of noise, toxic wastes, and greenhouse gases					0.649
Kaiser-Meyer-Olkin's (KMO) (Total = 0.808)	0.892	0.816	0.753	0.722	0.857
Engenvalues (Total = 6.227)	3.811	3.201	6.427	4.402	7.275
Common Variance Explained by individual factor (%) (Total = 83.933)	36.95	12.654	12.002	11.216	11.113
Cronbach's Alpha (Total = 0.801)	0.817	0.832	0.744	0.777	0.803
Bartlet's Test of Sphericity: Approx. Chi-Square = 1164.096, df= 303, Sig. 0.003.					

Source: IBM SPSS version 27 output.

Table 3 reveals a factor solution of the EFA, whereby 27 items uniquely loaded above 0.5 cutoff recommended by Tabachnick and Fidell (2001). Thus, we retained these 27 items and labeled factor 1 as Infrastructural challenge, factor 2 as Financial challenge, factor 3 as Policy and Regulatory challenge, factor 4 as Corporate Governance and Regulatory challenge, while factor 5 was labeled as Safety, Security and Environmental challenge. The retained number of items (factor loading > 0.5) for each factor is as follows: 6 for Infrastructure challenge, 5 for financial challenge, 4 for policy and regulatory challenge, 5 for corporate governance and managerial challenge, and 7 for safety, security and environmental challenge.

A total of 18 items were expunged from the initial 45 items. Sixteen of the 18 items were redundant (< 0.5), while 2 items cross-loaded on two factors. Items that clustered under financial challenge which were dropped from the original battery of items for redundancy are: *CH_6, CH_14, CH_28, CH_34, and CH_38*. Items that clustered under policy and regulatory challenge which were dropped for being practically irrelevant are*: CH_15, and CH_40*. Items that clustered under Corporate Governance and Managerial challenge which were dropped for redundancy are: *CH_16, CH_26, CH_29, and CH_35.* Items that clustered under safety, security and environmental challenge which were dropped for redundancy are: *CH_17, CH_18, CH_33, CH_36, and CH_37.* In addition, *CH_4 and CH_43* cross-loaded onCorporate Governance and Managerial challenge, and so were deleted from the battery of factorial loads.

Furthermore, table 3 shows that the Kaiser-Meyer-Olkin's (KMO) measure of sampling adequacy for the factors range from Middling (0.722 for Corporate Governance and Managerial challenge -) to meritorious (0.892 for Infrastructure -), with meritorious total KMO of 0.808. In addition, the sample is adequate (Chi-Square = 1164.096, df= 303, Sig. 0.000 < 0.003) at 95% confidence level Bartlett's test of sphericity, suggesting correlations between the variables are significantly away from zero. Moreover, eigenvalue of individual factors are greater than 1.0 {3.201 (financial -) to 7.275 (safety, security and environmental -)}, while total eigenvalue is 6.227 > 1.0.Moreover, explained variances of individual factors range from 11.113% (Safety, Security and Environmental -) to 36.95% (Infrastructural -), while the total explained variance is 83.933%.

These outputs suggest that factor analysis has statistical utility for these 27 items that represent the five-factor challenge of the airlines industry.

Also, Cronbach's alphas for the individual factors surpassed the acceptable Nunnalian threshold of 0.7, with the minimum value recorded on Policy and Regulatory challenge (0.744) and the maximum on Financial challenge (0.832), while total alpha score is 0.801> 0.7. Thus, homogeneity exists in all the families of items which consistently and reasonably explain the variances within the factor structure.

Study 2:

Upon conducting the EFA and ascertaining the factor structure of the challenges of the airlines, we redesigned the instrument based on the retained items and administered it to the aviation workers for the second time. It took us 18 weeks for 203 airline workers to respond to the questionnaire via survey monkey. The responses were exported to the Statistical Package for Social Sciences (IBM SPSS) version 27 to compute descriptive statistics on the factors. We conducted this aspect of the study to determine the sequence of importance of the factors that constitute a challenge to airlines operation in Nigeria. We also conducted further analysis to clarify reliability and validity of the dataset, with the aid of SmartPLS 3.2.9.

Descriptive Statistics

The degree of manifestation of the factors (clusters of challenges) in the industry is measured by their means, while skewness and kurtosis were used as measures of normality of the distribution. Mean values (M) between 1.0 – 2.4.0 signify low level of severity, while 2.5 - 3.4; 3.5 - 4.4; and 4.5 and above signify moderate, high and very high severity, respectively (Asawo, 2009). We followed thresholds of -2 and +2 for skewness (Sk) and kurtosis (Ku) according to recommendation of George and Mallery (2010), and Gravetter and Wallnau (2014).

Table 4 shows the outputs for mean, skewness and kurtosis of the data.

Table 4: Mean, skewness and kurtosis of the data.

Challenge		Min.	Max.	Mean	Std. Deviation	Skewness (S_k)		Kurtosis (K_u)	
	Stat	Stat	Stat	Stat	Stat	Stat.	Std. Error	Stat.	Std. Error
INF	203	2	5	4.62	0.520	1.037	.558	-1.752	1.011
FIN	203	2	5	3.81	0.871	0.993	1.021	1.903	0.439
PR	203	2	5	2.66	0.673	-1.668	0.098	0.879	0.643
CGM	203	2	5	3.08	0.882	-1.003	1.223	1.730	1.052
SSE	203	2	5	2.34	0.575	1.928	0.274	1.884	1.333
Note: INF = Infrastructure; FIN = Financial; PR = Policy and Regulatory; CGM = Corporate Governance and Managerial; SSE =									

Safety, Security and Environmental.

Source: IBM SPSS v27 output, 2020

Table 4 shows that infrastructure challenge manifests very highly in the industry (*M* = 4.62, SD = 0.520), followed by a high manifestation of financial challenge (*M* = 3.81, *SD* = 0.871). Moreover, both Policy and Regulatory challenge (*M* = 2.66, *SD* = 0.673), and Corporate Governance and Managerial challenge (*M* = 3.08, *SD* = 0.882) manifest moderately, while there is a low manifestation of safety, security and environmental challenge (*M* = 2.34, *SD* = 0.575).

This means that the most sever challenge facing airlines in Nigeria is infrastructural challenge, followed by financial challenge, governance and managerial challenge, and policy and regulatory challenge; whereas safety, securiy and security challenge is the least among the five challenges.

Furthermore, security and environmental challenge scored the highest skewness (S_k= 1.928, Std. Error = 0.274), while financial challenge recorded the highest kurtosis (K_u = 1.903, Std. Error = 0.439). Thus, the data set falls within the 2.00 threshold for normality.

4.2: *Validity and Reliability*

We exported the data from the IBM SPSS version 27 to SmartPLS 3 (Ringle, Wende & Becker, 2015) to conduct test on reliability and validity. Moreover, we did not conduct more normality tests because PLS-SEM accommodates ordinal data does not pose much restriction on sample size and data distribution (Esposito Vinzi, Trinchera & Amato, 2010). Results on the item-loadings, item-reliabilities, and the corresponding communalities (Average Variances Extracted) and internal consistencies (Cronbach's alphas) of the clusters of challenges are shown in table 5.

Table 5: Items-reliability, Average Variances Extracted and Cronbach's alphas.

Challenges	Items	Convergent Validity			Internal Consistency Reliability
		Loadings	Indicator Reliability	AVE	Cronbach's Alpha
		>0.70	>0.50	>0.50	0.70-0.90
INFRAS-TRUCTURE	**INF_1:**Standard runway and terminal facilities	0.816	0.666	0.565	0.821
	INF_2: Age and fleets	0.802	0.643		
	INF_3: Technology and Airport Information System	0.736	0.542		
	INF_4: Inadequate number and small fleet sizes of aircrafts	0.723	0.523		
	INF_5: Inadequate provision of power	0.717	0.514		
	INF_6: Lack of perimeter fencing of airports	0.709	0.503		
FINANCIAL	**FIN_1:** High operational cost	0.845	0.714	0.681	0.844
	FIN_2: Charges and taxes to the government	0.811	0.658		
	FIN_3: Scarcity of forex	0.759	0.576		
	FIN_4: Debt burden	0.804	0.646		
	FIN_5: Inadequate funding by government	0.793	0.629		
POLICY AND REGULA-TORY	**PR_1:** Poor implementation of policy.	0.792	0.627	0.610	0.792
	PR_2: Excessive control and interference by supervising ministry	0.840	0.706		
	PR_3: Misalignment between policies and the requirements of the sector.	0.777	0.604		
	PR_4: Lack of harmony between the aviation policy of the country and sub-regional policies	0.710	0.504		
CORPO-RATE GOVERNANCE AND MANAGE-	**CGM_1:** Lack of transparency and accountability.	0.827	0.684	0.584	0.783
	CGM_2: Incompetent management and poor business model	0.708	0.501		
	CGM_3: Inadequate training and personnel development	0.773	0.598		
	CGM_4: Poor Management-labour	0.726	0.527		

RIAL	relationship				
	CGM_5: Absence of competitive reward system	**0.782**	**0.612**		
SAFETY, SECURITY AND ENVIRON-MENTAL	**SSE_1:** Low level of implementation of safety measures	**0.738**	**0.545**		
	SSE_2: Poor emergency response procedures	**0.716**	**0.513**		
	SSE_3: Secure road to airport (robbery, theft, injury and others)	**0.719**	**0.517**		
	SSE_4: Secure airport terminal (robbery, theft, injury and others)	**0.784**	**0.615**	**0.573**	**0.808**
	SSE_5: Coordination among various security agencies at airports	**0.797**	**0.635**		
	SSE_6: Health security due to coronavirus (COVID-19) and other diseases	**0.824**	**0.679**		
	SSE_7: Emission of noise, toxic wastes, and greenhouse gases	**0.711**	**0.506**		

Note: INF = Infrastructure, FIN = Financial, PR = Policy and Regulatory, CGM = Corporate Governance and Managerial, SSE = Safety, Security and Environmental

Source: SmartPLS 3.2.9 output on research data, 2020

Table 5 indicates that all the items representing the five clusters of challenges scored above the 0.7 cut-off (Hair, Hult, Ringle & Sarstedt, 2014), ranging from 0.708 (Incompetent management and poor business model) to 0.845 (High operational cost). This translates to items reliabilities that exceed the acceptable 0.50 threshold (CGM_2 = 0.501 to FIN_1= 0.845). Also, the clusters of challenges score Cronbach's (1951) alpha values above the Nunallian threshold of 0.7 (Corporate Governance and Managerial challenge, $\propto = 0.783$ to Financial challenge,$\propto = 0.844$). Thus, homogeneity exists in all the clusters of items which consistently and reasonably explain the variances within the model.

Construct Validity

We checked data to ascertain if data are free from systematic measurement error. We considered convergent and discriminant validity.

Convergent validity is the degree to which the items under a particular cluster of latent variable measure the latent variable correspondingly both in theory and in practice. Moreover, convergent validity, which has Average Variance Extracted as its statistical measure, is the average of the squared loadings under each cluster of items. An AVE of 0.5 and above satisfies convergent validity (Taylor & Hunter, 2003).

Discriminant (divergent) validity is a quantitative measure of the degree to which a cluster of items differs from other clusters of the same theoretical origin. If a group of items correlates weakly with all other groups from the same theoretical domain, except for the one to which it is theoretically connected to, then it is said to exhibit divergent validity (Gefen & Straub, 2005). Following Wong (2019), we deployed the Heterotrait-Monotrait (HTMT) ratio of correlations to evaluate discriminant validity.

A data set does not have discriminant validity issue if its HTMT value is not above above 0.85 (Franke & Sarstedt, 2019). Furthermore, we conducted a bootstrapping of samples to establish the confidence intervals for HTMT inference. As a rule, discriminant validity problem is absent if the confidence intervals on all construct are less than 1.0 (Henseler et al., 2015). Also, discriminant validity problems not are present if the HTMT values are not higher than their corresponding set confidence level.

In the case of convergent validity, table 5 reveals that all the values for Average Variance Extracted (AVEs) are above 0.5. This means that each cluster of items explains more than 50% of variances in the dataset. Thus, the data does not have convergent validity issue.

Table 6 reveals the Heterotrait-Monotrait ratio (HTMT) of the correlations for the test of discriminant validity.

Table 6: Heterotrait-Monotrait ratio (HTMT) correlations for test of discriminant validity.

Challenges	**INF**	**FIN**	**PR**	**CGM**	**SSE**
INF	1.00				
FIN	0.317 CI [0.294;0.403]	1.00			
PR	0.386 CI [0.330;0.429]	0.383 CI [0.278;0.416]	1.00		
CGM	0.408 CI [0.372;0.511]	0.420 CI [0.394;0.527]	0.442 CI [0.411;0.560]	1.00	
SSE	0.379 CI [0.353;0.403]	0.307 CI [0.268;0.415]	0.372 CI [0.322;0.454]	0.416 CI [0.381;0.528]	1.00

Source: SmartPLS 3.2.9 output on research data, 2020

It could be observed in table 6 that all the $HTMT_{.85}$ values scored by the cluster of challenges are below Kline's (2011) recommended cut-off value of 0.85. In addition, none of the $HTMT_{inference}$ values on 85% normal bootstrap confidence interval, with a Bonferroni adjustment, included the value 1 on any of the constructs (Henseler et.al., 2015). Furthermore, none of the $HTMT_{.85}$ values fell outside its associated confidence interval. Thus, all the five clusters of challenges demonstrate sufficient discriminability.

V. DISCUSSION AND IMPLICATION OF THE STUDY

In identifying and ranking the challenges of airlines operations through the lens of theory of constraints, this study extrapolates the literature on civil aviation management. We contribute to the micro-foundations of operations management, wherein there is paucity of research that empirically investigated the relative weights or sequence of operational challenges of airlines in Sub-Saharan Africa.

In particular, we have scientifically generated a new set of comprehensive, reliable and valid items on employees' perception of the challenges of the airlines, using Nigerian airlines as subjects. We retained 27 parsimonious items, that displayed on a five-factor scale (see tables 3 and 5), which exhibited sufficient psychometric integrity across two field studies (N = 222 and N = 203).

We identified infrastructural, financial, policy and regulatory, corporate governance and managerial, and safety, security and environmental challenges as principal factors that constitute a cog in the wheel of airlines' performance. These empirically identified factors resonate with the anecdotal submissions of mangers and aviation pundits.

Moreover, scholars (e.g. Philip Lawrence, 2009; Pam, 2012; Ogunbodede & Odetunde, 2016; Umoh & Sylva; 2016; Xu & Dioumessy, 2019; Sylva, 2020) have separately submitted that the civil aviation industry of developing countries suffers constraints such as: degraded airport infrastructure, insufficient funding, ambiguous policy, unhealthy government interference and multiple taxes, weak institutional ethics and low managerial and capacity planning skills, poor security and safety norms, noise and gas pollution, and climate change and natural disaster.

For aviation managers and policy makers, this five-factor model of the challenges has pragmatic implication. Considering the need for airlines to continue their operations, even in this era of disruption and turbulence, the empirical identification and ranking of clusters of challenges, as conducted in this study, is auspicious. The findings of this study will give managers and policy makers understanding of the not only the factors that stifle airline operations, but also which challenges should be given the most attentionbased on their relative severity.

The results on convergent and discriminate validity suggest that employees perceive discrepancies among the challenges, even though all the challenges are interrelated. Therefore, researchers can deploy any or a combination of the five challenges (including their component items) independently in future studies.

We found that infrastructural challenge scored the highest mean, followed by financial, corporate governance and managerial, and policy and regulatory challenge, whereas safety, security and environmental challenge scored the lowest mean (see table 4). Thus, managers need to give heed to the finding that the most critical challenge they should address is infrastructural challenge, followed by financial challenge, whereas safety, security and environmental challenge is the least among the five challenges. Also, aviation managers and policy makers ought to understand that the need to pay attention to Policy and Regulatory, and Corporate Governance and Managerial factors despite the moderate mitigating effect they have on airline operations.

5.1: Limitations and Suggestions for Future Research Directions

Although our findings have theoretical and practical utility, they are not immune from certain limitations, therefore opening a window for future research. The organisational inquirer who seeks to interpret reality with laser-beam exactitude can at best do so with some sort of rounding off or approximation.

Firstly, we overly towed the path of objectivism and did not give enough room for subjectivism, whereby we administered survey instrument to the exclusion of rigorous interview sessions and qualitative analysis that would have exposed the full plumage of the challenges. Future studies should adopt methodological pluralism to compensate for the deficiencies of the quantitative approach.

Secondly, based on the much reported predominance of corruption and mismanagement in Nigerian organisation, we expected the Corporate Governance and Managerial challenge (M = 3.08, SD = 0.882) to be very high as infrastructural challenge or, conservatively, as high as financial challenge. Curiously, the dataset revealed that this particular challenge is moderate. It could be that managers and employees of the airlines decided to report what was socially desirable, especially as this factor bordered on transparency, accountability and managerial competence (Fernandes & Randall, 1992; Randall & Fernandes, 1991). Future studies should give more assurance of confidentiality to reduce social desirability effect.

Thirdly, the fact that final 27 items met the requirements for validity and reliability does not mean that other items are not relevant in practice. Moreover, validating items to discover underlying factors is not a startstop process (Gerbing & Anderson, 1988; Robinson & Bennett, 1995). Thus, researchers who are interested in extending the literature on aviation industry should generate more items and retest the five-factor model in other regions or continents.

Finally, because the aim of this study is to discover the factor structure on the challenges of the civil aviation industry, no hypothesis was formulated to investigate how these internal and external factors influence organizational outcomes. Thus, researchers can develop, validate and investigate hypothesized models on the nexus between these five factors (predictor variables) and organizational performance, or other criterion variables, in the aviation industry of other developing countries or regions.

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