

# Effect of Airports Infrastructure Development Projects on the Performance of Aviation Industry in Rwanda - A Case Study of Kigali International Airport

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**Abstract:** *The Government of Rwanda is heavily investing in airport infrastructure development, but there is limited study linking airports infrastructure development to civil Aviation performance. Therefore this study intended to assess the effect of airports infrastructure development projects on civil aviation performance. The general objective of the study was to assess the effect of Airports Infrastructure Development projects on Rwanda's Civil Aviation Performance. Specific objectives of this study were: To assess the effect of airports' terminal building facilities on service delivery. To identify the effect of airside infrastructure on aviation safety. To identify the effect of air traffic control facilities on air traffic management. The target population in this study was 243 RCAA staff and a sample of 30 respondents were selected using purposive sampling technique. Questionnaires were distributed to selected Rwanda Civil Aviation staff at Kigali International Airport to collect primary data. Descriptive and correlation research statistics were used to analyze the data gathered. Findings of the study on respondents' perceptions on airports terminal building and civil aviation performance revealed a strong positive correlation between the airports' terminal building and civil aviation performance ( $r = .69$ ,  $n = 30$ ,  $p < .001$ ). Two variables – airside infrastructure and aviation performance – also indicated a positive correlation value of ( $r = 0.067$ ,  $p\text{-value} < 0.001$ ). This showed that upgrades on airside infrastructure led to improved performance of aviation industry in Rwanda. Consequently, further correlation tests on research question three variables revealed a significant relationship ( $r = 0.360$ ,  $p\text{-value} < 0.001$ ); this revealed that enhancement of air traffic control facilities registered better civil aviation performance. Respondents tended to agree that airports' terminal building facilities installed during the airport upgrade, the status of airside infrastructure and air traffic control facilities affects the performance of Rwanda's civil aviation. During the study, it was noted that there is still congestion at peak hour (the peak hour passenger numbers is 450 yet the terminal upgrade was designed to handle 300 passengers at peak hour. The authority should therefore consider further expansion of the terminal building, the apron and construction of a parallel taxiway so as to further improve on Civil Aviation performance.*

## 1. Background of the Study

As demand for air transportation continues to grow, it will become increasingly difficult to accommodate the resulting traffic levels without significantly expanding airport infrastructure. However, many larger airports are already constrained in their ability to expand, and surrounding communities often strongly resist the construction of additional runways. A growing number of metropolitan areas, therefore, will need to use secondary airports or even construct new airports (Gosling, 2013).

Air transport infrastructure comprises airports, air traffic control (ATC) and the organizations involved in coordinating their provision and use between airlines, their handling agents and commercial concessionaries. They determine how airports ground handling services are provided. To date, Governments and Private Sector have invested in airports infrastructure projects. According to the World Bank, between 2010 and 2014, 132 Airports infrastructure projects were undertaken worldwide. These projects have attracted more than US\$32.8 billion (World Bank, 2014).

The discussion of air transport begins by looking at the capacity, condition, and utilization of airport infrastructure as well as the status of air traffic control (ATC) and navigation aids for commercial air traffic. The effective

overall capacity of an airport is mainly determined by its infrastructure facilities; such facilities may be airside (such as runways and airport parking space), landside (such as terminals) navigation aid and Air traffic control facilities. Airports infrastructure provides nodes in a network of domestic and international air links that is vital for Civil Aviation performance. It includes the physical structures, namely, airports terminal buildings, runways, aprons, taxiways and air traffic control centres, and the organizations involved in coordinating their provision and use. Without airports infrastructure, civil aviation cannot function, and without a well-functioning air transport system and the international linkages it provides, national markets will be smaller and some markets may not even exist, particularly for landlocked, isolated, and low-population-density countries (World Bank, 2005).

While airports infrastructure development plays an important role in terms of generating economic activity, its main role in the increasingly global environment is to facilitate service delivery in the aviation industry. Investment in airports infrastructure enriches countries by introducing new production capacity and jobs. While profits of domestic industry flow back into the economy, thereby furthering growth, foreign direct investment results in transfers of technology and know-how, as well as linkages to the global marketplace. Air transport is vital to tourism,

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which also is a source of enrichment for countries. (Phillip, 2008)

African Airports Infrastructure development is still lagging behind those of the rest of the world. The rapid expansion in Africa's aviation industry is hampered by a number of factors including; inadequate infrastructure development, poor record of safety and security, lack of adequate resources, distance and limited connectivity, lack of regulation and government actions are among the main constraints the industry is facing. These constraints add to competition and high operating costs resulting from surging oil prices. Addressing these challenges could significantly unlock the industry's potential for future growth (Ken, 2011).

A landlocked country, Rwanda faces various limitations in connecting the country to the rest of the world. Over the last decade, air transport has become a reliable solution as a mean to connect the country to the outside world. Acknowledging the large potential of air transport users, the government of Rwanda is trying to accommodate the air transport growth by rebuilding its Airports Infrastructure. Currently, the government is trying to build a new airport and renovate the exiting major airports so as to increase their capacity (RCAA, 2012).

The quality of air transport infrastructure is a key determinant of performance in the Aviation sector and development of air transport infrastructure supports Rwanda's economic growth. The Government of Rwanda spends each year a considerable amount of money to build, maintain and improve its air transport infrastructure in response to the growing number of passenger and freight mobility. This has greatly improved trade and commerce for a land locked country like Rwanda (Lufthansa, 2013).

In 2014, RCAA employed more than 300 staff, more than 600,000 passengers were transported in and out of the country and more than 700 metric tonnes of Cargo were transported by air in the same year. This in turn generated 16 billion Rwandan Francs in revenues. The Airport's major infrastructure includes a passenger terminal, a cargo terminal, a 3.5km runway, an apron with 22 parking stands. The airport's passenger terminal capacity is 600 passengers at peak hour (RCAA, 2014)

The historical air transportation of Rwanda started during the colonial era, established in 1934, Kigali International Airport, formally known as Grigoire, Kayibanda started as a small Aerodrome with a 900 meters runway, without a terminal building. The runway was later expanded to 1200 meters and in 1945, the first fixed wing aircraft a DC3 landed at the airport. In the subsequent years from 1967 – 1979, there was significant investment in the airport including father expansion of the runway to 3500m, installation of communication equipment like VOR/DME and in 1980 the existing passenger terminal was commissioned enabling the airport to handle wide body aircrafts like B747 and DC10 (ICAO, 2004).

In replacement of the Rwanda Airport Authority established in 1986, Civil Aviation Authority (CAA) was created by law

no 21/2004 of 10/08/2004 to take on the management, operation and maintenance of airport infrastructure. The Act was later revised in 2006 by law no. 44/2006 of 05/10/2006 forming Rwanda Civil Aviation Authority (RCAA). Its headquarters are situated in the city of Kigali, capital of the Republic of Rwanda and is managed in compliance with laws relating to public service. Rwanda is a signatory to the Chicago Convention of 7 December 1944 on International Civil Aviation Organization (ICAO). The Rwanda Civil Aviation's vision is to "Be a world class Civil Aviation Authority in safety, security and the provision of quality services." and its mission is to "Develop an efficient, safe and secure Civil Aviation industry in Rwanda." (RCAA, 2015).

## 2. Statement of the Problem

Effective performance of aviation industry is mainly determined by its Airports infrastructure facilities; such facilities include runways, taxiways, apron, passenger terminals, navigation aid and air traffic control facilities. (Ken, 2011)

Majority of airports in Africa are undergoing expansion in a bid to cater for rapidly growing passenger and cargo traffic volumes. Booming tourism and renewed interest in investing in Africa by foreign companies has left many countries struggling to boost the capacity of their airports. For instance, between 2011 and 2012 business activities at African airports rose from 45% to 80%. This trajectory has largely been attributed to the growth of the continents GDP of 6.1% contrary to the global estimation of 5.8%. (AfDB, 2014)

The World Bank recommends that African airports should restructure to facilitate commerce and tourism within and out of the continent, fostering sustainable development. However, there are a number of challenges facing governments and airport authorities as they seek to enhance Civil Aviation Performance. (World Bank 2015)

In 2014, the African Development Bank (AfDB) identified lack of passenger capacity volumes in Africa, high transportation costs, safety, constrained capacity and slow privatization as among issues affecting growth of the aviation industry. (AfDB, 2014)

According to Rwanda Civil Aviation Authority, In 2007 Kigali International Airport recorded 15 aircraft incidences; the terminal capacity 150 passengers at peak hour, with bottle necks in passenger processes. The apron configuration (Norse-in system) limited its capacity thus causing constant aircraft holding. (RCAA 2008) In effect, between 2009 - 2013, RCAA invested more than USD 40 million annually in infrastructure development projects aimed at upgrading Kigali International Airport. Such projects included Apron upgrade from nose-in to nose-out parking system, runway resurfacing, upgrade of its radar system, installation of an automated weather observing system and upgrade of the terminal building. (RCAA, 2014)

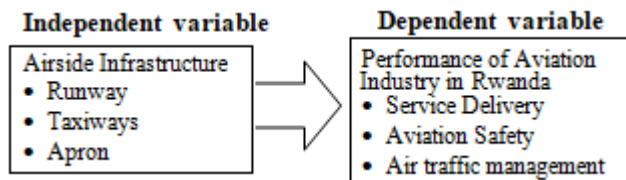
However, there is no research relating airports infrastructure development projects to civil aviation performance. This

research therefore, intended to assess the effect of airports infrastructure development projects on the performance of Rwanda's Aviation Industry.

### 3. Objective of the Study

To assess the effect of airside infrastructure on the performance of Aviation Industry in Rwanda.

### 4. Conceptual Framework



#### Research Design

The study employed a case study research design. In the case study, the researcher had time to understand problem or area of study in preliminary way and relate the variables of the study. This approach relied on direct research of a limited number of respondents of what is to be studied. Quantitative and Qualitative research methods were used to assess the impact of Airports Infrastructure Development on Rwanda's Civil Aviation Performance.

In this study the researcher applied both the quantitative and qualitative methods to obtain the data sought. This method was used to determine the number of people who participated in the study giving out their views depending on the level they understand the subject matter under study. Qualitative method helped the researcher to draw their attitude and perception of tax payment in Rwanda.

#### Population of the Study

The population has been defined by Grinnell (1990) as the totality of persons or objects with which a study is concerned. According to Bryman (2001), population is a

universe and defined it as a sum total of all units of analysis. Babbien (2001), also defined the target population as "the entire aggregation of respondents that meet the designated set of criteria". The target population of this study was 242 staff of Rwanda Civil Aviation, (RCAA).

#### Sampling technique

According to Christensen (1991) a sample is a subset of the population being studied. It represents the larger population and is used to draw inferences about that population. It is a research technique widely used in the social sciences as a way to gather information about a population without having to measure the entire population. The types of techniques that was used for this study is Purposive sampling technique. A sample of 30 respondents were selected purposively as follows 5 Unit Directors, 4 Inspectors and 21 heads of departments.

#### Data collection instruments

To assess the impact of airports infrastructure development on Rwanda's Civil Aviation Performance a combination of both secondary and primary data were used in the study. Primary data was collected through structured questionnaires to obtain data on every research question of the study. The questions were divided into two parts. The first part sought to assess the profile of respondents; the second part sought information on research questions.

### 5. Research Findings and Discussion

Effect of Airside Infrastructure on the Performance Aviation Industry in Rwanda, the third research question of the study was to assess the effect of airside infrastructure on Civil Aviation performance in terms of safety. The research focused on key infrastructure projects that were undertaken during the years under study. Such infrastructure includes runway, construction airside intervention roads, taxiway and apron. Findings on this research question are detailed in the table below.

**Table 1:** Perception on the effect of airside infrastructure on Civil Aviation performance

Statements	Strongly disagree		Disagree		Neutral		Agree		Strongly Agree		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
The status of runway contributes to the runway incidents and accidents.	0	-	0	-	0	-	7	23.3	23	76.7	30	100.0
Airside intervention roads affect search and rescue operations in case of an accident.	0	-	0	-	3	10.0	8	26.7	19	63.3	30	100.0
The single taxiway configuration at KIA affect aircraft handling during landing and take-off.	0	-	6	20.0	2	6.7	7	23.3	15	50.0	30	100.0
The Apron parking system at KIA affect the safety of aircrafts during ground handling operations.	1	3.3	4	13.3	0	-	12	40.0	13	43.3	30	100.0

The Table1, above shows that 76.7% of the respondents strongly agree and 23.3% agreed that the status of the runway prior to its upgrade contributed to incidents and accidents. Furthermore, 63.3% of the respondents strongly agreed that airside intervention roads affects search and rescue operations in case of an accident, 26.7 respondents agreed to the statement and 10% were neutral. Regarding the effect of the single taxiway configuration on aircraft handling during landing and takeoff, 50% respondents

strongly agreed to the statement, 23.3 agreed whereas 6.7% were neutral and 20% disagreed to the statement. In response to the effect of apron parking system on aircraft safety during ground handling, 43.3% strongly agreed, 40% agreed, 13.3% disagreed and 3.3% strongly disagreed.

**Rate of incidents and accidents at KIAA per 1000 aircraft movement**

In view of the major airside upgrade projects carried out at the airport, this information sought to find out if the rate of accidents and incidents have reduced at the airport during the period under review in this study. Results on the subject matter are indicated in the table below.

**Table 2:** Respondents' perception on whether the rates of incidents and accidents have reduced since 2009

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	27	90	90	90
	No	3	10	10	100
	Total	30	100	100	

Source: Primary data, 2018

Results from the Table 2, above indicated that 90% respondents confirmed that the rate of accidents and incidents per 1000 aircraft movement at the airport have reduced since 2009 and 10% disagree. This therefore confirms that the airfield infrastructure upgrade projects have contributed to the reduction in accidents and incidents at the airport.

**Rwanda's safety compliance level to ICAO standards and recommended practices**

This information sought to find out if Rwanda's compliance level to ICAO standards and recommended practices is above the minimum 60% compliance level recommended by the Abuja declaration as a result of the infrastructure upgrade projects. Results of the study are indicated in the table below.

**Table 3:** Rwanda's safety compliance to ICAO standards and recommended practices

		Frequency	Percent
Valid	Above 60% (minimum recommendation of the Abuja Declaration)	26	86.7
	Not sure	4	13.3
	Total	30	100

Source: Primary data, 2018

According to Table 3, above, 86.7% respondents confirmed that Rwanda's compliance to ICAO standards and recommended practice is above the minimum 60% compliance level recommended by the Abuja declaration as a result of the infrastructure upgrade projects. On the other hand, 13.3% respondents were not sure if the level has been achieved.

**Reliability of weather data generated by the Weather Observing System at KIA**

One of the projects undertaken during the period under review was automation of weather observing system at KIA. This information therefore sought to find out the reliability of the weather data generated by the automated weather observing system. Findings in this regard are detailed in the table 4. below.

**Table 4:** Reliability of weather data generated by the Weather Observing System installed at KIA

		Frequency	Percent
Valid	Very accurate	14	46.7
	Moderately accurate	9	30
	Sometimes non-operational	7	23.3
	Total	30	100

Source: Primary data, 2018

Findings in the table above indicated that 46.7% respondents believed that the automated weather observing system is very accurate. While 30% believed that the system is moderately accurate and 23.3% confirmed that the system at times is non-operational.

**6. Conclusion**

This study dealt with respondents whose profiles comprised a bigger number of middle managers, with majority of them having an educational qualification of first degree, most of which having five to ten years of working experience. This study assessed the effect of airports infrastructure development projects on Rwanda's Civil Aviation performance. Findings revealed that:

Respondents also tended to agree that the status of airside infrastructure affects aviation safety. Some of the airside infrastructure development projects respondents agreed that have affected aviation safety includes the runway re-surfacing, airside intervention roads that have improved search and rescue coordination in case of an accident and changing the apron parking system from Norse-in to Norse-out.

**7. Recommendations**

Based on limitations in terms of airside infrastructure, size of the terminal building and air traffic control facilities that still hinder Civil Aviation performance, following are the recommendation for improving Civil Aviation Performance:

- The Rwanda Civil Aviation Authority (RCAA) should consider construction of a parallel taxiway to ease traffic movement during landing and takeoff.
- The Air Traffic Control tower should be separated from the presidential terminal so as to improve on safety and security.
- The authority (RCAA) should also consider construction of Runway End Safety Areas (RESAs) so as to minimize damage on aircraft and casualties in case of missed landing.
- During the study, it was noted that there is still congestion at peak hour (the peak hour passenger numbers is 450 yet the terminal upgrade was designed to handle 300 passengers at peak hour. The authority should therefore consider further expansion at arrival and departure areas.

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