

# Erbil International Airport a New Competent in Middle East Hub Market

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*Abstract— in this paper a methodology to analyze the competitive location of Erbil International Airport (EIA) is proposed to be a Hub Airport in the Middle East Hub Market due to the lake of studies in this area. For this study, Dubai International Airport is selected to be compared with EIA from the perspective of location. A web-based application is designed to evaluate EIA's location to connect a set of Airports that have been selected from the worldwide Airports by special GIS tools. EIA can appear in the Middle East (ME) Hub Market as a strong competitor Hub Airport according to its strategic location, which is approved in this paper by creating a model, based on related scientific standards.*

**Keywords-** Competitive location; Hub Airport; Spoke Airport; Hub Market; transit flights.

## I. INTRODUCTION

For any state, Hub Airports have a significant influence on the global economy. For a government like Kurdistan Regional Government (KRG), which is in the process of getting its independency, busy Airport means attraction of international people and companies, which can help to develop KRG infrastructure in its new appearance. Furthermore, dealing with more internationals, lead to good relations with other countries around the world; help to find new working fields and job opportunities for our people by dealing with experienced people with long career history. For incoming travelers, the Airport contributes to their first impression of a city or country [1].

KRG controls its ground, but until now Kurdistan Air space is controlled by Iraqi government. Erbil International Airport (EIA) must follow all rules and regulations; Aeronautical Information Publication (AIP) of Iraqi Government. The AIP of Iraq is published by the Iraqi Civil Aviation Authority (ICAA) [2]. Kurdistan needs two initial steps. On one hand, KRG has no air transport organizations that registered in ICAO<sup>1</sup>. For instance, Iraq has ICAA. On the other hand,

despite the importance of aviation for our region according to its location between the east and the west there are no aviation faculties or even related departments in all the universities of Kurdistan.

There are two Airports in Kurdistan, EIA and Sulaimani Airport. KRG chose EIA to be the major Airport in the area because of its geographical nature and location.

EIA is about 10 KM far from Erbil city center, has a wide area to be expanded easily, a trained staff who have been successfully handling the operations of the Airport since its official opening in 2005, and it is 24/7 operation.

This is the first research about EIA that shows the strategic location of EIA and supports KRG to make better decision for the future of the Aviation in Kurdistan.

The rest of the paper is organized as follows; the background of the subject is presented in section (II). In section (III), the key idea as a proposal model is provided. The study analysis is detailed in Section (IV). The conclusion is deduced in section (V). Finally, the most significant suggestions and recommendations are given in section (VI).

## II. BACKGROUND

While this is the first published paper written about Kurdistan's Aviation in general and EIA especially, the need for presenting a background over the subject are arises:

### A. Erbil International Airport

After the freedom of Iraq, KRG decided to build its own gateway to the world in Erbil. By December 2003 the first regular service by Kurdistan Airlines had landed. At the same time, the work to modernize and improve the Airport technically continued, and on May 26, 2005, the Airport received its ICAO code ORER. On 3rd March 2010, the new Airport is opened; it is located close to Erbil city center. The new Airport has one of the world's longest runways 4,800 Meters long can handle all types of Aircrafts, 6 Aero-bridges, 20 Check-in counter, and special hall for transit flights[3]. Until now, the Airport has not been utilized for transit flights. After five successful years of working, the time has come for making studies & researches about how to upgrade the new Erbil International Airport. Figure 1 illustrates the continuous growth rate of passengers in EIA.

<sup>1</sup> The International Civil Aviation Organization (ICAO) is a UN specialized agency, established by States in 1944 to manage the administration and governance of the Convention on International Civil Aviation (Chicago Convention).

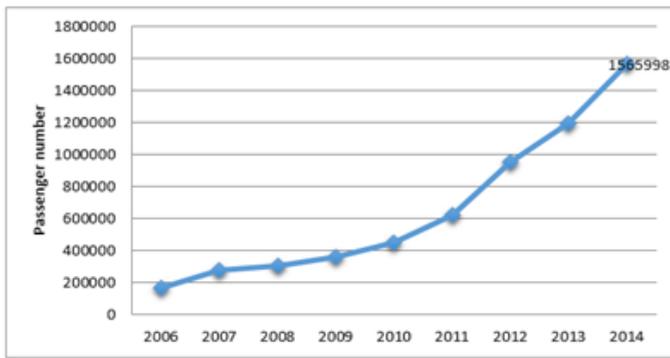


Fig. 1. Erbil International Airport annual passengers number.

### B. Direct and hub connectivity

Direct and transit is two types of flights between Airport A and Airport B that can be offered by Airlines depending on a number of factors. First, the size of the market is important. If the size of A and B markets larger than specific thresholders, an Airline can decide direct flight. Otherwise, the Airline decides transit flight via a Hub Airport [2]. Figure 2 shows Direct and Hub connectivity.

### C. Hub Market

It is common practice in competition law to leave the market definition open to a certain extent if it is not crucial for the outcome of the economic assessment [5]. Here, the word “market” is mentioned in two cases. The first one; Hub market to mention Hub airports competition to connect worldwide Airports. The second one; sub market to mention Hub airports competition to connect two regions, for instance Asia and Africa.

### D. The impact of Airport location to be a Hub Airport:

In general, one of the most crucial aspects for an Airport to be a Hub is its location in Hub-Spoke structure. The location depends on the distance between the candidate Hub Airport and the Spokes that need to be connected. The distance has an influence on some factors such as fuel and time. Economic is the base of Airlines working; less distance using a Hub Airport comparing with others means less fuel and time needed for connecting each couple of Spoke Airports [9].

### E. Why this study

Many experts in Aviation believe that EIA has enough factors to be a Hub Airport. This paper will evaluate and examine EIA’s location to be a Hub Airport in the ME to connect worldwide Airports.

## III. PROPOSED MODEL

In this section, the methodology of the study is explained. Starting from the system components, the selection of Spokes and Hub Airports in the Hub Spoke structure, and finally three levels of connectivity; Airport level, Regions level, worldwide level connectivity:

### A. System components

A 3-tier web based application is designed for data processing. Visual Studio 2010, MS SQL server 2008 r2, Internet Information Services (IIS) version 7, C#, ASP.NET,

Java script, and arc map V10.2.2 2014 are used for developing the proposed web based application.

The system can be accessed using two classes of users; admin user who can update data, and normal authorized user who can navigate through four web pages. The first page is a list of all Airports, Regions, and other details. The second page evaluates individual airport-pair connectivity; it deals with four dropdown lists to select source region, source Spoke Airport, destination region, and destination Spoke Airports. The third page evaluates individual region-pair connectivity using EIA compared with Dubai International Airport (DIA). The last compares EIA with DIA to connect all worldwide Airports. Figure 3 shows proposed web based application architecture.

### B. Competitor Hub Selection

For evaluating EIA location, DIA is selected to be compared with EIA because the second is located in ME and is one of the 10 top Hub Airports around the world [4]. The competitive position of Airports and airlines is usually measured in terms of ‘top ten’ lists [2].

### C. Spoke Airports selection

The Central Feature tool in Arc map 10.2.2 application <sup>2</sup> is used to select best Spoke Airports around the world in each region depending on location of the airports to be connected by EIA and DIA as a Hub Airports in Hub Spoke network. Figure 4 and 5 show EIA and DIA as Hub Airports to connect worldwide Airports. Above tool used to select central Airport per sex regions. Then each region divided to four parts (0-90), (90-180), (180-270), and (270-360) using the central Airport as the center point to the partition. For each single part the central Airport selected by central feature tool.

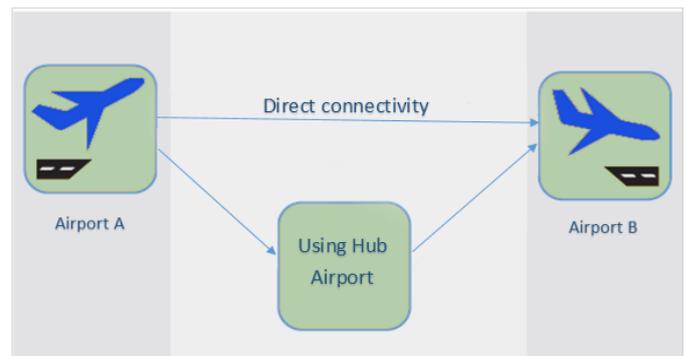


Fig. 2. Direct and Hub connectivity

### D. Airports level connectivity

Figure 6 illustrates Hub Airports competition in Airport-pair level connectivity. The connection of each individual Airport-pair requires calculating the distance between the two Spoke Airports two times, firstly using EIA as a Hub by implementing equation no (1). Secondly using DIA as a Hub by implementing equation no (2). As a result, equation, no (3) is used to calculate the difference between the distances of the results of equations no (1) & (2) [10]:

<sup>2</sup> ArcMap is the main component of Esri's ArcGIS suite of geospatial processing programs, and is used primarily to view, edit, create, and analyze geospatial data.

$$\text{Dis (EIA)} = \text{Dis (A} \rightarrow \text{EIA)} + \text{Dis (B} \rightarrow \text{EIA)} \quad (1)$$

$$\text{Dis (DIA)} = \text{Dis (A} \rightarrow \text{DIA)} + \text{Dis (B} \rightarrow \text{DIA)} \quad (2)$$

$$\Delta \text{ Dis} = \text{Dis (EIA)} - \text{Dis (DIA)} \quad (3)$$

Where Dis (EIA) is the distance between each 2 Airports when EIA is used as a Hub Airport, and Dis (DIA) when DIA is used as a Hub, Dis (A → EIA) is the distance between Airport A and EIA, Dis (B → EIA) Airport B and EIA, Dis (A → DIA) Airport A to DIA, Dis (B → DIA) Airport B to DIA, and Δ Dis is the different between Dis (EIA) and Dis (DIA).

$$\text{RDis (DIA)} = \left( \sum_{n=1}^m \text{Dis (Airport (n)} \rightarrow \text{DBX)} \right) / m \quad (4)$$

$$\text{RDis (EIA)} = \left( \sum_{n=1}^m \text{Dis (Airport (n)} \rightarrow \text{EBL)} \right) / m \quad (5)$$

$$\Delta \text{ RDis} = \text{RDis (DIA)} - \text{RDis (EIA)} \quad (6)$$

Where RDis (DIA) is the average distance between a region and DIA, RDis (EIA) is the average distance between each region and EIA, Dis (Airport (n) → EBL) and Dis (Airport (n) → DBX) are the distance between each single Airport within a region with EIA and DIA. Δ RDis is the different between EIA and DIA distances, and m is the number of Airports within a region.

F. Worldwide level connectivity:

The last distance evaluation for best Hub Airport is in the level of worldwide Airports. The average distance for connecting all the Airports around the world is calculated for each Hub Airport according to equations (4), (5), and (6) by calculating all the selected worldwide Airports instead of Regions level calculation.

IV. RESULTS:

From the view of location, the web based application that developed to evaluate the location of EIA compared with DIA showed three levels of connectivity; Airport-pairs, region-pairs, and all the worldwide Airports. First, individual Airport-pairs can be checked by selecting each two Airports and evaluate the best Hub Airport to connect them. Second, for individual region-pairs, there are 15 sub Markets. EIA has better location than DIA to connect 11 of them as a Hub Airport, while for the other four sub Markets DIA is better than EIA. Table I shows best Hub in region-pairs connectivity investigation.

TABLE I. BEST HUB IN REGIONS LEVEL CONNECTIVITY

ID	Sub Market investigation in terms of Kilo Meters			
	Sub Market	Dis EIA	Dis DIA	Best Hub
1	N America & Africa	15433	17459	EIA
2	N America & Europe	13971	17149	EIA
3	N America & Australia	23904	23984	EIA
4	N America & S America	23042	25518	EIA
5	N America & Asia	15325	16016	EIA
6	Africa & Europe	7562	9620	EIA
7	Africa & Australia	17495	16455	DIA
8	Africa & S America	16633	17989	EIA
9	Africa & Asia	8916	8487	DIA
10	Europe & Australia	16033	16145	EIA
11	Europe & S America	15171	17679	EIA
12	Europe & Asia	7454	8177	EIA
13	Australia & S America	25104	24514	DIA
14	Australia & Asia	17387	15012	DIA
15	S America & Asia	16525	16546	EIA

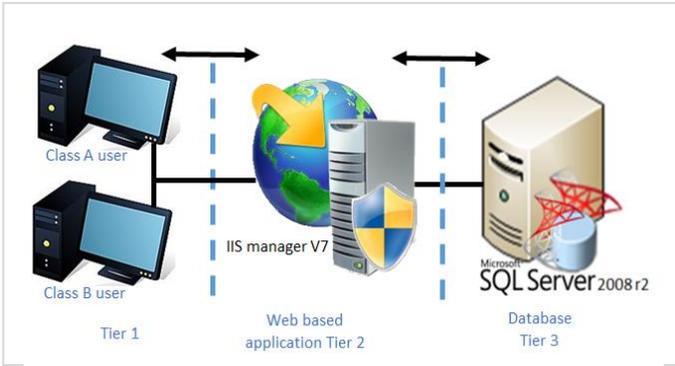


Fig. 3. Proposed web based application architecture (three tiers)

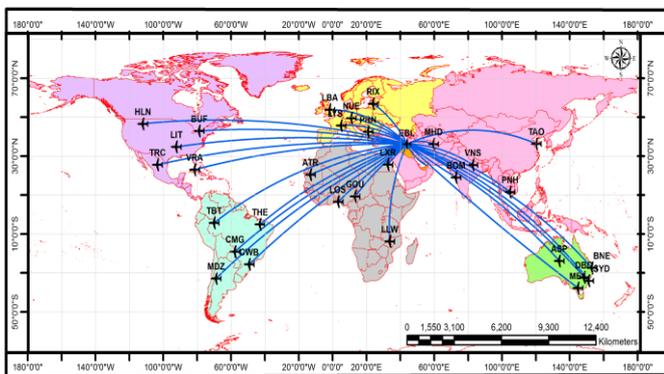


Fig. 4. Erbil International Airport connects the worldwide Airports

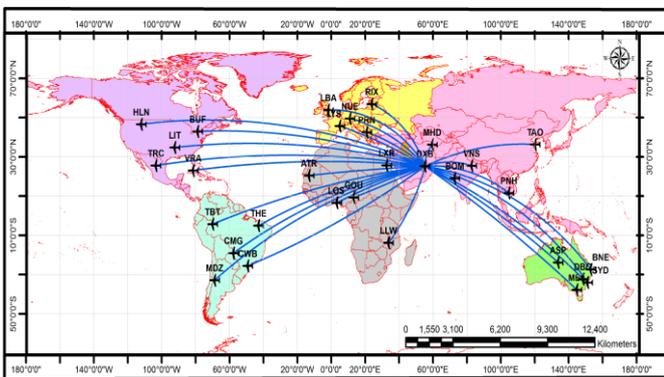


Fig. 5. Dubai International Airport connects the worldwide airports

E. Regions level connectivity:

The average distance between each regions-pair via both Hub Airports are calculated using the following equations [10]:

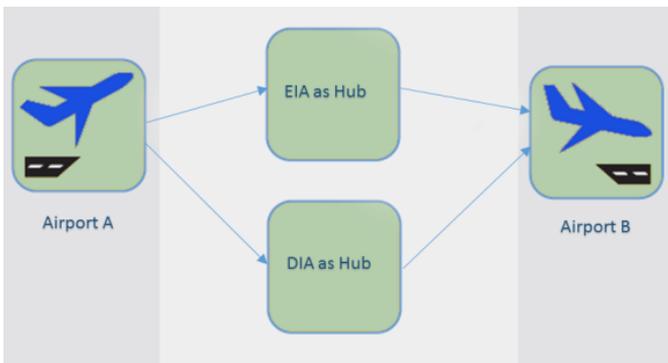


Fig. 6. Airports-pair level connectivity

Last but not least, as average distance of all the selected Airports around the world to be connected via EIA is 7998 KM, while to be connected via DIA is 8358 KM. This level of connectivity could be used to attract big Airlines that have too many distributed destinations around the world in all the regions. Figure 7 shows average distance to connect all the Airports around the world by both competitor Airports.

Consequently, EIA exceeds DIA to connect the worldwide Airports. For example, the distance between Africa and Europe using DIA as a Hub 9620 KM is much greater than using EIA 7562 KM; in average each single transit flight between Africa and Europe via EIA 2058 KM will be earned compared with DIA. On the other hand, the distance between Africa and Asia via EIA is 8916 KM and via DIA is 8487 KM, in this case by using EIA more 429 KM than DIA are needed for each single transit flight between Africa and Asia, but EIA is better option than DIA in 11 of 15 sub Hub Markets, therefore EIA is the best option to connect all the worldwide Spoke Airports. Starting transit flights will help the Airport economy to be enhanced and then expand the Airport to appear as a strong competent in the ME Hub Market.

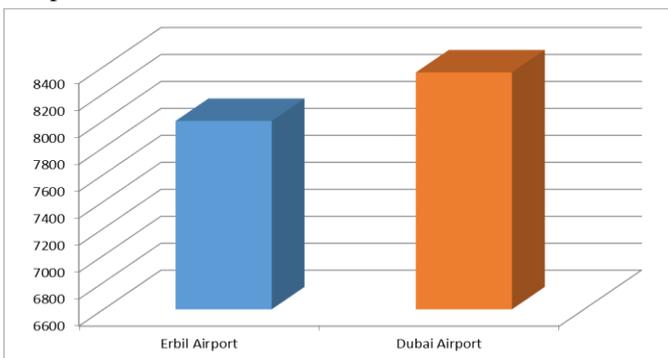


Fig. 7. Worldwide Airports level connectivity

## V. CONCLUSION

A model to analyze the competitive position of EIA in ME Hub Market was designed. DIA Airport selected to be compared with EIA, because of its classification under top 10 Hub Airports around the world. The proposed model consisted of 3 levels of connectivity as follow:

The first level; Airport-pair connectivity. The user can investigate better Hub Airport to connect each couple of Spoke Airports and the system provides adequate information. For

example, to connect Queen Alia International Airport (ME/Jordan) with Ottawa International Airport (America/Canada) via EIA needs 10032 KM, via DIA needs 12780 KM.

The second level; Region-pair connectivity, the system can automatically analyses full connection among all the regions in term of couples. Connecting the world is divided into 15 sub Markets, EIA location is better than DIA for connecting 11 out of 15 sub Markets, for instance Asia and Europe.

The last level; EIA can connect the worldwide Airports with 360 KM less than DIA per each single flight.

It is also clear that the competitive environment is not the same in all markets and for all Airports. This has important implications for policy-makers and regulators.

In addition, Passengers are now better informed than ever, as the internet has made searching for travel and accommodation and comparing between options easier than ever. Approving EIA's competitive location is significant to attract Airlines, then passengers are automatically attracted by low ticket prices using EIA as a Hub.

## VI. SUGGESTIONS AND RECOMMENDATIONS

KRG could find out new directions for its economic. Hub Airport has a good influence on economy, for example, DIA contributes over 26.7 billion USD to the economy and 21% of the employment in Dubai as declared in there official website. For the above reason the authors suggest the following:

- KRG should decide to upgrade EIA to a Hub Airport with strong plan to attract Airlines and Passengers.
- The most important step is to build academic staff for the future of the Airport by opening Aviation and Air Transport Institutes and colleges in Kurdistan universities.

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