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Appraisal of economic impact diversification by a new airport development

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Abstract

In most of the cases the decision to invest in a new airport is not simple, mainly, because the complications in planning process, the amount of capital need to invest before the business establishment and the high number of stakeholders involved in decision process. The decision process is more complicated in restricted economic conditions and financing assumptions, where the project business plan performance is strongly related to regional development prospects and future airport business outputs in medium-long time horizon. This paper provides the evaluation methodology approach into a context to support decisions towards airport development projects. The proposed methodology provides an evaluation framework based on a combination of an ex ante assessment analysis taking into consideration the airport economic impact and its contribution to regional economy. The Input Output analysis framework is used to determine the economic footprint of the airport development and a series of key performance indicators is introduced to review the project performance in a given economic system. The case study focused on new airport in Heraklion of Crete (at Kasteli valley), which is one of the most attractive tourist destinations in south-east Mediterranean. Conventional wisdom is to present a systematic approach appropriate to apply is relevant projects, providing the essential tool to support decisions at level of strategic planning.

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Keywords: Airport economic impact, airport development assessment, quantitative evaluation, infrastructure investment apparaisal.

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1. Introduction

Nomenclature

OECD	Organization Economic Cooperation and Development
IMF	International Momentary Fund
EU	European Union of 28 states
TRB	Transportation Research Board
ACI	Airport Council International
IATA	International Air Transport Association
FAA	Federal Aviation Administration
E-C	Euro-Control: European Air Traffic Agency
HCAA	Hellenic Civil Aviation Authority
HER	IATA Code for Heraklion airport
LCC	Low Cost Carrier
FTE	Full Time Equivalent jobs
CBA	Cost Benefit Analysis
IO	Input Output analysis
KPI	Key Performance Indicator
GDP	Gross Domestic Product
CAGR	Compound Annual Growth Rate
EUR	European Union Currency

Despite economic uncertainty and aviation business volatility, air transport shows signs of growing trends. According to IATA's latest 20-Year Air Passenger Forecast Report (IATA, 2018), 7.8 billion passengers are expected to travel in 2036, a near doubling of the 4 billion air travelers expected to fly 2018. The prediction is based on a 3.6% average CAGR. In Europe, according to Euro control latest report (E-C, 2018), by 2040 there will be 16.2 million flights, 53% more flights than in 2017.

This continuing trend of air traffic growth has, however, not been respond by an adequate expansion of air transport infrastructure, and the aviation industry is facing the challenge of dealing with a range of congestion problems (Santos et al., 2015). One of the aims of the challenges is to focus on the scale of future needs is aviation is to meet demand. The response to the capacity gap faced involves a broad range of actors such as airlines, airport operation authorities, stakeholders, decision makers.

Air transport infrastructure provides the capacity to support the domestic and international route networks that are vital for the growth of air transport. Without adequate infrastructures, the air transport system cannot be efficient in terms of wellbeing and meet the social and economic goals. This has been identified as a high risk especially for isolated and low-population-density regions where economic stability and growth heavily depended by aviation development (Dimitriou, 2017).

The development of air transport infrastructure to meet future demand needs is on the top of the agenda for governments, airport authorities and regional development regulators. This is due to the recognition that airport and air transport development has a vital role in contributing to wider socioeconomic development principles and is a key driver for new income generation and business growth (Dimitriou, 2018). This is especially more crucial for economies based on tourist sector (Dimitriou and Sartzetaki, 2018; Lu, 2011). Consequently, there is a risk that a significant share of the predicted growth in air transport demand will be left unaddressed if existing airports do not expand and/or new airports are not built to meet this demand (Hoti et al., 2007). In these regions, aviation business risks that affect airport planning and project financing lead to difficulties to support decisions for increase of capacity (Dimitriou et al., 2017). The key challenge is that the complexities of current financing schemes and the uncertainty in economy mean that decision making for investments in new infrastructure projects such as airports, has to be made within a complicated, and high risk economic framework in terms of project financing conditions and regional economy risks (Dimitriou, 2018).

Decision makers have recognised the contribution of air transport investment to the economy (Dimitriou et al., 2017; Vickerman, 2008; Santos et al., 2014). Governments and authorities therefore rightly acknowledge the benefit of investments in transport infrastructure projects in order to achieve socioeconomic goals. In principal, the stakeholders of all functions of transport, economic, social and environmental system involved in decision process consider different perspectives. In terms of diversity of the decision maker's expectations, this may lead to conflicts in planning and implementation of strategic plans, making authorities and different stakeholders defense to increase capacity (Dimitriou, 2016).

This paper focuses on an evaluation framework that provides a step up and down methodology, which in two stages makes use of a combination of assessment and evaluation methodologies. The proposed methodology provides an evaluation framework based on a combination of an ex ante assessment analysis taking into consideration the airport economic impact and its contribution to regional

economy, to estimate the economic contribution and the diversity of economic impact to regional economy on one hand; and a series of key performance indicators introduced to review the efficiency decisions to implement a project in terms of timing and economy efficiency on the other. This approach is essential to provide key messages to national governments, decision makers and aviation authorities regarding the contribution of an airport investment towards regional development. The case study adopted to illustrate the application of this methodology is a new regional airport with high seasonal traffic characteristics on the island of Crete in Greece, one of the most attractive tourist destinations in South-east Mediterranean.

The paper is organised as follows: Following from this introduction, the key literature sources and concept analysis are presented, along with a description of the methodology assessment framework. The case study is considered in the next section with the application of the framework. This results in a comprehensive assessment through the incorporation of the appropriate KPIs. The paper finally outlines the conclusions and references.

2. Literature review and Concept analysis

There is a wide range of empirical results and *ex* post assessments in the literature highlight the importance of transport infrastructure projects economic impact towards regional development (Dimitriou 2018, Miller et al., 2015; Mackie et al., 2014; Kiel et al., 2014). Crescenzi et al., (2012) highlight the fact that transport infrastructure has represented one of the milestones that lead to development and cohesion in the European Union (EU) and examined the contribution of transport infrastructure investments on regional economic growth in the EU between the period 1990 and 2004. The results of a panel data regression analysis indicate very high returns of infrastructure investments on economic growth, highlighting key issues about the opportunity costs of more transport infrastructure investments across most of Western Europe nations.

Investment decisions in transport infrastructures are made under uncertainty over future impacts. Ex-ante appraisal of the effectiveness of transport infrastructure projects minimizes this uncertainty and plays a crucial role in any case for decision making and selecting transport infrastructure projects for funding. Kelly et al., 2015 analyzed the impact of 10 large transport projects located in eight different countries that are financed from EU Cohesion mechanisms and found that there is a clear need to improve the quality and consistency of ex ante analysis especially in the fields of capital cost estimation, travel demand modelling and risk analysis. Additionally they identified many limitations in the decision making analytical methods, such as cost benefit analysis and multi-criteria analysis.

Transport project ex-ante evaluations identify that limitations for such projects include the fact that they are capital intensive and require long preparation periods; have very long pay-back periods during which risks (un)intentionally from the evaluation may arise and/or market trends may alter. Cost Benefit Analysis (CBA) is an analytical method that is used frequently in ex-ante analysis and is applied to investments in transport infrastructures in order to provide a tool to decision makers before going on a decision (Dimitriou et al., 2015, Elliason et al., 2012; Rus et al., 2004). Mackie et al. (2014) present the role and use of CBA in transport planning process, based on a survey of a number of case studies where CBA plays an important role in decision making, and consider whether CBA appraisal results actually influence decisions or have many limitations.

TRB, (2008) identifies that the quantification benefits as part of the CBA methods for air transport infrastructures impact are calculated through economic impact analysis. Economic impact analyses usually employs two methods for determining economic impacts (Dimitriou, 2018). The first is input-output (I/O) analysis. IO models are based on inter-industry data to determine how effects in one industry will impact other industries (Santos et al., 2015). Based on this concept, multipliers are calculated and used to estimate economic impact caused by a change in final demand. IO models estimate the structural changes in the economy, in terms of linkages between economic sectors when an exogenous change such a new project takes place (Zeng, 2010, Reis et al., 2009). The most common use of IO model is to evaluate the impact of exogenous changes in the external components on the interdependent components and on primary inputs (Correa et al., 2001). Another method used for economic impact analyses is based on economic simulation models. These are more complex econometric and General Equilibrium Models (CGE). They are based on the concept of IO analysis, and in addition they forecast the impacts caused by future economic, price and demographic changes (Dimitriou et al., 2017).

Gudmundsson et al. (2014) highlighted the high independency of the expansion of London Heathrow Airport with the economic development by estimating the spillover effects using regression analysis to intercontinental air traffic data from 1990 to 2012. Lu (2011) compared the economic benefits from airport operation with the negative side effects such as environmental costs by using Input Output analysis and concluded that the economic benefits generated from the airport outweigh the negative side effects. Selner et al. (2010) used an econometric endogenous growth model to estimate the impact of air accessibility on GDP and investment growth based on a regression approach on a sample of 15 European countries for the period 1993 and 2006 and predicted the economic effects of an increase in capacity at Vienna International Airport. The results highlight the high elasticity of air connectivity with GDP and investment growth.

In the decision making process, alongside economic impact analysis, there is need for quantitative tools to be used not only to provide the economic impact of a new project to decision makers but also to give a tool for the managing of strategy-based decisions by monitoring goals and objectives, such as KPIs where a series of ratios and indexes are taken into consideration to define results to

support decisions and define results. Kiel et al. (2014) analyzed the way the impact of investments in transport infrastructures can be measured by using different indicators such as changes in employment and GDP. Raul et al. (2009) defined a group of strategic objectives and KPIs that provide information as to whether the objectives and targets are being reached. Owyong et al., (2001) identified the KPIs required to achieve sustainability objectives in developing countries and proposed an analytical decision model and a structured methodology for sustainability appraisal in infrastructure projects with analytical process for multicriteria decision-making and performance KPIs (Dimitirou, 2018).

3. Methodology Framework

The methodology framework deals with the estimation of the contribution of new airport project development towards economic development. The assessment framework provides quantitative results to support decision for investment into the context of the added value of these investments into the regional economy.

The contribution of the new airport project development towards economic development is addressed by adopting coverage indexes of the regional targets towards economic development. The decision making framework assessment provides quantitative answers to make sure that a proposed decision for an airport investment creates added value for the national economy. The proposed methodology in this paper provides a decision support framework used to evaluate the contribution of the investment in a new airport in covering the regional goals towards economic development. The methodology is based on a combination of the assessment appraisal of the impact caused by a new airport on national economy based on IO analysis and the evaluation of the coverage of national targets and objectives that an investment in a new airport project causes using the appropriate indexes. The proposed framework provides a step up to down methodology and is divided in three sections as analyzed analytically below.

3.1. Airport development economic impact

Investing in airport boosts economic activity in the region it serves. This economic activity flows through other parts of the regional economy as constructing and operating the infrastructure increases the requirements for goods and services from industries in the supply chain. The impacts arising as a result of airport development can be divided into four distinct categories: (1) direct, (2) indirect, (3) induced (4) catalytic. (Reis et al., 2009)

Direct On-airport employment is created by the activities and services generated in-site the airport (for example fixed based operators). Vasigh et al., (2013) highlight that indirect impact is generated from off-site economic activities that are directly related to the onsite activities (for example travel agencies, retails and fuel suppliers). Induced impact is caused by the increase in employment and income generated from direct and indirect impact. The induced impact on national or regional economy is estimated by multipliers based on IO analysis, which is used to estimates how the change in demand for one business sector affects others sectors and the economy as a whole.

IO analysis is based on the concept of multipliers is used to construct disaggregated multipliers based on IO national tables. IO tables can provide a complete picture of the flow of products and services in an economic system for a given year, clarifying the relationship between producers and consumers and the exchange of goods and services among economic sectors. This illustrates all monetary market transactions not only between businesses but also between them and final demand sectors (i.e. consumers, government, investment, exports, etc.). Therefore, the measurement of the impact as a result of new airport development can be defined by the increase in employment (jobs) and GDP growth (income approach). The IO assessment in the paper involves two steps: In the first the additional jobs created by the new airport are estimated while in the second the additional income is calculated (Correa et al., 2001).

The estimation results of the IO model is an ‘nxn’ matrix of multipliers that embodies n production sectors per unit of final consumption of commodities produced by n industry sectors that can provide also the indirect and induced effects by means of the Leontief matrix. In the first step we estimate the vector X which expresses the total direct, indirect and induced impact of the airport on employment. This is accomplished through the use of the Leontief inverse matrix (Dimitriou and Sartzetaki, 2017). Catalytic impact captures the way in which the airport facilitates the business of other sectors of the economy through a number of mechanisms such as tourism and trade increase and productivity (Dimitriou, 2018).

3.2. Employment and income concentration

For the evaluation of the contribution of an airport project development towards the economic development, two ratios defining the concentration of airport employment and income generation in relation to total regional employment and income were adopted.

The Employment Concentration Ratio (ECR) is defined as the measure of the size of employment generated by the airport in relation to the total employment in the region. It ranges from 0 to 1.0, moving from 0 which indicates very low concentration of the airport generated employment in relation to the regional economy to 1.0 that indicates a single monopolistic producer if all the employment

in the region was created by the airport. The Income Concentration Ratio (ICR) is the measure of the size of income generated by the airport in relation to the total income in the region over time. It ranges from 0 to 1.0, moving from 0 which indicates very low concentration of the airport in relation to the regional economy to 1.0 that indicates a single monopolistic producer if all the income in the region was created by the airport.

$$ECR_t = (\frac{e_{airport}}{e_{region}})_t \qquad (1)$$

$$ICR_t = (\frac{I_{airport}}{I_{region}})_t \qquad (2)$$

If ECR and ICR are below 0.25 indicate a low concentration of the employment and income generated due to the airport in relation to the total employment of the region.

If ECR and ICR is between 0.25 to 0.50 indicate moderate concentration of the employment and income generated due to the airport in relation to the total employment of the region.

If ECR and ICR above 0.50 indicate high concentration of the employment and income generated due to the airport in relation to the total employment of the region.

The above KPIs support the decision making process in investing in transport infrastructures and especially in a new airport. The highest values correspond to high level of implication towards regional and economic development and governmental authorities should focus on the implementation of the project.

3.3. Coverage of regional targets towards economic development

Achieving economic growth and unemployment reduction are targets set by regional authorities towards economic development. In order to monitor the regional targets towards economic development during the construction and operation period of a new air transport infrastructure development, two indicators are adjusted to meet the requirements of investigation of the coverage of these targets to increase employment and income.

3.3.1. Employment Target Cover Indicator (ECI)

The Employment Target Cover Indicator (ECI) represents the annual coverage of the employment target set by the region, linked with the airport investment for the year t. ECI provides indications to decision makers regarding the expected coverage of the employment target for the year t for the construction and operation period respectively.

$$ECI_t = (\frac{e_{airport}}{e_{target}})_t \qquad (3)$$

Where:

t =the year of the construction and operation period, respectively;

$e_{airport}$ = new jobs created from the airport construction and operation for year t; e_{target}=employment growth regional target according to government projections for year t

The ECI_t ranges between 0 and 1. If ECI_t is below 0.25 indicates a very small coverage of the target of the national employment growth in year t; If ECI_t is between 0.25 and 0.5 indicates a medium coverage of the target of the national employment growth in year t; If ECI_t is above 0.5 indicates an very large coverage of the target of the regional employment growth in year t by the employment generated due to the airport.

The above KPI supports the decision making process in investing a new airport. The highest value corresponds to high coverage of the regional target towards regional economic development in terms of increased employment and decision makers and stakeholders should focus on the implementation of the project.

3.3.2. Income Target Cover Indicator(ICI)

The Income Growth Target Cover indicator (ICI) represents the annual coverage of the national income growth target by the airport for the year t. ITCI provides indications to decision makers regarding the expected coverage of the income growth target for the year t, for the construction and operation period respectively.

$$ICI_t = (\frac{i_{airport}}{i_{target}})_t \qquad (4)$$

Where:

t =the year of the construction and operation period, respectively;

$i_{airport}$ = new income generated from the airport construction and operation for year t, i_{target} =new income generated as national target according to government projections for year t.

The ICI_t ranges between 0 and 1. If ICI is below 0.25 indicates an very small coverage of the target of the national income growth in year t by the income generated due to the airport development; If ICI_t is between 0.25 and 0.5 indicates a medium coverage of the target of the national income growth in year t; If ICI_t is above 0.5 indicates a very large coverage of the target of the national income growth in year t.

The above KPI supports the decision making process in investing a new airport. The highest value corresponds to high coverage of the regional target towards regional economic development in terms of increased income and decision makers and stakeholders should focus on the implementation of the project.

3.4. Diversification Economic Impact KPI

The entropy measure compares the existing employment or income distributions among different sectors in a region to an equiproportional distribution. Higher entropy performance indicator values indicate greater relative diversification, while lower values indicate relatively more specialization. The maximum value of the measure would result with the equal distribution of employment among all sectors. The minimum value of zero (maximum specialization) would occur if employment were concentrated in one sector. On the other hand, if employment were distributed equally among the N sectors, the entropy index would reach its maximum value, indicating perfect diversity. The Diversification Economic Impact performance Indicator (EI) is used as a measure of economic diversity. The entropy index is calculated based on employment data for 38 sectors (classification ISIC Rev. 4/ NACE Rev. 2), grouped in 10 categories ISIC 4 (Dimitriou et al., 2017).

$$EI_t = \sum_{I=1}^{N} S_i \ln(\frac{1}{S_i}) \qquad (5)$$

where

N= is the number of grouped sectors,

Si =share of economic activity in ith sector and *ln* is natural logarithm.

This KPI evaluates the diversification of the different sectors of the case study area economic system prior and after the airport project implementation and thus the contribution of the project to the differentiation of the economic system and therefore towards economic development.

4. Case study

4.1. Economic conditions of the case study area

Greece's after a depression since 2011 until 2016 (Table 1), in 2017 economic recovery is gaining traction. GDP has started to recover after having fallen by a quarter from 2011 (Table1). In the last two years, the pace of reforms has accelerated and broadened (IMF, 2018). Despite these positive developments, challenges abound GDP per capita is still 25% below its pre-crisis level. The public debt is still high and a source of significant vulnerability. (IMF, 2018).

According to IMF 2018, the unemployment rate in Greece remains stuck at close to its highest level since the onset of the economic crisis but according to projections the expected unemployment rate in Greece will decrease through the end of 2020. Based on the government and IMF latest projections the national targets for income and employment rate increase are presented in Table 1.

Table 1. Real GDP growth and unemployment rate (2011-2017) and projections for 2018-2023 for Greece (IMF, 2018)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Real GDP Growth (annual percent change)	-9.1	-7.3	-3.2	0.7	-0.3	-0.2	1.4	2	1.8	1.8	1.6	1	1.9
Real GPD growth target (Bio)							1.6	0.6	-0.2	0	-0.2	-0.6	0.9
Unemployment rate	17.9	24.4	27.5	26.5	24.9	23.6	21.5	19.8	18	16.4	15.2	15	14.7
Employment rate increase target (%)							2.1	1.7	1.8	1.6	1.2	0.2	0.3

Crete is the largest island in Greece, the fifth largest in the Mediterranean. Due to the island's location and landscape formation, Crete enjoys significantly more sunny days and high temperatures throughout the year than other destinations in the Mediterranean. Because of its microclimate, most of the urban areas are spatially located on the north coastline of the island. The GDP of Crete

accounts for over 5% of national GDP. Tourism is the major industry in the economy of the island and accounts for over 30% of local GDP.

Figure 1: Case study airport location (source: google maps; accessed July 2018)

4.2. New airport project features

Traditionally, Crete attracts a high number of tourists because of the climate, the coast along the Mediterranean, the spatial allocation of islands as well as the high number of archeological places. Crete is a faraway European destination (over 3.000 miles) from the countries that represent the main sources of tourist market. Thus, the transport participation in the total holiday package is high and depends on the time window the origin, and the final destination.Heraklion airport (IATA: HER) is the biggest airport in Crete and the second busiest airport in Greece, with fast growing volumes, handling above seven million tourists a year (7.4 million in 2017), (HCCA, 2018). The Heraklion airport serves both business and leisure traffic, providing accessibility most big cities in Greece and airports accommodate charter airlines in Europe. Analyzing the volumes of Crete tourist market, the higher share is from European regions, which represents more than 90% of total International Tourist Arrivals, diachronically. The traffic innovation of Heraklion airport is given in Figure 1, providing the nature of aviation business has been developed.

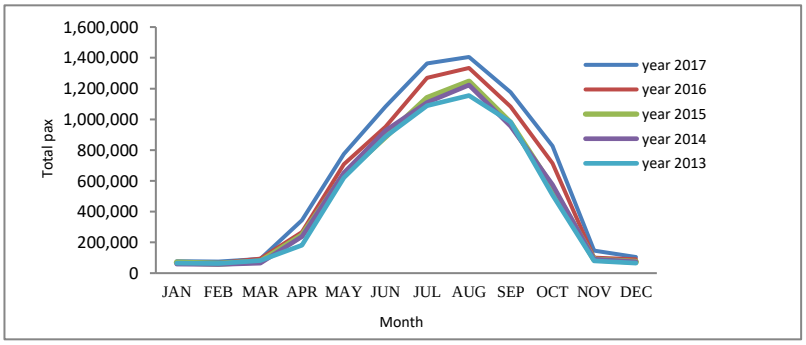

Figure 2: Passengers at Heraklion International Airport 2013-2017, (source: HCAA, 2018)

The 80% of total passenger traffic concerns the tourism season (May – October) and around 50% concerns the peak season extend from July to September each year. The nature of tourism and aviation business along with the seasonal nature of demand leads to growth of charter and seasonal flights to/from Heraklion airport. The demand for air travel in the Greece is predicted to grow from the current levels by the year 2040. Therefore airport capacity around the country needs to increase as failure to increase the capacity will have a negative impact on regional and national economic growth and international competitiveness..

Given the importance of tourism to the regional economy there is key question towards strategic planning to ensure and evaluate that the future aviation needs of the island will be satisfied. The airport has constraints imposed by its limited runway length, terminal facilities and safety standards, operational constraints. These issues, coupled with a need to increase capacity, means that there is a need for the re allocation for the airport. In response to this situation, the Government of Greece intends to build a new international airport under an international tender, located in Kastelli, a new site 20 km north of the city of Heraklion. The Government acknowledges that this new gateway will help the still struggling economy to recover. In 2017 there was bidder in the international tender for the project development. The airport is expected to be completed in 5 years. The new facility could meet an increased seasonal demand from 8 to 10 million passengers, annually. It would become Greece's second-busiest airport after Athens (capital of Greece) for international traffic accommodating the majority of the seasonal international tourist arrivals at national scale.

The Project concerns the design, construction and commissioning of a new international airport in the area of Kasteli of Crete, with a capacity of fifteen (15) million passengers per year. The construction cost of the new airport is estimated at EUR800 million comprised mainly of the construction costs of runways, terminal, roads, parking lots and control tower. The project financing and management scheme will follow Public-Private Partnerships (PPP) Guidelines. The new airport will be developed on a design, build, finance, operation and maintenance (DBFOM) basis for a period of 35 years. The key technical features for the new airport in comparison with the existing one depicted in the Table 2.

Table 2 Key features of existing and new airport

Airport infrastructure	**Existing Airport**	**New Airport**
Terminal area (sq. meters)	41,800	60,000
Number of runways for civil aviation	1	1
Length of runway (meters)	2,680	3,200
Aircraft parking places on apron	19	44
Airport territory (hectares)	278	600
Distance from Heraklion city (kms)	3	35

Source: Tender documents for the new airport in Kastelli (2017)

4.3. Economic Impact footprint in construction period

Based on an assumed peak on-site construction workforce of 1000 employees (FAA, 2013), direct employment supported by implementation of the proposed airport development is estimated to average 1100 FTE positions a year for four years, giving a total of 4000 annual FTE positions over the five years of construction period. Flow-on employment is estimated to average 324 FTE positions a year for five years, giving a total of 1620 annual FTE positions over the five years construction period. Total employment supported by implementation of the proposed development is estimated to average 570 FTE positions a year for five years, giving a total of 2855 annual FTE positions over the five year construction period. Table 3 presents analytically the calculated annual impacts in terms of employment and income for the five years of the new airport construction period.

Table 3 Annual employment and income generated during construction period

	Contribution by the project			
	Direct	Indirect	Induced	Total
Employment (FTE jobs)				
1st year	800	250	575	1,625
2nd year	1,200	380	855	2,435
3rd year	1,200	380	855	2,435
4th year	1,000	310	715	2,025
5th year	500	150	355	1,005
5 years average	940	294	671	1905
Income (€ million)				
1st year	16	5.0	64	85
2nd year	24	7.5	96	127.5
3rd year	24	7.5	96	127.5
4th year	20	6.0	80	106
5th year	10	3.0	38	51
5 years average	18.8	5.8	74.8	99.4

In terms of employment, it is estimated that due to airport project in the construction period will be generated 640 direct, 294 indirect, 671 induced and 1905 total FTE jobs on average annually for the 5years period. In terms of income it is estimated that due to airport project in the construction period will be generated EUR18.8 mio direct, EUR 5.8mio indirect, EUR 74.8mio induced and EUR 99.4mio total FTE jobs on average annually for the 5years period.

4.4. Economic impact footprint in operational period

4.4.1. Future traffic scenarios and assumptions for Direct impact generation

The operating life of the airport is set at 35 years. Assumption scenarios for the direct impact of the airport have been constructed for the first year of operation of the new airport. The relocation and expansion of the airport is expected to enable an increase of air passengers and reach 10-12 million passengers in the initial stage of operation (first year of operation). Based on data traffic 2012-2017 (HCAA, 2018), 3 scenarios for future traffic were developed as presented in Table 4.

According to ACI (2015) analysis on the social and economic impact of European airports suggested that every 1000 passengers travelling through European airports is associated with an average 0.954 direct jobs (ACI 2015), highlighting that economies of scale are significant in the airport environment even though different airline business models and operations require different number of workers on and around the airport campus. Based on this analysis and other evidence that connecting passengers create 3% less direct jobs than Origin/Destination passengers and Low Cost Carriers (LCC) passengers generate 20% less direct jobs than non LCC passengers ; an analysis of the data traffic at Heraklion 2012-2017 (HCAA, 2018) and information regarding the use of the airport by LCCs indicates estimation of average of 700 employees for the months of high demand (7 months of high demand for the low scenario, 9 months of high demand for the basic and full season demand (12 months) for the high scenario) and of 400 employees for the non-high demand months.

Table 4. Employment and income generation estimations for the operation period (1st year)

	Low scenario	Basic scenario	High scenario
Number of passengers (million pax)	8	10	12
Annual Direct employees per million pax	575	625	700
Annual Direct employees	4,600	6,250	8,400
Employment (FTE jobs)			
Additional Annual Direct employees (generated by the new airport)	2,600	4,250	6,400
Annual Indirect employees	780	1,280	1,950
Annual Induced employees	2,385	3,899	5,872
Annual Catalytic employees	11,000	20,000	25,000
Total annual employees	16,765	29,429	39,222
Income (€ millions)			
Additional Annual direct income(generated by the new airport)	78	109	150
Annual indirect income	24	33	45
Annual induced income	55	100	138
Annual Catalytic income	330	450	600
Total annual income	409	691	933

4.5. Coverage and Economic Diversification KPIs

Applying the performance indicators towards regional development adopted in methodology framework to evaluate the contribution of the airport to cover the regional targets for economic development, results show that ECI for the employment growth will be 0.10 in first year of construction, 0.15 of second year, 0.13 in the third year of construction, 0.08 in the fourth year and 0.10 in the fifth year. The achievement of the target in first year of operation will be 0.30 for the low scenario, 0.35 for the medium scenario and 0.45 for the high scenario. ICI for the income growth will be 0.07 in first year of construction, 0.10 of second year and 0.09 in the third year of construction and 00.05 in the fourth year and 0.07 in the fifth year. The achievement of the target in first year of operation will be 0.20 for the low scenario, 0.25 for the medium scenario and 0.30 for the high scenario.

Table 6 KPIs of airport performance towards regional development over time

	Economic Concentration KPIs			
	ECR	ICR	ETCI	ITCI
Construction period				
1st year	0.07	0.04	0.10	0.07
2nd year	0.10	0.05	0.15	0.10
3rd year	0.07	0.04	0.13	0.09
4th year	0.06	0.02	0.08	0.05
5th year	0.06	0.02	0.10	0.07
1st year of Operation period				
Low scenario	0.15	0.06	0.30	0.20
Medium scenario	0.20	0.08	0.35	0.25
High scenario	0.25	0.10	0.45	0.30

The above KPIs in operation period are above 0.25 thus correspond to high coverage of the regional target towards regional economic development in terms of increased employment and income and decision makers and stakeholders should focus on the implementation of the project.

Table 7 Economic Impact diversification KPIs

Economic Sector Category		**Economic Impact diversification (EI) of the Region**		
Code	Description	Prior to airport development (existing)	Construction period (5 years average)	Operation period (1st year)
A	Agriculture, forestry and fishing	0.30	0.29	0.27
B_C_D_E	Mining and quarrying, manufacturing, electricity, gas, steam, air conditioning and water supply, sewerage, waste management and remediation activities	0.20	0.22	0.25
F	Construction	0.17	0.30	0.20
G_H_I	Wholesale and retail trade, repair of motor vehicles and motorcycles, transportation and storage, accommodation and food service activities	0.35	0.40	0.60
J	Information and communication	0.05	0.06	0.10
K	Financial and insurance activities	0.06	0.07	0.06
L	Real estate activities	0.01	0.03	0.10
M_N	Professional, scientific and technical activities, administrative and support service activities	0.17	0.20	0.20
O_P_Q	Public administration and defence, compulsory social security, education, human health and social work activities	0.27	0.28	0.25
R_S_T_U	Arts, entertainment, recreation, other service activities, activities of households as employers, undifferentiated goods and services producing activities of households for own use, activities of extraterritorial organisations and bodies	0.16	0.16	0.16

This KPI evaluated the diversification of the different sectors of the case study area economic system prior and after the airport project implementation and thus the contribution of the project to the differentiation of the economic system and therefore towards economic development.

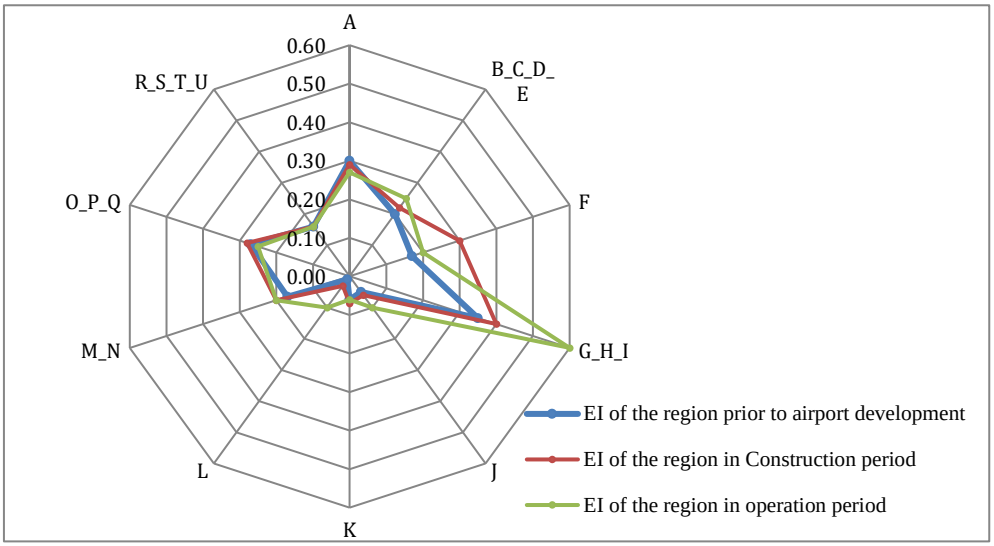

Figure 3 Economic Impact Diversification KPI for the airport project development (construction and operation period)

Analyzing the diversification index and investigating the forward linkage sectors of the average annual estimated macro-economic effects associated with the project, those key economic sectors that will mainly benefit from the project are highlighted. During construction period, the key sector that moves from the value 0.17 to value 0.30 will be the construction sector. This indicates that a unit change in final demand in this sector will create an above average increase in activity in the economy, and unit change in all sectors of the final demand will create an above average increase of output in this sector. During Operational period the key sector that are enlarged are the trade, transportation and accommodation, therefore the group of sectors corresponding to Wholesale and retail trade, repair of motor vehicles and motorcycles, transportation and storage, accommodation and food service activities move form value 0.35 to 0.60.

5. Conclusions

The paper promotes an evaluation methodology approach into a context to support decisions towards airport development projects. The proposed methodology provided an evaluation framework based on a combination of an ex ante assessment analysis taking into consideration the airport economic impact and its contribution to regional economy. The Input Output analysis framework was used to determine the economic footprint of the airport development and a series of key performance indicators was introduced to review the project performance in a given economic system. The case study focused on new airport in Heraklion of Crete (Kasteli valley), which is one of the most attractive tourist destinations in south-east Mediterranean.

The results suggest that investment in airport infrastructure in restricted economic conditions and financing assumptions, where the project business plan performance is strongly related to regional development prospects and future airport business can contribute to meet the regional targets towards regional economic development. The key performance indicators estimated provide strong evidence of the existence of a long term co-integrating relationship between economic growth, infrastructure investment and unemployment reduction resulting in the achievement of regional economic targets especially in difficult economic circumstances under stress. Increasing and sustaining the level of air transport investment can make a positive contribution to the achievement of the objectives of accelerated and regional economic growth, contribute to achieve and cover the targets for socioeconomic development. It is imperative, therefore, to encourage decision makers to invest in such infrastructures as part of a decision making process to bring about a sustained recovery in economies suffering from stress and reduce the high levels of poverty and unemployment within a country.

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