(2) Replacing Costs

After the construction of the short-term facilities, the following costs will be incurred every 15 years (First year 2010) in replacing air navigation equipment which accounts for 70% of the construction cost of the air navigation systems work in the short-term development.

Table 15.2.2 Replacing Costs

(1,000 Colones)

Item	Foreign Currency	Costa Rican Currency		Total
		Financial	Economic	
Replacing Cost in 2010	215,490	7,398	6,658	222,148

(3) Operation and Maintenance Costs

Operation and maintenance costs include personnel cost and material and equipment costs.

a) Personnel Cost

As described in Section 13.4, Additional Airport Staff, operation and maintenance staff of Juan Santamaria Airport will be increased to meet with the airport facilities developed for the short-term requirement.

The total number of airport staff is estimated to be 262 persons from the present 205 persons, i.e. additional 57 staff.

Additional personnel costs required for the development of Juan Santamaria Airport is calculated by multiplying the number of additional staff by an average salary at Juan Santamaria Airport (56,600 colones/month including general administration cost) as shown in Table 15.2.3.

Figure 15.2.3 Additional Personnel Cost

Year	Number of Additional Staff (Persons)	Cost per Person per Month (Colones)	Annual Financial Cost (1,000 Colones)	Annual Economic Cost (1,000 Colones)
1996 ~ 2015	57	56,600	38,700	34,800

b) Material and Equipment Costs

The additional material and equipment costs required for the operations and maintenance of the facilities in the short-term development are estimated by the following method and shown in Table 15.2.4.

Civil and Building Facilities : 1% of construction cost for civil and architectural works

Equipment : 5% of equipment cost for air navigation systems and airport utilities

Table 15.2.4 Annual Costs for Material and Equipment

(Unit: 1,000 Colones)

Item	Foreign Currency	Costa Rican Currency		Total Economic Cost
		Financial	Economic	
Civil and Buildings	33,917	12,969	11,672	45,589
Equipment	41,045	4,659	4,193	45,238
			Grand Total	90,827

15.2.3 Project Benefits

(1) Benefits to be Quantified

The development of Juan Santamaria Airport will offer various benefits to the national and regional economies. In this Study, the following economic benefits were quantified and evaluated:

(a) Benefit due to accommodation of the overflow of foreign passengers

(b) Benefit of increasing foreign earnings from foreign visitors

(c) Benefit due to increase of LACSA'S revenue

(d) Time saving benefits to Costa Rican passengers

(e) Benefit due to accommodation of the overflow of export cargo

(f) Benefit due to the increase of employment by construction work

(2) Definition of "Without Project Case"

This Project is designed to expand the air transport services at Juan Santamaria Airport by redeveloping the existing airport. Hence the "without project case" is specified as the maintenance of the existing airport in the present condition with minimum maintenance and replacement.

In the "without project case", it is next necessary to determine the capacity of the existing Juan Santamaria Airport at the present condition. The existing international and domestic passenger terminal buildings, and cargo terminal buildings have already reached their capacities as evaluated in Section 6.2. Therefore it is assumed that in the "without project case", the traffic will remain constant at the present level (1990).

The overflow of traffic which cannot be accommodated in the "without project case" is estimated as the difference between future air traffic demand in the "with project case" and the existing airport capacity, i.e. the present traffic volume.

(3) Definition of "With Project Case"

Since these economic and financial analyses are carried out for the evaluation of the short-term development project, the economic benefit and financial revenues generated by the long-term development project will not be considered in this estimation.

Therefore, the air traffic demand in the "With Project Case" will not exceed the capacity of airport facilities developed by the short-term development of which the design target year is 2000.

Therefore, in the estimation of demand "With Project Case", passenger and cargo demand are assumed to reach their limit in the year 2000 and to continue at the same volume after the year 2000.

The future traffic demand, incremental traffic in "With Project" and "Without Project" traffic are presented in Table 15.2.5.

(4) Estimation of Project Benefits

a) Benefits due to Accommodation of the Overflow of Foreign Passengers

The airport operation revenue such as aircraft landing charge, navaid charge, airport tax from passengers etc. will increase by the accommodation of the overflow of passengers. The incremental revenue by foreign passengers will be accounted for as a benefit by the project, but the revenue by Costa Rican passengers should not be accounted because it is a transfer portion. This benefit is quantified by the equation 15.2.1.

$$BAPt = RTt\ (ATAX \times CONV + BSGP) \quad \text{---------- (15.2.1)}$$

where,

BAPt	;	Benefits in the year t due to accommodating the overflowed foreign passenger
RTt	;	Incremental foreign passengers in year t (= 0.61 x (International Passenger))
ATAX	;	Airport tax for departing foreign passenger in 1991 (= 574 Colones)
CONV	;	Conversion factor from two-way to one-way (= 1/2)
BSGP	;	Operating revenue of the Airport per passenger (= 370 Colones) BSGP is obtained by equation 15.2.2

$$BSGP = TTRE \times JSRE \times PACO \times SHAP/JSPA \quad \text{----- (15.2.2)}$$

where,

TTRE	;	DGAC income received from all related airlines in 1990. The breakdown is shown in Appendix 13.3.1 (= 326,027,000 Colones)
JSRE	;	Share of Juan Santamaria Airport of the total operating revenue of DGAC in 1991 (= 0.9)
PACO	;	Price escalation factor to convert from 1990 price to 1991 price, informed by Banco Central (= 1.264)
SHPA	;	The portion of operating revenue allocated to passengers (= 0.92). This ratio is estimated by the following procedure:

In 1991, the passenger fare between Miami and Juan Santamaria was US$400 on an average, and the freight charge per ton was US$580 on an average. Therefore, one ton of cargo is equivalent to 1.45 pax. In 1990, the international pax was 923,000 and the international cargo was 67,000tons. The 67,000tons cargo is equal to 97,000pax (= 67,000 x 1.45). Therefore, the total pax is 1,020,000 pax (= 923,000 + 97,000), hence the cost and revenue could be allocated between pax and freight by 92% and 8% respectively.

JSPA	;	Annual passenger volume in 1990 (= 923,000 persons)

The benefits due to accommodation of the overflow of foreign passengers is shown in Table 15.2.6.

Table 15.2.5 Traffic Volume in Case of "Without the Project"and "With the Project"

	1990	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
"With Project" Traffic																								
Passengers(Persons)																								
-International	922,969	1,071,788	1,121,394	1,171,000	1,264,800	1,358,600	1,452,400	1,546,200	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000
-Domestic	64,778	94,311	104,156	114,000	118,980	123,960	128,940	133,920	138,900	138,900	138,900	138,900	138,900	138,900	138,900	138,900	138,900	138,900	138,900	138,900	138,900	138,900	138,900	138,900
-Total	987,747	1,166,099	1,225,549	1,285,000	1,383,780	1,482,560	1,581,340	1,680,120	1,778,900	1,778,900	1,778,900	1,778,900	1,778,900	1,778,900	1,778,900	1,778,900	1,778,900	1,778,900	1,778,900	1,778,900	1,778,900	1,778,900	1,778,900	1,778,900
Cargo (tons)																								
-International	66,903	100,040	111,085	122,131	142,739	163,347	183,956	204,564	225,172	225,172	225,172	225,172	225,172	225,172	225,172	225,172	225,172	225,172	225,172	225,172	225,172	225,172	225,172	225,172
Import	25,120	32,953	35,564	38,175	42,496	46,817	51,138	55,459	59,780	59,780	59,780	59,780	59,780	59,780	59,780	59,780	59,780	59,780	59,780	59,780	59,780	59,780	59,780	59,780
Export	41,783	67,087	75,521	83,956	100,243	116,530	132,818	149,105	165,392	165,392	165,392	165,392	165,392	165,392	165,392	165,392	165,392	165,392	165,392	165,392	165,392	165,392	165,392	165,392
-Domestic	279	461	521	582	607	633	658	684	709	709	709	709	709	709	709	709	709	709	709	709	709	709	709	709
-Total	67,182	100,501	111,607	122,713	143,347	163,980	184,614	205,247	225,881	225,881	225,881	225,881	225,881	225,881	225,881	225,881	225,881	225,881	225,881	225,881	225,881	225,881	225,881	225,881
Incremental Traffic in WP																								
Passengers(Persons)																								
-International		148,819	196,425	248,031	341,831	435,631	529,431	623,231	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031
-Domestic		29,533	39,378	49,222	54,202	59,182	64,162	69,142	74,122	74,122	74,122	74,122	74,122	74,122	74,122	74,122	74,122	74,122	74,122	74,122	74,122	74,122	74,122	74,122
-Total		178,352	237,802	297,253	396,033	494,813	593,593	692,373	791,153	791,153	791,153	791,153	791,153	791,153	791,153	791,153	791,153	791,153	791,153	791,153	791,153	791,153	791,153	791,153
Cargo (tons)																								
-International		33,137	44,182	55,228	75,836	96,444	117,053	137,661	158,269	158,269	158,269	158,269	158,269	158,269	158,269	158,269	158,269	158,269	158,269	158,269	158,269	158,269	158,269	158,269
Import		7,833	10,444	13,055	17,376	21,697	26,018	30,339	34,660	34,660	34,660	34,660	34,660	34,660	34,660	34,660	34,660	34,660	34,660	34,660	34,660	34,660	34,660	34,660
Export		25,304	33,738	42,173	58,460	74,747	91,035	107,322	123,609	123,609	123,609	123,609	123,609	123,609	123,609	123,609	123,609	123,609	123,609	123,609	123,609	123,609	123,609	123,609
-Domestic		182	242	303	328	354	379	405	430	430	430	430	430	430	430	430	430	430	430	430	430	430	430	430
-Total		33,319	44,425	55,531	76,165	96,798	117,432	138,065	158,699	158,699	158,699	158,699	158,699	158,699	158,699	158,699	158,699	158,699	158,699	158,699	158,699	158,699	158,699	158,699
"Without Project"Traffic																								
Passengers(Persons)																								
-International	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969
-Domestic	64,778	64,778	64,778	64,778	64,778	64,778	64,778	64,778	64,778	64,778	64,778	64,778	64,778	64,778	64,778	64,778	64,778	64,778	64,778	64,778	64,778	64,778	64,778	64,778
-Total	987,747	987,747	987,747	987,747	987,747	987,747	987,747	987,747	987,747	987,747	987,747	987,747	987,747	987,747	987,747	987,747	987,747	987,747	987,747	987,747	987,747	987,747	987,747	987,747
Cargo (tons)																								
-International	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903
Import	25,120	25,120	25,120	25,120	25,120	25,120	25,120	25,120	25,120	25,120	25,120	25,120	25,120	25,120	25,120	25,120	25,120	25,120	25,120	25,120	25,120	25,120	25,120	25,120
Export	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783
-Domestic	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279	279
-Total	67,182	67,182	67,182	67,182	67,182	67,182	67,182	67,182	67,182	67,182	67,182	67,182	67,182	67,182	67,182	67,182	67,182	67,182	67,182	67,182	67,182	67,182	67,182	67,182

Table 15.2.6 Benefits due to Accommodation of the Overflow of Foreign Passengers

(Unit: Million Colones)

Year	1996	2000	2005	2010	2015
Total Benefits	137	287	287	287	287

b) Benefits of Increasing Foreign Earnings from Foreign Visitors

Implementation of the project will increase the foreign exchange earnings from foreign passengers. This benefit is quantified by the equation 15.2.3.

$$BRTt = RTt \times CONV \times FREX \times (1+GRF)^t \times VAGA \times RAPA \quad (15.2.3)$$

where,

BRTt ; Benefits in the year t due to increasing foreign passenger

FREX ; Average expenditure of foreign passenger in Costa Rica. This value is obtained by the passenger traffic survey carried out in this study. The details are described in Appendix 15.2.1. (= 82,000 Colones)

GRF ; Annual growth rate of foreign expenditure estimated by the growth of GDP of visited foreigner's countries. (= 0.03)

VAGA ; Value-added ratio in general average. The ratio is determined by referring to the average ratio of Malaysia and Thailand, since the personnel income level of both countries is nearly equal to that of Costa Rica and no value-added ratio is available for Costa Rica (= 0.28)

RAPA ; The portion of the incremental added-value ratio which should be attributed to the project investment (= 0.17)
RAPA is obtained by equation 15.2.4

$$RAPA = PAXP/(TBRT \times RCPA) \quad (15.2.4)$$

where,

PAXP ; Opportunity cost of the project investment for pax (= 769,000,000 Colones)

TBRT ; Added value in yearly average (= 7,428,000,000 Colones)

RCPA ; Share of capital reward in added value. The detailed estimation is shown in Appendix 15.2.2 (= 0.6)

The benefits of increasing foreign earnings from foreign visitors is shown in Table 15.2.7.

Table 15.2.7 Benefits of Increasing Foreign Earnings from Foreign Visitors

(Unit: Million Colones)

Year	1996	2000	2005	2010	2015
Total Benefits	472	1,114	1,291	1,497	1,735

c) Benefits due to Increase of LACSA'S Revenue

Increase in the air fare revenue of LACSA by the overflow of foreign passengers will expand the employment opportunity of Costa Rican people. This will contribute to the national economy.

This benefit is quantified by the equation 15.2.5.

$$BLAt = RTt \times SHLA \times FARE \times VAPA \times RALA \text{---------- (15.2.5)}$$

where,

- BLAt : Increase in the fare revenue of LACSA
- SHLA : Share of LACSA in all airlines in 1991 source: DGAC (= 0.34)
- FARE : Average pax fare between Juan Santamaria and Miami in 1991 is used as typical air fare (= 54,000 Colones)
- VAPA : Value-added ratio (personnel cost): (total operating cost) indicate the contribution ratio of the employment opportunity of Costa Rican people (= 0.43)
- RALA : The portion of the incremental added-value ratio which should be attributed to the project investment (= 0.30).
  RALA is obtained by equation 15.2.6.

$$RALA = PAIP/TBLA \times RCR3 \text{---------- (15.2.6)}$$

where,

- PAIP : Opportunity cost of the project investment for pax (= 769 Mill. Colones)
- TBLA : Added value in yearly average (= 3,227 Mill. Colones)
- RCLA : Share of capital reward in added value. The detailed estimation is shown in Appendix 15.2.2 (= 0.8)

The benefits due to increase of LACSA's revenue is shown in Table 15.2.8.

Table 15.2.8 Benefits due to Increase of LACSA'S Revenue

(Unit: Million Colones)

Year	1996	2000	2005	2010	2015
Total Benefits	494	1,036	1,036	1,036	1,036

d) Time saving benefit of Costa Rican passengers

The improvement of the passenger processing area in the terminal building and introduction of new equipment will reduce the queuing time of passengers. This time saving benefit will be quantified only for Costa Rican people but not for foreign visitors because only Costa Rican time contributes to the national economy.

This benefit is quantified by the equation 15.2.6.

$$BSTt = WSSt \times (1 - SHFR) \times TSPT \times (1+GRC)^t \times TV \text{---------- (15.2.6)}$$

where,

- BSTt : Benefits due to saving in queuing time of Costa Rican pax
- WSSt : Total pax in "with project case"
- SHFR : Average share of foreign pax in total pax between 1981 and 1990 (= 0.61 source: DGAC)
- TSPT : Saving time of queuing in new terminal building estimated from passenger traffic survey (= 20 minutes)
- GRC : Yearly growth rate of the time value of Costa Rican pax taking account of the growth rate of GDP in Costa Rica. (= 0.03)
- TV : Time value of Costa Rican pax (= 4.67 colones per minute in 1991) This TV is obtained by equation 15.2.7.

$$TV = INCOS/WRDY/WRMN \text{---------- (15.2.7)}$$

where,

INCOS : Average annual income of Costa Rican passenger obtained by interview survey (= 675,000 colones/year)
WRDY : Average working day (= 300 days)
WRMN : Average working time per day (= 8hrs x 60 minutes = 480 min)

The time saving benefits of Costa Rican passengers is shown in Table 15.2.9.

Table 15.2.9 Time Saving Benefits of Costa Rican Passengers

(Unit: Million Colones)

Year	1996	2000	2005	2010	2015
Total Benefits	53	78	90	105	121

e) Benefits due to Accommodation of the Overflow of Export Cargo

The airport development will enable it to accommodate the overflow of export cargo. This benefits the national economy.

This benefit is quantified by the equation (15.2.8).

$$BEXt = WCGt \times PEX \times REXF \times RACG \quad \text{---------- (15.2.8)}$$

where,

BEXt : Benefits due to accommodating the overflowed export cargo.
WCGt : Incremental exported cargo in "with" project case
PEX : Average price per ton of exported cargo estimated from the trading record in 1991 (= 445, 711 Colones)
REXF : Value-added ratio in agricultural department. The ratio is determined referring to the average ratio of Malaysia and Thailand, since the personnel income level of both countries is nearly equal to that of Costa Rica and no value-added ratio is available for Costa Rica. (= 0.7)
RACG ; The portion of the incremental added-value which should be attributed to the project investment (= 0.011)
RACG is obtained by equation 15.2.9

$$RACG = CRGP/(TBEX \times RCCG) \quad \text{---------- (15.2.9)}$$

where,

CRGP ; Opportunity cost of the project investment for cargo (= 81,000,000 Colones)
TBEX ; Added value in yearly average (= 36,025,000,000 Colones)
RCCG ; Share of capital regard in added value. The detailed estimation is shown in Appendix 15.2.2 (= 0.2)

Benefits due to accommodation of the overflow of export cargo is shown in Table 15.2.10.

Table 15.2.10 Benefits due to Accommodation of the Overflow of Export Cargo

(Unit: Million Colones)

Year	1996	2000	2005	2010	2015
Total Price	201	424	424	424	424

f) Benefits due to the Increase of Employment Demand by Construction Work

Construction work for the airport development will provide new employment demand in the labor market. This benefit is quantified by the increase in the income of un-skilled labor as indicated in equation 15.2.10.

$$BADt = USLt \times (WAGE - SWAG \times PACO) \quad \text{---------- (15.2.10)}$$

where,
BADt : Increase in the income of unskilled labor (value in 1991)
USLt : Number of unskilled labor employed by the project as shown in Table 15.2.11

Table 15.2.11 Number of Un-Skilled Laborers

(Unit: man-days/year)

Year	1993	1994	1995
Number of Un-skilled laborers	4,400	58,000	36,000

WAGE : Wages paid to unskilled labor employed by the project (= 1,000 Colones/day)
SWAG : Shadow wage for the unskilled labor. This is the minimum salary in 1990 as confirmed by Banco Central (= 272 colones/day)

Benefits due to the increase of employment by construction works is show in Table 15.2.12.

Table 15.2.12 Benefits due to the Increase of Employment by Construction Work

(Unit: Million Colones)

Year	1993	1994	1995
Total Benefits	2.8	38.7	23.7

15.2.4 Economical Evaluation of the Project

(1) Premises

a) Evaluation period

The evaluation period covers the 25 years from 1991 to 2015. The construction period will be three years from 1993 to 1995. In 1996 the airport will start its new service.

b) Life expectancy and salvage value

The life expectancy of the project investment is assumed to be 25 years. The salvage value is assumed to be zero (0) after 25 years from the inauguration of short-term development.

The residual value of the project investment is considered to be the last year of the evaluation.

Table 15.2.13 Economic Cash Flow

Item Year	1990	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	NPV	
1. Traffic in WP																										
1-1 Passengers(Persons)																										
International (*1)	922,969	1,071,788	1,121,394	1,171,000	1,264,800	1,358,600	1,452,400	1,546,200	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000		
1-2 Cargo(ton)																										
International Export	41,783	67,087	75,521	83,956	100,243	116,530	132,818	149,105	165,392	165,392	165,392	165,392	165,392	165,392	165,392	165,392	165,392	165,392	165,392	165,392	165,392	165,392	165,392	165,392		
2. Incremental Traffic in WP																										
2-1 Passengers(Persons)																										
International		148,819	198,425	248,031	341,831	435,631	529,431	623,231	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031		
2-2 Cargo(ton)																										
International Export		25,304	33,738	42,173	58,460	74,747	91,035	107,322	123,609	123,609	123,609	123,609	123,609	123,609	123,609	123,609	123,609	123,609	123,609	123,609	123,609	123,609	123,609	123,609		
3. Traffic in WOP																										
3-1 Passengers(Persons)																										
International	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969		
3-2 Cargo(ton)																										
International Export	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783	41,783		
4. Number of Un-skilled Labour(Man-day)	4,400	58,000	36,000																							
5. Benefits																										
a) Overflowing Pax					137	175	212	250	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287	287		
b) Foreign Earning					472	619	775	940	1,114	1,147	1,182	1,217	1,254	1,291	1,330	1,370	1,411	1,453	1,497	1,542	1,588	1,636	1,685	1,735		
c) LACSA's Revenue					494	629	765	900	1,036	1,036	1,036	1,036	1,036	1,036	1,036	1,036	1,036	1,036	1,036	1,036	1,036	1,036	1,036	1,036		
d) Time Saving					53	59	65	71	78	80	83	85	88	90	93	96	99	102	105	108	111	114	118	121		
e) Overflowing Cargo					201	257	312	368	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424		
f) Construction Employ		3	39	24																						
Residual Value																								1,338		
Benefit Total		3	39	24	1,357	1,739	2,130	2,530	2,939	2,975	3,012	3,050	3,089	3,129	3,170	3,213	3,257	3,302	3,349	3,397	3,447	3,498	3,550	4,942		
6. Cost																										
a) Construction		764	2,733	3,155																						
b) Replacement																			222							
c) Additional Personnel					35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35		
d) Additional M & E					91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91		
Cost Total		764	2,733	3,155	126	126	126	126	126	126	126	126	126	126	126	126	126	126	348	126	126	126	126	126		
7. Net Benefit		-761	-2,694	-3,131	1,231	1,613	2,004	2,404	2,813	2,849	2,886	2,924	2,963	3,003	3,044	3,087	3,131	3,176	3,001	3,271	3,321	3,372	3,424	4,816		
8. Discounted Value at End of Year 1991																									NPV	
a) At Rate of 12%		-607	-1,918	-1,990	698	817	906	971	1,014	917	830	750	679	614	556	504	456	413	348	339	307	279	253	317	7,456	
b) At Rate of 20%		-529	-1,559	-1,510	495	540	559	559	545	460	388	328	277	234	198	167	141	119	94	85	72	61	52	61	1,837	
c) At Rate of 30%		-450	-1,226	-1,096	331	334	319	295	265	207	161	125	96	76	59	46	36	28	21	17	13	10	8	9	-312	
9. EIRR = 27.5%																										
10. Benefit /Cost Ratio																									TOTAL	B/C
a) At Rate of 12% B=		2	28	15	770	881	963	1,022	1,060	958	866	783	708	640	579	524	474	429	389	352	319	289	262	328	12,639	2.4384
C=		609	1,945	2,005	71	64	57	51	45	41	36	32	29	26	23	21	18	16	40	13	12	10	9	8	5,183	
b) At Rate of 20% B=		2	22	11	545	582	594	588	570	480	405	342	289	244	206	174	147	124	105	89	75	63	54	62	5,774	1.4667
C=		531	1,582	1,522	51	42	35	29	24	20	17	14	12	10	8	7	6	5	11	3	3	2	2	2	3,937	
c) At Rate of 30% B=		2	18	8	365	360	339	310	277	216	168	131	102	79	62	48	38	29	23	18	14	11	9	9	2,537	0.8942
C=		452	1,244	1,105	34	26	20	15	12	9	7	5	4	3	2	2	1	1	2	1	1	0	0	0	2,948	

*Note (*1) : Traffic in WP will reach its ceiling in year 2000 because of no investment for long-term development.*

c) Opportunity Cost

The opportunity cost of capital is set at 12% based on the evaluatio criteria for the selection of viable project by the Government of Costa Rica.

The economic cash flow of costs and benefits are shown in Table 15.2.13.

(2) *Results of Economic Evaluation*

The Economic Internal Rate of Return (EIRR), Benefit/Cost Ratio (B/C Ratio) and Net Present Value (NPV) of the Project are calculated and summarized in Table 15.2.14.

Table 15.2.14 Evaluation Indicators

EIRR (%)	B/C Ratio (*)	NPV (Colons) (*)
27.5	2.44	7,456,000,000

Note (*): At discount rate of 12 %.

The result of the economic analysis shows that the development of Juan Santamaria Airport is feasible because the EIRR of 27.5% exceeds the opportunity cost of capital (12%) in Costa Rica.

15.2.5 Sensitivity Analyses

Sensitivity analyses were also carried out to provide probablistic judgement on the investment. The EIRRs were calculated on various projections and summarized in Table 15.2.15.

Table 15.2.15 Results of Sensitivity Analyses

Projections		EIRR (%)
Original Case		27.5
Case 1	Costs down by 10% and Traffic Demands up by 10%	35.2
Case 2	Costs up by 10%	25.5
Case 3	Traffic Demands down by 10%	22.2
Case 4	Costs up by 10% and Traffic Demands down by 10%	20.4

The above sensitivity analyses show that even if the project costs go up by 10% and traffic demands go down by 10% simultaneously, the project maintains a high EIRR of 20.4% more than the opportunity cost 12%.

15.2.6 Indirect/Intangible Benefits

Although the cost-benefit analysis has been executed based on direct and tangible benefits, projects in the transport sector are generally characterized by extensive indirect and intangible benefits which are not quantified by the cost-benefit analysis.

In this particular case, the implementation of the Project will bring the following indirect and intangible benefits:

(a) Promotion of safety, reliability and punctuality in the aircraft operation and air transport.

(b) Promotion of convenience and comfortability for the airport users such as air passengers, welcomers, well wishers.

(c) Promotion of foreign investment:
Development of the airport will promote foreign investment to Costa Rica by offering high speed and efficient air transportation.

(d) Enhancement of foreign trade and communication:
Costa Rica with a long tradition of democracy and political stability has the potential to play an important role as a trading and communication center in Central America. Satisfactory air transport enhances foreign trade and communications with the countries of Central, North and South America, and Europe.

15.3 Financial Analysis

15.3.1 Introduction

Financial analysis is usually carried out on projects which are accompanied by revenue. The main objective of a financial analysis is to make clear whether or not the revenue from a project itself is enough to carry out implementation, maintenance and operation of a project.

15.3.2 Expenditures

(1) Investment Costs

The financial investment cost of the Project has been described in Section 15.2.2 (1) and (2) together with the economic cost.

(2) Operation and Maintenance Costs

a) Personnel Cost

With the implementation of this Project, the number of personnel for Juan Santamaria Airport is assumed to increase from the present 204 to 261.

The future personnel cost for Juan Santamaria Airport is estimated as described in Section 15.2.2 (3) a).

b) Material and Equipment Costs

The costs for material and equipment are the financial costs described in Section 15.2.2 (3) b).

15.3.3 Revenue

(1) Revenue to be Quantified

(a) Revenue from the overflow of international passengers.

(b) Revenue from the overflow of international cargo.

(2) Estimation of Revenues

a) Revenue from the Overflow of Passengers

This revenue is composed of aircraft landing charges, navaid charge, airport tax from passengers, etc. obtained from international overflow of passengers.

This revenue is estimated by the equation 15.3.1.

$$FPSt = DRTt \times FSGP \times (1 + IMDO) + RTt \times CONV \times ATAX \times VAPA + (DRTt - RTt) \times CONV \times ATDO \times VAPA \quad \text{---------- (15.3.1)}$$

where,

FPSt	;	Amount of the revenue from passengers in year t
DRTt	;	Incremental international passengers in year t
FSGP	;	Operating revenue of the Airport per passenger (= 370 Colones/person)
IMDO	;	Domestic passenger portion estimated based on the revenue of SANSA (= 2%)
RTt	;	Incremental foreign passengers in year t (= 0.61 x (International passengers))
CONV	;	Conversion factor from two-way to one-way (= 1/2)
ATAX	;	Airport tax for a foreign passenger in 1991 (= 574 Colones)
VAPA	;	Profit ratio of the Airport in 1991 by DGAC record (= 0.47)
ATDO	;	Airport tax for Costa Rican passengers in 1991 (= 5,623 Colones)

The revenues from the overflow of passengers is shown in Table 15.3.1.

Table 15.3.1 Revenues from the Overflow of International Passenger

(Unit: Million Colones)

Year	1996	2000	2005	2010	2015
Total Revenue	333	699	699	699	699

b) Revenues from the Overflow of International Cargo

This revenue is obtained from the international incremental cargo and is estimated by the equation 15.3.2.

Table 15.3.3 Financial Cash Flow

Item Year	1990	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
1. Traffic in WP																									
1-1 Passengers(Persons)																									
International (*1)	922,969	1,071,788	1,121,394	1,171,000	1,264,800	1,358,600	1,452,400	1,546,200	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	1,640,000	
1-2 Cargo(ton)																									
International	66,903	100,040	111,085	122,131	142,739	163,347	183,956	204,564	225,172	225,172	225,172	225,172	225,172	225,172	225,172	225,172	225,172	225,172	225,172	225,172	225,172	225,172	225,172	225,172	
2. Incremental Traffic in WP																									
2-1 Passengers(Persons)																									
International		148,819	198,425	248,031	341,831	435,631	529,431	623,231	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	717,031	
2-2 Cargo(ton)																									
International		33,137	44,182	55,228	75,836	96,444	117,053	137,661	158,269	158,269	158,269	158,269	158,269	158,269	158,269	158,269	158,269	158,269	158,269	158,269	158,269	158,269	158,269	158,269	
3. Traffic in WOP																									
3-1 Passengers(Persons)																									
International	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	922,969	
3-2 Cargo(ton)																									
International	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	66,903	
4. Revenue																									
a) Overflowing Pax		0	0	0	333	425	516	608	699	699	699	699	699	699	699	699	699	699	699	699	699	699	699	699	
b) Overflowing Cargo		0	0	0	41	52	63	74	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	
c) Residual Value																								1,372	
Revenues Total		0	0	0	374	476	579	682	784	784	784	784	784	784	784	784	784	784	784	784	784	784	784	2,156	
5. Expenditure																									
a) Construction		825	2,819	3,219																					
b) Replacement																			222						
c) Additional Personnel					39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	
d) Additional M & E					93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	93	
Expenditure Total		825	2,819	3,219	132	132	132	132	132	132	132	132	132	132	132	132	132	132	354	132	132	132	132	132	
6. Net Profit		-825	-2,819	-3,219	242	344	447	550	652	652	652	652	652	652	652	652	652	652	430	652	652	652	652	2,024	
7. Discounted Revenue at End of Year 1991																									TOTAL
a) At Rate of 0%		0	0	0	374	476	579	682	784	784	784	784	784	784	784	784	784	784	784	784	784	784	784	2,156	16,028
b) At Rate of 10%		0	0	0	232	269	297	316	333	302	275	250	227	206	188	171	155	141	128	117	106	96	88	219	4,117
c) At Rate of 20%		0	0	0	150	160	162	159	152	127	106	88	73	61	51	42	35	29	25	20	17	14	12	27	1,510
8. FIRR= 5.7%																									
9. Discounted Expenditure at End of Year 1991 ;																									TOTAL
a) At Rate of 0%		825	2,819	3,219	132	132	132	132	132	132	132	132	132	132	132	132	132	132	354	132	132	132	132	132	9,725
b) At Rate of 10%		682	2,118	2,199	82	75	68	62	56	51	46	42	38	35	32	29	26	24	58	20	18	16	15	13	5,802
c) At Rate of 20%		573	1,631	1,552	53	44	37	31	26	21	18	15	12	10	9	7	6	5	11	3	3	2	2	2	4,074

*Note (*1) : Traffic demand will reach its ceiling in year 2000 because of no investment for long-term development.*

$$FCGt = (IECt + IICt) \times FSCG \quad \text{---------- (15.3.2)}$$

where,
FCGt ; Amount of the revenue from cargo in year t
IECt ; Incremental exported cargo in year t
IICt ; Incremental imported cargo in year t
FSCG ; Operating revenue of the airport per cargo
(= 370 x 1.45 = 537 Colones/ton)

The revenues from the overflow of cargo is shown in Table 15.3.2.

Table 15.3.2 Revenues from the Overflow of Cargo

(Unit: Million Colones)

	1996	2000	2005	2010	2015
Total Revenue	41	85	85	85	85

15.3.4 Financial Evaluation of the Project

(1) Premises

The evaluation period, lifetime value shall be the same as for the economic analysis.

It should be noted that the financial analysis of the Project was carried out as a public utility works under the condition that revenue and expenditures are controlled by the Government of Costa Rica.

(2) Calculation and Evaluation

The FIRR (Financial Internal Rate of Return) is calculated by comparing the expected revenues and expenditures as shown in Table 15.3.3. The calculated FIRR is as low as 5.7 %. The project, therefore, will not be financially feasible unless a loan with low interest is available.

However, if it is possible to increase the existing charges quantified in the above analysis by 30 percent at the time of completion of the project and then increase them by 40 percent every ten years, the FIRR increase to 12.4 % which is considered more or less financially feasible.

In order to attain the possibility of increasing the airport charges, the aircraft landing charge and airport service tax which constitute a large part of the total revenues were compared in Table 15.3.4 and 15.3.5.

Even assuming that the aircraft landing charge is increased to 130 % of the present level, that is 235 US$ for DC-10, the level of charge is still relatively low as compared with other countries.

On the other hand, the present airport service tax is low for non-resident passengers comparing to that of the countries in the vicinity of Costa Rica. The present tax for non-resident passenger could increase by a rate of more than 30 %.

Table 15.3.4 Comparison of Aircraft Landing Charge of DC-10

(Unit: US$)

Country	Airport	Landing Charge
Costa Rica	Juan Santamaria	181
United States	J.F.K.	860
West Germany	Frankfurt	2,950
United Kingdom	Heathrow	750
Mexico	Mexico city	910
Thailand	Bangkok	990
Japan	Narita	4,760

Note: As of February 1992 with MTOW 252 ton

Table 15.3.5 Comparison of Airport Tax

(Unit: US$)

Country	Domestic	International
Costa Rica	-	Resident 43.25 Non-Resident 4.25
Panama	-	15.0
Nicaragua	-	10.0
Chile	12.5	12.5
Mexico	11.5	10.0
Thailand	7.9	7.9
Japan	15.7	15.7

CHAPTER 16 CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 16 CONCLUSIONS AND RECOMMENDATIONS

16.1 Conclusions

As a result of the comprehensive study presented in this report which includes airport master planning of three airports, selection of a priority project and the feasibility study on the short-term development project of Juan Santamaria Airport (the Project), it is concluded that the existing Juan Santamaria Airport be rehabilitated and developed in order to solve the present capacity problems and to cope with the traffic requirements anticipated up to the year 2000. The Project will consist of construction of a new apron, taxiway and new cargo building, improvement of the existing runway and road pavement, expansion of the passenger terminal building, and installation of airport utilities.

These conclusions have been reached for the following major reasons:

a) The short-term development of Juan Santamaria Airport was selected as the highest priority project from the viewpoints of importance and urgency in the international airport system of Costa Rica.

b) The Project offers maximum use of the existing facilities with minimum investment and enables flexible selection for the implementation of the long-term development to comply with international standards.

c) The project cost is estimated at 6,863 million Colones in the short-term development and the economic internal rate of return (EIRR) is 27.5 percent. Hence, the Project is feasible from the viewpoint of the optimum allocation of resources in the national economy.

d) The value of FIRR is estimated as low as 5.7%. This is because the financial analysis of the Project was carried out as a public utility work under the condition that revenue and expenditures are controlled by the Government of Costa Rica.

e) The implementation of the Project will have impacts on:

- Contribution to international tourism development,
- Contribution to increase opportunities for trade and business,
- Enhancing foreign investment,
- Generating employment opportunities, and
- Assurance of air transport safety.

16.2 Recommendations

(1) It is recommended that the Project be implemented as soon as possible and, therefore, that the preparatory work be initiated at the earliest possible date.

(2) This study proposes the long-term development plan of Juan Santamaria Airport in which airport facilities will meet with international standards. However, some problems related to poor meteorological conditions and the aircraft noise will remain unsolvable if the airport remains at the existing site.

It is therefore recommended that a comprehensive study be started to determine the feasibility of a new airport development, to compare that with the long-term development plan proposed in this study, and to finally decide on the development of the existing airport or the construction of a new airport.

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