ICAO Air Transport Symposium

Strategies and Tools for Sustainable Air Transport

Economic Impact Analysis Methods for Airports

- Case Study in Korea -

The Korea Transport Institute

Department of Aviation Policy and Technology

ICAO · OACI · ИКАО 国际民航组织 · ايكاو

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I Research Overview

- Background and Purpose

1. Research Overview

Background and Purpose

1) Background

- ✓ Increases in demands for the analysis of airports' economic impact for understanding local businesses and policy formulation
- ✓ Absence of a clear definition of the scope and itemized details of airport impacts
- ✓Lack of detailed analysis method and framework

2) Purpose

- ✓ Prepare a local compensation system standard in response to airport noise impacts
- ✓ Estimate inter-regional and national impacts for future airport policy formulation
- ✓Proposing an airport categorization system according to the impacts

Ⅱ Economic Impact of the Airport and Assessment Items

- Establish the definition of impact
- Formulate impact items

II. Economic Impact of the Airport and Assessment Items

Establish the definition of impact

✓ Internal and external Impacts according to the flow of resources due to the construction or operation of airports

✓ Internal impact: direct, indirect, linkage impacts

Internal & External Impact

Direct impact

- Effects generated as the direct result of airport construction and operation

Indirect impact

- Effects generated as the side effects of the direct impacts

Linkage impact

- Effects generated by the direct and indirect impacts through a linked industrial supply chain

External impact

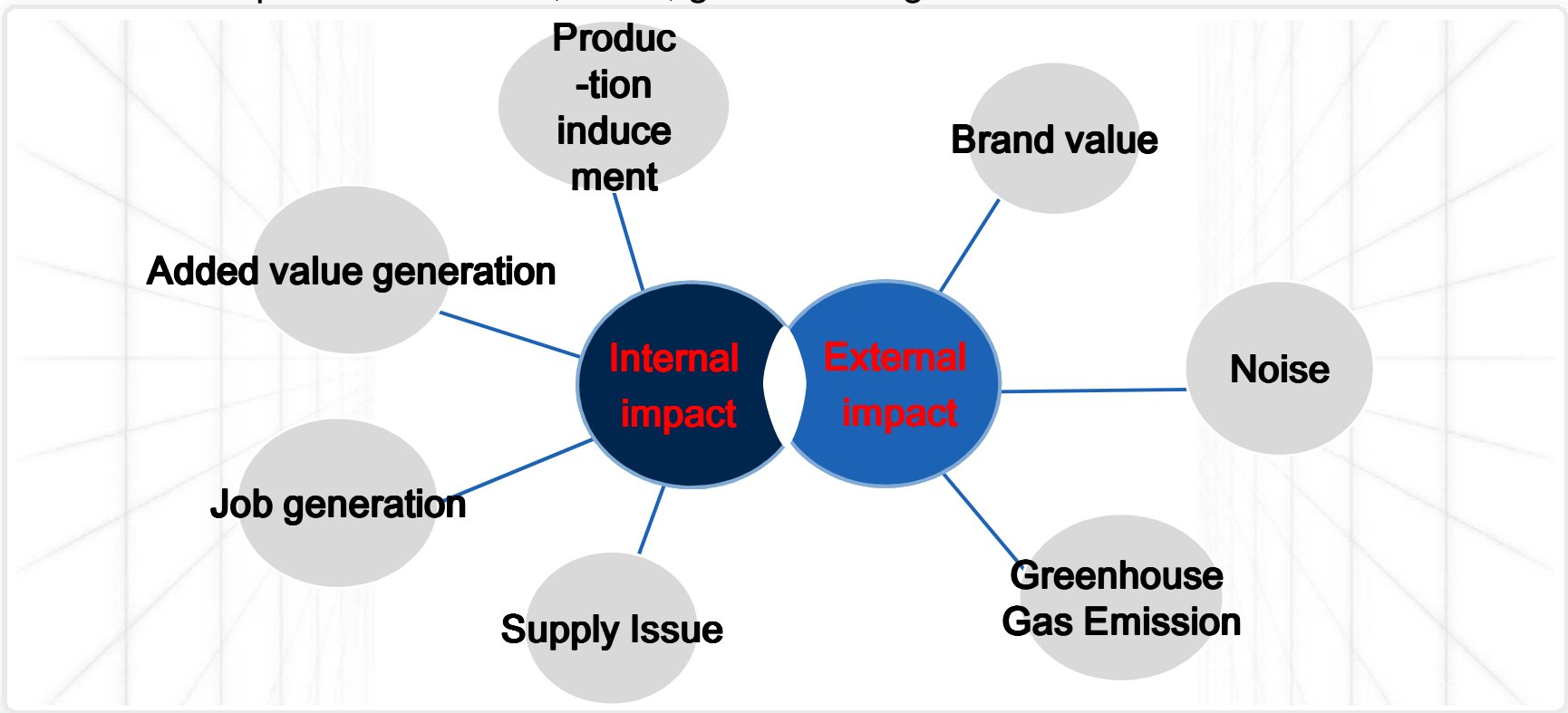
- Cannot be categorized as direct, indirect or linkage impact, but generated through airport construction and operation

II. Economic Impact of the Airport and Assessment Items

Formulate impact items

✓ Internal impact: production inducement, generation of added value, Supply issue, generate jobs

✓ External impact: brand value, noise, greenhouse gas emission

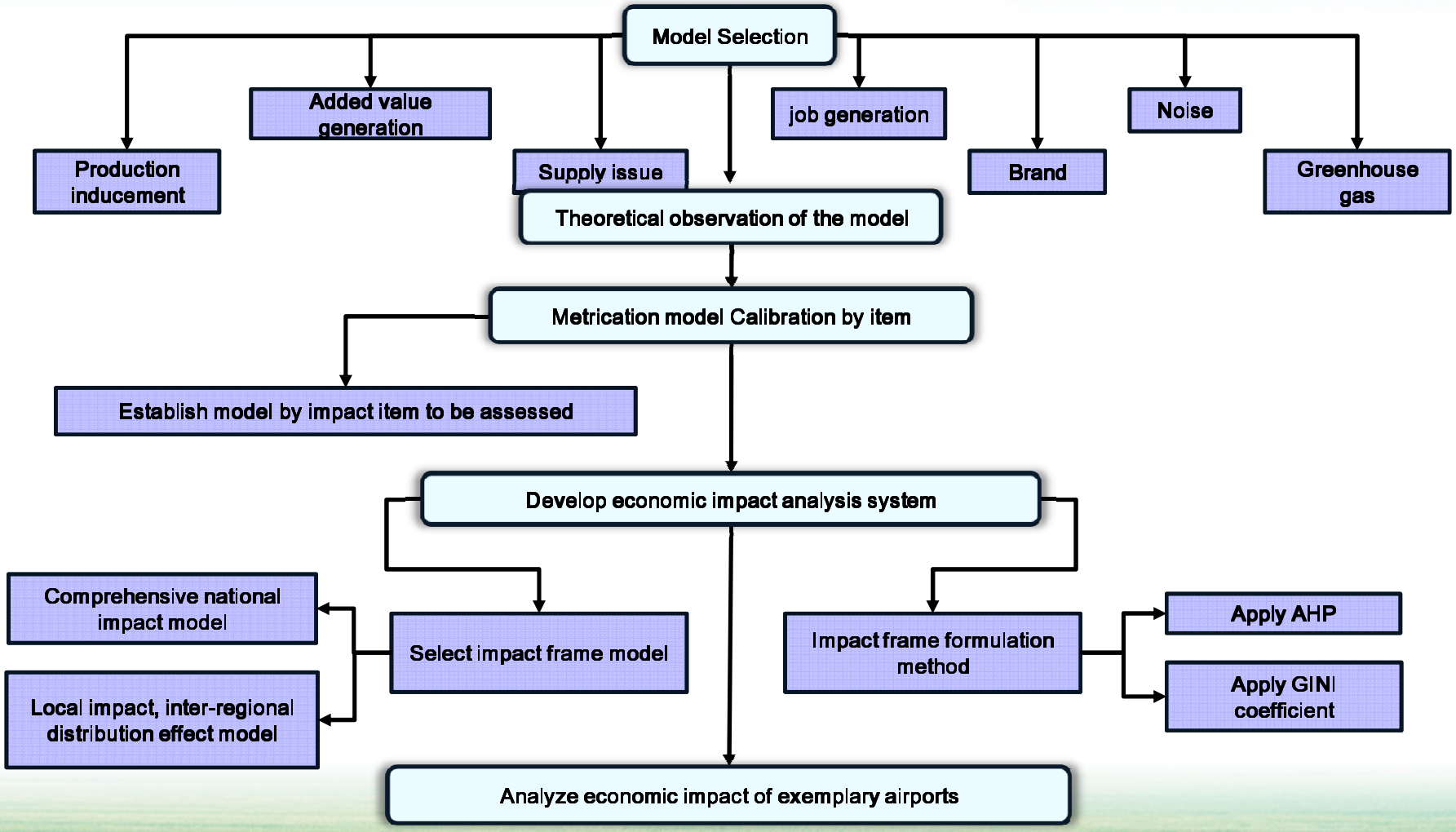


Ⅲ Economic Impact Analysis Methodology

- Analysis method flow chart
- Metrication model by assessment item
- Metrication model calibration by assessment item
- Development of economic impact analysis system

III. Economic Impact Analysis Methods

Analysis method flow chart



III. Economic Impact Analysis Methods

Metrication model by assessment item

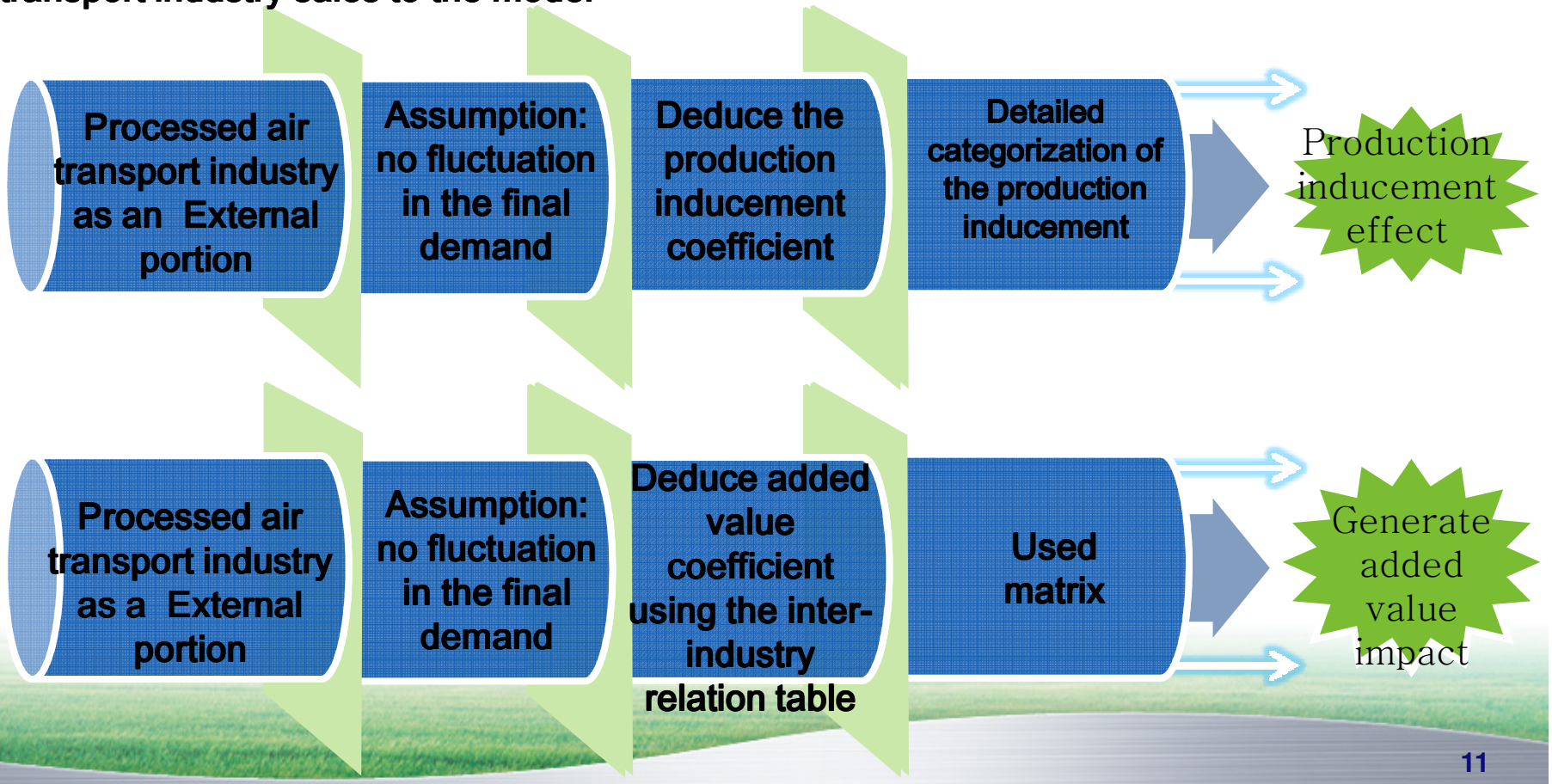
Assessment item	Metrication model	Special notes
Production inducement effect	MRIO	Categorized into national and local
Added value generation effect	MRIO	Categorized into national and local
Job generation effect	MRIO	No currency value Excluded from the comprehensive impact
Supply issue effect	MRIO	Categorized into national and local
Brand value effect	IPS Brand Asset model	Only pure airport brand value reflected
Noise effect	Regression model	Establish a regression model using actual compensation cost Only reflects airports where noise compensation projects are underway
Greenhouse gas emission effect	Unit Cost	Apply carbon value and existing atmosphere pollution emission methodology

III. Economic Impact Analysis Methods

Metrication model calibration by assessment item

1) Establish MRIO model

✓**Re-categorized to reflect the impact and input parameter such as construction cost, air transport industry sales to the model**



III. Economic Impact Analysis Methods

Metrication model calibration by assessment item

1) Establish MRIO model

- Estimate the number of employees in each industry in the total business research report as new elements
- The standard proposed in this report is applied without modification

→ Generate employment effect

- Apply and deduce the methodology proposed in the existing theory without modification

→ Supply Issue effect

→ Pricing effect

III. Economic Impact Analysis Methods

Metrication model calibration by assessment item

2)Establish brand value effect model

Financial data assessment

↓

Deduce industry index

✓ Apply weighted average of the sales during the past three years as a financial approach

✓ Apply inflation for the present value

✓The industry index indicates the brand effect on each industry

✓ Utilize the industry index proposed by Ministry of Commerce, Industry and Energy, Korea Institute of Design Promotion (2002), 「Research on brand value assessment」

✓ Use the air demand forecasting data in 「The 4th National Mid/Long-Term Airport Development Plan」 to estimate each airport's brand earnings

III. Economic Impact Analysis Methods

Metrication model calibration by assessment item

3) Establish greenhouse gas impact model

✓ Analyze the greenhouse gas savings benefit in the air industry

(「Transportation Facility Investment Assessment Guideline」 : Reflect CO_2 only for the greenhouse gas savings benefit item in the road and railway sector)

✓ Refer to the methodology and "basic unit" used in previous researches

- KOTI's (2008) 「Air Transport Sector Greenhouse Gas Emission Scale Estimation and Management Measure」
- Ministry of Land, Transport and Maritime Affairs'(2009) 「Transportation Facility Investment Assessment Guideline, Amended Version」
- Ministry of Land, Transport and Maritime Affairs and Korea Institute of Construction & Transportation Technology Evaluation and Planning (KICTEP,2010) 「Transportation Sector Greenhouse Gas Reduction and Comprehensive Management Technology Development」

✓ In this research, we used Tier 1 methodology within the IPCC guideline, which is the clearest and simplest (Currently, to estimate the gas emission in the air transport sector, the 2006 IPCC guideline is used)

III. Economic Impact Analysis Methods

Metrication model calibration by assessment item

4) Establish noise impact model

✓ Use regression model (independent variable: A/C mov't, dependent variable: Noise index)

Forecasting formula	R^2	D-W
$Cost_z = 0.67 \times Flight_z - 165274.7$ (4.75) (-3.71)	0.16	1.52

Note : ( ) indicates t-value

✓ The noise countermeasure compensation used in specific airports with severe noise problems

Designated noise problem airport (Noise impact 75WECPNL ~)	Designated notification date
Incheon Airport	Nov 30 2010
Gimpo Airport	Jun 21 1993
Gimhae Airport	Sep 01 1994
Jeju Airport	Jul 01 1993
Ulsan Airport	Dec 05 2006
Yeosu Airport	Dec 05 2006

✓ Rest of airports excluded from Noise impact model

III. Economic Impact Analysis Methods

Develop economic impact analysis system

1) Comprehensive nationwide impact model

- ✓ The method of simply adding individual impacts facilitates application and comprehension
- ✓ The individuality of the relations between each impact cannot be guaranteed
- ✓ Simulation formats can cause confusion in actual application
- ✓ The method of reflecting policy makers' opinions simplifies complicated mechanisms, can be applied to reality in various ways
- ✓ The CGEmodel is hard to establish, but is important for interpretation

AHP Technique (Analytic Hierarchy Process) Used

2) Comprehensive local area impact model

- ✓ Local impacts can also have influence on policies
- ✓ The meaning of consolidation is null, as it is reinterpreted as national impact
- ✓ The degree of impact an airport has on its region and other areas is important in determining the characteristics of the airport

GINI Coefficient applied

III. Economic Impact Analysis Methods

Develop economic impact analysis system

3) Result of deducing weights for establishing an impact frame

- ✓ It was analyzed that the direct impact is deemed more important than the indirect impact
- ✓ Especially, corporations and non-specialists deemed the direct impact more important
- ✓ Even by the overall average, the importance of direct and indirect impacts were found to be 0.797,and 0.203 each

Assessment item		Specialist (10)	Corporation (5)	Carrier (5)	Non-specialist (5)	Total
Direct impact		**0.763**	**0.865**	**0.755**	**0.821**	**0.797**
	Production inducement effect	**0.333**	**0.413**	**0.427**	**0.396**	**0.383**
	Added value generation effect	**0.291**	**0.296**	**0.230**	**0.271**	**0.277**
	Supply issue effect	**0.139**	**0.156**	**0.097**	**0.154**	**0.136**
Indirect impact		**0.237**	**0.135**	**0.245**	**0.179**	**0.203**
	Greenhouse gas	**0.080**	**0.022**	**0.091**	**0.071**	**0.067**
	Noise	**0.059**	**0.088**	**0.079**	**0.082**	**0.078**
	Brand value	**0.098**	**0.025**	**0.075**	**0.026**	**0.060**

Ⅳ Airport Impact Case Study

- Result of case analysis
- Airport categorization by impact

IV. Airport Impact Case Study

Result of case analysis

- ✓ Cases include 8 int'l airports (excluding Incheon Int'l Airport), and 6 domestic airports
- ✓ Proposed airport categorization system based on national and local standards based on the developed analysis system
- ✓ 2010 national standard airport impact categorized into direct, indirect, linkage and external impacts

❖ **Assessment item result by national impact categorization** **(Unit: 0.1 billion won/year)**

2010	Assessment item	GMP	PUS	CJU	KWJ +MWX	CJJ	TAE	RSU	KUV	HIN	USN	WJU	KPO	YNY	Total
Direct impact	Production inducement	38,752	17,923	34,832	3,210	2,857	2,548	1,411	392	357	2,263	157	728	19	105,449
	Supply issue	33,423	15,455	30,128	2,779	2,472	2,205	1,223	338	309	1,958	136	631	16	91,073
Indirect impact	Production inducement	1,732	801	1,561	144	128	114	63	18	16	101	7	33	1	4,720
	Added value	392	181	353	33	29	26	14	4	4	23	2	7	0	1,069
	Supply issue	8,959	4,143	8,076	745	663	591	328	91	83	525	37	169	4	24,413
Linkage impact	Production inducement	16,571	7,663	14,937	1,378	1,226	1,093	606	168	153	971	68	313	8	45,154
	Added value	5,781	2,673	5,211	481	428	381	212	58	53	339	24	109	3	15,753
	Supply issue	46,156	21,343	41,604	3,837	3,414	3,045	1,689	467	427	2,703	188	871	22	125,767
External impact	Greenhouse gas	494	229	446	41	37	33	18	5	5	29	2	9	0	1,347
	Noise	335	19	19	-	-	-	2	-	-	3	-	-	-	377
	Brand	1,223	740	561	46	40	64	16	3	5	28	2	8	2	2,739

Note: 1$≒1000won

IV. Airport Impact Case Study

Case analysis result

2010, inter-regional production inducement effect result(Unit: 0.1 billion won/year)

- ✓ The inter-regional airport impact is similar to the national impact results
- ✓ Impact concentrated on regions connected by routes or housing the given airport

2010	GMP	PUS	CJU	KWJ +MWX	CJJ	TAE	RSU	KUV	HIN	USN	WJU	KPO	YNY
Seoul	48,674	2,408	5,397	495	445	359	219	60	48	306	30	103	3
Incheon	2,484	643	1,857	169	190	146	75	21	13	81	12	42	1
Gyeonggi	4,129	1,362	2,945	270	313	226	120	33	27	172	21	65	2
Daechun	257	89	232	21	37	14	10	3	2	11	1	4	0
Chungbuk	349	129	299	27	3,093	19	12	3	3	16	1	5	0
Chungnam	2,957	406	2,360	217	200	160	96	27	8	51	10	46	1
Gwangju	226	98	538	3,717	14	13	56	12	2	12	1	4	0
Jeonbok	336	155	785	128	21	20	48	444	3	20	1	6	0
Jeonnam	4,295	1,655	4,292	414	236	271	1,766	61	33	210	14	78	2
Daegu	300	202	289	27	19	2,938	12	3	4	25	1	41	0
Gyungbuk	1,169	629	1,029	95	75	107	42	12	13	80	5	832	1
Busan	1,143	20,784	1,033	94	64	82	42	12	31	211	4	24	0
Ulsan	5,959	4,437	5,062	465	311	433	206	57	88	2,979	20	124	2
Gyungnam	2,609	1,399	2,250	206	170	186	91	25	413	185	11	54	1
Gangwon	186	69	135	12	11	10	6	2	1	9	179	3	21
Jeju	88	51	40,939	23	6	5	22	6	1	7	0	2	0
Sum total	75,159	34,516	69,441	6,382	5,205	4,989	2,824	780	689	4,374	313	1,432	36

Note : The vertical column means region, the horizontal row means airport

IV. Airport Impact Case Study

Case analysis result

❖ 2010, inter-regional added value generation effect result(Unit: 0.1 billion won/year)

2010	GMP	PUS	CJU	KWJ +MWX	CJJ	TAE	RSU	KUV	HIN	USN	WJU	KPO	YNY
Seoul	8,503	562	1,116	102	122	79	45	12	11	71	7	23	1
Incheon	538	135	375	34	53	32	15	4	3	17	3	9	0
Gyeonggi	917	294	580	53	90	49	24	7	6	37	5	14	1
Daechun	49	16	41	4	10	3	2	0	0	2	0	1	0
Chungbuk	55	20	44	4	700	3	2	0	0	3	0	1	0
Chungnam	763	72	545	50	61	40	22	6	1	9	2	11	0
Gwangju	46	21	102	538	3	3	12	2	0	3	0	1	0
Jeonbuk	62	30	143	26	4	3	10	63	1	4	0	1	0
Jeonnam	1,169	440	1,049	100	74	70	266	14	9	56	4	20	0
Daegu	49	35	44	4	4	458	2	0	1	4	0	9	0
Gyungbuk	159	87	128	12	12	16	5	1	2	11	1	126	0
Busan	206	3,545	167	15	13	14	7	2	7	48	1	4	0
Ulsan	1,715	1,307	1,305	120	105	118	53	15	26	567	5	34	1
Gyungnam	380	229	298	27	28	26	12	3	69	28	2	8	0
Gangwon	36	13	24	2	3	2	1	0	0	2	28	1	3
Jeju	20	11	5,926	4	1	1	5	1	0	1	0	0	0
Sum total	14,666	6,816	11,888	1,096	1,284	917	483	133	136	863	57	262	7

Note : The vertical column means region, the horizontal row means airport

IV. Airport Impact Case Study

Airport categorization by impact

1) National standard airport categorization result

✓ Define the impact by unit operation cost in the national impact as the marginal impact, and categorize airports by marginal impact according to operation cost
✓ This result is the basic research before attempting airport categorization for future policy formulation. May be subject to change.
✓ Also, the result serves as a proposal for categorization

❖ **2010, result of airport categorization by marginal impact (weighted value applied)**

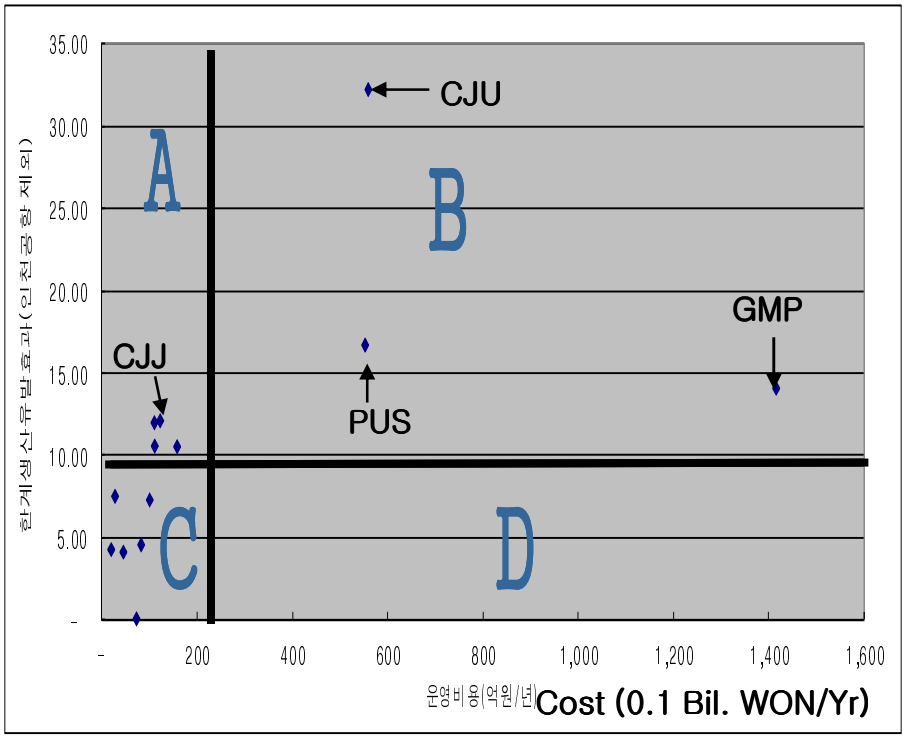
Classification	PUS	CJU	KWJ+MWX	CJJ	TAE	RSU	KUV	HIN	USN	WJU	KPO	YNY
Marginal Production inducement	B	B	A	A	A	C	C	C	A	C	C	C
Marginal added value	B	B	A	A	A	C	C	C	A	C	C	C
Marginal Supply issue	B	B	A	A	A	C	C	C	A	C	C	C
Marginal job generation	B	B	A	A	A	C	C	C	A	C	C	C
Marginal Greenhouse gas and Noise	B	B	C	A	A	C	C	C	A	C	C	C
Marginal brand value	B	B	C	C	A	C	C	C	C	C	C	C
Marginal comprehensive impact	B	B	A	A	A	C	C	C	A	C	C	C

Note: A category: low operation cost, high regional diffusion effect, B category: high operation cost, high regional diffusion effect. C category: low operation cost, low regional diffusion effect, D category: high operation cost, low regional diffusion effect

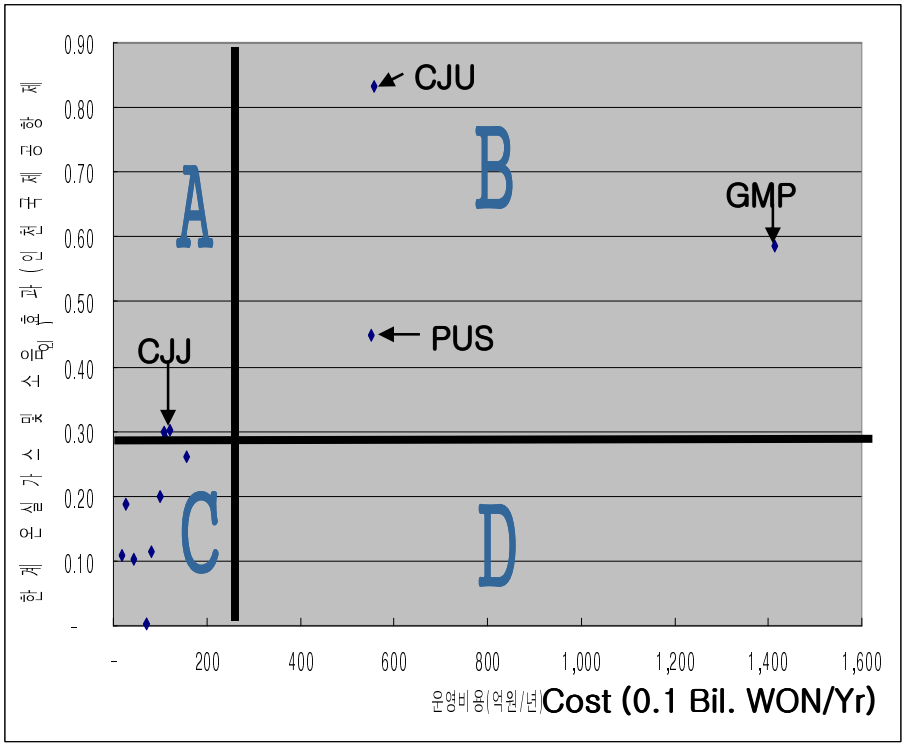
IV. Airport Impact Case Study

Airport categorization by impact

1) National airport categorization result (2010)



< Example of airport categorization based on Production inducement>

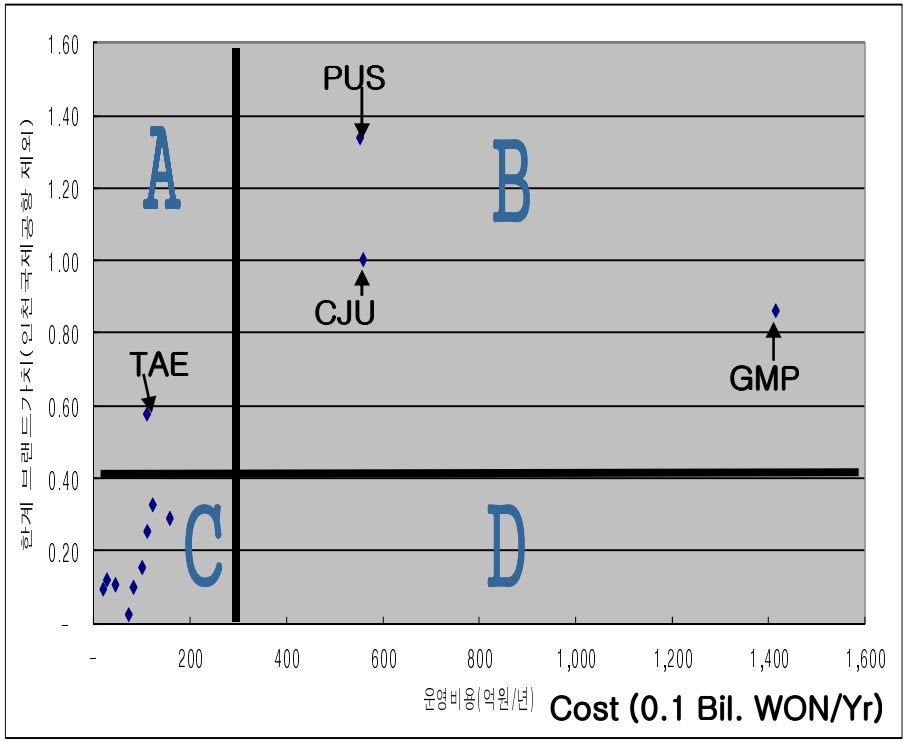


< Example of airport categorization based on Greenhouse gas and noise>

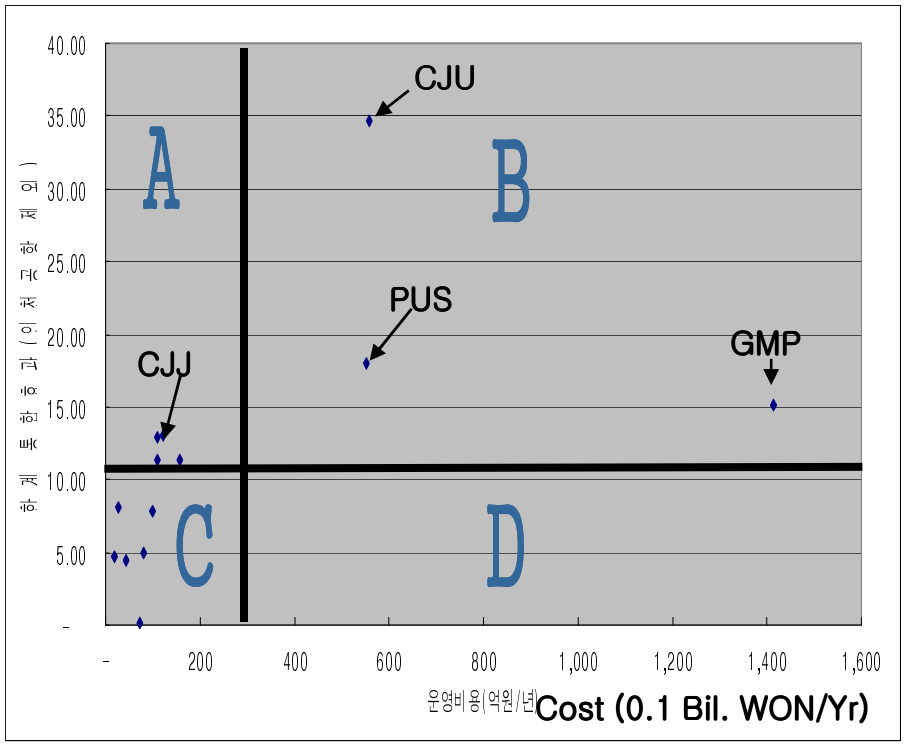
IV. Airport Impact Case Study

Airport categorization by impact

1) National airport categorization result (2010)



< Example of airport categorization based on Brand value>



< Example of airport categorization based on Comprehensive impact>

V Conclusion and Policy Proposals

- Conclusion
- Policy Measures

V. Conclusion and Policy Proposals

Conclusion(1)

✓ In order to improve the methodology of analyzing airports' economic impacts, establish the concept of economic impact, formulate impact assessment items, and develop a consolidated analysis system

✓ Establish an airport categorization system by applying the developed analysis system to actual domestic airports

✓ Propose impact items including brand value generation and additional impacts such as greenhouse gas and noise, as well as domestic and overseas impacts

✓ Consolidate national impacts by using the AHP technique

V. Conclusion and Policy Proposals

Conclusion(2)

✓ **Simultaneously, determine the distribution of airport impacts through inter-regional impacts**

✓ **The results of this research will propose the policy directionalities for quantitative airport assessment and devise compensation systems based on the noise impacts**

✓ **Prepare the basis for judging whether the airport should be built, considering the interrelation among airport**

✓ **Propose a systematic airport policy development standard based on the airport categorization system**

V. Conclusion and Policy Proposals

Policy Measures

✓ **Prevent inadequate use of budget by ensuring efficient investment – use for new airport feasibility assessment**

✓ **Basis for the local community members of areas impacted by airport noise – demand compensation and countermeasures to the local governments**

✓ **Use for estimating the scale of reinvestment or airport policies according to airport categorization by cost and impact**

Aim High, Fly Higher

for the Single Sky

Thank You !

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