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PERFORMANCE EVALUATING FRAMEWORK OF AN INTEGRATED GOAL-RELATED TRANSPORT POLICY

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Abstract: This study constructs a comprehensive framework for analyzing and evaluating the performance of urban transport policies. The content of urban transport policies can be classified into four interrelated categories: investment, pricing, regulation and subsidy. These four categories are combined as policy elements to generate policy alternatives. A case study of a second biggest city in Taiwan building a new MRT system is considered. To simulate the interrelationship among these four policy elements, the result shows that an integrated goal-related transport policy with four elements is required, and is more effective than single element to pick up the public transport market share.

Key Words: public transport, transport policy, travel demand model, investment, pricing, regulation, subsidy.

1. INTRODUCTION

Urban transportation problems are gradually developing into serious problems due to the motorization and the urbanization in every metropolis over the world. These problems are included congestion, pollution, public deficits, etc. In order to tackle them, government authorities make hugely efforts to institute a mechanism that formulates the urban transport policies with different various degrees of goal-setting. In practice, encouragement of the public transport development is the key to success in the conduct of urban transport policy studies (Kirchhoff, 1995; Pucher and Stefana, 1995; Bonnel, 1995; Meyer, 1999). Though the Taiwan government declared that developing the public transport was the most important, but it just focused on policy declaration rather than concrete actions and actual policies. Therefore, clearly and efficiently proposals and especially the implementation of them is most important, especially in qualitative and quantitative analysis.

In the past, Taiwan government just paid attention to the investment policy rather than other related transport policy instruments. In fact, pricing, regulation and subsidization are the important considerations when dealing with the urban transportation problems. The successful experiences in other countries showed that if these four elements (investment, pricing, regulation and subsidy) are well considered, the countries do not only tackle their transportation problems, but also gain infrastructure-funding benefits. Although these four elements have more interactive relationships in urban transportation assessment, it is more difficult and complex to analyze their interaction. Some research simplified the elements and/or ignored the some of these elements (pricing, regulation and subsidy) to facilitate the assessment and/or simulation easy (May 1991; May, 1995; Pucher 1995).

The main purpose of this study is to construct a goal-related comprehensive framework and describe a systematic approach for analyzing and evaluating the performance of urban transport policy alternatives. The study will first is to integrate suitable transport policy elements and efficient strategies that are in related to investment, pricing, regulation and subsidization in urban transport systems. The efficient ones would be suggested through this performance evaluating process and will most effectively contribute to the solutions of transportation problems in urban area. Therefore, the contents of this study, the framework and the assessment methodology are discussed individually in section 2; in section 3 a case study follows while in section 4 the empirical results are outlined; the comparisons and inferences after the evaluation framework are presented in section 5; and the final section provides some concluding comments.

2. METHODOLOGY

The methodology applied in this study firstly is to construct a goal-related comprehensive framework based on the traditional procedure of transportation planning process. The technological processes in this paper can be separated into three phases. First, the combinations of four categories of urban transport policies as a completely package (investment, pricing, regulation and subsidy) generate “policy alternatives”. Second, a transport planning software, MINUTP, is used to simulate the classic four-stage transport model (trip generation, trip distribution, mode split and trip assignment) and to compute the travel demand and the changes of public transport market share. And finally, the feasible alternatives that can substantially be satisfied the travel demands are assessed based on their cost and benefit analysis to select the best transport policy alternative.

2.1 Goal-Related Comprehensive Evaluation Framework

The goal-related comprehensive framework is illustrated in Figure1. It starts with a goal-setting and just shows clearly a general direction (Step1). In order to improve the urban transportation problems, the mainly goal is to encourage people to use the public transport more frequently, as described in the next section. It then sets up an explicit objective about how many percentages there are in the public transport market share (Step2). The next step is to construct a combination of investment, pricing, regulation and subsidy to generate some possible and reasonable policy alternatives. The combinations themselves allow the interactions between four categories to be assessed (Step3).

Then, use the classic four-stage of trip generation, trip distribution, mode split, and trip assignment will to be used to predict the number of trips made within an urban area by type

(work, non-work, etc.); time of day (peak period, daily, etc.); zonal origin-destination (O-D) pair; the mode of travel used to make these trips (Meyer 2001); and the routes taken through the transport network by these trips (Step4). Each policy alternatives which was analyzed through the travel demand, has to be checked whether the alternatives satisfy the essential level of service or not (Step5). After the iterations, evaluate the whole transport system performance will be evaluated to find feasible alternatives and calculate the demand of the subsidization (Step6).

However the iteration procedure described below ensures that the shape of the surface is only important close to the optimum alternative. The alternatives appraisals employed a combination of quantitative evaluation and qualitative judgment. The main analytic tool was the benefit-cost analysis, which represents each alternative at a strategic level. The set of alternatives should be structured to provide a range of options to decision maker that illustrates the trade-offs among costs, transportation benefits, and other impacts. The feasible alternatives that can satisfy the travel demand are evaluated based on their cost and benefit analysis to select the optimum alternative (Step7).

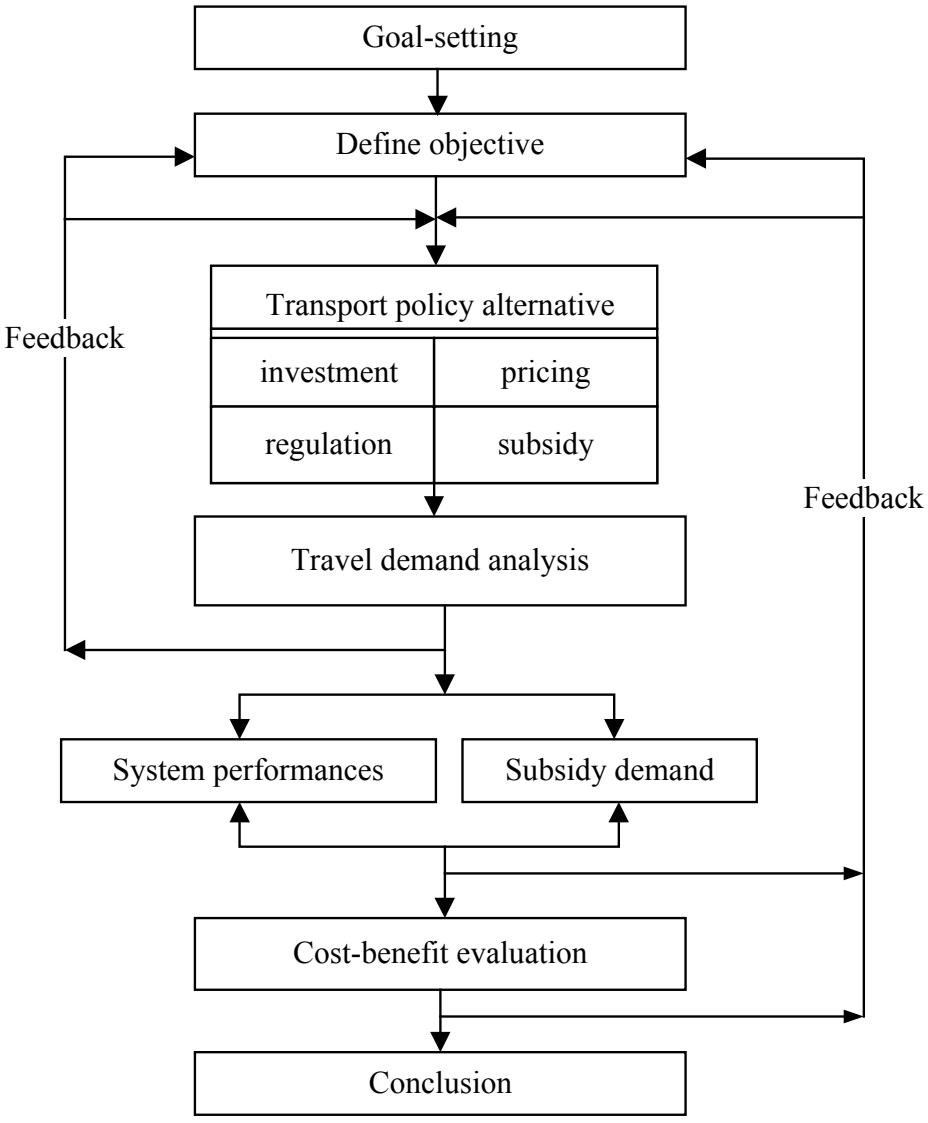

Figure 1. The Comprehensive Framework

2.2 Transport Policy Alternatives

Transport policy should not give undue emphasis to infrastructure. For instance, pricing strategies, regulation strategies, subsidy strategies are in terms of significant to solve urban transportation problems. In the recent studies (May, 1991; May, Shepherd and Timms, 2000), a distinction has thus been made between infrastructure investment, pricing policies, private transport regulation and public transport subsidy. Therefore, according to the characteristics of the urban, the type of transportation system, and the demand of the travel, we could found that urban transport policy combine four categories of urban transport policy elements (investment, pricing, regulation and subsidy) to generate policy alternatives. The four when integrated, from a complete transport policy alternative. Thus there are many strategies, instruments or actions in place in each ones. In practice, it is often easier to distinguish between those which can be quickly and cheaply implemented, and those which have longer lead times or significant budget implications. The potential policy instruments under each of these headings are considered briefly below.

Investment

Conventionally, the solution choice to the transport problems has been between private and public transport ones and, in particular, between road building and bus or rail service improvements. On the private transport, the main instrument here is clearly road building. Where new roads are being provided, there is growing interest in changing for their use and thus providing a dedicated, relatively congestion free route. For Public transport, the range of options is much wider. Applied case in this study is Kaohsiung, of which a new MRT system is currently under construction. And the Light Rail Transit offers a far wider range of new solutions. Besides, bus system is a common already existing public transportation mode in Taiwan. To improve the efficiency of bus operation is also useful. The network of bus and the shuttle bus between MRT and light rail is helpful to increase the market share of public transportation.

Pricing

In practice, the fare of the public transport system and the running costs of a private vehicle are the two main parts in pricing policies with regard to the whole urban transport system. In order to give an incentive to people to change from private vehicles to public transport, a decrease of the fare level should be considered. Furthermore, May (1991) founds that parking charge policies and charges for car use, whether by supplementary licensing or road pricing, have an important part in the comprehensive transport policy. The research results from Site and Filippi (1995) show, that car pricing, which includes fuel taxes, parking and road pricing, is often proposed as a key component in solving peak-hour traffic congestion and related energy-related and environmental problems. So, the parking fee and the out of pocket cost for the private modes users are used to design different scenarios.

Subsidy

Many countries have subsidized their public transport systems as a result of competitive tendering, for example, European, United Stated, Australian, New Zealand or Israeli (Barnum and Gleason, 1979; Bly et al., 1980; Pucher et al., 1983; Anderson, 1983; Kim and Spiegel, 1987; Karlaftis and Mccarthy, 1998). Based upon several studies analyzing the effects of public transport subsidies on a system's performance, there is a consensus that public

transport have increased a system's effectiveness but compromised its efficiency and overall performance. The significant increase in public transit subsidies, which has kept fares below operating costs and maintained or expanded services regardless of profitability. To encourage a higher usage of the public transportation, using the marginal cost pricing and average cost pricing is used in order to subsidize the bus system.

Regulation

An important part to be considered in terms of regulation is parking and the enforcements that make those regulations effective. However, how to design suitable indicators to assess the effects of the transportation planning process is difficult. This study tries to include as many policy instruments as possible. For example, increasing the road speed to catch the effect of traffic enforcement; changing the time of out of vehicle to reflect the change of parking spaces.

3. APPLICATION TO KAOHSIUNG

The comprehensive framework of integrated goal-related transport policy presented in this paper has been applied to the transport network of Kaohsiung, a metropolis of Taiwan having around 1.5 million inhabitants. Kaohsiung is the biggest commercial harbor and the second biggest city in Taiwan. Table 1 shows the statistic data of Kaohsiung, including land and population, public work, and transportation and communication. Besides, Kaohsiung municipal government has been preceding a mass repaid transit (MRT) system. The system will not only fulfill a transport function but will also provide the framework and catalyst for the development of the fabric, the economy and the quality of life of the area, and for the promotion of community life, culture and art. Kaohsiung had an important position, so it is necessary to construct a faultless transport policy before the MRT system is in operation.

Table 1. Statistic of Kaohsiung

Items	2000	2001	2002	2003
Land & Population				
Total area (Km^2)	153.6	153.6	153.6	153.6
Number of population (1,000 People)	1,491	1,494	1,510	1,509
Number of household (1,000 Household)	498	507	519	523
Volume of house (People)	3.00	2.95	2.91	2.87
Public Works				
Area of road (Km^2)	19.26	19.79	19.96	N.A.
Share area of road per car (m^2)	52	52	52	N.A.
Transportation & Communication				
Cars owned per 1,000 person (Vehicle)	244	252	253	256
Motorcycles owned per 1,000 person (Vehicle)	643	668	677	686
Average passengers per bus per operated (Vehicle)	46	47	45	42

Source: Kaohsiung City Government (2004) (http://www.kcg.gov.tw/~dbaskmg/statistics/)

Before to formulate and evaluate the transport policies of one certain urban area, regarded to the characteristics of it, the developments blueprint of it, the types of the whole transportation system in it, and the differences of travel demands were important. Because the completely transport policies design should conform to the long term development of the urban area, consider also other categories and not just pay attention to the transport investment. In order to encourage a transfer from private transport to public transport with resulting efficiencies and environmental benefits, and to assist in improving accessibility and encouraging

regeneration, the formulation and evaluation of the scenarios pay particular attention to the objectives that have been found during the consultations with the Kaohsiung. According to the planning of Kaohsiung (encourage people to use the public transit as much as possible), we designed the four categories and their strategies.

Table 2 details the naming convention adapted for the different measures under each category scenarios. In the investment element, it stars with the existing network (included rail and city bus). Then, step by step the transport network will be enlarged by adding two lines of MRT, one cycle LRT line, etc. In the pricing element, five different schemes are designed independently. In the regulation element, three schemes evaluate the change of the out of vehicle time (e.g. waiting time, transfer time, time for looking for the parking space). Combining these three elements (investment, pricing and regulation), through transportation planning processes can simulate the predicted demand of the number of bus passengers. According to the results of Wang and Chen (2004) who estimated the average cost and marginal cost of the Kaohsiung city bus, we can calculate the amount of subsidy.

Table 2. Four Categories And Their Strategies

Categories	Strategies
Investment	Ⅰ. Existing network (include rail and bus) Ⅱ. Establish the orange and red line of MRT. Ⅲ. Development the Ling Kong Harbor Freight Line (LKL) to the LRT system. Ⅳ. Adding shuttle bus between MRT and LRT. Ⅴ. Decreasing the bus headway.
Pricing	Ⅰ. Free for city buses. Ⅱ. Small rising the parking fees of private modes. (car: 40 NTD/hr, motorcycle: 20 NTD/hr) Ⅲ. Large rising the parking fees of private modes. (car: 50 NTD/hr, motorcycle: 25 NTD/hr) Ⅳ. Small rising the traveling cost of private modes. (car: 5 NTD/km, motorcycle: 2 NTD/km) Ⅴ. Large rising the traveling cost of private modes. (car: 9 NTD/km, motorcycle: 4 NTD/km)
Regulation	Ⅰ. Intensify parking control enforcement. Ⅱ. Reduce parking space. Ⅲ. Drive against traffic regulations.
Subsidy	Ⅰ. Bus subsidy according to the average cost. Ⅱ. Bus subsidy according to the marginal cost.

Note: The exchange rate (between currencies) is 1 USD = 34 NTD.

4. EMPIRICAL RESULTS

According to these four elements and their strategies (Table 2), continue the framework steps to simulate the travel demand in the future 2010.

4.1 Single Element Simulation

The single element simulated results are presented on Table 3. The percentage of public transport market share figures out by modal split process. The pcu-hr, the pcu-km and the number of total bus passengers are counted by the results of the traffic assignment. After the iterations, each simulation implies a certain level of the subsidy, which can calculate the demand of the subsidization by the marginal cost pricing and the average cost pricing.

Table 3. Single Element Simulation Results

	Public transport %	PCU-Hr	PCU-Km	Bus passenger	Subsidization by MC	Subsidization by AC
unit		1000	1000	person/day	US$ per day	US$ per day
Investment						
Ⅰ	4.53%	983	38,235	211,155	33,958	31,495
Ⅱ	12.44%	922	36,816	336,789	68,882	14,735
Ⅲ	15.84%	880	35,796	398,968	78,822	21,193
Ⅳ	15.98%	883	35,871	482,952	93,395	30,931
Ⅴ	16.18%	878	35,765	567,087	114,187	24,503
Pricing						
Ⅰ	4.53%	983	38,245	211,467	40,542	105,953
Ⅱ	7.19%	937	37,209	349,653	58,605	45,947
Ⅲ	9.88%	1,075	40,364	288,720	47,299	40,796
Ⅳ	5.42%	968	37,756	236,501	37,002	37,970
Ⅴ	8.38%	934	36,594	315,404	45,714	60,133
Regulation						
Ⅰ	4.93%	994	38,393	227,990	36,665	34,005
Ⅱ	5.36%	993	38,316	245,294	39,131	37,414
Ⅲ	4.53%	1,018	37,762	208,220	34,335	28,838

Note: 1. The exchange rate (between currencies) is 1 USD = 34 NTD.
2. The predicted year is 2010.

To analyze all strategies of each element, firstly, Table 3 also shows that the "Do-minimum" scenario (*Investment* Ⅰ) represents the situation whereby policy and infrastructure remain unchanged in 2010 (the public transport market share is 4.53%). The single element policy evaluation indicates that the public transportation investments undoubtedly are indeed useful strategies for promoting the market share of public transit, such as building the MRT system makes the public transport market share goes to 12.44% (*Investment*Ⅱ), and adding the LRT line gets up to 15.84% (*Investment*Ⅲ). Therefore, the more accessibilities and conveniences improve, the more public transport systems use.

Second, fare free strategy is failed to attract people to use the public transport systems more (*Pricing* Ⅰ), and this fact also indicates that the bus fare is inelastic. Rising the parking fee forces people change their mode choice from private to the public because the market share changes from 4.53% to 7.19% (*Pricing*Ⅱ). However, the parking fee of motorcycle is free now in Taiwan, if the decision makers plan to charge for motorcycle, how to soothe the counterforce will become a big issue. It would be feasible to be suggested to start with design the sufficient spaces for parking, and then make gradual progress for charging levels. The public transport market share becomes 5.42% for small raising the traveling cost of private modes. The amount of total bus passengers increase 12% under this strategy (*Pricing*Ⅳ). The higher traveling cost of private modes, the less use of them. The effects of transfer from private modes to public modes are significant.

Third, regulation element is difficult to reflect into the quantifiable policy evaluation framework. To simplify, we simulate each strategies by adjusting the waiting time for the public transport and the searching time for finding a parking space. Intensify parking control enforcement (*Regulation* Ⅰ) increases users' searching time to find parking spaces. *Regulation*Ⅱ increases the public transport market share to 5.36% and the number of bus passenger increases 20% (from 171,110 to 204,148 passengers). The simulation effect of drive against traffic regulation (*Regulation*Ⅲ) is insignificant. Thus, we delete this strategy in the next iterations. To compare three elements to each other, we can find that the effect of pricing

and regulation alone would be less significant than investment. Last, though the load factor, we can calculate the subsidy because the average cost is 45.63 NTD per bus-kilometer and the marginal cost is 17.46 NTD per bus-kilometer (Wang and Chen, 2004). We find that the *Investment*Ⅴ need the biggest subsidization from Table 3, and the *Investment*Ⅰ is the smallest.

4.2 Two Elements Simulation

According to the single element simulation, we can delete some insignificant alternatives and then combine each two elements of them to investigate the interrelationships between them. Table 4 shows all results of the two elements policy evaluation. Compare to single element situations, integrated two elements can prove amply that the multiplicative effects, such as an integration of the investment of the MRT and large increase of parking fee (*Investment*Ⅱ+ *Pricing*Ⅲ) will add the public transport market share more than 5% higher than separated. Besides, the parking fee strategies (*Pricing*Ⅱ, *Pricing*Ⅲ) are effective in every investment strategy. When a policy alternative includes investing the LRT line and small increasing the parking fee (*Investment*Ⅲ+ *Pricing*Ⅱ) will lead the public transport market share up to 21.29%. The third and fourth rows of Table4 present the pricing element has similarity under these two investment strategies. Once again improve that the orbital investments in Kaohsiung are necessary and helpful to deal with the transportation problems.

From Table5, the outcomes of pricing-regulation integration have finite effects. Even the biggest effective one is 15.42%, (*Pricing*Ⅴ+ *Regulation*Ⅱ), which is only closed to invest LRT line only (*Investment*Ⅲ). It indicates that if we can inhibit the use of private modes effectively, the private mode users will transfer to the public transport systems. In addition, the obvious effects (rising the traveling cost vs. all *Regulation* element, row four and five on Table 5) deserve to be mentioned. In short, two elements indicated that investment-pricing, investment-regulation, or pricing-regulation combinations all have makeup effects compared with single element policy.

Table 4. The Public Transport Market Share of Two Elements

	Investment Ⅰ	***Investment*** Ⅱ	***Investment*** Ⅲ	***Investment*** Ⅳ	***Investment*** Ⅴ
	4.53%	12.44%	15.84%	15.98%	16.18%
Pricing					
Ⅰ	4.53%	12.44%	15.84%	16.00%	16.18%
Ⅱ	7.19%	17.37%	21.29%	21.49%	21.70%
Ⅲ	9.88%	23.19%	28.18%	28.51%	28.75%
Ⅳ	5.42%	14.33%	17.69%	17.90%	18.07%
Ⅴ	8.38%	16.94%	20.51%	20.68%	21.05%
Regulation					
Ⅰ	4.93%	12.87%	16.33%	16.54%	16.70%
Ⅱ	5.36%	13.79%	17.38%	17.58%	17.75%

Note: The predicted year is 2010.

Table 5. The Public Transport Market Share of Two Elements (*Con.*)

	Pricing Ⅰ	***Pricing*** Ⅱ	***Pricing*** Ⅲ	***Pricing*** Ⅳ	***Pricing*** Ⅴ
Regulation	4.53%	7.19%	9.88%	5.42%	8.38%
Ⅰ	4.93%	7.24%	10.49%	13.31%	15.04%
Ⅱ	5.36%	7.78%	11.08%	13.63%	15.42%

Note: The predicted year is 2010.

4.3 Three Elements Simulation

From the single element results, it can be found that the transportation investment is an essential condition to development the public transport system. In pricing element, the strategies are distinguished especially those which related to the increasing the private modes cost. Although the simulation results are not as manifest as other elements in the regulation elements, the consideration is necessary in the entirety transportation policy assessment. Furthermore, from the two elements intersect analyze, the reciprocal effects are significant and complement each other. The contention that the integrated transport polices should be considered more extensively is proved here. Because the MRT system in Kaohsiung has been constructed and the LRT system has been planned, *Investment*Ⅲ and *Investment*Ⅳ are used in three elements policy evaluation as showed in Table 6. The three elements policy evaluation indicated that investment, pricing as well as the significant raising of parking fees together would have the most dramatic effect to increase public transport market share (could be above 24%). Under *Investment*Ⅳ, all the alternatives are better than *Investment*Ⅲ (row 2 are all better than row 1). The reciprocal effects are more bigger the one and two elements policy evaluation.

Table 6. The Market Share of Three Elements Combination

		Investment Ⅲ	***Investment*** Ⅳ
Pricing Ⅱ	no	21.29%	21.49%
	Regulation Ⅰ	21.70%	22.04%
	Regulation Ⅱ	22.20%	23.19%
Pricing Ⅲ	no	28.18%	28.51%
	Regulation Ⅰ	29.50%	29.84%
	Regulation Ⅱ	30.67%	31.01%
Pricing Ⅳ	no	17.69%	17.90%
	Regulation Ⅰ	18.81%	19.23%
	Regulation Ⅱ	19.88%	20.09%
Pricing Ⅴ	no	20.51%	20.68%
	Regulation Ⅰ	21.89%	22.12%
	Regulation Ⅱ	23.04%	23.26%

Note: The predicted year is 2010.

4.4 Four Elements Combination _Integrated Transport Policy Alternatives

As mentioned above, one of the main purposes of this study is to integrate suitable transport policy elements and efficient strategies that are in related to investment, pricing, regulation and subsidization in urban transport systems. We systematic integrate four elements though section 4.1 to section 4.3 and produce the eight integrated policy alternatives are showed on Table 7. The results of the demand forecasting procedures are produced marked effects. Though the goal-related comprehensive framework for analyzing and evaluating the performance of urban transport policy alternatives, the public transport market share of these eight alternatives are all get up to 25%. The highest public transport market share breaks through 40% (D and H). There are evidences that combined different elements of transport policies can bring the huge and positive influences to increase the public transport market shares. The makeup effect could be even higher if subsidies to public transport are added.

In short, if the Kaohsiung city governments plan to raise the public transport market share to 25% in year 2010, though this evaluation framework, the red line and Orange line MRT system and one cycle LRT line should invest; the parking fee for car should increase to 40 NTD per hour and for motorcycle is 20 NTD per hour；the traveling costs need to increase to 5 NTD per kilometer for car and 2 NTD for motorcycle. Furthermore, the regulation measures are also need to force people to use their private modes less. In the above policy condition, the city bus needs to be subsidized 7.69 million USD per year by average cost pricing or 28.82 millions USD by marginal cost pricing.

Table 7. The Detail Results of Integrated Transport Policy Alternatives

	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Policy Alternatives Abbreviation	***I***(Ⅲ) ***P***(ⅡⅣ) ***R***(ⅠⅡ)	***I***(Ⅲ) ***P***(ⅡⅤ) ***R***(ⅠⅡ)	***I***(Ⅲ) ***P***(ⅢⅣ) ***R***(ⅠⅡ)	***I***(Ⅲ) ***P***(ⅢⅤ) ***R***(ⅠⅡ)	***I***(Ⅲ) ***P***(ⅡⅣ) ***R***(ⅠⅡ)	***I***(Ⅳ) ***P***(ⅡⅤ) ***R***(ⅠⅡ)	***I***(Ⅳ) ***P***(ⅢⅣ) ***R***(ⅠⅡ)	***I***(Ⅳ) ***P***(ⅢⅤ) ***R***(ⅠⅡ)
Public Transport Market Share (%)	**25.57%**	**32.50%**	**33.68%**	**40.65%**	**25.83 %**	**32.78 %**	**34.02 %**	**41.04 %**
Marginal Cost Pricing	0.16	0.16	0.15	0.16	0.17	0.17	0.17	0.17
Average Cost Pricing	0.41	0.42	0.40	0.41	0.44	0.46	0.44	0.45
Subsidized by MC	78,971	93,539	100,147	115,771	91,072	106,998	116,089	133,808
Subsidized by AC	21,075	30,474	23,908	33,535	42,272	61,727	55,078	74,004

Note 1. The predicted year is 2010.
2. The amount of subsidized money is counted by US dollar.
3. The unit of marginal cost or average cost pricing is USD per passenger.
4. The unit of subsidized by marginal cost or average cost is USD per day.

5. CONCLUSIONS

To improve the urban transport problems, Taiwan government paid much attention to investment policies rather than to other relating strategies and actions in the past. In fact, pricing, regulation, and subsidy are the indispensable consideration to improve the urban transport. In fact, investment, pricing, regulation, and subsidy are the mainly four elements that are directly related to policies of urban transport system. And they have more interactive relationships in urban transport assessment, obviously.

In addition, urban transport policy should not be limited to position statements only. It requires specific strategies and actions related to goals and objectives, which are derived from careful quantified studies and evaluations. From the viewpoint of transport systems, the content of urban transport policies can be classified into four interrelated categories: investment, pricing, regulation and subsidy. In fact, these four interrelated policy elements should be combined into an integrated goal-related transport policy. This study constructs a comprehensive framework and develops a systematic approach for analyzing and evaluating the performance of urban transport policies. In order to simulate the integrated performances, it combines four categories of urban transport policies: investment, pricing, regulation and subsidy to generate policy alternatives. Through the transportation planning process, the major findings include the following:

First, the single element policy evaluation indicates that the investment is indeed a useful strategy for promoting the market share of public transit. For example, the rapid transit with light rail system would increase the public transport market share up to 15.84%. The effect of pricing and regulation alone would be less significant. Second, the two elements policy evaluation suggests that investment-pricing, investment-regulation, or pricing-regulation

combinations all have makeup effects as compared with a single element policy. Third, the three elements policy evaluation shows that investment, pricing as well as the significant raising of parking fees together would have the most significant effect in increasing public transport market share (above 24%). And the finally, the makeup effect is even higher if subsidies to public transport are added.

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