Assessment of Alternative Structures for Privately Operated Bus Systems

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Increasing concern for the mobility, environmental, and resource problems of growing or over-reliance on the automobile as a form of transport has created a strong desire for modern, efficient, and attractive public transport systems in Seoul. Practically, this generally translates into the efforts to build more subway lines. In Seoul, a total of 125 km of subway line is being constructed during the 1993–1996 period. It is expected that 300 km of subway system will be in place before 2000. This planned expansion of subway lines has placed tremendous pressures on Seoul bus transport systems, particularly bus operators. The post-subway period 2000s can be considered as a traumatic time for Seoul's bus systems. Thus, it seems obvious that alternative bus industry structures should be explored within the context of privately provided bus services. This article is concerned with various problems inherent in bus operators and characteristics surrounding bus operation in Seoul. Then it examines potential alternatives for bus industry structures, and provides advantages and disadvantages associated with each alternative.

The bus industry in Seoul is characterized by a predominance of small and independent private companies. As of 1992, a total of 90 bus companies provided intra-urban bus services. No company operated more than 150 buses, and the average fleet size was 93 vehicles. The service network totaled 349 routes, of which 74 were seat bus routes. The average round trip route length (i.e., distance from the base terminus or depot to the outer terminus) was 42.6 km. The average headway for city and seat bus was 7 min in peak period (Table 1).

The Ministry of Transportation sets fares, establishes guidelines for determining the number of buses to be licensed on each route, and regulates bus design. City or provincial governments are responsible for route planning and the licensing of bus operations.

The system is thus regulated by government, and the individual bus operators are left with little freedom to make the basic decisions that in most countries are regarded as their prerogative (subject usually to government approval), for instance to propose the services they wish to operate or the fare they will charge. Although there is a certain degree of flexibility in setting headways and frequencies, the operator is not free to decide the size of vehicle to operate or the color that it is painted.

As a result, in spite of the existence of 90 companies in Seoul, there is very little real productive competition between them. Indeed, about the only element of competition is a degree of on-the-road competition, in which routes serving the same destination but operated by different companies stop at the same stop and compete to get there first. Despite the lack of effective competition, the current structure provides few compensating gains in terms of coordination and integration. It would be difficult to achieve service improvements that would leave the existing profits of bus operators unchanged. Thus, in some respects, the Korean system combines the disadvantages of both the regulated and competitive concepts, with few of the benefits.

An average route length was 41.6 km for city bus and 46.8 km for seat bus, respectively. The route pattern is a mixture of cross city services, crossing mostly the central area of Seoul. Another feature is considerably parallel, running along the main arterial roads in the corridors. Given the radial nature of the road network and the consequent concentration of bus route as the central area is approached, it is not surprising that key passenger boarding and alighting areas are heavily congested.

One of the implications of the overlap in routes and extensive parallel running is that there are strong competitive pressures on operators to run the maximum number of buses at all times, because the share of revenue along the main corridors between operators will be determined principally by the relative number of buses. That is certainly a benefit to riders because of short headways during peak hours. In addition, the cost structure of the industry, with its low variable cost element, also encourages maximum use to be made of each bus. In a situation in which there is little external control over the frequencies at which a given number of buses are dispatched, this may lead to intentional bunching of buses at specific times perceived by the operator as representing the peak of the peak, with consequent irregular and possibly lengthy intervals between buses at other times.

It is quite common to observe the bunching of buses on major corridors leading to the city centers during peak hours. There is a long headway on routes in less populated areas. Some buses do not even stop at the bus stops, despite the fact that a couple of riders are waiting for buses.

There may also be pressure on drivers to indulge in unsafe driving practices, such as racing and queue jumping. However, it appears that the strongest incentive for drivers to speed and drive dangerously comes from inadequate running times allowed in the schedules, which almost certainly do not adequately reflect current traffic congestion levels, and delays caused by subway construction.

POTENTIAL OBJECTIVES AND ASSESSMENT

The potential objectives for the bus system, based on the current policies of government, are explored against which alternative industry structures can be evaluated. Of course, the total set of possible objectives is almost inevitably inconsistent—some will directly conflict with others. Potential objectives include

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TABLE 1 Bus Operating Characteristics

	Number of Routes	Number of Buses	Headway		Average Route Length(Km)	Number of Operating Frequency per Day	Operating Time per Trip(min)
			Peak	Off-peak			
City Bus*	275	6,709	7	8	41.6	8.7	124
Seat Bus**	74	1,307	7	8	46.8	8.0	115

* A city bus has a capacity of 80 passangers with 20 seats and 65 standees.

** A seat bus is a seat-only bus with a capacity of 45 seats. No standee is allowed in seat bus. An operating speed of seat bus is much higher than city bus due to the limited number of stops.

1. Provision of a comprehensive network of services to meet passenger demand,
2. Reduction of central area traffic congestion,
3. Making effective integration of the bus and subway system,
4. Providing passengers with adequate levels of comfort and safety.
5. Maintaining stability in the industry, and
6. Keeping costs and fares at a reasonable level.

Reviewing the current system with these objectives in mind, it is concluded that

1. Bus operation is financially viable.
2. Peak overloading continues to be a problem.
3. The high level of bus-to-bus transfers suggests that existing services may not closely reflect passengers' journey patterns.
4. There is a built-in reluctance to reduce service levels or abandon weak routes.
5. High capacity buses should be considered as a means of relieving overcrowding and reducing street congestion.
6. Although it is a stated objective to integrate the bus and subway systems, very little has been achieved or seems likely to be achieved under present institutions: the restructuring of routes, the provision of convenient interchange facilities, and the integration of fare systems are not likely to occur on a significant scale.
7. Efficient use of the network is hampered by the great complexity of the present route system and the limited information on the system available to the public.
8. Standards of vehicle maintenance appear high. The main safety problems relate to dangerous driving behavior of drivers and unrealistic schedules.
9. The scope under the present system for the cross-subsidization of services is very limited because of the small number of routes operated by the typical company.
10. Current policy is to discourage the formation of new companies; this limits the possibilities of introducing new techniques and management methods, and removes an incentive to existing companies to strive for improved performance.
11. Although bus planning is effectively in the hands of the city government, the resources that it devotes to this subject are very limited in terms of numbers and professional skills. There is also very little monitoring of operators' compliance with license conditions.
12. Major restructuring of the network is almost impossible with present institutions, as it would disturb the profitability of existing companies. It would be extremely difficult (*a*) to design a new route system that would leave the existing profits of individual companies unchanged and (*b*) to convince them that this would be the case so that they would agree to the changes.

ALTERNATIVE INDUSTRY STRUCTURES

Assessing the current operating practices in detail, there are seven potential alternatives:

1. Merger of companies into a small number of large private companies in each city,
2. Merger of companies into a single private company,
3. Merger of companies into a single public company,
4. A single cooperative system,
5. A district cooperative system,
6. Revenue pooling of different operators, or
7. A metropolitan transit authority.

Some of these alternatives are described further in the following sections.

Single (Large-Scale) Operator

This structure has great potential benefits in terms of coordination and integration, which is why it is so common elsewhere. If such a solution were adopted in Seoul, it would be logical for the undertakings to also own the subway systems where they exist, which implies some form of public ownership.

However, the evidence reviewed in this work suggests that merger of all urban bus companies into one organization would not improve efficiency. It should be noted that merger of all Seoul's urban bus companies would produce one of the world's largest urban bus operators. Clearly, the problems of managing the very large bus organizations that would result from such mergers would be completely beyond the experience of the current bus industry management. Therefore, in the absence of competition or a profit motivation, the single operator has a marked tendency to inefficiency, particularly if there is political intervention in day-to-day operation.

Several Large Companies

The creation of a small number of large bus companies in each city is another possibility, but this would still give rise to considerable problems of integration and coordination of services and fare, particularly with the subway system. However, this alternative would solve some of the problems inherent in the current system. Several large companies could enhance the scope for cross-subsidy. This alternative could lead to a reduction of the number of separate companies with which government agencies have to deal.

Moreover, the existence of potential competition would act as a spur to efficiency, although if each company were given a territorial monopoly (probably necessary to achieve an adequate level of cross-subsidy between routes), competition would be restricted to the supply of services (i.e., the right to operate routes instead of "on-the-road").

If a structure of a small number of large companies is to work effectively, it is important that regulating agencies are able to exercise the concept of replaceability: that is, it must be possible to replace an operator who fails to provide the required services, by transferring routes from one company to another. However, this alternative may pose a difficulty of integrating bus and subway services if the bus companies are large and powerful. There is a general lack of evidence that larger bus companies will be any more efficient than the current small companies.

Operator Cooperative

The cooperative system basically has two elements: a thorough revision of route network so as to produce a sensible and efficient route pattern, and a way of operating the fixing revised routes, by rotating them between companies, to provide an even distribution of costs and revenues. The basic principle is that the allocation of company group to route group rotates each week, so that in Week 1 Company Group A operates Route Group 1, in Week 2 Company Group A operates Route Group 2, etc. The intention is thus that every operator has the same share of the total revenue.

The cooperative system is a uniquely Korean institution that appears to work well and to be accepted by both operators and government as far as medium-sized cities are concerned. Its main disadvantage is that it involves additional dead mileage in moving buses and crews between the company's operating base and the terminus of the routes that it is operating each day. Such costs are estimated to add 1.5 to 2 percent to operating costs in a medium-sized city like Daejeon. In order to avoid this drawback, it seems necessary to provide large-scale garages as a common basis for accommodating supportive facilities and maintaining operating vehicles for all of the participating companies. Possible advantages from this common garage come from the expansion of in-house maintenance work to include major overhauls: the development of a more responsive route-planning function. City governments have been asked by bus companies to build up such facilities between the company's operating bases and the terminus of the routes.

At a more conceptual level, cooperatives also suffer from the disadvantage that they lack a competitive spur. In Daejeon, a cartel of the bus companies was formed. The cooperative has not accepted new members and has monopolized city transport. There is little incentive to innovation, particularly as far as network development is concerned. The fact that costs and revenues are shared equally also reduces the potential gains to individual companies that wish to promote change. In Gwangju, city government complained that the cooperative is not service oriented and has not done enough to discourage dirty buses or discourteous crew.

Despite these disadvantages, it is generally believed that the cooperative principle has many significant benefits that rank it above the options considered so far for overcoming the disadvantages of the present industry structure. It retains the small companies to be regarded as efficient operating units, and retains the private ownership that provides a major incentive to keep costs down. It also has the advantage of being a Korean solution that has evolved in a Korean context.

In the largest cities such as Seoul and Busan, a single cooperative would involve largely dead mileage routes; in Seoul, there are 275 city bus routes. It is therefore impractical and inefficient for all companies to rotate around all routes.

Thus, if the cooperative principle were to be applied to Seoul and Busan and other very large cities, a number of separate cooperatives would have to be created—perhaps 10 to 15 in Seoul and 4 to 5 in Busan. Ideally, each cooperative should have its own area of the city and a similar profitability profile, and it should be small enough to allow bus drivers to learn all of the routes operated. This should keep the increase in operating costs down to approximately 2 to 2.25 percent.

Revenue Pooling

It could be argued that the moving of company buses around the route under the cooperative system to equalize revenue per bus is unnecessary and wasteful. A simpler method would be a revenue-pooling system, whereby all of the revenues collected by individual companies would be deposited into a pool; this would then be shared between the companies on an agreed basis.

Revenue-pooling agreements in other countries have usually involved a fairly small number of major operators, typically two or three. Where only bus companies are involved, the revenue is usually shared on the basis of bus kilometers operated. Sometimes, however (particularly if the revenue from railways as well as buses is pooled), the revenue is shared on the basis of the percentage of revenue accruing to each company in the last year before the introduction of the pooling system. Either of these systems can work satisfactorily with a small number of operators who trust each other and in situations in which demand and the transport system are fairly static.

If the situation is changing rapidly as it is in Seoul, there will be a frequent need for adjustments to the shares of revenue that would be a cause of endless argument. In addition, the cooperative system equalizes both revenues and costs between operators, whereas a pooling system equalizes only revenues; some operators may therefore incur higher than average costs per kilometer or per bus because of the nature of their routes, and will demand a higher share of the revenue.

The current situation of the industry in Seoul does not promote mutual trust between operators; indeed, there is widespread suspicion that operators understate the revenue they receive so as to minimize tax liabilities and strengthen the case for fare increases. In these circumstances, the requirement of a revenue-pooling system in which all operators honestly report their revenues is not feasible. However, some changes in fare collection systems would provide a way of overcoming this problem. Nevertheless, the prospects for an immediate application of revenue-pooling systems are not good, and although revenue pooling in practice might evolve once cooperatives are firmly established, it is not an institutional option that can be pursued now.

Metropolitan Transit Integration Authorities

The final option considered is the formation of metropolitan transit integration authorities or MTIA. This concept is of an agency responsible for providing public transport by purchasing services from operating companies. It would not operate any services itself, but would determine what services should be provided.

The basic division of functions between the MTIA and operating companies would be that the Authority

1. Monitors passenger demand,
2. Plans services (routes, frequencies, capacities),
3. Produces service specification (outline timetable),
4. Decides fares, and
5. Markets the services to the public.

The operating companies

1. Operate services,
2. Employ operating and maintenance staff,
3. Own assets (vehicles, depots, etc.),
4. Produce detailed timetables, vehicle, and crew duties, and
5. Supervise operations.

This distribution of functions is similar to that of the transport communities of West Germany.

In considering this structure, it is important to note that virtually all of the proposed functions of the transit integration authority—surveying demand, planning services, regulating headways, determining bus stop locations, and setting fares—are currently performed in Korea by some branch of government and not by the operators. The authority would simply bring these functions together into one body for each city.

Although there are similarities to the German model, there are several important differences. First, in Korea the transit integration authority could not be a voluntary grouping of operators, because it is highly unlikely that the large number of private companies would all voluntarily agree to changes. Thus, the authority would have to be a public institution with powers granted by legislation. Where they are in operation or under construction, subways should also be under the control of the MTIA.

A second important difference is in the area of revenue collection and distribution. If (as in Germany) the companies were responsible for collecting fares and handing over the revenue to the Authority, it is likely that not all revenue would be handed over. There would also be considerable difficulties in deciding an appropriate basis for revenue distribution. For these reasons, revenue collection would have to be entirely in the hands of the authority, ideally through abandoning the taking of cash on bus and the enhancement of the current token and ticket schemes. The authority would then reimburse the operators for running the services, either according to an agreed formula, or on the basis of prices tendered when contracts to run services were agreed.

For the MTIA to function effectively, two aspects are vital. The first is that there is close monitoring of the performance of operators so that good operators who consistently provide the specified services can be distinguished from poor performers. The second is that there should be no unwillingness to replace operators who do not perform well or who are too expensive. The principal advantage of the MTIA concept is that it breaks the link between the profitability of the individual bus operator and the routes that it operates, thereby facilitating network restructuring, bus/subway integration, and closer matching of supply to demand.

ASSESSMENT OF ALTERNATIVE STRUCTURES

To evaluate alternative industry structures, the concordance analysis was used (*1,2*). A concordance analysis is designed to select the most desirable alternatives out of a series of competing alternatives. The selection is based on a multiplicity of criteria. Each criterion is provided with a preference score, so that both quantitative and qualitative effects can be taken into account.

In an effort to establish effect matrix, 15 transport professionals and related officials were asked to provide ratings on the effects of alternative bus industry structures. They were requested to give a 100 value to the most favorable alternative and 0 value to the worst one. To establish a degree of relative importance and to provide a test of consistency in the numerical weighting to follow, the same panel members were interviewed successively to make a series of comparison. The normalized effect matrix was completed as in Table 2.

Pre-evaluation was conducted by imposing a set of constraints (in the form of threshold values or minimum acceptable level) as a basis for elimination from further consideration. Thus, 12 criteria in Table 2 become 7 in Table 3.

The next step undertaken was the elimination of less favorable alternatives. For a given vector of importance weights W, one can compute the concordance and discordance indices, IC^{ij} and ID^{ij}, for alternative O_i relative to alternative O_j.

$$IC = \begin{pmatrix} -- & IC^{12} & IC^{13} & ---- & IC^{1N} \\ IC^{21} & --- & IC^{23} & ----- & IC^{2N} \\ & & \cdot & & \\ & & \cdot & & \\ & & \cdot & & \\ IC^{N1} & IC^{N2} & ------- & & IC^{N,N-1} \end{pmatrix}$$

$$ID = \begin{pmatrix} -- & ID^{12} & ID^{13} & ------ & ID^{1N} \\ ID^{21} & -- & ID^{23} & ------ & ID^{2N} \\ & & \cdot & & \\ & & \cdot & & \\ & & \cdot & & \\ ID^{N1} & ID^{N2} & -------- & & ID^{N,N-1} \end{pmatrix}$$

The IC^{ij} and ID^{ij} can be formally defined as the concordance index, for alternative O_i with respect to O_j, and the discordance index, for alternative O_i with respect to O_j, respectively.

The next step was to establish the concordance dominance matrix F. The elements f_{ij}, $i = 1, \ldots n; j = 1, \ldots n; i \neq j$ of the concordance dominance matrix F are defined as:

$$f_{ij} = \begin{matrix} 1 \text{ if } IC^{ij} \geq \overline{IC} \\ 0 \text{ otherwise} \end{matrix} \quad \text{(threshold value)}$$

Discordance matrix G is obtained in a similar manner to F. The elements g_{ij}, $i = 1, \ldots n; j = 1, \ldots n; i \neq j$ are defined as:

$$g_{ij} = \begin{matrix} 1 \text{ if } ID^{ij} \leq \overline{ID} \\ 0 \text{ otherwise} \end{matrix} \quad \text{(threshold value)}$$

Note that in both F and G, a unit entry for the ith row and jth column indicates dominance of O_i over O_j.

Because the decision rule is to consider O_i to outrank O_j, if both $IC^{ij} \geq \overline{IC}$ and $ID^{ij} \leq \overline{ID}$ are true, then a joint dominance matrix E obtained by operation on F and G is defined. The elements e_{ij}, $1, \ldots, n; j = 1, \ldots n; i \neq j$ are defined as:

$$e_{ij} = f_{ij} \cdot g_{ij}$$

It can be observed that e_{ij} takes the value of unity only when $f_{ij} = 1$ and $g_{ij} = 1$, indicating that both conditions for dominance are met; otherwise, $e_{ij} = 0$.

TABLE 2 Evaluation of Alternative Industry Structures

Criteria \ Structure	Existing Small Companies	Several Large Companies (Private)	Single Private Bus Company	Single Public Transit Company	Single Cooperative (small City only)	Several Coopera-tive(large City only)	Revenue Pooling (many Private operators)	Metropolitan Transit Integration Authority(1)
Facilitate matching of supply to demand	0.30	0.61	0.70	0.75	0.72	0.60	0.60	0.76
Facilitate bus route rationalization/adaptability to change	0.10	0.61	0.70	0.80	0.75	0.60	0.30	0.81
Facilitate bus;subway integration	0.15	0.10	0.30	0.90	0.30	0.40	(2) 0.50	0.91
Permit use of high capacity buses	0.30	0.60	0.75	0.75	0.50	0.45	0.40	0.70
Allow cross-subsidization of unprofitable but socially necessary services	0.30	0.60	0.75	0.90	0.70	0.60	0.60	0.90
Permit bus;bus transfer ticketing and /or Travelcards	0.10	(3) 0.30	0.80	0.85	0.70	(3) 0.60	0.50	0.86
Permit bus;subway through ticketing and/or Travelcards	0.05	0.20	0.40	0.90	0.60	0.40	(2) 0.40	0.90
Permit distance-related bus fares (stage/Zonal)	0.30	0.50	0.60	0.70	0.70	0.60	0.50	0.70
Ease of Implementation / acceptability to existing companies	0.50	0.45	0.10	0.40	0.42	0.60	0.10	0.40
"workability" post-implementation	0.75	0.62	0.70	0.70	0.60	0.60	0.30	0.20
Incentives to efficiency & innovation	0.30	(4) 0.62	0.70	0.60	0.55	0.52	0.40	(5) 0.50
Impact on cost increase	0.52	(6) 0.40	(6) 0.30	(6) 0.05	(7) 0.50	(7) 0.51	0.51	(7,8) 0.20

Note : 1. Assumes Authority works through several operator cooperatives.
2. Assumes Subway Corporation involved in pooling.
3. Assumes transfer ticketing between companies or cooperatives can be arranged.
4. Assumes concept of replaceability can be implemented.
5. Assumes competitive tendering.
6. Detrimental effect particularly in short term ; may not be so bad in longer term.
7. Assumes cooperatives can achieve some economies e.g. in joint purchasing or central workshops, but these are likely to be offset by increased 'dead' mileage.
8. Allows for costs of tendering and administration.

TABLE 3 Weighted Normalized Alternative Effect Matrix

Alternative \ Criteria	C_1	C_2	C_3	C_4	C_5	C_6	C_7
O_1(Existing)	0.30	0.10	0.15	0.30	0.75	0.30	0.52
O_2(Large Private)	0.61	0.61	0.10	0.60	0.62	0.62	0.40
O_3(Single Public)	0.75	0.80	0.80	0.75	0.70	0.60	0.05
O_4(Single Coop)	0.72	0.75	0.30	0.50	0.60	0.55	0.50
O_5(District Coop)	0.60	0.60	0.40	0.45	0.68	0.52	0.51
O_6(Authority)	0.76	0.81	0.81	0.70	0.20	0.50	0.20

Through the same rating procedure as earlier, the weight vector for the reduced set of criteria was generated as follows:

C_1: Service provision	(0.08)
C_2: Route change	(0.18)
C_3: Transfer	(0.20)
C_4: High capacity	(0.07)
C_5: Workability	(0.25)
C_6: Efficiency	(0.08)
C_7: Cost	(0.14)
	Σ 1.00

Based on the weighted normalized alternative matrix, the following concordance matrix (*IC*) and discordance matrix (*ID*) were constructed.

$$IC = \begin{vmatrix} — & 0.41 & 0.62 & 0.62 & 0.62 & 0.62 \\ 0.59 & — & 0.79 & 0.61 & 0.59 & 0.54 \\ 0.39 & 0.22 & — & 0.14 & 0.14 & 0.61 \\ 0.39 & 0.40 & 0.87 & — & 0.59 & 0.54 \\ 0.39 & 0.42 & 0.87 & 0.42 & — & 0.54 \\ 0.39 & 0.47 & 0.40 & 0.47 & 0.47 & — \end{vmatrix}$$

$$ID = \begin{vmatrix} — & 0.26 & 1.00 & 0.27 & 0.18 & 1.00 \\ 1.00 & — & 0.74 & 0.22 & 0.33 & 0.76 \\ 1.00 & 0.99 & — & 0.70 & 0.67 & 0.91 \\ 0.92 & 0.28 & 0.96 & — & 0.26 & 0.73 \\ 0.70 & 0.42 & 0.98 & 0.15 & — & 0.87 \\ 1.00 & 1.00 & 0.32 & 0.72 & 0.58 & — \end{vmatrix}$$

Having completed *IC* and *ID* matrices, it is necessary to decide on threshold values. Average index (0.58) was applied in this case. The resulting concordance matrix *F* and discordance matrix *G* are then:

$$F = \begin{vmatrix} — & 1 & 0 & 0 & 0 & 0 \\ 0 & — & 0 & 0 & 0 & 0 \\ 1 & 1 & — & 1 & 1 & 0 \\ 1 & 1 & 0 & — & 0 & 0 \\ 1 & 1 & 0 & 1 & — & 0 \\ 1 & 0 & 1 & 0 & 0 & — \end{vmatrix} \quad G = \begin{vmatrix} — & 0 & 0 & 0 & 0 & 0 \\ 1 & — & 0 & 1 & 1 & 0 \\ 0 & 0 & — & 0 & 0 & 1 \\ 1 & 1 & 0 & — & 1 & 0 \\ 1 & 1 & 0 & 1 & — & 1 \\ 0 & 0 & 0 & 0 & 0 & — \end{vmatrix}$$

By confirming *F* and *G*, *E* is obtained.

$$E = \begin{vmatrix} — & 0 & 0 & 0 & 0 & 0 \\ 0 & — & 0 & 0 & 0 & 0 \\ 0 & 0 & — & 0 & 0 & 0 \\ 1 & 1 & 0 & — & 1 & 0 \\ 1 & 1 & 0 & 1 & — & 0 \\ 0 & 0 & 0 & 0 & 0 & — \end{vmatrix}$$

The two undominated alternatives turned out to be Alternatives 4 (single cooperative) and 5 (district cooperative). However, Alternative 5 generally received higher values on important criteria than Alternative 4. Thus, Alternative 5 was chosen as the best alternative. This outcome is generally consistent with a prior expectation, as the district cooperative has great potential benefits for a large city like Seoul in terms of revenue redistribution and route rationalization. The other reason for this outcome appears to be that district cooperative would not require much of the municipal expenditures. Although the criterion "bus and subway integration" appears rather low, the remaining criteria are more than enough to offset this criterion.

CONCLUSION

This research reveals that the idea of substantial mergers of bus companies and public ownership should be rejected. The existing companies are efficient profit-oriented units, even though some suffer from financial difficulties. However, the role that the bus industry is asked to fulfill is changing rapidly, and its weakness is in its slow adaptability under the conditions of changing passenger demands. The major issue is therefore how to devise an industry structure that preserves the best features of the current institutions while allowing for a greater level of flexibility to meet the needs of passengers.

One of the most important features of the current system is the reliance on small private companies to provide services. As suppliers of services, they appear to function well. However, from the point of view of the requirements for a network of services, the multiplicity of companies is counterproductive. Therefore, there is a strong need for much improved coordination among bus companies. This can be achieved by the formation of operator cooperative along the lines already followed in Daejeon and Gwangju cities.

The most feasible alternative turned out to be the district cooperative. The largest city, Seoul, is too large for a single cooperative and has the added dimension of subway systems. Therefore, the companies should be grouped into a number of cooperatives of between 500 and 700 buses on a district basis. This alternative leaves the basic supply side of the industry unchanged, but it opens up many possibilities for making better use of the supply of bus services through network restructuring and revenue redistribution.

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