IMPROVING EFFICIENCY IN THE LOGISTICS SECTOR FOR SUSTAINABLE TRANSPORT DEVELOPMENT IN THE REPUBLIC OF KOREA

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ABSTRACT

Freight transportation has increased very rapidly in the Republic of Korea owing to economic growth and expanding international trade. However, the freight transport sector in the Republic of Korea has been regarded as inefficient and the inefficiencies can be attributed to many factors, including an outdated regulatory framework, business practices and a lack of proper infrastructure. Since freight transport demand is derived from economic activities that are expected to grow in the future, improving efficiency in the sector has important implications for sustainable transport development in the country.

In the present paper, the past trends and characteristics of domestic freight transportation in Korea are examined. The modal shares of domestic freight transport are analysed and future freight volumes by different modes are estimated, based on current trends and an alternative scenario in consideration of the proposals for future investment in transport infrastructure development. The effects in terms of greenhouse gas emissions for these two alternative future freight transport conditions are examined. The causes of inefficiency in the freight transport sector in the Republic of Korea, which includes infrastructure capacity problems, regulatory framework and business practices, are also discussed.

The previous and ongoing efforts to improve efficiency in the logistics sector through policy measures are discussed. The policy measures focus mainly on a modal shift to environment-friendly modes, infrastructure provision and enhancing operational efficiency. Finally, an estimate of the potential reduction in CO_2 emissions as a result of these efforts is presented.

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INTRODUCTION

Freight transportation has increased very rapidly in the Republic of Korea owing to fast economic growth and expanding international trade. It has provided indispensable service to economic growth. However, it has also been regarded as relatively inefficient. The inefficiencies can be attributed to many factors, including an outdated regulatory framework, business practices and a lack of proper infrastructure. Since freight transport demand is derived from economic activities that are expected to grow in the future as well, improving efficiency in the freight transport sector has important implications for sustainable transport development in general.

In the present paper, the past trends and characteristics of domestic freight transportation in the Republic of Korea are examined. The modal shares of domestic freight transport are analysed and future freight volumes by different modes are estimated, based on current trends and an alternative scenario in consideration of the proposals for future investment in transport infrastructure development. The causes of inefficiency in the sector are then discussed, including regulatory regimes, business practices, the lack of standardization in logistics facilities and equipment and the lack of an integrated logistics information system. Finally, past and present policy measures to improve efficiency in the logistics sector in the Republic of Korea and the potential impact of these efforts on energy consumption and the environment, particularly in terms of a reduction in greenhouse gas emissions are examined.

I. CHARACTERISTICS OF FREIGHT TRANSPORT IN KOREA

During the eleven-year period between 1988 and 1999, the growth in domestic freight movement showed a high positive correlation with the growth of real gross domestic product (GDP). Up to 1997, freight transportation increased very rapidly along with the increase in GDP levels. However, the domestic freight transport volume dropped dramatically in 1998 owing to the economic crisis and has not yet recovered its previous level. Table 1 shows real GDP and domestic freight movement in the Republic of Korea by year.

Table 1. Change in real GDP and domestic freight in the Republic of Korea, 1988-1999

Year	Real GDP (billions of won)	Annual change in real GDP (percentage)	Domestic freight (millions of ton-km)	Annual change in domestic freight (percentage)
1988	226,543.2	-	59,047	-
1989	241,006.9	6.38	61,522	4.19
1990	263,430.4	9.30	65,704	6.80
1991	287,737.9	9.23	74,091	12.76
1992	303,383.9	5.44	90,268	21.83
1993	320,044.2	5.49	96,438	6.84
1994	346,448.1	8.25	97,782	1.39
1995	377,349.8	8.92	110,722	13.23
1996	402,821.2	6.75	114,367	3.29
1997	423,006.7	5.01	121,899	6.59
1998	398,312.6	-5.84	87,316	-28.37
1999	436,798.5	9.66	86,525	- 0.91

Source: Lee, Sungwon, Myungnee Lee and others, 2001. Macroeconomic impact analysis of environmental regulations in the transport sector, internal document (Korea Transport Institute).

Freight transportation in the Republic of Korea has several distinctive characteristics. The most salient trend in the domestic freight transport in the Republic of Korea is the ever-growing role of road transport, both in terms of absolute tonnage transported and its modal share. The dominance of road freight transport has been led by the explosive increase in private truck operations in domestic freight movement. Contrary to the dominance of road freight transport, the role of rail transport, which is considered as more environment-friendly, has shrunk, both in terms of tonnage transported and its modal share. The reduced role of rail is owing partly to capacity constraints, as more time slots have been assigned for passenger services while the total rail capacity has remained virtually the same. Another important environment-friendly mode, maritime transport, has been able to maintain its relatively stable modal share in freight transportation in recent years. Freight transportation by air has increased in absolute terms, but its modal share is still negligible in the domestic sector. Table 2 shows the trend of freight modal share during the last 11 years.

Table 2. Modal share of domestic freight movement in the Republic of Korea, 1988-1999

(Millions of ton-km and percentage)

Year	Road		Rail		Maritime		Air		Total	
1988	28,603	(48.44)	13,784	(23.34)	16,617	(28.14)	43	(0.07)	59,047	(100.00)
1989	30,002	(48.77)	13,605	(22.11)	17,852	(29.02)	63	(0.10)	61,522	(100.00)
1990	30,842	(46.94)	13,663	(20.79)	21,127	(32.15)	72	(0.11)	65,704	(100.00)
1991	34,781	(46.94)	14,494	(19.56)	24,737	(33.39)	79	(0.11)	74,091	(100.00)
1992	39,910	(44.21)	14,256	(15.79)	36,008	(39.89)	94	(0.10)	90,268	(100.00)
1993	43,210	(44.81)	14,658	(15.20)	38,465	(39.89)	105	(0.11)	96,438	(100.00)
1994	48,661	(49.76)	14,070	(14.39)	34,935	(35.73)	116	(0.12)	97,782	(100.00)
1995	52,825	(47.71)	13,838	(12.50)	43,936	(39.68)	123	(0.11)	110,722	(100.00)
1996	54,834	(47.95)	12,947	(11.32)	46,452	(40.62)	134	(0.12)	114,367	(100.00)
1997	63,741	(52.29)	12,710	(10.43)	45,299	(37.16)	149	(0.12)	121,899	(100.00)
1998	43,343	(49.64)	10,372	(11.88)	33,461	(38.32)	140	(0.16)	87,316	(100.00)
1999	42,603	(49.23)	10,072	(11.64)	33,699	(38.95)	151	(0.18)	86,525	(100.00)

Source: Lee, Sungwon, Myungnee Lee and others, 2001. Macroeconomic impact analysis of environmental regulations in the transport sector, internal document (Korea Transport Institute).

In road transport, only about one fifth of freight is moved by commercial carriers, which are regarded as more energy efficient owing to their higher load factor. Most of the remaining freight is transported by privately owned trucks which are less efficient and cause more damage to the environment. The prevalence of less efficient private freight transport is one of the major causes of energy inefficiency in the transport sector.

Until recently, the commercial freight industry in the Republic of Korea was protected by a strict licensing system. It also suffered from the collusive behaviour of the operators. As a result, the industry lost its competitiveness. Like other industries under entry regulations and price control, the domestic freight transport industry has suffered from low productivity and service levels. Nor has the industry been responsive to changing consumer needs. As a result, many consumers have turned away from commercial freight transporters and relied on their own private freight transportation, which has ultimately led to the dominance of private transporters.

In general, the logistics sector in the Republic of Korea can be regarded as relatively inefficient compared with the advanced countries. Logistics costs in the Republic of Korea are estimated at over 16 per cent of GDP as of 1995, which is at least 50 per cent more than those of the United States of America.[1] The major causes of inefficiency are the shortage of logistics-related infrastructure, operational problems and the problem of economies of scale in logistics firms, which are mainly small and medium-sized.

All the major freight-related infrastructure, that is, railways, highways, seaports and airports, is experiencing capacity problems. The capacity-related problems are causing congestion and creating bottlenecks along the major arteries of freight transportation. Rail freight transportation is a particular case in point. It has been severely squeezed to accommodate an increased number of passenger services, which has caused severe capacity constraints and consequent falls in market share and the volume of freight transported. Other logistics-related facilities such as freight terminals and storage facilities also have capacity constraints. Infrastructure capacity problems, which result in bottlenecks and congestion, are the main sources of high logistics costs. Besides increasing costs, they also have adverse implications for energy consumption and the environment.

From an operational perspective, there are also other sources of inefficiency in domestic freight transportation. The state of utilization of IT is one such important area. There are noticeable gaps in the utilization of IT among logistics service providers of different transportation modes. Electronic information systems have often been developed by IT firms in isolation from each other. As a result, data and information are not shared or cannot be exchanged. This deficiency in logistics information systems has led to unnecessary delays in freight transportation, overstocking of inventories, a low load factor and inefficient trucking operations, all of which have contributed to higher costs. Another very important problem that needs urgent attention is the lack of standardization in logistics-related facilities and equipment. Logistics can be regarded as a system that needs centralized operation and management. Standardizing logistics-related equipment and facilities could improve overall efficiency in freight transportation.

Last, the slow progress made in improving logistics information systems and standardizing logistic-related facilities and equipment has been largely attributed to the fact that most logistics firms in the Republic of Korea are small and medium-sized businesses. The lack of economies of scale and reliability problems associated with small logistics firms have often provided a strong incentive for manufacturing firms in the Republic of Korea to set up their own logistics division or even to operate their own freight vehicle fleets.

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[1] Logistics costs are defined here as the sum of transportation and storage-related costs.

II. THE GROWTH OF ROAD FREIGHT TRANSPORT AND ITS IMPLICATIONS FOR SUSTAINABLE TRANSPORT DEVELOPMENT

Freight transport demand, by nature, is a derived demand that may be affected by various socio-economic factors and the level of economic activity. Forecasting of underlying variables representing these factors, therefore, should precede the forecasting of freight transport demand. Table 3 shows forecasting of key economic indicators that are considered relevant in estimating domestic freight transport demand. Among the economic indicators, the vehicle ownership rate has been estimated by a lagged power growth function, where vehicle ownership approaches a pre-assumed saturation point. The function had a stock adjustment term, considered real per capita GDP as a purchasing power proxy, and the vehicle ownership cost was represented by the sum of vehicle purchase cost and annual fuel cost (Lee and others 1999). For estimation purposes, real per capita GDP and fuel prices have been assumed to increase at 3 per cent per annum over the next 20-year period.

The vehicle ownership rate is estimated to increase from about one vehicle for every four persons in 2000 to about two vehicles for every five persons in 2020. The forecast vehicle ownership rates are presented in table 3 along with forecast population and number of registered vehicles.

Table 3. Key economic indicators, 2000-2020

	1995	2000	2005	2010	2015	2020
Population (Thousands of persons)	45,093	47,274	49,123	50,618	51,677	52,358
Per capita GDP (Thousands of won)	8,459.1	9,101.2	10,550.8	12,231.3	14179.4	16,437.9
Vehicle ownership rate (per person)	0.1878	0.2444	0.2862	0.3263	0.3643	0.3994
Vehicle registration (Thousands of vehicles)	8,469	11,555	14,061	16,516	18,828	20,909

Source: Lee, Sungwon, Meeyoung Shin and others,1999. Comprehensive policy measures for environment-friendly transport (Korea Transport Institute).

The total vehicle mileage for each vehicle type is estimated by using the forecast number of vehicles and the estimated average vehicle mileage. Average vehicle mileage has been estimated by fitting a growth curve that best explained the past trend. It may be noted here that the estimated average annual vehicle mileage decreases as the number of vehicles increases. Table 4 presents the estimated total vehicle mileage by vehicle type up to 2020. As shown in the table, the total truck mileage is expected to almost double in the 20-year period between 2000 and 2020. The predominance of private trucks in freight transportation is expected to continue during this period.

Table 4. Estimated vehicle mileage, 2000-2020

(Millions of km)

		1999	2000	2005	2010	2015	2020
Passenger car	Private passenger car	145,679	150,566	179,162	209,209	237,600	263,099
	Taxi	22,265	22,871	26,757	31,086	35,251	39,019
	SUV[a/]	7,601	7,856	9,348	10,915	12,397	13,727
Bus	Small and medium private	12,541	13,528	17,138	20,402	23,511	26,331
	Heavy-duty private	2,640	2,848	3,608	4,295	4,950	5,543
	Small and medium commercial	202	218	278	332	382	428
	Heavy-duty commercial	3,753	4,062	5,179	6,173	7,114	7,967
Truck	Small and medium private	41,881	45,254	57,542	68,557	79,011	88,489
	Heavy-duty private	2,435	2,631	3,345	3,986	4,594	5,145
	Small and medium commercial	3,154	3,413	4,352	5,187	5,978	6,695
	Heavy-duty commercial	6,308	6,827	8,705	10,374	11,956	13,391

[a/]SUV: sports utility vehicles such as four-wheel drive jeeps.

Greenhouse gas emissions have been estimated by vehicle type according to the revised Intergovernmental Panel on Climate Change guidelines and relevant emission factors of representative vehicle type (IPCC 1996). Table 5 presents the estimation results. In 2020, emissions by freight vehicles of CO_2, which is the most important greenhouse gas, are estimated to account for about 31 per cent of total emissions, compared with 38.7 per cent in 1999 (Lee, Lee and others 2001). Although the freight transport sector is not expected to grow as much as the transport sector as a whole, managing freight transport demand remains crucial to reducing overall energy consumption and the adverse environmental impacts caused by emissions from transport vehicles.

The forecast of freight transport modal shares up to 2020 is presented in table 6. The forecast is based on the assumption that the current trend will continue and new infrastructure will be constructed to satisfy the increase in demand. This forecast can therefore be considered as a baseline case against which the effects of policy measures can be analysed. Freight transport is expected to almost double during the next two decades if the current trend continues. The environmental burden imposed by freight transport will therefore be much greater in the future and therefore special efforts will be required to ensure sustainable transport development in the Republic of Korea.

Table 5. Estimation of greenhouse gas emissions, 2000-2020

(Thousands of tons)

	Year	NO_x	CH_4	NMVOC	CO	N_2O	CO_2
Passenger car	1999	119.5	4.0	100.0	535.3	0.1	28,885.0
	2000	126.8	4.3	106.4	570.8	6.3	30,991.0
	2005	156.9	5.4	133.8	723.3	8.4	40,526.7
	2010	189.3	6.6	164.1	894.3	11.0	51,638.3
	2015	220.8	7.7	191.4	1043.0	12.8	60,223.5
	2020	246.4	8.5	213.6	1164.2	14.3	67,218.4
Bus	1999	53.0	0.6	16.3	71.6	0.1	8,374.5
	2000	56.2	0.6	17.4	76.3	0.4	8,891.4
	2005	62.3	0.7	19.8	87.0	0.4	9,953.4
	2010	68.8	0.8	21.9	96.1	0.4	10,997.4
	2015	79.4	0.9	25.3	110.8	0.5	12,681.8
	2020	87.1	1.0	27.7	121.6	0.6	13,916.9
Truck	1999	154.3	2.6	30.3	132.7	0.1	23,534.4
	2000	162.1	2.8	31.8	139.4	1.3	24,717.2
	2005	169.8	2.9	33.4	146.5	1.4	25,921.6
	2010	187.6	3.2	36.9	161.9	1.5	28,640.5
	2015	216.4	3.7	42.6	186.7	1.7	33,027.0
	2020	237.4	4.0	46.7	204.9	1.9	36,243.7
Total	1999	326.8	7.2	146.6	739.7	0.3	60,794.0
	2000	345.1	7.7	155.7	786.6	7.9	64,599.6
	2005	389.0	9.0	187.0	956.8	10.2	76,401.7
	2010	445.8	10.6	222.9	1,152.3	13.0	91,276.1
	2015	516.5	12.3	259.2	1,340.5	15.1	105,932.3
	2020	571.0	13.6	288.1	1,490.6	16.8	117,379.1

CH_4: methane; CO: carbon monoxide; CO_2: carbon dioxide; N_2O: nitrous oxide; NMVOCs: non-methane volatile organic compounds; NO_x: oxides of nitrogen

Table 6. Baseline forecast of domestic freight transport in the Republic of Korea, 2000-2020*

(Millions of ton-km and percentage modal share)

Year	Road	Rail	Maritime	Air	Total
2000	43,883 (49.23)	10,375 (11.64)	34,712 (38.95)	156 (0.18)	89,126 (100.00)
2005	51,066 (49.23)	12,073 (11.64)	40,394 (38.95)	182 (0.18)	103,715 (100.00)
2010	59,791 (49.23)	14,136 (11.64)	47,295 (38.95)	213 (0.18)	121,435 (100.00)
2015	70,462 (49.23)	16,659 (11.64)	55,736 (38.95)	251 (0.18)	143,108 (100.00)
2020	83,597 (49.23)	19,764 (11.64)	66,125 (38.95)	298 (0.18)	169,784 (100.00)

* This forecast represents the baseline case under the assumption that current modal share will be maintained in the future.

III. POLICIES FOR IMPROVING EFFICIENCY IN FREIGHT TRANSPORT

Improving efficiency in freight transportation can be approached in various ways. The improvement of vehicle efficiency could be a major area of development. Possible measures include improving the aerodynamics of the vehicle design, increasing engine efficiency, or developing alternative fuel vehicles that are less polluting and more environment-friendly. Transport policy measures could also help to improve efficiency in freight transportation. Such measures could include policies in favour of a modal shift to more energy-efficient modes, investments in infrastructure expansion and regulatory reforms to promote efficiency and competitiveness in the freight transport industry. Although vehicle efficiency is important in securing environmental sustainability, the present paper focuses on policy-oriented measures in discussing the efforts of the Republic of Korea for sustainable transport development through improvements in the logistics sector.

The Government of the Republic of Korea recognizes the importance of logistics-related problems in the country and has enacted several pieces of legislation and made long-term plans to improve efficiency in the sector. In 1995, the Logistics Facilitation Act was revised and the Distribution Centre Development Act was passed in order to provide financial incentives to developers. In 1997, the Freight Industry Act was passed in order to ease the entry regulations governing entry into the industry. These pieces of legislation were intended to facilitate the development of logistics-related infrastructure and to deregulate the freight industry in order to increase the efficiency of the logistics sector and thereby strengthen the overall competitiveness of the Republic of Korea economy (Transport Yearbook 1998).

Energy efficiency in freight transportation can be achieved by a modal shift to a more energy-efficient means of transportation such as rail. In order to ease railway capacity constraints such as those mentioned earlier, 23 new railway lines with a total length of 3,870 km are being planned, among them the Seoul to Pusan High Speed Rail Link (Ministry of Construction and Transport 1999). It is expected that the expanded railway network would relieve capacity constraints and be able to reverse the current trend and increase the market share of rail in domestic freight transportation.

In order to remove bottlenecks along the major arteries of freight transportation, major investments in road transport infrastructure are also planned. By 2011, 33 new expressways are to be constructed, with a total length of 3,383 km. In the air transportation sector, three new airports and the expansion of nine major domestic airports are also planned. In the water transport sector, four new seaport developments and the expansion of seven seaports are currently under way.

In the area of logistics-related infrastructure development, eight integrated freight terminals and four inland container depots are being constructed. These new facilities are expected to lower logistics costs, improve overall efficiency and contribute to regional development.

For logistics information system development, an integrated logistics information system is being developed in three stages. The integrated system is intended to enable electronic data interchange (EDI) and provide freight traffic information such as real-time freight and vehicle location. In the first stage of development (1996-1998) overall planning and construction of the main EDI centre were completed; in the second (1998–2000) commercial EDI service was planned and in the third stage (2001–2015) further development of commercial EDI service and development of several local EDI centres are planned.[2]

The Government and the private sector are also pursuing the standardization of logistics-related facilities and equipment. The Government has adopted the “unit load system rule” that provides standardized specifications for containers, loading equipment, freight trucks and freight packages. Tax exemption for investments in logistics standardization is also allowed, in order to enhance the standardization process.

Meanwhile, government regulations on the logistics industry have been relaxed. The complicated classification system in the freight transport industry has been repealed and regulations on entry to the industry via a system of licences have been replaced by a less stringent registration system which allows entry into the industry by firms meeting specified minimum requirements. Previously, entry into the freight transport industry required certain amount of minimum endowed capital as well as a minimum number of freight trucks and parking and other related facilities. Before 1999, the minimum capital requirement for the regular freight liners was 300 million won and the minimum fleet requirement was 30 trucks. Even when all of these requirements were met, the licensing of a new freight operator was a long and strict process.

Since freight modal shares can be influenced by infrastructure development and policy instruments, long-term freight modal shares have been estimated taking into account future infrastructure investments and changes in policy. Table 7 gives such a freight modal

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[2] For further information on EDI in freight transportation in the Republic of Korea, refer to Kwon, O., 1997. “Proposed advanced commercial operations in the Republic of Korea”, *Transportation Research Record 1602*, (Transportation Research Board, Washington, DC).

share estimation. Most investments planned in the logistics sector are geared to expanding the role of energy efficient transport modes such as railways and maritime transport. These investments are intended to shift a part of the road freight traffic to railways and water transport.

Table 7. Long-term forecast of domestic freight transportation in the Republic of Korea taking into account major investments in infrastructure development, 2000-2020

(Millions of ton-km and percentage modal share)

Year	Road	Rail	Maritime	Air	Total
2000	43,285 (48.57)	10,700 (12.01)	34,976 (39.25)	164 (0.19)	89,126 (100.00)
2005	46,860 (45.18)	14,483 (13.96)	42,126 (40.62)	245 (0.24)	103,715 (100.00)
2010	50,730 (41.77)	19,601 (16.14)	50,737 (41.78)	366 (0.31)	121,435 (100.00)
2015	54,921 (38.37)	26,529 (18.53)	61,109 (42.71)	548 (0.39)	143,108 (100.00)
2020	59,457 (35.02)	35,906 (21.15)	73,601 (43.35)	820 (0.49)	169,784 (100.00)

Note: The road freight forecasting has been done by the author. Rail and other modal shares have also been estimated by the author, taking into account infrastructure investments in "National logistics visions and policies for the twenty-first century" (Korea Transport Institute 1999).

In table 7, it can be seen that the share of rail freight transport is expected to grow rapidly. This is because the high speed rail link currently under construction would relieve some existing rail capacity from passenger transport to freight transport. Freight transport by air is also expected to grow rapidly, but the absolute tonnage transported is expected to remain small. The share of road freight transport is expected to decrease over the next 20 years as rail and maritime transport expand. Although losing market share, road freight transport would still experience significant growth in absolute terms owing to growth in overall freight movement demand.

The expected changes in freight modal shares will have a favourable impact on the environment: they are expected to increase energy efficiency and thereby help in reducing the greenhouse gas emissions produced by the transport sector. Estimates of CO_2 emissions from freight transportation have been made for this alternative scenario of modal shares and are presented in table 8. The estimation takes into account the current energy efficiency of different modes and forecast changes in modal share. The energy efficiency of different modes has been calculated and checked against the current energy consumption statistics for accuracy. Table 8 shows the potential greenhouse gas (CO_2) reductions up to 2020 owing to changes in freight modal shares. It is estimated that a reduction of CO_2 emissions of up to 6.54 per cent can be achieved in the transport sector by the proposed investments and the consequent modal shift.

Table 8. CO_2 emissions by type of domestic freight transport and their reduction potential, 2000-2020

(Thousands of tonnes of carbon)

		2000	2005	2010	2015	2020
Baseline	Road (private)	5,409	6,294	7,370	8,685	10,304
	Road (commercial)	1,203	1,400	1,639	1,931	2,291
	Rail	74	86	101	119	141
	Maritime	347	404	473	557	661
	Air	63	73	86	101	120
	Total by freight transport	7,096	8,257	9,668	11,394	13,518
Modal shift policy as in "National logistics visions and policy for the twenty-first century" (Korea Transport Institute, 1999)	Road (private)	5,409	6,049	6,446	6,525	6,604
	Road (commercial)	1,203	1,318	2,222	2,847	3,541
	Rail	74	104	134	182	246
	Maritime	347	400	437	532	647
	Air	63	101	146	197	266
	Total by freight transport	7,096	7,973	9,387	10,282	11,304
Reduction potential		-	284	282	1,111	2,214
Total emissions by the transport sector		18,681	22056	26,565	30,855	33,869
Reduction rate (percentage)		-		1.06	3.60	6.54

Source: Lee, Sungwon, Myungmee Lee and others, 2001. Macroeconomic impact analysis of environment regulation in the transport sector, internal document (Korea Transport Institute).

CONCLUSION

Freight transportation is indispensable to economic activities. However, it also imposes a great burden on the environment through harmful emissions. As freight transportation demand is dependent mainly on economic activities, it is expected to increase further as the economy grows. It is estimated that overall domestic freight transportation demand will increase by about 196 per cent over the next twenty-year period. If the current trend continues, greenhouse gas emissions by the freight transport sector are expected to increase by about 190 per cent over the same period. However, with the construction of new railways and other planned major infrastructure projects, the share of rail in domestic freight transportation is expected to increase by 9.51 per cent, while the share of road transport is expected to decrease significantly during this period. This shift in modal shares could have a positive impact on greenhouse gas emissions, which may be reduced by about 6.54 per cent of the estimated total emissions from the transport sector.

Owing to the derived nature of demand, reducing the adverse environmental impacts of freight transportation is regarded as very difficult. The current policy measures for sustainable development in domestic freight transportation in the Republic of Korea focus mainly on a modal shift to environment-friendly modes. However, policies for increasing operational efficiency in freight transportation are also being pursued. These include the development of an integrated logistics information system, deregulation of the freight transport industry and standardization of logistics-related facilities and equipment. With the expected changes in modal shares brought about by these policy measures, energy consumption and the resulting adverse impacts on the environment could be significantly reduced.

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