Economic Feasibility of Off-Track Elevators in Prairie Provinces of Canada

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Fifty percent of Canada's export grain originates on uneconomic branch lines. Peculiarities of the Canadian grain-handling and transportation system are such that virtually all the grain elevators that handle export grain are located on a rail line. Therefore, abandonment of a branch line results in the closure of on-line delivery points, and western grain producers are forced to deliver their grain an additional distance, thus resulting in higher delivery costs. The concept of an off-track elevator arose as a possible solution where all indications suggest that a branch line should be abandoned but, after this is done, relatively long grain-hauling distances would be incurred by the producer. The study focuses on one subdivision in the Saskatchewan Province in western Canada. It considers the comparative costs and savings of (a) leaving the branch line intact, (b) total abandonment of the branch line with the producer hauling to the closest alternative elevator, (c) an off-track elevator to continue operation at one or more designated delivery points after the line is abandoned, and (d) limited rail service to one or more designated delivery points on the uneconomic branch line to be abandoned. The study examines the distribution of savings and costs to government, railways, elevator companies, and producers for these options.

There has been considerable review of railway branch lines in western Canada, which started in 1977 with the Grain Handling and Transportation Commission (the Hall Commission) and was followed in 1978 by the Prairie Rail Action Committee (PRAC) and in 1980 by Doug Neil, a member of Parliament. In each instance, the review had the objective of recommending to the federal government whether or not branch lines should be retained or abandoned. There were a number of lines identified where all indications suggested that they be abandoned; however, in each case, relatively long hauling distances would be incurred by grain producers along those lines. The concept of off-track elevators arose as a possible solution to this particular situation. Within this context, therefore, the Research Branch of the Canadian Transport Commission (CTC) was requested by Neil to analyze 12 potential off-track sites in the Prairie Provinces.

In this analysis, an off-track elevator is defined as an elevator from which rail service had been withdrawn as a result of a recommendation from the Hall Commission, PRAC, or Neil. The continued operation of an off-track elevator requires that the grain be trucked from a point without rail service to a point with rail service (a transshipment point). It was further assumed that the federal government would be responsible for the cost of moving the grain (i.e., commercially trucking it from the off-track elevator to the transshipment point) as well as the cost of handling the grain a second time at the transshipment point.

This paper examines the economics of the off-track elevator concept as compared with the alternatives--first, the complete abandonment of the branch line and closure of all the associated delivery points and, second, the maintenance of rail services only to those points considered for potential off-track operation. The study compares the off-track operation with these alternatives from two different points of view. First, the study examines changes in the long-run costs of handling and transporting the grain. Second, it examines the changes in cash outlay of the federal government relative to changes in the trucking costs of the grain producers.

Changes in long-run costs consist of reductions in rail-line-related costs, branch-line rehabilitation costs, and capacity-related elevator costs as opposed to increases in farm-trucking costs. Government outlays consist of annual rail subsidy payments, payments for branch-line rehabilitation, payments for commercial trucking, and payments for secondary elevation of the grain. Producers' outlays consist of the increases in trucking costs.

The long-run cost analysis, to be complete, should include the added road cost associated with higher truck traffic. Unfortunately, the effects of incremental truck traffic on road cost are not understood and, at best, only a qualitative statement of the effect of increases in truck movements that result from branch-line abandonment can be made at this time.

Although the 12 potential off-track sites in Figure 1 were examined, only the site at Handel, Saskatchewan, will be discussed in this paper. A separate report (1) examines all 12 sites.

LONG-RUN COSTS AND CASH OUTLAYS: METHODOLOGY

Pattern of Producers' Grain Deliveries and Commercial Truck Movements

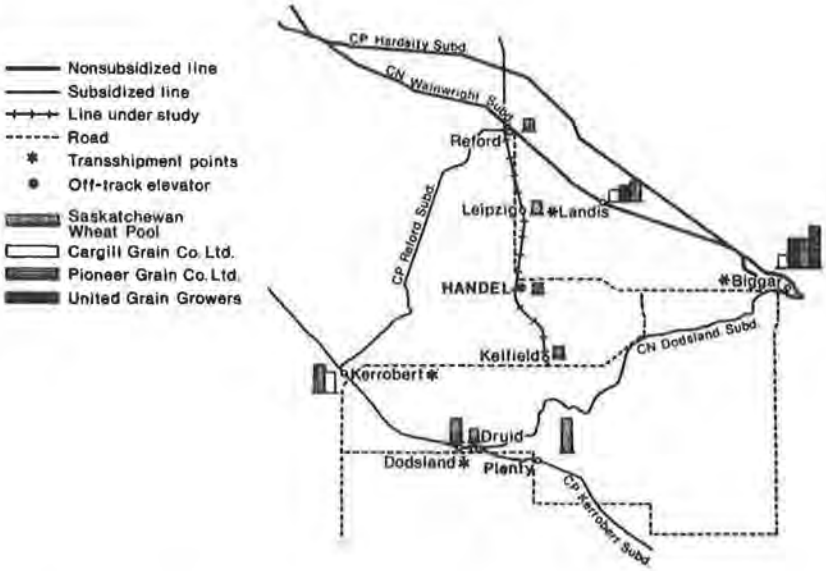
Determination of the new delivery pattern of grain following abandonment of a branch line is essential to the estimation of costs associated with farm trucking, commercial trucking, secondary elevation, and government subsidy payments. The closure of delivery points on an abandoned branch line forces the affected producers to choose alternative points on a neighboring line. The establishment of an off-track operation at a selected point will attract some, but not all, producers from the abandoned line, as others may find themselves closer to a delivery point on a neighboring line. Figure 2 locates the off-track elevator at Handel relative to the neighboring branch-line delivery points and road networks. The computer model PHAER (2), developed by the CTC Research Branch, was used to simulate the new delivery pattern by assigning the grain produced on each farm affected by closure to the closest alternative delivery point. It simultaneously estimates the new haul distance for each producer and the incremental bushel miles.

It was assumed that the grain from the off-track delivery point would be commercially hauled to a delivery point located on a line in the basic network. In selecting this point, consideration was given to the following constraints or trade-offs:

1. Road access: The road access to the transshipment point must be able to accommodate five-axle bulk-carrier trucks of approximately 80 000-lb gross weight. In all cases studied, adequate paved-road access existed. However, some segments were subject to administrative weight restrictions. These were disregarded under the assumption that special permits could be negotiated with the appropriate provincial authorities.
2. Elevator company: Companies that operate the elevators at the points of transshipment must be the same as those that operate the elevators at the off-track delivery points. Profitable operation of the off-track elevators would be questionable other-

Figure 1. Location of off-track elevator sites in Canadian Prairie Provinces.

Figure 2. Off-track elevator at Handel, Saskatchewan.



wise. At the same time, it was assumed that the secondary elevation rate would approximate the marginal cost of elevation.

3. Elevator capacity at the point of transshipment: The elevator company at the point of transshipment should have a sufficiently large capacity to handle the additional grain without exceeding a ratio of receipt over physical capacity of 6:1. The system average was in the order of 3:1, and a ratio of 6:1 was considered by the trade to be operationally possible and desirable. In most of the cases examined, there was insufficient capacity at a single point to handle all of the grain from the off-track delivery point. Therefore, in most instances several points were selected for the transshipment of the grain. An alternative approach would have been to upgrade a single point to receive all of the grain. In the cases studied, however, upgrading costs would have exceeded the cost of trucking longer distances.

4. Category of neighboring line: Under the terms of the Canadian Railway Act, the federal government of Canada pays a subsidy to the railways for losses incurred in the operation of uneconomic branch lines that have been designated by the government as lines that cannot be abandoned. Grain represents the bulk of the traffic on these lines and the entire movement of this grain is subsidized, i.e., the movement on the branch line itself and the subsequent movement of the grain once it has left the branch line.

In 1977, the consulting firm of Snavely, King and Associates estimated that the average subsidy outlay per bushel on grain-dependent lines was approximately 16.5¢ (3). Of this, 4.2¢ was to cover costs related to the movement on the branch line while 12.3¢ was to cover the cost of moving the grain after it left the branch line. The subsidy payment after the grain leaves the branch line arises because the low freight rates (Crow's Nest Rates) set by Canadian statute do not cover the costs of movement. Approximately half the grain movement in

Canada originates on uneconomic branch lines and therefore government subsidies compensate the railways for the loss incurred on the entire movement of the grain to terminal points. However, on grain not originating on branch lines the railways received no subsidy to cover the gap between costs and revenues.

The closure of an uneconomic branch line would, on average, save government subsidy payments of 4.2¢/bushel for the branch-line movement, on the realistic assumption that the grain would move to another uneconomic line where the subsidy demand on the government would not be increased. If a branch-line closure were to cause the diversion of grain to elevators on lines not classified as uneconomic, the government would also apparently enjoy a further saving of 12.3¢/bushel, as the railway revenue shortfall occasioned by the Crow's Nest Rates is not subsidized on grain that does not originate on uneconomic lines. This provides the government with the option of commercially trucking a longer distance to a transshipment point on a line not classified as uneconomic to reduce its subsidy payments. Given a cost of commercial trucking of 0.35¢/bushel mile, the trade-off would be beneficial to the government if the increase in trucking distance was less than 34 miles. However, this saving in government cash outlay is not a genuine cost saving. The off-line cost of moving the grain has not been reduced and, corresponding to the reduction in the cash outlay by the federal government, there would be an equivalent increase in the burden carried by the railways from transporting grain at rates that do not cover costs.

Rail Costs

Abandonment of a grain-dependent branch line has two consequences: a reduction in the long-run cost of transporting the grain by rail (the line-related saving) and the avoidance of rehabilitation and upgrading expenditures (the rehabilitation saving).

Line-related savings are equated to the long-run line-related cost of the length of track considered for abandonment. Long-run line-related costs for grain-dependent lines have been developed for both Canadian National Railways (CN) and Canadian Pacific Limited (CP) by the Commission on the Costs of Transporting Grain by Rail (4) in 1974 and updated in 1977 (3). The average long-run line-related cost per mile of track in 1977 amounted to $11 598 for CN and $11 113 for CP. Note that line-related costs developed by Snavely (3) include normalized maintenance expenditures that are higher than the current deferred-maintenance expenditures of the railways.

Throughout this paper, the figures used to calculate upgrading and rehabilitation savings were the most recent figures submitted by the railways either to PRAC (5) or to Doug Neil, special advisor on prairie branch lines to the former Minister of Transport, Don Mazankowski. They reflect 1977 costs and were estimated by the railways on the basis of the actual costs incurred in their rehabilitation and upgrading work to that date.

Reductions in volume-related costs induced by branch-line abandonment have been assumed to be small and therefore were neglected in calculating the rail savings. According to Snavely (3), of the total branch-line costs, only 6 percent were volume related (on-line volume-related costs are slightly underestimated by Snavely because of the absence of crew wages) and 94 percent were line costs. Off-line costs were essentially volume related. However, they are unlikely to be affected by branch-line abandonment alone without major and concerted readjustment in the operating practices of the railways, elevator companies, and the Canadian Wheat Board (6). Evaluation of the effects of retention of rail services on these potential operating improvements was considered beyond the scope of this analysis.

Elevator Costs

The total cost of elevator operations has been broken down into three components: a fixed portion, a capacity-related portion, and a volume-related portion. It was assumed that the closure of an elevator would result in a saving equal to the sum of the fixed and capacity-related portions of the cost.

A total cost function, which reflects the above breakdown of components, has been estimated from data provided to the CTC Research Branch by the Canada Grains Council. These data result from a 1972-1973 survey of companies operating in Saskatchewan by the Area Eleven Subcommittee of the Canada Grains Council (7) and were updated to 1977 price levels by the use of appropriate Statistics Canada indexes.

The cost function is summarized as follows:

Total annual cost of elevation (in dollars) = 12 180
+ 0.151 88 x (physical capacity in bushels)
+ 0.075 33 x (total grain receipts in bushels).

All coefficients are significant at the 1 percent level with $R^2 = 0.84$.

The same cost function provides an estimate of the marginal cost of elevation that was used to calculate the secondary elevation cost at the transshipment points. Assuming that elevating additional grain does not require a change in the physical capacity, the marginal cost is the coefficient of the volume-related term in the preceding calculation and amounts of 7.5¢/bushel.

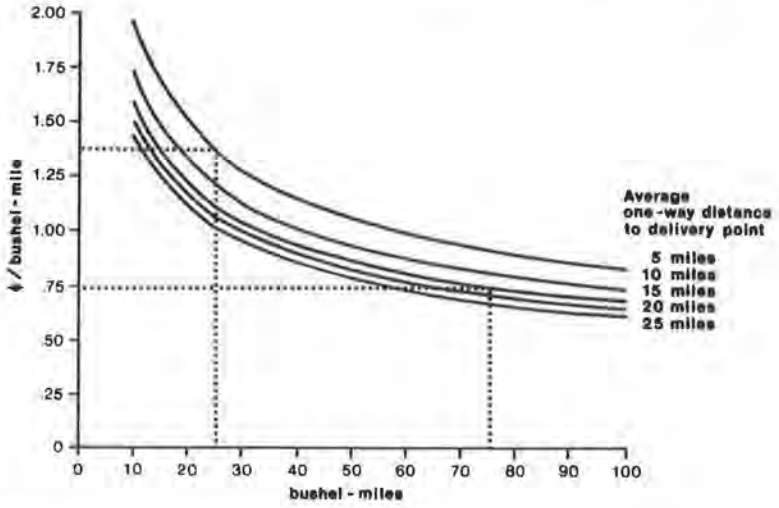
Farm-Trucking Cost

The long-run cost of farm trucking was based on an update by the CTC Research Branch of the previous work in the reports of the Area Eleven Subcommittee (7) and of the Hall Commission (8). A long-run cost function was reestimated by using the same 1972 survey of farm trucks conducted by Kulshreshtha in Saskatchewan and updated to 1977 price levels (9). The cost function and associated results are summarized in the calculation of the long-run farm-trucking cost function (1977 prices) given below:

Log (average cost in cents per bushel mile) = 2.9510
- 0.3803 log (total bushel miles) - 0.1876 log (one-way distance to delivery) - 0.3012 log (capacity of truck box in bushels) - 0.2566 log (age of truck).

(Note that all coefficients are significant at the 1 percent level with $R^2 = 0.63$, average capacity of truck box is 216 bushels, and average age of truck is 15.3 years.) The cost function was applied for each affected producer by using, first, preclosure delivery distance and bushel miles and, second, the new delivery distance and bushel miles incurred by delivery to the closest alternative delivery point. The difference between the second and first cost estimate is, of course, the additional farm-trucking cost, as demonstrated in Figure 3. From this graph it is seen that for a producer who, prior to closure, was delivering 5000 bushels 5 miles (25 000 bushel miles), his or her cost per bushel mile would be 1.37¢ and the total cost $342.50. After closure, if the distance was increased by 10 miles to a total trucking distance of 15 miles, the total bushel

Figure 3. Average total cost per bushel mile for producers trucking in Prairie Provinces.



miles would be 75 000 at a cost of 0.75¢/bushel for a total cost of $562.50. The incremental trucking cost is therefore $220.00.

Commercial Trucking Costs

The long-run cost of commercial trucking was based on a study by Trimac Consulting Services of Calgary, Alberta (10), which is updated biennially for Transport Canada. Costs for 1977 were obtained by interpolation of the cost data published in 1976 and 1978. These costs were converted to a cost per bushel mile for each of the Prairie Provinces and are summarized below:

Province	Cost (¢)
Alberta	0.37
Saskatchewan	0.35
Manitoba	0.36

The derivation assumed the use of an 82 000-lb gross weight vehicle designed for bulk commodities, which had a net payload of approximately 50 000 lb, or some 800 bushels of wheat. Annual use of the truck was limited to 25 000 miles because of short hauls and loading-unloading times. The unit costs include a rate of return to represent profits and therefore should provide an estimate of the rates that may be negotiated with appropriate carriers. Applied to a 30-mile haul in Manitoba, the unit cost produced a trucking cost of 10.8¢/bushel, which was consistent with a rate of 9¢/bushel quoted by the Manitoba Pool for hauls between 0 and 30 miles.

Road Costs

The effect of branch-line abandonment on the road network has been the subject of submissions by provincial governments to the Hall Commission and to a number of CTC hearings on branch-line abandonment. Although there is consensus that there will be incremental road costs consequent on the abandonment of branch lines and on delivery-point closure, estimates vary widely because of a lack of data, which requires that a large number of assumptions be made. As an example, in CTC hearings on the abandonment of the Shamrock subdivision in Saskatchewan, the highest estimate of incremental road costs was five times higher than the lowest estimate. Experts at Transport Canada and Public Works Canada think the very high estimates cannot be substantiated. However, in the case of complete abandonment, the additional financial burden imposed on provincial governments and to a lesser extent on municipal governments would be at least as large as the burden imposed on the producers for added farm-trucking costs.

In the case of off-track operation, the impact may be slightly smaller in that commercial truck movements would replace a large percentage of the farm vehicle miles. The unit used to measure traffic from the standpoint of roadbed and road-surface deterioration is the equivalent standard axle load (ESAL). The ESAL is equivalent to an 18 000-lb axle load, and a cross-reference system has been set up that allows for the expression of any vehicle weight and axle combination in terms of ESALs. The number of ESALs associated with the commercial truck movement in all 12 branch-line cases was between 3 and 4. Based on the information given in the Hall Commission report (8), this number would have little impact on road costs.

ESTIMATE OF LONG-RUN COSTS AND CASH OUTLAY FOR THE OFF-TRACK ELEVATOR AT HANDEL

From Table 1 it will be seen that complete abandonment of 27.9 miles of the Kelfield subdivision (Brass to Kelfield) without an off-track elevator would effect a saving of $310 000/year in rail-line costs and avoid a government rehabilitation and upgrading cost of $439 000/year. Elevator closures would result in a reduction in fixed costs of $103 000/year. The increase in farm trucking costs for producers would be in the order of $50 000/year.

Similarly, abandonment with an off-track elevator established at Handel would save both rail-line costs and government rehabilitation and upgrading costs. However, government expenditures required to cover the cost of commercial trucking and secondary elevation would be about $152 000/year. Elevator savings on fixed costs would be reduced from $130 000 to $64 000/year. The increase in farm-trucking costs for producers would be about $21 000/year, compared with $50 000 in the case of complete abandonment.

If the rail line were maintained to Handel from Brass, the saving in rail-line-related costs would be only $103 000/year instead of $310 000, and government costs for rehabilitation would be only $147 000/year instead of $439 000. There would be no requirement for government expenditure to cover costs of commercial trucking or secondary elevation. Elevator savings and the increase in costs to producers would be the same as for the off-track elevator alternative.

Table 2 presents an examination of changes in government and producers' annual cash outlays that result from the implementation of the various options and shows that a new option has been added. This alternative trucking option was included to show the effect of commercially trucking a slightly longer distance to a transshipment point on a branch line not classified as uneconomic.

The complete abandonment of the Kelfield subdivision would result in annual savings to the government of $594 000, of which $155 000 is in subsidy payments to the railways and $439 000 in rehabilitation costs. The increase in farm-trucking costs for producers would be in the order of $50 000/year.

With complete line abandonment and the establishment of an off-track elevator at Handel, the added farm-trucking cost to producers would be reduced to $21 000/year. There would be no requirement from the government to cover line-rehabilitation costs and upgrading, but costs of $75 000 would be incurred for secondary elevation and $77 000-$84 000 for commercial trucking. Depending on whether or not the alternative elevator to which the grain was commercially trucked was located on a subsidized grain-dependent line, the net annual saving to the government would be between $428 000 and $485 000 instead of $594 000, and the increased cost to the producer would be $21 000 instead of $50 000.

With partial abandonment and the line maintained to serve Handel only, subsidy payments would be reduced by $51 000 to $230 000, and rehabilitation costs would be reduced by $147 000 to $292 000. There would be no expenditure for commercial trucking or secondary elevation. The net saving to the government would be $198 000. The increase in farm-trucking costs for producers would be $21 000/year, the same as that for the off-track alternative.

Table 1. Long-run cost analysis—CP Kelfield subdivision.

Item	1977 Cost ($000s/year)		
	Abandonment of Kelfield[a]	Off-Track Operation at Handel	Rail Line Maintained to Handel
Saving			
Rail-line related	310	310	103
Rail rehabilitation	439	439	147
Elevator	103	64	64
Total	852	813	314
Cost			
Added farm trucking	50	21	21
Commercial trucking[b]	-	77	-
Secondary handling	-	75	-
Total	50	173	21
Net saving	802	640	293
Net cost of alternative to complete abandonment	0	162	509

[a]The Kelfield subdivision is close to the Dodsland subdivision recommended for abandonment by the Hall Commission. Because a substantial portion of Dodsland grain would go to Kelfield, the analysis is based on the assumption that Dodsland has already been abandoned.
[b]Transshipment is at Landis, Kerrobert, and Dodsland.

Table 2. Government and producers' cash outlays.

Item	1977 Cost ($000s/year)				
	Current Configuration[a]	Abandonment of Kelfield	Handel Off-Track Trucking		Rail Line Maintained to Handel
			Option 1[b]	Option 2[c]	
Subsidies on Kelfield grain	281	126	140	76	230
Subsidy reduction	-	155	141	205	51
Cost					
Commercial trucking	-	-	77	84	-
Secondary elevation	-	-	75	75	-
Net government outlay[d]	281	126	292	235	230
Rehabilitation outlay	439	-	-	-	292
Total government outlay	720	126	292	235	522
Reduction in government outlay	-	594	428	485	198
Producers' added farm-trucking costs	-	50	21	21	21

[a]This assumes the Dodsland subdivision has already been abandoned.
[b]Transshipment at Landis, Kerrobert, and Dodsland.
[c]Transshipment at Landis and Biggar.
[d]Excludes rehabilitation.

Table 3. Net savings and distribution of savings from alternative abandonment options.

Abandonment Options	1977 Cost ($000s/year)				
	Net Saving	Distribution			
		Government	Rail Company	Elevator Company	Producers[a]
Without off-track elevator	802	594	155	103	-50
With off-track elevator and commercial trucking to					
Nearest on-line point with same elevator company	640	428	169	64	-21
Nearest on-line point on unsubsidized line with same elevator company	633	485	105	64	-21
Line retained to point considered for off-track elevator	293	198	52	64	-21

[a]Minus signs show losses.

SUMMARY AND CONCLUSIONS

Summarized in Table 3 (for the Kelfield subdivision) are the annual net savings; the distribution of savings between the government, railway, and elevator company; and the increased farm-trucking costs to the producer for each abandonment option. The largest savings are to be gained from complete abandonment without the off-track operation. However, savings from an off-track operation are almost as high in that the savings in branch-line rehabilitation and upgrading costs far exceed the cost of commercial trucking and secondary elevation. A relatively small saving is to be had from partial abandonment with rail service to points considered for an off-track operation.

Producers are likely to incur an increase in farm-trucking costs in all three options but it is, of course, smaller with the off-track operation or the rail line maintained to Handel. The increase in cost to the province or the municipality for road maintenance may also be as high as the producers' increase in farm-trucking cost for the first two options.

The government stands to gain approximately twice as much from any form of branch-line abandonment as the railways or elevator companies. For the most part, the savings are in the rehabilitation and upgrading costs that are avoided if the branch line is abandoned. The cost to the federal government for the establishment of an off-track elevator at Handel as opposed to complete abandonment of the Kelfield subdivision is more than $100 000/year. This would save producers about $29 000/year. This leaves open the alternative of a farm-trucking subsidy, but such a consideration is beyond the scope of this analysis.

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Logistics Strategies for Regional Growth

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This paper analyzes the capability of the logistics system to (a) cope with regional growth and (b) be used as a tool to initiate desired growth. The focus is on small towns and rural areas (STRAs) of regions. Distinctions are made between operational and functional approaches to the analysis of logistics resources. An operational perspective of transportation resources results in the hind-part-before use of operational techniques as the basis for the design of strategies for resource use. This results in considering the transportation system and the transportation activities as ends to themselves. A functional perspective of logistics resources recognizes that transportation is only one subset of a group of related resources that collectively are means to an end. It recognizes that the function of the logistics system is to support the marketing effort of the users who collectively make up the economic infrastructure of regions. It also recognizes that strategies for the use of the system are designed in light of its market-support function and that operating techniques flow from strategies. Problems associated with the operational perspective are discussed as a backdrop for suggested strategies for the logistics system. The strategies suggested are designed to (a) improve the economic and temporal connections between STRAs and their markets and sources of supply and (b) relate the function of the system to certain environmental features.

Logistics resources are significant elements in the management of regional change. The purpose of this paper is to analyze the capability of the logistics system both to cope with change thrust on a region and to initiate desired regional change. The first objective is to relate the functional role of the logistics system to the relevant environmental features that may influence regional change. The second objective is to outline some strategies that will lead to more effective use of logistics resources and thus improve the prospects for strengthening the economic connections of small towns and rural areas (STRAs) with their nodal cities.

The functional approach, rather than an operational approach, is used to emphasize distinctions between the function and activities of the logistics system, to differentiate between economic ends to be