An Economic Analysis Of Unit-Train Facility Investment

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Abstract

Country elevators competed chiefly through increased efficiency in grain handling and transportation. The development by the railroads of more favorable rates for multi-car shipments (unit train) has led grain cooperatives and other agribusiness firms to invest in high speed rail load out facilities. In this study the feasibility of an investment in a unit-train load out facility is analyzed. The impact of grain through put volume, unit rate transportation savings, discount rates, and grain-cleaning costs is also determined.

Keywords: unit train transportation, agribusiness finance, grain marketing

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Introduction

The historic role of country elevators within the wheat commodity marketing system was grain assembly. Country elevators received grain from producers and assembled it to ship to terminal elevators by truck or rail car. As the marketing system evolved, country elevators competed chiefly through increased efficiency in grain handling and transportation. This quest for economies of scale and scope led to increased firm size through both acquisitions and consolidations. The historic structure of the grain marketing system consisted of three or more tiers of firms: a large number of local country elevators which assembled grain, regional terminal elevators which consolidated grain from the regional elevators and the final tier of export elevators. In recent years, the role of regional elevators in consolidating grain has diminished as larger local elevators have taken on the role of shipping directly to domestic and foreign end users.

A variety of factors, including increased marketing expertise of local elevator merchandisers, advances in information technology, and deregulation of rail rates have contributed to this decentralization of the grain marketing system. (Dahl). With this decentralization, grain increasingly moved from its point of production or from a gathering point near the point of production to the domestic user or export point without passing through a terminal elevator. The development by the railroads of more favorable rates for multi-car shipments contributed to this trend.

Shipments from the elevator to the buyer can be made via single-car (normally involving 1-24 cars), multi-car (normally involving 25-49 cars), or unit-car (normally either 50 or 100 car) trains, and shuttle trains (Vachal and Bitzan, 2000). Shuttle trains are dedicated 100 car unit trains that operate on a fixed, predetermined schedule. The minimum and maximum number of cars included in each shipment type may vary slightly by rail carrier and commodity. Single-car and multi-car grain shipments are generally bound for domestic destination, while unit-trains and shuttle-trains are generally bound for larger domestics processors and export facilities and have to meet certain defined origin destination.

There is a rate savings in shipping via larger car trains. While the exact limits vary by rail carrier, trains in the 100 to 110 car range are usually represent the maximum size for a train. The unit car rate savings reflects the savings that the rail carriers experience when they do not have to consolidate grain cars with other users in assembling an optimal length train. Uniform Railroad Costing System (URCS) shows reduction in car-day cost at origin and destination by 50 percent when a multi-car or unit-train movement is specified, reflecting reduced loading/unloading, switching, and waiting time per car. Locomotive switching costs at origin and destination are reduced by 50 percent for multi-car shipment and 75 percent for a unit-train (Tolliver and Bitzan, 2002). Kenkel and Anderson (2002) identified unit train freight rate advantages for transportation from Oklahoma country elevator locations to Gulf markets ranging from 5-15 cents/bushel ($1.80 to $5.5/tonne) relative to single car rates.

This rate structure provided country elevators with the incentive to modernize their load-out facilities. To qualify for favorably rates, the elevator must be able to load a 100-car train (approximately 360,000 bushels or 9800 tonnes) in a set maximum amount of time, usually 12-14 hours. Because of these throughput requirements, along with associated infrastructure for blending, weighing, cleaning and grading, a unit-train load out facility involves a large investment (up to $6 million dollars).

In their quest for efficiency and increased profitability, local elevators and other grain handling firms continue to evaluate unit-train load out projects. When, as in many of the recent unit train projects, the grain handling firm is organized as a producer-owned cooperatives, the profitability of the unit-train project directly impacts the return of the participating grain producers. For these reason, information about the return on investment for unit-train load out project and the factors which influence profitability is of great interest to grain marketing agribusiness firms.

Previous Research

In a previous study of unit-train profitability, Vachal et al. examined the feasibility of uni-train load out facilities for hard red spring wheat elevators in the Northern Plains. The authors analyzed several scenarios including a “greenfield” start-up scenario in which all grain receiving, storage and load out infrastructure had to be constructed and several other scenarios involving smaller investment and lower grain throughput. The authors identified four key factors to be considered: production density, dependence on rail marketing, railroad spreads, and desire of customers to use unit-train shipments. The authors concluded that elevators handling over 10 M bushels could afford to make a $2M investment in a 100 car unit-train load project. The authors also concluded that the benefit/cost relationship would vary with each elevators unique cost situation.

The current study builds to this line of important research in several areas. While the previous study was based on hard red spring wheat in the Northern Plains, this study investigates reprehensive costs and returns for hard red winter wheat elevators in the Southern Plains. This study also provides a more systematic analysis of the impact of various cost factors on unit train project profitability. Another factor, not addressed in the North Dakota study, is the fixed and variable costs associated with grain cleaning. In recent years, wheat elevators, particularly those in the Southern Plains, have found it necessary to clean a percentage of their grain in order to meet end-user and export specifications.

Objective

The objective of this study is to evaluate the feasibility of wheat unit-train load out facilities. The study incorporates actual construction and operating costs from a recent unit-train load out project in Oklahoma. In addition to base-line feasibility analysis the impact of discount rates, grain throughput, unit train transportation rates and grain cleaning requirements on unit-train profitability is examined.

Methods of Analysis

The total benefit for the elevator from shipping wheat through a unit train versus marketing it through traditional channels is expressed as:

$$B_t = Q_t\,(P_{UT} - P_{TR})_t + Q_t\,(TS)_t \qquad (1)$$

where B is the difference between total revenue from selling wheat through the unit train and selling through the traditional channels. Q is the quantity of wheat available for shipment. P_{UT} is the price received from the unit train buyer, P_{TR} is the terminal market price (P_{UT}-P_{TR} is referred to as "price premium" throughout this study), and TS is the transportation cost savings per bushel from using a unit-train. In other words; B measures the net price advantage and transportation cost savings per bushel of wheat shipped by unit train, compared to selling wheat via other channels.

The total cost of constructing and operating the unit-train load out facility is expressed as:

$C_t = C_{It} + C_{At} + C_{Vt}$ (2)

Where C_I represents the original infrastructure investment costs, C_A represents the annual operating costs and C_V represents the variable operating costs. A more detailed breakdown of cost estimates within these categories is provided in the data section.

In this study, three measures are used for evaluating return to elevator's investment on unit-train load-out facility: net-present-value (NPV), benefit-cost ratio (B/C), and internal-rate-of-return (IRR). The calculation of net-present-value (NPV) of the profit on investment is as given by Gittinger (1982):

$$NPV = \sum_{t=1}^{N} \frac{B_t - C_t}{(1+i)^t} \quad (3)$$

where B_t is the same as was defined earlier, C_t is the infrastructure cost (it is assumed here that the entire amount of C_t occurs in year zero) plus operating costs of the load-out facility (for the years after), i is the discount rate (the risk adjusted cost of capital), N is the number of years that the investment is expected to last. Positive NPV's indicate investment profitability, while negative values present unprofitability.

The benefit-cost ratio is calculated as:

$$B/C = \frac{\sum_{t=1}^{N} \frac{B_t}{(1+i)^t}}{\sum_{t=1}^{N} \frac{C_t}{(1+i)^t}} \quad (4)$$

A greater than one B/C indicates investment profitability.

A third measure of profitability of investment is the internal rate of return (IRR). IRR represents the discount rate that sets the NPV equal to zero. A project's IRR is compared with the firm's discount rate (risk adjusted cost of capital). If the IRR is greater than the firm's discount rate, then it is concluded that the investment is profitable. Unprofitability is concluded if the opposite is true.

Sources of Data

In this study, the base line investment and operation costs were obtained from a recent unit-train load out project in Oklahoma. The project involved the construction of over 3 miles of railroad track, the addition of a 250,000 bushel concrete storage tank, the renovation of an existing concrete elevator and the construction of a high-speed elevator leg, in-line scale, load-out platform and reclaim augers. The cooperative also elected to install a 10,000 bushel/hour grain cleaner at a cost of over $100,000. The project involved a total investment of close to $2 million. The base-line initial investment and annual costs are provided in Table 1. While actual investment and operating costs vary for each particular firm, the data is thought to be representative of recent unit train projects that use existing storage structures.

Table 1: Baseline Investment 100 Car Load-out Facility

Rail Trackage and Switches	$1,000,000
Conveyance and load-out systems	$400,000
Cleaning equipment	$100,000
Storage facility upgrades	$250,000
Switch Engine	$150,000
Truck scale up-grade	$100,000
Total	**$2,000,000**

Annual operating costs consist of fixed cost and variable cost associated with the load-out operation. Fixed costs include insurance, taxes, and administrative expenses. In keeping with the principles of NPV, B/C and IRR calculation, interest and depreciation costs are not included as annual costs. Annual depreciation is not included because the initial investment amount is reflected as an outflow in year 0. Interest costs are not included because the interest effect is captured through the discount rate. A profile of annual fixed costs is provided in Table 2.

Table 2: Annual Fixed Costs for 100 Car Unit-Train Load Out Facility

	% of Property Plant	Baseline Cost
Salary and Benefits	NA	$145,050
Insurance	.88%	$17,500
Maintenance	1.25%	$25,000
Property Tax*	2%	$32,000
Supplies and Miscellaneous	NA	$34,000

* property tax based on buildings and track improvements only

Variable costs include wages (overtime), electricity, fuel, and grain cleaning costs grain inspection and sampling fees, interest on working capital, and other costs. A summary of variable costs is provided in Table 3. The operating costs reported by the Oklahoma case elevator case example were similar to those reported by Vachal et al. (1999) and appear to be representative for typical 100 car unit-train load out facilties.

Table 3: Variable Costs for a 100 Car Unit-Train Load Out Facility

Item	Per unit cost	Baseline Cost
Overtime	$450/train	$10,800
Grain Inspection	$800/train	$19,200
Grain Inspection Overtime	$675	$16,200
Electricity	$.01/bushel	$86,000
Grain Cleaning* (labor, electricity and shrinkage)	$.055/bushel	$23,650

* Baseline grain cleaning costs assume cleaning 5% of grain throughput

Results

This study looks at various scenarios that assume various discount rates, transportation cost savings, grain volumes, and variable cost structures that deviate from the baseline. The baseline in this study is a facility that ships twenty-four 360,000 bushels, 100-car trains each year for a total grain throughput of 8.6M bushels. This facility is assumed to be built at a total cost of $2M which would be representative of a project utilizing existing grain storages and grain receiving systems. The baseline investment assessment assumed that the unit-train project generated a combined transportation rate savings and price advantage of $.10/bushel. Five percent of the grain was cleaned. The baseline discount rate was 10%. The results of the investment analysis using baseline assumptions is provided in Table 4. The investment analysis indicated that a unit-train load out project was profitable at baseline assumptions. The results indicate that if the entire benefit of the savings were to be passed on to producers (as would be the case in a cooperative grain elevator) producers would gain over $.04/bushel. The per bushel benefit could also be interpreted as an upper limit on the amount that an elevator could raise its bid price in order to attract needed throughput to a load-out project.

Table 4: Profitability Analysis of 100 Car Unit-train Load Out Facility

Net Present Value	Net Present Value per Bushel	Benefit to Cost Ratio	Internal Rate of Return
$ 377,877	$.043	1.08	14.62%

Discount Rates

As the discount rate, or cost of capital, goes up the NPV and B/C go down. The impact of discount rate on the profitability analysis of the 100 car unit-train project is provided in Table 5. As the table indicates, the unit-train load out project is profitable at the 10% baseline discount rate. The discount rate used in investment analysis should reflect the firm's interest costs and an appropriate risk premium. The unit-train project would not be acceptable for elevators with a risk adjusted interest cost of over 14.86%.

Table 5: Effect of Discount Rate on Profitability of a 100 Car Unit-Train Load Out Investment

Discount Rate	Net Present Value	Benefit to Cost Ratio	Internal Rate of Return
3.00%	$ 1,218,683.17	1.20	14.87
5.00%	$ 921,638.37	1.16	"
10.00%	$ 401,030.00	1.08	"
15.00%	$ (8,307.09)	0.99	"
18.00%	$ (172,181.10)	0.95	"
20.00%	$ (262,720.66)	0.92	"

Transportation Cost Savings

As mentioned previously, unit-train transportation savings generally range from $.05 to $.15/bushel depending on the rail carrier and a particular elevator's next best transportation and marketing alternative. This savings represents both the savings in rail shipping rates and the price premium at the destination market. Elevators shipping via dedicated shuttle trains typically receive an additional savings of $.03 over unit-train rates. The impact of transportation cost savings on unit-train load out profitability are summarized in Table 6. The minimum or "break-even" transportation cost savings needed, assuming all other parameters are at baseline values, is $.093/bushel.

Table 6: Effect of Transportation Cost Savings on Profitability of a 100 Car Unit-Train Load Out Investment

Transportation Cost Savings	Net Present Value	Benefit to Cost Ratio	Internal Rate of Return
$ 0.08	$ (596,213.98)	0.86	0.56
$ 0.10	$ 364,572.88	1.08	14.87
$ 0.12	$ 1,325,359.73	1.29	26.13
$ 0.14	$ 2,286,146.59	1.51	36.23

Grain Volume

As would be expected for a project with a high portion of fixed costs, unit-train investment return was very sensitive to grain volume (annual throughput through the load out facility) (Table 7.) The break-even grain volume was 90.56% of baseline capacity or approximately 7.489M bushels/year. The analysis indicated that an elevator that only achieved

90% of its projected capacity through the unit-train facility would experience a negative net present value of almost ($23,000).

Table 7: Effect of Grain Volumes on Profitability of a 100 Car Unit-Train Load Out Investment

Percent of Capacity	Grain per Year (Millions Bushels)	Net Present Value	Benefit to Cost Ratio	Internal Rate of Return
80%	6.880	$ (399,695.77)	0.91	4.01
85%	7.310	$ (205,940.36)	0.95	7.02
90%	7.740	$ (22,937.94)	0.99	9.68
95%	8.170	$ 170,817.47	1.04	12.34
100%	8.600	$ 364,572.88	1.08	14.87
105%	9.030	$ 558,328.29	1.12	17.29
110%	9.460	$ 752,083.70	1.17	19.64

Grain Cleaning

Domestic and foreign end-user specifications for wheat purchases typically require dockage levels below .5%. Unit-train load out managers typically find that they must clean at least a portion of their wheat inventories to meet these levels. Antidotal evidence from the case study elevator suggests that managers may not anticipate the impact of grain cleaning costs on unit-train load out facility profitability. The impacts of grain cleaning costs on the unit train investment are summarized in Table 8. The analysis indicated that a facility could clean up to 18.7% of its grain and still maintain a positive NPV, when all other parameters were at baseline levels. The importance of grain cleaning costs to a particular elevator would depend on the crop quality characteristics in the local production area and the elevators success in accurately grading grain and passing on dockage related price discounts to the producer.

Table 8: Effect of Grain Cleaning on Profitability of a 100 Car Unit-Train Load Out Investment

% Grain Cleaned	Net Present Value	Benefit to Cost Ratio	Internal Rate of Return
5.00%	$ 364,572.88	1.08	14.87
10.00%	$ 232,464.69	1.05	13.12
15.00%	$ 100,356.49	1.02	11.39
20.00%	$ (31,751.70)	0.99	9.55
25.00%	$ (163,859.89)	0.96	7.64

Investment Cost

Investment cost for a 100 car unit-train load out project varies across firms. This would be expected to particularly true for projects that are constructed in conjunction with existing receiving and storage facilities. The impact of project cost on load-out profitability is summarized in Table 9. The results illustrate that, with other assumptions at baseline, unit-train load facilities are feasible only for elevators that can achieve a total investment cost of $2,364,572 or less. The pattern of results in Table 9 can be inferred from the calculated net present value at the baseline investment cost. However, because some cost such as property taxes and insurance were assumed to vary with investment level, it was necessary to explicitly calculate the profitability measures shown in Table 9 at the alternative investment cost levels.

Table 9: Impact of Project Cost on Profitability of a 100 Car Unit-Train Load Out Investment

Total Project Costs	Net Present Value	Benefit to Cost Ratio	Internal Rate of Return
$1,800,000	$ 580,584.05	1.14	18.41
$2,000,000	$ 364,572.88	1.08	14.87
$2,200,000	$ 148,561.70	1.03	11.84
$2,400,000	$ (67,449.47)	0.99	9.22
$2,600,000	$ (283,460.65)	0.94	6.90

Summary and Conclusions

The analysis indicated that investment in 100 car unit-train load out facilities appear to be profitable for a typical country wheat elevator. The per-bushel benefit of the load out project was approximately $.04/bushel. This represents the benefit that could potentially be passed on to producers from a 100 car unit-train load out project. The results also imply that, at baseline cost assumptions, grain elevators considering unit-train projects could not afford to increase grain bids by more than $.04/bushel in order to attract sufficient grain for the load out operation. The per bushel transportation rate/market premium associated with unit train shipments and grain throughput levels were identified as major factor influencing profitability. The percentage of grain cleaned was also shown to have a moderate impact on profitability. This study results add to the understanding of an important infrastructure component of today's rapidly decentralized grain marketing system. The results should be useful for agribusiness firms and producer owned cooperatives that are considering unit-train load out projects.

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