Case Study

The Feasibility of Investing in a High-Speed Grain-Handling Facility in Kansas

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Abstract
Rural communities often combine quantitative and qualitative approaches to determine which investments can be supported by the local economy. In this case study, the goal of an economic development council (EDC) in rural Kansas was to promote economic and population growth by making the best use of the local resources. From a list of potential investment projects, the EDC identified a high-speed grain-handling installation as an opportunity to facilitate local economic growth. A community leader then had to determine whether an investment in such a facility was financially feasible for the community. This case study emphasizes the applied financial analysis methods used to make investment decisions about rural projects. It presumes a variable mix of historical grain prices and local grain production to project the most likely profit outcome. Thus, it helps inform investment decision of the EDC and county commissioners.

1 Introduction

The Economic Development Council (EDC) of Stafford County, Kansas, was founded in 2011. The council was eager to promote economic growth opportunities in south-central Kansas. Director Carolyn Dunn's focus was on job creation and entrepreneurship to improve the county's economic performance.

The economic performance of many rural communities' lags behind that of most metropolitan and micropolitan areas, and Stafford County, which faces challenges similar to those of other rural communities across the state, was no exception in this regard. In the county of 4,200 residents, the agriculture and food processing industries employ approximately 36 percent of the total workforce and represent 35 percent of the gross regional product (KDA 2017). Agricultural production is not unique in south-central Kansas, and Dunn's focus was on the county's unique strengths rather than its weaknesses.

In 2018, the EDC, County Board of Commissioners, and White's FoodLiner united to invest in and operate a grocery store in the county seat—St John, Kansas. After the successful launch of the grocery store, Dunn envisioned a designated area in the county that could perform the value-added services of shipping, storing, transloading, and merchandising corn, wheat, soybeans, and milo. Stafford County's proximity to a U.S. interstate, easy access to two Class I railroads, land zoned for the development of an airport, secondary railway line, and industrial storage complemented the county's infrastructure. A high-speed grain-handling facility would anchor the development project and likely attract collaboration interests from a Class I railroad as well as from grain merchandising and grain exporting companies.

Dunn and the Board of County Commissioners envisioned a high-speed grain-handling facility that would support local grain companies, shippers, and carriers of corn to ports in California, the Gulf of Mexico, and the Pacific Northwest. Additionally, the facility would serve as a storage location for animal feed purchased by local feedlots. Dunn was ambitious, but cautious. She trusted her intuition but wanted to validate the premise of a high-speed grain-handling facility with supporting data and financial analysis. She encouraged a consultant to study the financial costs and benefits and agreed with the consultant that

input from key supply chain network and logistics suppliers would enhance the study's results. She believed that input from the BNSF Railroad, local cooperatives, and grain companies would provide additional insight into the financial viability and feasibility of the high-speed grain-handling facility for the county.

The decision to invest is based on an analysis that stems from the application of strategic and financial management concepts. The strategic management focus discerns the practicability of the county's resources and the potential of a high-speed grain-handling facility to create a competitive advantage for the county. Moreover, the financial analysis concentrates on the commercial viability of the long-term investment.

2 History of Grain-Handling Facilities

High-speed grain-handling facilities are considered to be "sub-terminal elevators" and are commonly referred to as shuttle loaders, which are devoted to the storage, loading, and distribution of grain commodities. They are specifically designed for long-distance transportation, moving grain from origin to destination as a shuttle train (75–120 dedicated railcars). High-speed grain-handling facilities experienced peak growth in the early 2000s, following a rapid expansion of U.S. grain production (USDA 2013). However, the number of grain shuttle loaders has dwindled; only 1 percent to 2 percent of Midwestern rural communities remain viable investment locations for these loaders, mainly because grain storage capacity has become oversaturated (Kowalski 2014). Within a 60-mile radius of Stafford County, there are six shuttle loader facilities, three of which comprise more than 90 percent of the area's storage capacity.

Grain handling involves four main steps: inbound shipments, processing, storage, and outbound shipments. Country elevators routinely receive grain directly from farmers, who store the grain, sell it to processors and exporters, or both. Shuttle loader facilities can load and unload inbound and outbound shipments by truck, railcar, river barge, and ocean-going vessel. These facilities feature handling equipment that operates at higher speeds than that of country elevators. This equipment significantly reduces grain unloading and loading time and improves worker safety and product quality.

Among more recent grain elevator innovations are fully automated elevator legs, conveyors, and gate systems that allow grain to be routed automatically from the initial receiving pit through the facility's warehouse and storage bins to the railcar for outbound shipments. Additionally, some facilities have state-of-the-art blending software to reduce the intermingling of commodities and improve inventory management.

A high-performing shuttle loader facility requires a larger capital investment than many country elevators. A shuttle loader is specifically designed to capture the benefits of economies of scale by handling large quantities of grain in short periods of time (Bekkerman and Taylor 2017). Thus, a shuttle loader reduces the average cost of grain, increases the opportunity to market grain for export, and vastly contributes to investors' return on investment (ROI) when compared with investments in small country elevators. Figure 1 illustrates the role that shuttle loaders play when grain is exported or used domestically. Farmers and country elevators supply grain to the shuttle loader, which supplies grain to both livestock feed yards and export elevators. An average-sized shuttle loader in Kansas has the capacity to manage approximately two million bushels of grain storage.

Dunn pondered whether an investment in a shuttle loader was a wise choice. She still had many questions. What shuttle loader size and trading capacity was best suited for Stafford County? At what point would the investment in a shuttle loader become profitable? What were stakeholders' criteria for capital investments in the county? What incentives would attract potential investors? Were the county's resources and capabilities—locally harvested grain quantities, country elevators, rail transportation, community financial support, and skilled personnel—sufficient?

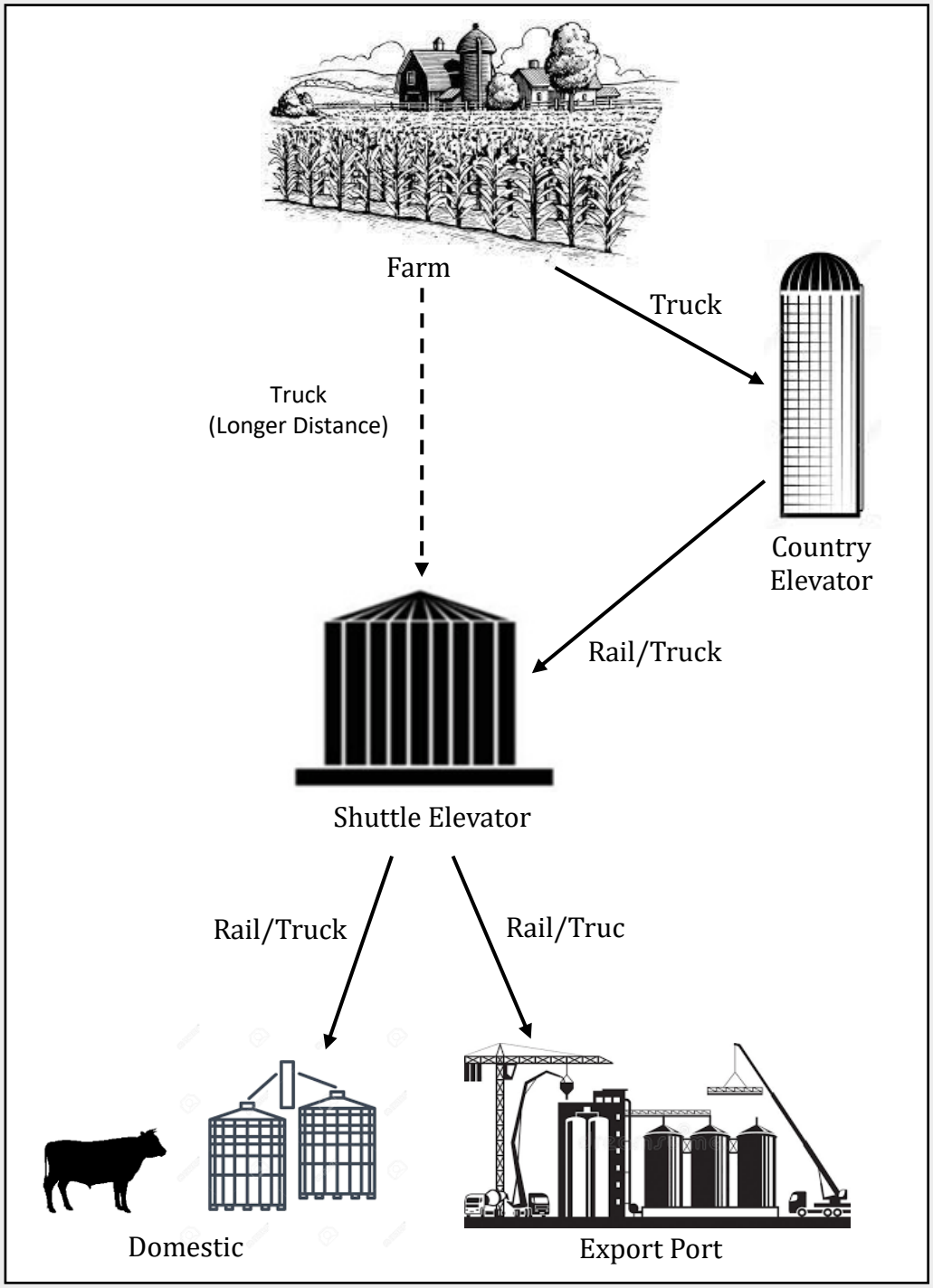


Figure 1. Traditional Supply Chain Flow of Grain

Source: Adapted Ndembe and Bitzen (2018).

Dunn was certain that the county commissioners would support her search for answers to these critical questions. She had some experience in public fundraising, already having attracted private investments to the county and having negotiated contracts to create successful public-private partnerships. However, to make an informed investment decision, she needed a better understanding of the operational and financial aspects of a high-speed grain-handling facility.

3 Risk Factors Impacting a Decision to Invest

Dunn sought the answers to her questions. She called on her network of grain companies, food processors, state port authorities, railroad companies, and Kansas State University consultants to identify which factors might determine whether an investment was feasible.

Like other agricultural enterprises, grain merchandising is often characterized by large quantities and low profit margins. Consequently, a great amount of throughput is needed to cover fixed and variable costs. Additionally, well-established relationships with local country elevators and grain producers are fundamental for ensuring that a minimum amount of grain is available for trade. Many industry experts argue that a profitable shuttle-loading facility must make 3 to 4 grain shipments per month or turn its inventory over 9 to 10 times per year. Furthermore, grain merchandising activities should contribute an estimated $0.13 to $0.15 per bushel to the company's net grain margin. The gross margin calculation, or the conversion cost used in grain, includes the selling price, the origination or purchase price, and transportation and handling costs (USDA 2015).

The degree of competition from other grain-handling and storage agribusinesses in the area will affect the time it will take to reach an acceptable return on investment. The higher the concentration of shuttle loaders in the area, the lower the probability that a proposed facility would outbid the competitors, thus lowering grain profit margins. Additionally, margins are significantly shaped by agreements and relationships with railroads; the number of inbound and outbound railcars used for the shuttle loader could impact the county's ability to negotiate favorable transportation rates.

Management and labor are other costs to consider. The proposed shuttle loader requires 11 salaried and wage-earning employees, including a merchandising manager, an operations manager, a logistics supervisor, elevator operators, and administrative staff. The county must recruit industry professionals that have the knowledge to execute the business strategy related to generating revenue from merchandising activities, creating cost-saving opportunities, and responding to competitors. Dunn understood the EDC's role in minimizing the cost of business in the county by providing incentives such as tax incentives, including abatements, subsidies, and equity partnerships in investments.

Finally, Dunn considered how an investment would be capitalized, either through debt or equity financing. If through debt financing, the interest rate would affect the cash flow of the business. If through equity financing, the investors would need to have similar long-term expectations.

After receiving a list of key risk factors and the type of risk they presented, Dunn considered the extent to which each factor was significant and its relative weight on the final decision. For example, did the amount of tradeable grain present a significant investment risk? Could the county ensure that the necessary quantity of grain was available? Were relationships with the supply chain network (local farmers and cooperatives) significant to the investment decision—that is, could the county justify the investment without a strong network of suppliers?

Dunn ranked each risk factor's significance—low, medium, or high—on the basis of her perception of each factor's importance to the decision maker. Then, she assessed each factor by attributing a percentage weight corresponding to its relative impact on the decision. The weight and the significance ranking prioritized each risk factor's relative importance to the investment decision. For instance, the risk factor "quantity of grain traded" was considered to have "high" significance and was attributed a weight of 20 percent, suggesting that the decision maker valued ability to trade volume more than lower-weighted risk factors when considering the decision to invest in a grain-handling facility. Finally, a collective evaluation of each risk factor helped inform the decision to invest. Table 1 summarizes the risk factors, their significance, and their relative weights.

Table 1. Risk Factors[a]

Risk Factor	Risk Type	Significance	Weight
Volume traded	Value Chain		
Supplier relationship	Value Chain		
Carrier (railroad) relationship	Value Chain		
Commodity prices spread	Market		
Transportation cost	Market		
Competition	Market		
Interest rates	Market		
Capital structure (debt versus equity financing)	Credit		
Management and labor	Operational		
Public-private partnership	Operational		

[a]See Teaching Notes. Students are to insert values into the last two columns.

4. A Resource-Based View of the County

Corn and wheat are the main crops of the six counties comprising south-central Kansas. Among these counties, Stafford County ranks third in total production volume of corn and fifth in that of wheat. From 2011 to 2017, the county had approximately 536 farms that produced 145 and 107 million bushels of corn and wheat, respectively (KDA 2017). The vast majority of these farms rely on three main country elevators to store and market commodities, and these elevators account for approximately 70 percent of the storage capacity in the region (Briggeman et al. 2016).

Table 2 shows the number of country elevators and their respective grain market share in the area of study. A total of 11 shuttle train elevators with multi-commodity storing and handling capabilities exists within a 70-mile radius of St John, Kansas. The top three grain companies (in terms of grain storage capacity) own a total of five elevators (located east and west of St John) that represent approximately 90 percent of the total regional grain market share (Table 3).

The potential buyers of wheat and corn from a shuttle loader are livestock feeders, export terminal elevators, and out-of-state flour mills. Numerous flour mills are located in the state of Oklahoma; livestock feed yards are found in the Texas Panhandle, the largest cattle-feeding area in the United States. The potential customers for a shuttle loader are feedlots and ethanol plants located near St John and in the surrounding counties. Maps 1 and 2 show the proposed grain shuttle loader's competitors and suppliers within a 60-mile radius.

Table 2. Market Share of Country Elevators in the Area of Study

Country Elevator	Capacity (mil bu)	Market Share (%)
Company G	12,927,000	35.84
Company H	6,995,000	19.40
Company I	6,613,000	18.34
Company B	2,230,000	6.18
Company J	2,217,000	6.15
Company K	1,550,000	4.30
Company L	1,284,000	3.56
Company M	1,375,000	3.81
Company N	418,000	1.16
Company O	456,000	1.26
Total	36,065,000	100.00

Note: Constructed on the basis of data compiled from Arthur Capper Cooperative Center Interactive Maps.

Table 3. Market Share of Shuttle Loaders in the Area of Study

Shuttle Loader	Capacity (mil bu)	Market Share (%)
Company A	23,530,000	33.57
Company B	25,980,000	37.07
Company C	14,540,000	20.74
Company D	2,943,000	4.20
Company E	1,800,000	2.57
Company F	1,300,000	1.85
Total	70,093,000	100.0

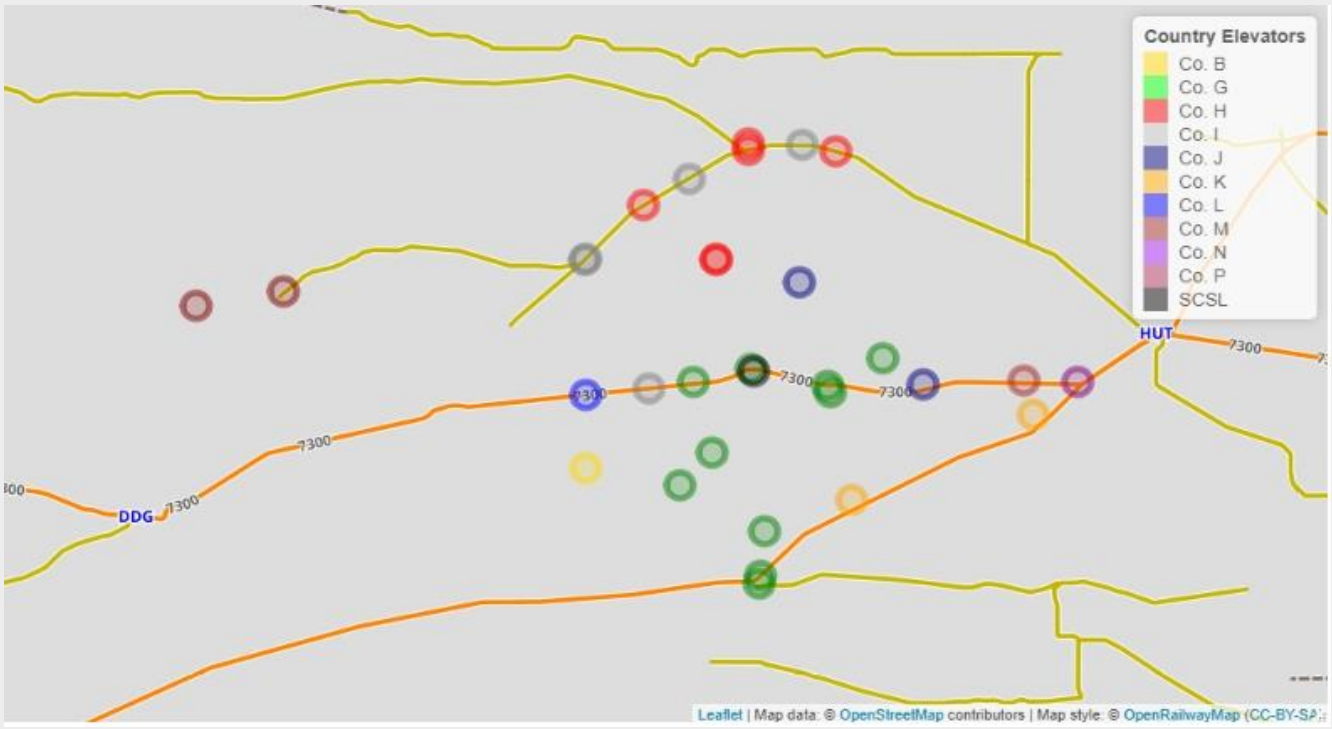
Note: Constructed on the basis of data compiled from Arthur Capper Cooperative Center Interactive Maps.

Map 1. Grain Shuttle Loaders in South-Central Kansas

Note: The facility (SCSL) is located in the heart of St John, Kansas. The Class I BNSF railway runs east and west, passing from Hutchison in the east through Stafford County and continuing west to Dodge City.

Recently, several investors, including local, regional, and international grain companies, have become motivated to invest in a grain shuttle loader in Stafford County, thereby accessing additional opportunities to merchandise grain to terminal markets. International grain-trading corporations typically expect to pay back a capital investment in a maximum of five years; regional grain companies and local cooperatives generally invest in shuttle loaders to gain access to non-local markets and export markets. Thus, small to medium-sized companies have an opportunity to market grain in regions that are otherwise beyond their geographic scope. Often, small or undercapitalized organizations accept a payback period of 5 to 15 years on capital investments, or they raise money through debt financing.

ROI criteria vary in accordance with each investor's risk-reward profile. For some investors, an ROI between 4 percent and 8 percent is reasonable, whereas for others, an ROI between 6 percent and 13 percent is ideal. Almost all investors compare the ROI to the cost of acquiring capital (i.e., the discount or interest rate). If the ROI is greater than that cost, the companies are more likely to invest. To further



Map 2. Grain Country Elevators in South Central Kansas

Note: The facility (SCSL) is located in the heart of St John, Kansas. The Class I BNSF railway runs east and west, passing from Hutchison in the east through Stafford County and continuing west to Dodge City.

incentivize investors, the EDC was prepared to cover approximately 30 percent of the investment expenditure, which included the cost of land, trackage, and switches.

5 Investment Specifications

Two grain elevator designs are best suited for a shuttle loader: standard commercial steel bins and concrete annex bins. Commercial cylindrical steel bins have thick walls and additional reinforcements to withstand repeated filling, emptying, stirring, and blending. These bins have an average life of approximately 20 years and a loading and unloading efficiency rate of 60,000 bushels per hour. Concrete annex bins are composed of a concrete foundation and concrete pads with piles as well as a concrete floor, walls, roof, and tunnels. They have an average life of 40 years and a maximum loading and unloading efficiency rate of 90,000 bushels per hour (SAMA 2015).

The proposed facility would have a bin storage capacity of two million bushels and would be constructed on 100 acres of land and along 11,000 linear feet of railroad track. The track would connect to the mainline Class I railroad for transloading cargo. The total estimated capital expenditure costs for the steel and concrete construction are approximately $16.8 million and $20.8 million, respectively.

6 Applied Financial Analysis

The input from Dunn's network answered many questions. Dunn understood the risk factors that could have adverse or favorable effects, the estimated capital expenditure costs, the expected ROI for potential investors, and the extent of the county's resources and capabilities. She then had to determine the financial feasibility of the high-speed grain-handling facility.

A net present value (NPV) model was used to determine the project's financial feasibility. Three crop market share scenarios were developed to account for the supply variability of corn and wheat: base, optimistic, and pessimistic. Each scenario considered payback periods of 5, 10, and 15 years for each of the two building designs (concrete and steel). The base scenario was established on 10-year

Table 4. Volume of Trade in the Area of Study			
Variables	**Base**	**Pessimistic (10% Decrease in Market Share)**	**Optimistic (10% Increase in Market Share)**
Corn (bu)	2,682,458	2,399,079	2,965,837
Wheat (bu)	4,579,219	4,170,039	4,988,400
Total bushels	7,261,678	6,559,118	7,954,237
Turns per year	3.63	3.28	3.98
Shipments/month	1.51	1.37	1.66

average crop production and grain rail shipments, assuming that the shuttle loader would be involved in handling 50 percent of the available grain. The pessimistic scenario assumed a 10 percent market share reduction from the base scenario. The optimistic scenario assumed a 10 percent market share increase from the base scenario. Table 4 summarizes the annual number of traded corn and wheat bushels, provides the monthly estimate of shipments for each grain, and approximates the inventory turnover for a facility with a capacity of two million bushels.

According to the base model, the new shuttle loader would control 50 percent of the shipment volume in Stafford County. That estimate accounted for a reasonable amount of grain from surrounding counties, varying between 5 percent and 15 percent of market share (shipment volume) of the surrounding area's total production. Grain margin estimates were trickier to establish. The ability to profit from merchandising activities is dependent on the decision to store or trade grain and on the market conditions that influence grain prices. Typically, grain storage is less profitable than grain trading. Shuttle loader owners have more incentive to trade than to store grain, given that they have invested in the infrastructure to transport grain by rail. A review of grain price history revealed that Stafford County's storage margins oscillated between \$0.03 and \$0.05 per bushel and that grain trading margins oscillated between \$0.15 and \$0.23 per bushel for wheat and corn, respectively.

The three market share scenarios included the quantity of grain traded, the grain storage cost, and the grain marketing margins. Each scenario was used to project income statements (pro-forma) and perform an NPV analysis to determine the financial feasibility of the project. Grain handling costs, fixed costs, depreciation of grain bins, interest, and tax expenses were included in the pro-forma. These variables were gathered and constructed from local and regional economic sources. Next, the operating cash flow (OCF) was calculated as follows:

$$\text{OCF} = \text{EBIT} + \text{D\&A} - \text{TAX} - \text{INTEREST} \quad (1)$$

As seen above, the OCF reflects the cash a company generates from its operations less the operating expenses and changes in working capital. In the case of Stafford County, the OCF was the projected net cash flow over a period of 5–15 years. EBIT represents the company's earnings before interest and tax, and D&A stands for depreciation and amortization. The last two components represent the tax on earnings and debt interest accrued.

The following equation was used to calculate the NPV:

$$NPV = C_0 + \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} \quad (2)$$

The first term, C_0 ,refers to the project's capital expenditure cost (CAPEX). The second term, $\sum_{t=1}^{T} \frac{C_t}{(1+r)^t}$, refers to the discounted cash flow (DCF) formulation. C_t is the annual OCF, and r is the discount rate or the rate of return that could be earned through alternative investments.[1] NPV is best described as the

[1] The discount rate of 6.75 percent was estimated on the basis of the Omaha Federal Reserve's quarterly lending interest rates for farm machinery and equipment (15-year maturity). A positive NPV signifies that the projected earnings (in present

value of all future cash flows over the entire life of an investment discounted to the present DCF minus the initial CAPEX.

7 Financial Assessment

In Stafford County, grain production is the primary industry and as much a part of the culture as any other business area. Economically, grain is abundant, but marketing options are lacking. Dunn and the county commissioners were unsure if an investment was financially feasible without equity or debt financing from private investor(s) who might consider a partnership, joint venture, or strategic alliance.

On the basis of the pro-forma income projections, three scenarios were used to identify a feasible option. The base scenario takes into consideration a 50 percent market share of grain handled in the target area. The optimistic (pessimistic) scenario is represented by a 10 percent increase(decrease) of the base scenario's market share. The capital expenditure estimation of a two-million-bushel shuttle loading capacity and constructed with either steel or concrete building material was based on an average cost per bushel of $5.5 and $7.5, respectively.

Table 5 summarizes an option for private investment. It includes two building material types, three scenarios, and three payback periods. The financial loss was projected to be $3,794,000 for the most favorable price and cost conditions of a steel building, optimistic grain marketing opportunities, and 15-year timeline.

The initial reaction of the EDC's staff was as follows: "Wow, all results are negative; that can't be good." Considering the key drivers that most influenced these results, Dunn said, "Well, we knew this could be a possibility, so we had a contingency plan in place. Given the funds I believe I can raise, the county can contribute $5.8 million to the project." Another EDC staff member concurred: "That ought to make the difference in the financial results." The funds could be raised through public debt or from private investors who would benefit from reducing their grain-to-market cost.

Table 6 summarizes this information, the NPV analysis, and a reduction of $5.8 million in CAPEX based on the expected contributions the EDC could raise through grant funding and fundraising events.

The EDC was disappointed by the study's results but understood that the investment was not feasible, not because of the contribution from the county but due to other factors. "So, then, at what point does this investment become feasible?" Dunn asked. Various scenarios were stress tested by adjusting the assumptions for volume, conversion margins, and other key risk factors until a plausible scenario was found.

Table 5. NPV Financial Results for Private Equity Investment[a]

Building Material	CAPEX ($Mil)	Scenario	Payback Period		
			5 Years	10 Years	15 Years
Steel	$16.8	Base	($13,933,000)	($11,182,000)	($8,644,000)
		Optimistic	($11,977,000)	($7,632,000)	($3,794,000)
		Pessimistic	($15,667,000)	($14,330,000)	($12,950,000)
Concrete	$20.8	Base	($17,933,000)	($15,182,000)	($12,644,000)
		Optimistic	($15,977,000)	($11,632,000)	($7,794,000)
		Pessimistic	($19,667,000)	($18,331,000)	($16,950,000)

[a]See the assumptions made for the three scenarios and CAPEX estimations in the Financial Assessment section. The assumptions for building materials are found in the Investment Specifications section.

dollars) exceed the capital cost of the project's funding. A negative NPV signifies insufficient generation of present cash flow earnings to cover for the CAPEX.

Table 6. NPV Financial Results with Contribution[a]

Building Material	CAPEX ($Mil)	Scenario	Payback Period		
			5 Years	10 Years	15 Years
Steel	$11	Base	($8,049,000)	($5,297,000)	($2,759,000)
		Optimistic	($6,092,000)	($1,747,000)	$2,090,000
		Pessimistic	($9,782,000)	($8,446,000)	($7,066,000)
Concrete	$15	Base	($12,049,000)	($9,297,000)	($6,759,000)
		Optimistic	($10,092,000)	($5,747,000)	($1,910,000)
		Pessimistic	($13,782,000)	($12,446,000)	($11,066,000)

[a]See the assumptions made for the three scenarios and CAPEX estimations in the Financial Assessment section. The assumptions for building materials are found in the Investment Specifications sections. An additional $5.8 million in capital expenditure (attributed to the cost of trackage and railroad switches was discounted on the basis of public financial contributions from EDC's grand funding and other fundraising events.

Table 7 summarizes the results for the adjusted scenarios based on an increase in the base scenario of volume traded from 50 percent to 63 percent. Similarly, Table 8 summarizes the ROI results for the adjusted scenarios.

Table 7. NPV Financial Results for Profitable Scenarios[a]

Building Material	CAPEX ($Mil)	Scenario	Payback Period		
			5 Years	10 Years	15 Years
Steel	$16.8	Base	($7,773,000)	$516,000	$8,018,000
		Optimistic	$3,709,000	$7,817,000	$17,897,000
		Pessimistic	($12,014,000)	($7,103,000)	($2,291,000)
Concrete	$15	Base	($11,773,000)	($3,484,000)	$4,018,000
		Optimistic	($7,709,000)	$3,817,000	$13,897,000
		Pessimistic	($16,014,000)	($11,103,000)	($6,291,000)

[a]See the assumptions made for the three scenarios and CAPEX estimations in the Financial Assessment section.

Table 8. ROI for Profitable Scenarios[a]

Building Material	CAPEX ($Mil)	Scenario	Payback Period		
			5 Years	10 Years	15 Years
Steel	$16.8	Base	-12.19%	7.35%	12.72%
		Optimistic	-1.64%	15.25%	19.27%
		Pessimistic	-26.19%	-2.70%	4.86%
Concrete	$20.8	Base	-17.50%	3.25%	9.31%
		Optimistic	-8.01%	10.29%	15.03%
		Pessimistic	-30.26%	-5.88%	2.28%

[a]See the assumptions made for the three scenarios and CAPEXestimations in the Financial Assessment section. The assumptions for building materials are found in the Investment Specifications sections.

8 Looking Ahead

Dunn mulled over the adjusted scenarios. The real economic power comes from unlocking the region's ability to find alternative uses for local resources. Her approach toward rural development focused on the use of land-intensive natural resources, corn and wheat, for economic growth. Dunn's optimism and determination were undeterred. The key questions remained:

- Would development of land-intensive natural resources be worth the needed investment? The plan for high-speed grain-handling equipment was built on the premise of finding alternative uses for local resources that would provide additional grain marketing opportunities.
- What potentially better investment options for employing the county's economic resources should be considered? Should the county consider investments not so focused on the region's resources, such as other grain-handling and storage businesses that involve transloading, third-party logistics, or long-term storage operations?
- How should Dunn compare and contrast financial and economic costs and benefits to uncover new opportunities that would yield a favorable outcome?

Dunn knew that the county had to continually improve. What should she recommend to the county's Board of Commissioners?

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