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ABSTRACT

A procedure for the use of financial analysis in decision making about implementing cable television and securing all possible services is outlined. A six-stage decision making flow chart is provided; the six stages then explained and elaborated. The six stages are: define all realistic options; eliminate certain options because of lack of interest; define financial pass-fail criteria; determine financial feasibility of all remaining options; test sensitivity of results to basic assumptions. A financial flow chart is also included. It is suggested that similar flow charts be constructed for other decision making areas related to cable television, such as who shall operate the system. This procedure replaces the recommendations contained in the "Cable Economics" report conclusion. (SK)

THE USE OF FINANCIAL ANALYSIS IN DECISION MAKING:

Cable Economics Section IV

CABLE TELEVISION INFORMATION CENTER
The Urban Institute
2100 M Street, N.W., Washington, D.C. 20037

PREFACE

This document was prepared by the Cable Television Information Center under grants from the Ford Foundation and the John and Mary R. Markle Foundation to The Urban Institute.

The primary function of the center's publications program is to provide policy makers in local and state governments with the information and analytical tools required to arrive at optimum policies and procedures for the development of cable television in the public interest.

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IV. THE USE OF FINANCIAL ANALYSIS IN DECISION MAKING

Introduction

Although it is a separate document, this report is a continuation of "Cable Economics," and replaces Section IV, the Conclusion of that report. The basis of the analytic procedure covered in this new Section IV is that local officials responsible for implementing cable TV want to secure all possible services from a cable system that a system operator can afford to provide.

The income statement constitutes neither a complete test of financial feasibility nor a complete financial analysis. In that example, only one cable design and one ownership "package" were examined.

Local officials should also be concerned with a number of design choices, ownership options and franchise considerations. These considerations would increase the number of separate and distinct Pro Formas that the municipality would need to analyze.

Other policy concerns, such as realistic and reasonable subscriber rates and franchise fees, high quality origination programming and the esthetics of construction, are as important to the municipality as the design, ownership and franchise issues. These issues also have economic implications that should be examined during the financial analysis.

Thus, in addition to testing a single design and ownership option for economic feasibility, a complete analysis would examine the financial implications of all of the likely combinations that a community would be interested in. Ultimately, franchising authorities want to be in a position of determining, before choosing a cable operator, which choices are infeasible, which are clearly feasible and thus may be required from all applicants, and which options are open to negotiation. In order to achieve this objective, officials must test the large list of possible options until only a few key feasible combinations remain. The filtering process is not limited to the use of financial criteria. For example, franchising authorities could decide that they have no interest in public ownership of the system.

By separating the determination of the options to be analyzed from the actual analysis of those options, it is possible to develop an overall flow chart of this decision making process. This is shown in Figure 3.

It should be realized that this flow chart is a simplification of the decision making process. As an example, Stage 3 shows that in order to pass on the feasibility of each basic ownership, a pass/fail mechanism must be developed for each one. For profit and nonprofit ownership, this mechanism can be defined as a target rate of return on equity, while for municipal ownership, it may be the ability to repay a municipal bond over a reasonable period of time.

While the mechanism can easily be defined, the specific target rate of return varies from system owner to system owner and the bond repayment time table varies from community to community. These variations depend, in part, upon the propensity of the system owner to take financial risks.

As another example of oversimplification, Stage 6 does not explain how officials separate mandatory requirements from negotiable desires, in an economic sense.

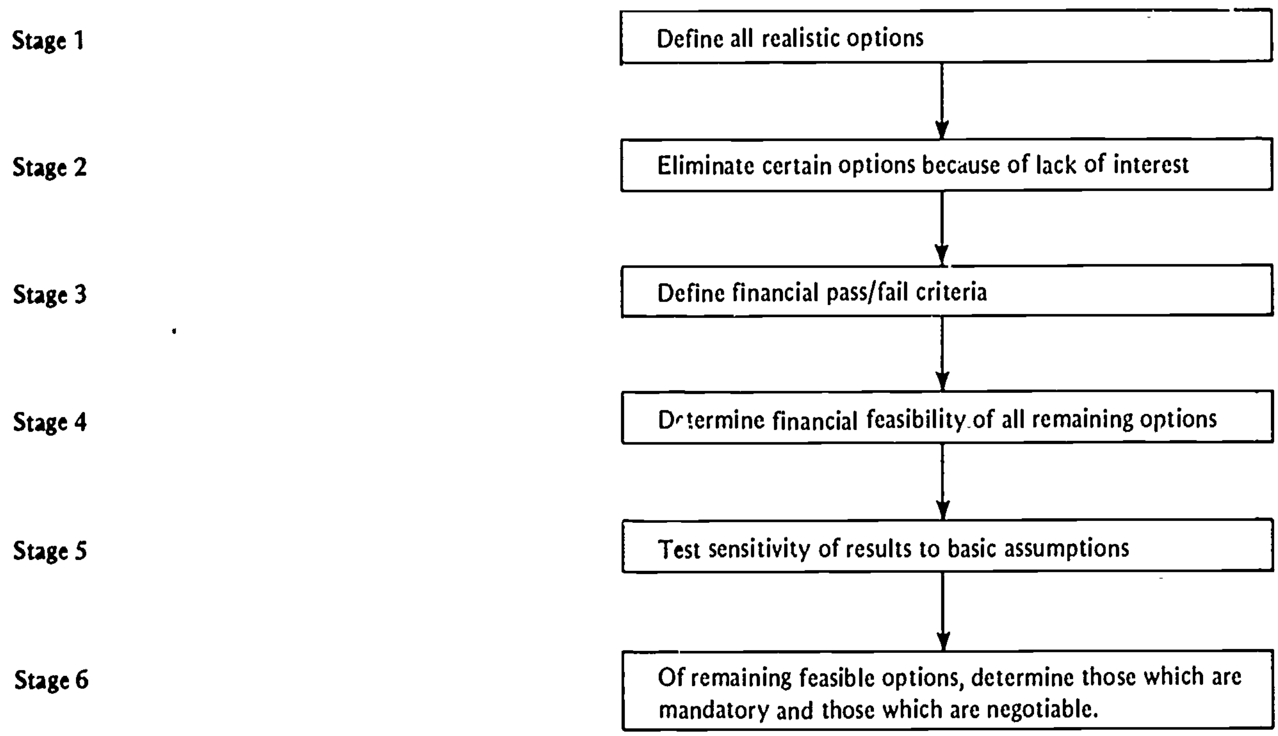
Suppose the results of a hypothetical analysis indicate that, for a given set of assumptions, lowering subscriber rates from $6 per month to $5 and increasing the program origination budget from $25,000 per year to $50,000 could be achieved without lowering system viability. If the information and analysis were perfectly correct, this would indicate that both options could be made mandatory.

However, by reducing the subscriber rate and increasing origination expenses while slightly decreasing penetration, the hypothetical system could become financially infeasible. It was further noted that if each option is changed individually over a narrow range (e.g., origination expenses held constant while the subscriber rate is decreased, etc.) and then tested against changes in penetration, system viability is not significantly affected in this example.

This analysis would indicate that only one of the two desired options might be made mandatory. In the event that penetration is lower then the usual optimistic projections, a system operator would not be able financially to support both options without affecting the rate of return. But the other option could be made a negotiable option. The franchising authority, through this analytic process, gains valuable insights into what it can and cannot expect from cable, and the process of developing policy becomes more realistic.

In the subsequent section of this chapter, a complete financial analysis for Cabletown is presented and explained. The estimates used in this analysis were derived from the Cable Television Information Center's cable financial projection computer model. The model permits a large number of options to be tested in a short period of time.

Figure 3. Cable TV Decision Making Flow Chart



In summary, a complete financial analysis examines all of the major options that are available within the design and implementation of a modern cable system. While it does not make the final decisions, it can play a valuable role in the ultimate decision process.

How to Use Analytic Models in Support of Analysis

All of the feasibility tests in the succeeding sections will be completed with the use of a device called an analytic model. A model is basically a procedure that attempts to forecast, on paper, what might happen if a cable system were operating in a given community. It does this by serving as an analogy for the real operation of the system. Through the use of a series of equations and assumptions and local information, a cable financial model calculates revenues, capital expenditures, operating costs, net income, cash flow and (possibly) rate of return.

The complexity or sophistication of such a model depends in large measure upon the needs of the user. The fundamental rule in building analytic models is that as the complexity and accuracy increase, the cost of developing a model also increases (usually at a faster rate). This relationship can be expressed in the following set of empirical equations.

The cost to develop a model that is 85 per cent accurate is double the cost of a model that is 80 per cent accurate. Each succeeding five percentage point increase in accuracy also involves a doubling of cost. Above 95 per cent the equation is no longer valid. Because of all of the uncertainties that exist in the real world, no model can ever be 100 per cent accurate.

The major issue in developing and in using such a model is to determine what the franchising authority is willing to pay and the degree of accuracy it needs.

In developing or using cable models, this cost and accuracy relationship expresses itself in four distinct levels of analytic models, each more sophisticated than the preceding one:

1. "Rules of Thumb"
2. "Calculating Machine"
3. Simulation
4. Probability Analysis — Monte Carlo.

RULES OF THUMB

The "rules of thumb" model is both the easiest model to develop and the easiest to use. It consists of a series of simple cost relationships developed over time, which reflect average or normal cable operations. Some typical hypothetical rules of thumb might be:

* The distribution plant costs $5,000 per mile
* It costs $50 to connect each subscriber
* A final penetration of 50 per cent is achieved after three years of operation
* Operating costs, at saturation, are equal to 50 per cent of revenue.

With these and other typical rules, a quick Pro Forma for a community can be developed. However, if local conditions are not typical of cable industry experience in localities of similar size, the results can be very misleading.

While rules of thumb may have many flaws, they should not be discounted entirely. The key to using rules of thumb correctly is that the rules should be on a component basis rather than an aggregate basis, e.g., at the level of renting space on utility poles rather than at the total operating cost level. When the rules at the component level are used, two things occur. The component cost often will not be very significant from a total cost point of view and errors in the rules will not adversely affect the overall results; and, in any case, the component cost upon which the rule is based can be modified to reflect local conditions more readily than an aggregate cost. For example, if pole rental costs were significant, it would take much less local research to determine the average number of poles per mile than it would to modify a rule that states: "Operating costs are 50 per cent of annual revenues."

CALCULATING MACHINE

The next level of sophistication is an analytic model which requires the use of either a programmable calculator or a computer. With this approach, the user specifies all of the major input data. This includes the number of subscribers added each year, the number of miles of cable plant, the cost per mile of plant, the headend cost, the cost of program origination, depreciation rules, the number of employees needed annually and the cost per employee. This input data is calculated by the machine in a predetermined manner and the results are produced in a correct financial framework, i.e., annual projections of revenue, operating costs, net income, etc. The machine does no estimating by itself; it rearranges the input data into the correct format.

As an example of this technique, the user might input the following revenue and capital cost data:

Input	Description
1	Annual number of subscribers
2	Annual subscriber rate
3	Miles of cable plant
4	Cost per mile of cable
5	Headend cost
6	Other capital costs
7	Depreciation schedule — per cent depreciated each year

The model might proceed in the following manner:

Annual Revenue = (Input #1) x (Input #2)
Capital Expenditures = (Input #3) x (Input #4) + (Input =5) + (Input #6)
Annual Depreciation = Capital Expenditures x (Input #7)

If the inputs are valid and the data is placed into the machine in the correct order, the final results can be very realistic. All the machine does in the case is to eliminate some of the repetitive hand calculations.

If the user determining and specifying the input data is an expert, this level of modeling is quite useful. It is particularly advantageous in sensitivity testing where modifying such basic assumptions as subscriber penetration can be easily accomplished. Its chief weakness is that it does depend upon expert advice. An incorrect estimate of penetration, for example, will invalidate results generated by the model.

SIMULATION

The level three model represents a significant change in modeling philosophy. In the lower level models, all cost and penetration estimates are independently derived; the computer essentially serves as a large adding machine.

The simulation approach calculates all of the cost and subscriber numbers inside the model. It estimates penetration based upon a series of regression equations that were derived from historical observations of existing cable systems.

In a reasonable well-developed simulation model, its accuracy, at worst, is equal to the level two model. This is because the simulation model does away with the need for expert advice. In this case, the expert is inside the computer.

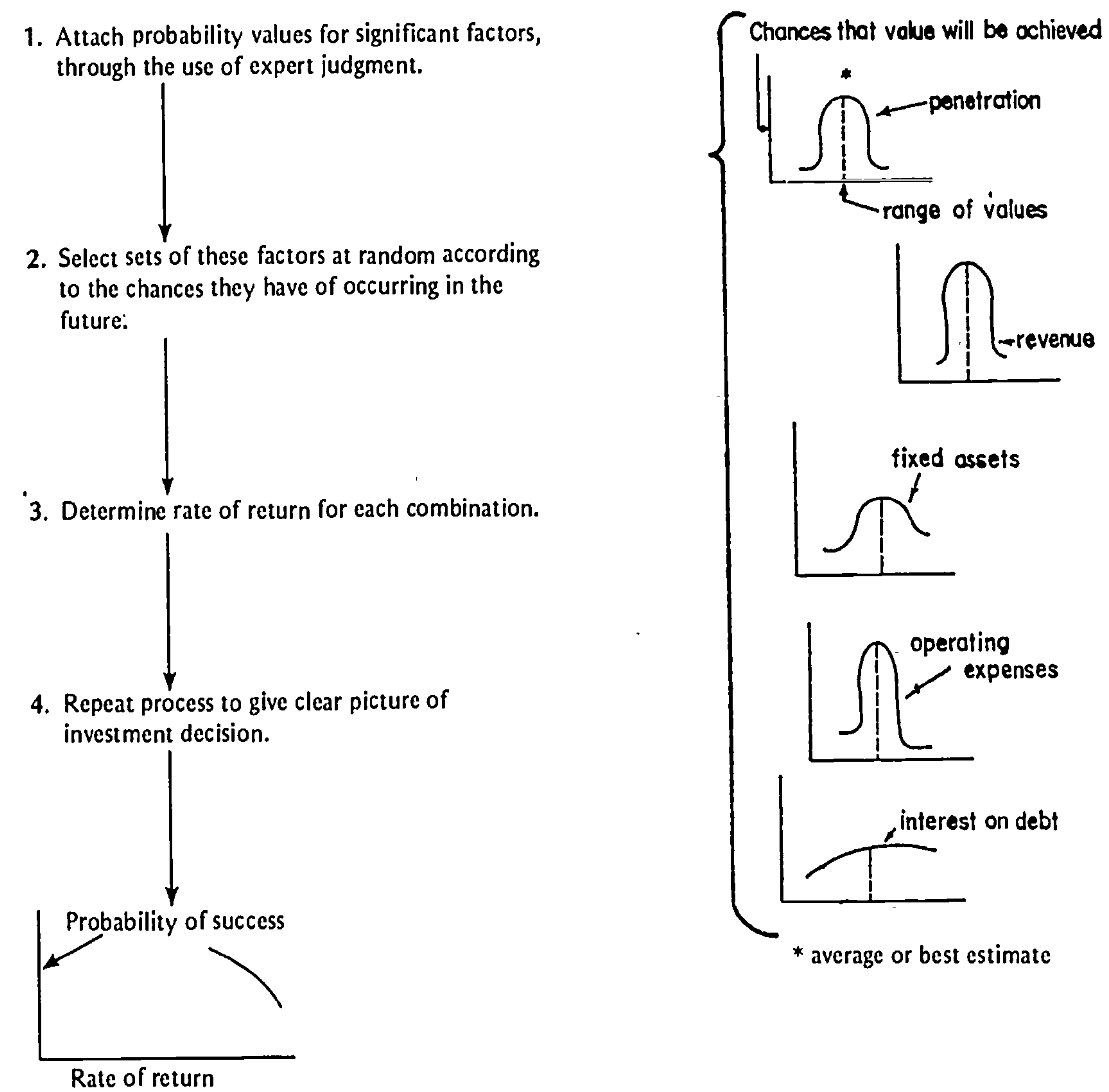
Because this model estimates at the component level, inputs are also needed at this level. Thus, the specification process is more elaborate and rigorous than any of the other models. For example, if underground construction were required, a level two model would be satisfied with merely an educated guess of the per mile construction cost. The simulation model, on the other hand, actually calculates the construction cost. Since this cost is a function of street material (i.e., concrete, asphalt or soil), street thickness, conduit requirements, number of cables and local labor rates, all of this information must be put into the computer.

PROBABILITY ANALYSIS—MONTE CARLO

All of the previous models, independent of their inherent accuracies, have one major flaw: None of them can account, in any rigorous and quantitative manner, for the uncertainties that exist within the real world. These models produce a projection of feasibility based upon the concept that the world is certain and these estimates have no uncertainty attached to them.

By utilizing a mathematical technique call uncertainty analysis, it is possible to attach a probability that the predicted performance of the cable system will be achieved, given the uncertainty of future events. The procedure involves random selection of values for cost or revenue factors which cannot be estimated with certainty. A computer makes such selections 50 to 100 times, and develops a statistical portrait of the odds that the cable system will succeed. Because the procedure resembles some games of chance, it became known as the "Monte Carlo" technique, named after the famous gambling resort in Monaco. The process is demonstrated in Figure 4.

Figure 4. Simulation for Financial Analysis Planning



Because this level of modeling involves probability analysis, the interpretation of the results can be difficult for the layperson to understand. But, the information it departs more than compensates the user, since there is included a specific assessment of the risk that cable television in a community might fail. There is, however, a cost associated with this increase in information. Model development time is increased over that for lower level models, and the computer time and computer cost needed to perform one financial analysis is also increased. In addition, to properly use the uncertainty analysis, more time must be spent developing the inputs than with the level three model.

The Use of Financial Analysis in Cable Decisions

To illustrate all of the steps involved in a complete financial analysis, Cabletown will serve as a hypothetical suburb in a major television market. The basic demographic characteristics of Cabletown are shown in Table 2.

The analytic process that will be developed in this and succeeding sections is analogous to the study phase[1] that many communities follow before drafting their cable television ordinances.

If this example were to follow a scenario of the study phase, it might be as follows: A cable TV study committee had been established by the mayor of Cabletown. The committee was charged with developing a plan of action that the town would use in developing its ordinance and franchise. One of its first official acts was to appoint a subcommittee that would analyze the economic implications of alternative service options. The following section represents the process by which the subcommittee might arrive at its results.

Instead of such a scenario, what follows is an examination of both the analytic process that is usually employed and the results of this analysis.

STAGE 1. DEFINE ALL REALISTIC OPTIONS

At the earliest stages of a study phase, local officials must define the options they want to consider within their analysis. It is a common tendency to pursue an almost infinite set of possible combinations of options. For example, if local authorities were interested in three ownership options, three design options, two franchise options (one or more franchise areas), two different franchise fees, two levels of program origination, four different subscriber rates and two different construction techniques, this would amount to 576 unique combinations that must be tested against each other for financial feasibility. While this "shopping list" of options is neither elaborate nor unusual, it does suggest that some method must be used to realistically narrow the number of combinations that must be analyzed.

One way to reduce initially the number of options would be to assign arbitrary values to those options not at issue in the beginning. One example might be the franchise fee. While the exact final percentage of the system's gross revenues will not be decided upon at the early stages of the study process, there would always be some level of franchise fee in the

Table 2[a]. Demographics of Cabletown

Population	= 63,000
Number of households	= 20,000
Annual growth in population	= 3%
Median family income	= $11,500
Annual growth in income	= 3%
Percentage of homes with color TV sets	= 75%
Percentage of homes with UHF-equipped TV sets	= 95%
Annual growth in color TV set ownership	= 3%

Signals available "over-the-air"
- Three networks – All VHF
- No duplicate network stations
- One independent – UHF
- One educational – UHF

Quality of signals
- Networks – On the border of the A contour[b] – all of good to average quality
- Independent – Midway between the A & B contours – poor to good quality
- Educational – On the border of the A contour -- good to average quality

There are no unusual geographical factors. Some hills valleys are present which account for pockets of poor signal quality. The town may be considered a bedroom community of the major market city.

[a]It should be noted that these characteristics are somewhat different from those shown on pages 8-9. The changes reflect a more accurate approximation of available signals.

[b]See "a Glossary of Cable Terms," *Publications Service*, Cable Television Information Center, 1972, p. 9.

[1]See 'A Suggested Procedure. An Approach to Local Authorization of Cable Television,' *Publications Service*, Cable Television Information Center, 1972.

ordinance. So, by fixing the franchise fee at some realistic base value throughout the first set of feasibility analyses, the number of combinations that must initially be tested is reduced.

The following table illustrates the results of such an approach; the arbitrary values assigned to some of the options are based upon existing standards within the industry.

Table 3. Elements of the Feasibility Analysis

Options Assigned Some Arbitrary Values	Assigned Value
Franchise fee	Three per cent of gross revenues
Basic subscriber rate	$6.00 per month[a]
Type of construction	All aerial construction
Program origination equipment	$75,000
Program origination annual budget	$25,000
Options to be Tested	**Choices**
System configuration & capability	1) Single trunk cable/single feeder cable 2) Dual trunk/single feeder 3) Dual trunk/dual feeder[b]
Ownership	1) For profit 2) Not for profit 3) Municipal
Number of franchises	Entire city—one franchise Dividing city into two equal areas – two franchises

[a]The subscriber rates, interest rates, bond rates, etc., used throughout this section were arbitrarily chosen for illustrative purposes; they are hypothetical and may not reflect "current" standards.

[b]The dual trunk/dual feeder option no longer represents a standard design option within the cable TV industry. It has been included within this analysis because it usually represents the "worst case" or most capital intensive option.

The initial number of combinations has now been reduced from 576 to 18. This does not imply, however, that the values of some of the options have been irrevocably fixed; variations of the values will be addressed later in this chapter.

Each of the remaining options represents a distinct difference in engineering philosophy or social philosophy. The following chart portrays some of the engineering alternatives available in the distribution system configuration option.

Table 4. Distribution System Alternatives

Alternative	Immediate Capacity	Expansion Capability
1. Single trunk-single feeder w/converter	30 channels to subscribers	4 channels subscriber return
2. Dual trunk-single feeder w/converter	30 channels to subscribers, some closed circuit; two-way	30 channels to subscribers; 4 channels subscriber return; closed-circuit; two-way
3. Dual trunk-dual feeder, A/B switch	18 channels to subscribers	30-60 channels to subscribers, 4 channels subscriber return; closed-circuit; two-way

The eighteen remaining combinations can now be tested to determine the financial feasibility of each option.

STAGE 2. ELIMINATE CERTAIN OPTIONS

At this stage in the analysis, local officials do not want to eliminate any of the eighteen options and Stage 2 in the flow chart (on p. 8) is now applicable.

STAGE 3. DEFINE FINANCIAL PASS/FAIL CRITERIA

In order to proceed with the actual testing of financial feasibility, a pass/fail mechanism must be developed for each ownership option. As noted earlier, while the precise pass/fail mechanism is easy to define, the determination of the target rate of return or the length of the bond issued should depend upon many factors.

For the purpose of this paper, it is assumed that the pass/fail mechanisms are as follows:

Ownership Option	Mechanism
For profit	15 per cent after tax rate of return on equity
Nonprofit	10 per cent after tax rate of return on equity
Municipal ownership	15-year bond repayment schedule[1]

These rates were chosen because they represent realistic average rates for all three ownership options.

A 15 per cent rate of return for private companies enables the company to cover the cost of borrowing capital and to develop profits that can be used to build additional systems. The difference between the interest cost and the rate of return is the reward to the entrepreneur for assuming the risks associated with building the cable company. For a non-profit system, a lower rate of return is appropriate. This rate permits the non-profit company to repay its debt and have sufficient working capital to continuously modernize its cable plant. Finally, a fifteen-year bond for a municipality approximates the useful expected life of the cable equipment.

[1]The unstated assumption with municipal ownership is that the funds needed to build the system will come from either a general obligation or revenue bond We have assumed that no local officials will fund such a project out of surplus government funds.

Concept of Rate of Return

The discussion on rate of return in Chapter II touched briefly upon the concept of the time-value of money and rate of return as an interest-like indicator of an investment's attractiveness over time.

Both of the concepts might be better illustrated through the use of hypothetical examples.

The time-value of money means that a dollar one year from today is "worth" less than a dollar today. This is due not to inflation but rather to the fact that if the dollar were deposited in a savings account today and received compound interest while on deposit, at the end of the year, the amount on deposit will have grown to more than one dollar.

Although inflation would have also have the effect of making future dollars "worth" less than present dollars, the difference between these two concepts lies in the definition of "worth." Inflation expresses the buying power of a dollar while interest involves the growth in the number of dollars.

When it is said that a future dollar is worth less than a present dollar because of inflation, this is interpreted as "the buying power of a future dollar is less than the buying power of a present dollar."

The same statement of involving future dollars under interest means that a dollar can earn interest, either deposited in a bank or on an investment, and at the end of some specified period of time the investor will have accumulated more than the initial dollar.[2]

For example, if a person deposits $1,000 in a bank that pays 4 per cent interest compounded annually, at the end of five years the thousand dollars will have grown to $1,217. Thus, if an investor were offered the choice of $1,000 today or $1,000 five years from now, the obvious choice would be to take the money today, and, if it were not needed immediately, deposit it in a bank to earn interest. In this particular example, the investor would choose between $1,000 today or $1,217 five years from now.

Thus, any business opportunity that would require $1,000 now would have to "return" more than $1,217 after five years to the investor before a decision were made to invest rather than leave the money in the bank.

In this hypothetical case, the minimum rate of return of an attractive investment would be four per cent.

[2]While interest and inflation can — and often do — occur simultaneously, the general framework of financial analysis and rate of return analysis disregards the impact of inflation. This is done because inflation is an external problem and would have an equal impact on all of the investment opportunities.

The analytic procedure behind this rate of return concept would be to equate all of these future "returns" to the initial investment, by the mathematical use of an appropriate rate of return (or "discounting," as it is commonly called). Equating future to present value is simply the reverse of compounding interest and can be expressed in the following mathematical formula:

$$P = V\left[\frac{1}{(1+i)^n}\right]$$

where P = present value

V = future return

i = annual interest rate or rate of return

n = the year the future return occurs

For example, to prove the previous relationship between $1,000 and $1,217, the following would be used:

V = $1,217

i = 4%

n = 5

P = to be determined

Then: $$P = V\left[\frac{1}{(1+i)^n}\right] = \$1,217\left[\frac{1}{(1+.04)^5}\right]$$

$$= \$1,217\left[\frac{1}{1.2167}\right] = \$1,217\ (0.8219) = \$1,000$$

In rate of return calculations, P (which can also be defined as the equity needed to start the business), V and n — the number of years it takes before the future return is obtained — are usually known factors. What is unknown is i — the rate of return. Using the formula above, the rate of return can be defined as that rate of interest which equates the present value of the expected future returns to the equity needed to start the business, or as the interest rate that sets the left hand side of the equation equal to the right hand side.

For example, suppose it costs $5,000 to start a business. The business breaks even for nine years (net income = zero for the first nine years) and in the tenth year shows a return of $20,227. What would the rate of return be?

With P = $5,000

V = $20,227

n = 10 years

then $$\$5,000 = \$20,227 \times \left[\frac{1}{(1+i)^{10}}\right]$$

where i = unknown.

Solving for that value of *i* which sets both sides of the equation equal to zero is a trial and error process. The procedure is to select interest rates until the proper one is found. The figures below illustrate the procedure:

Interest Rates	$\$20,227 \times \left[\frac{1}{(1+i)^{10}}\right]$
0%	$20,227
10%	$7,798
20%	$3,266

Since the value of the expression above should be equal to $5,000, the rate of return is somewhere between 10 per cent and 20 per cent. Using an interest rate of 15 per cent produces the following:

$$\$20,227 \times \left[\frac{1}{(1+.15)^{10}}\right] = \$5,000$$

In this example an investor would receive a 15 per cent rate of return on an investment of $5,000.

In analyzing cable systems, the procedure is somewhat more involved because return occurs in every year of operation rather than in just one year as the previous example showed. In the cable case, each future return must be brought back to its present value using an assumed rate of return. The sum of all present values then equals the total investment.

Business activity is normally measured in one of two ways — the net income after taxes technique or the total cash flow technique. Net income after taxes is typically defined:

Net Income After Taxes = Total Revenue — Total Operating Expenses — Interest — Taxes — Depreciation

Capital expenses never directly enter into the calculation of net income after taxes. Rather, capital expenses are calculated through the depreciation term. The larger the capital investment needed, the larger will be the depreciation term and, hence, the lower the net income (all factors remaining the same). The rate of return on net investment can then be used as the measure of the success of a business activity.

The other measure of business activity is "total cash flow" (which is also referred to as "total working funds"). In this approach, all real receipts and expenses (regardless of whether they are capital or operating) are looked at when they actually occur. Total cash flow is defined:

"Total cash flow" = borrowing + revenue — operating expenses — interest — taxes — capital expenditures — debt repayment

The total cash flow approach is almost always used in conjunction with discounting the rate of return. This enables the rate of return to be obtained from the series of cash flows. Capital expenditures enter directly into the calculation, not indirectly as in the net income approach. In fact, depreciation's only role in cash analysis is the role it plays in determining income taxes.

The cash flow technique is used by most major corporations in analyzing individual capital expenditures projects. The net income, or earnings approach, as it is frequently called, is normally used for analyzing the total activities of an ongoing corporation. Because of the capital intensive nature of a cable system, and the difficulty of using net income during the startup period of a business, the discounted rate of return on total cash flow will be used in analyzing Cabletown.

In estimating rates of return, the analytic model used is the level four or Probability Analysis model. The results of this computer analysis state either the probability associated with making the target rate of return or the probability associated with repaying the municipal bond within the target time frame. In order for a particular option to be deemed financially feasible, the minimum probability of success has been placed at 75 per cent. All of the quantitative measures of probability of success can be grouped and interpreted in the following manner:

Probability Ranges	Interpretation[1]
1. if the probability of success is between 0 per cent and 49 per cent:	1. the investment is extremely poor
2. if the probability of success is between 50 per cent and 74 per cent:	2. the investment is fair, but still has considerable risk associated with it
3. if the probability of success is between 75 per cent and 89 per cent:	3. the investment is good
4. if the probability of success is between 90 per cent and 100 per cent:	4. the investment is excellent

[1]The interpretation of the result is basically contingent upon the willingness of a company or a municipality to take risk. The range shown above should not be interpreted as having specific applicability to a particular company or municipality.

STAGE 4. DETERMINE FINANCIAL FEASIBILITY OF ALL REMAINING OPTIONS

With the determination of the pass/fail mechanism having been made, the analysis can proceed with Stage 4 — testing the feasibility of the options. Before Pro Forma estimates can be derived, certain required data must be developed. This would include such items as the number of miles of cable plant, size and type of cable, amplifier type and amplifier spacing, feeder cable to trunk cable ratio, headend requirements, antenna and tower requirements, interest rates, etc.

Engineering Specifications

Since it has been assumed that this analysis is taking place early in the study phase, no engineering analysis has been performed. Without complete system specifications, many of these data must be guessed.

Using historical information, and/or educated guesses, the following list, reflecting the description of the Cabletown system, was developed:

Table 5. Cabletown System Specifications

Number of miles of street = 267
Number of strand miles = 200
Number of feeder miles = 183.3
Number of trunk miles = 45.8
Feeder cable = 75% - .500" foam cable
25% - .412" foam cable
Trunk cable = 80% - .750" foam cable
20% - .500" foam cable
One headend
Three VHF signals
Type of VHF antennas — dual array
Two UHF signals
Type of UHF antennas dual array
Three imported signals - 2 independent - 1 education
All aerial construction
Amplifier type — 30 channel one-way; two-way capability

The reference sources used in deriving the required estimates for the initial Cabletown example have been used for the new estimates.[1]

Based upon the engineering specifications and the previously noted reference sources, the basic financial Pro Formas can be constructed and, in turn, analyzed. While all of the calculations developed in this analysis were done using the Cable Television Information Center's computer-assisted financial forecasting model, they can be calculated "by hand." The following examples also show how the basic Pro Forma Income Statement is constructed and how the results are analyzed. Those readers not interested in the detailed calculations can skip to page 23 where the analysis of the feasibility Pro Formas begins.

Number of Subscribers[2]

The first estimate to be made is that of subscriber penetration. The estimates for the number of subscribers are based upon a methodology developed by the Rand Corporation.[3] The methodology assumes that the following factors must be considered to estimate the number of subscribers:

* Annual service charge (the lower the charge, the higher the penetration)
* Off-the-air signal quality (the poorer the signal quality, the higher the penetration)
* Number of signals carried via cable (the more signals carried, the higher the penetration)
* Percentage of homes with color TV sets (the more homes with color sets, the higher the penetration)
* Median family income (the higher the income, the higher the penetration)
* Number and type of local television stations (UHF, or VHF, network, independent, or educational)[4].

Based upon the methodology noted above, the results in Figure 5 were obtained.[5]

Revenues

Since the rate structure is one of the mandatory options, and held constant for this set of runs, annual revenues can also be estimated. These are shown in Figure 6.[6]

Capital Expenditures[7]

The distribution system cost is subject to the specific system configuration being used. Single trunk/single feeder (ST/SF) systems cost approximately $6,080 per aerial strand mile, and dual trunk/single feeder (DT/SF) systems average $6,520 per mile, while dual trunk/dual feeder systems cost about $10,090. For these three options, the distribution costs (not including subscriber costs) are as follows:

System Configuration	Cost Per Mile	Total Cost
ST/SF	$6082	$1,216,400
DT/SF	$6521	$1,304,250
DT/DF	$10,090	$2,018,050

[1]See *Cable Economics*, Footnote, p. 8.
[2]See *Cable Economics*, page 11.
[3]See Park, *Prospects for Cable in the 100 Largest Television Markets*, Rand Corporation, 1971. It should be emphasized that the model is based upon existing cable systems which are generally less sophisticated technically than the hypothetical system. Moreover, subscriber estimates given by the model make no allowance for new services. Therefore, the estimates in this report are likely to be conservative.
[4]See the FCC's cable television rules, 47 C.F.R. §76.51-76.65.
[5]The estimates shown here and in succeeding sections are representative of a particular set of inputs. They should neither be interpreted as typical of all cable TV systems nor as rules of thumb to be used in analyzing other systems.
[6]See *Cable Economics*, page 13.
[7]See *Cable Economics*, page 11.

Figure 5. Subscriber Penetration Estimates

YEAR	POPULATION	PENETRATION (%)	AVERAGE SUBSCRIBER COUNT
1	20000	18.3	3652
2	20600	37.8	7788
3	21218	39.1	8297
4	21855	40.4	8833
5	22510	41.7	9396
6	23185	43.1	9988
7	23881	44.4	10609
8	24597	45.8	11260
9	25335	47.1	11943
10	26095	48.5	12657

Figure 6. Annual Revenue Estimates[a]

Year	Subscribers	New Subscribers	New Installation Income[1]	Turnover Income[2]	Total Installation Income[3]	Basic Service[4]	2nd Outlet Income[5]	Service Income[6]	Total Income[7]
1	3652	3652	54792	5425	60271	262944	17593	280537	340808
2	7788	4136	62037	11682	73719	560736	37428	598164	671883
3	8297	509	7633	12446	20079	597384	39861	637245	657324
4	8833	536	8035	13249	21284	635976	42406	678382	699666
5	9396	563	8449	14095	22544	676512	45131	721643	744187
6	9988	592	8877	14982	23859	719136	47958	767094	790953
7	10609	621	9318	15913	25231	763848	50951	814799	84003
8	11260	651	9770	16891	26661	810720	54105	864825	891486
9	11943	683	10236	17914	28150	859896	75337	917233	945383
10	12657	714	10715	18984	29699	911304	60784	972088	1,001787

Key:
1. New Installation Income = (New subscribers) x $15 (fee for new connection)
2. Turnover Income = (Total subscribers) x (15% turnover rate) x ($10) (fee for reconnection)
3. Total Installation Income = New installation income + turnover income
4. Basic Service Income = (Total subscribers) x $72 (yearly rate for basic service)
5. 2nd Outlet Income = (Total subscribers) x (20% of homes with 2nd outlet) x $24
6. Service Income = Basic service income + 2nd outlet income
7. Total Income = Total installation income + service income

[a] Columns (1), (2), (4), (5) cannot be reproduced if the formulas above are used. The center's computer model counts partial subscribers, i.e., those who have been connected to the system for less than one year. The subscriber totals shown above are rounded off from the center's model.

Figure 7. Distribution System Expenditures

Year	ST/SF or DT/SF Option Cost Per Subscriber	DT/DF Option Cost Per Subscriber	New Subscribers	ST/SF or DT/SF Total Cost	DT/DF Total Cost
1	51.19	40.36	3652	186930	147386
2	51.19	40.36	4136	211645	166872
3	51.19	40.36	509	26040	20531
4	51.19	40.36	536	27411	21612
5	51.19	40.36	563	28826	22728
6	51.19	40.36	592	30285	23878
7	51.19	40.36	621	31787	25063
8	51.19	40.36	651	33333	26281
9	51.19	40.36	683	34921	27534
10	51.19	40.36	714	36551	28819

Subscriber drop costs for either the ST/SF option or the DT/SF option are about $51.00 per subscriber, while the cost for the DT/DF (without converter) option is $40.00.

The total costs are shown in Figure 7.[1]

The program origination equipment — one of the mandatory options — is assumed to cost $75,000, and to operate with an annual operating budget that starts at $25,000 per year and grows 3 per cent annually.

The headend cost is derived from the following individual component costs:

Item	Cost
Tower	$17,750
Antennas	$ 4,090
Signal processing	$33,685
Building	$ 6,080
FM equipment	$ 2,130
Installation	$ 7,850

For the dual trunk/dual feeder case, an additional $1,180 must be added for common equipment, bringing the total cost for this option to $72,765.

The two remaining major capital expenditures components are: 1) tools, test equipment and spare parts; and 2) furniture and leasehold improvements. The costs for item 1) are estimated as a percentage of total capital costs, while costs for 2) are estimated on the basis of the number of subscribers in year 10. For Cabletown, these estimates are:

System Configuration	Tools, Test Equipment, and Spare Parts	Furniture and Leasehold Improvements
ST/SF	$31,600	$15,958
DT/SF	$32,839	$15,958
DT/DF	$42,743	$15,958

Total capital expenditures, which is the sum of the individual expenditures, is shown in Figure 8:

Figure 8. Total Capital Expenditures

Year	Total Capital Costs ST/SF	Total Capital Costs DT/SF	Total Capital Costs DT/DF
1	1597480	1686560	2317190
2	211645	211645	166872
3	26040	26040	20531
4	27411	27411	21612
5	28826	28826	22728
6	30285	30285	23878
7	31787	31787	25063
8	33333	33333	26281
9	34921	34921	27534
10	36551	36551	28819
Total	2058279	2147359	2680508

[1]Total cost again may not be replicable because of rounding off errors, both in the subscriber count and the cost per option.

it should be noted that the increased capability of having a shadow trunk cable[1] installed during initial construction raises total capital costs by only 4 per cent.

Operating Expenses[2]

Having estimated system revenues and capital costs, the next step in the analysis is estimating operating expenses.

Depreciation[3]

In order to calculate depreciation, the following depreciation life of equipment will be used:

[1]See "Technology of Cable Television," *Publications Service*, Cable Television Information Center, 1973, p. 22.
[2]See page 13.
[3]See page 7.

Figure 9. Equipment Depreciation Life	
Item	Depreciation Life
Headend equipment, distribution system equipment, program origination equipment, furniture and leasehold improvements	10 years straight line
Subscriber drop equipment	6 years straight line
Test equipment	3 years straight line

Based upon the depreciation life of equipment shown in Figure 9 and the sum of capital expenditures shown in Figure 8, the annual depreciation charges are shown in Figures 9A and 9B.

Figure 9a. Annual Depreciation Charges (Single Trunk/Single Feeder Option)

Year	Headend, Distribution, Origination and Furniture Costs	Headend, Distribution, Origination and Furniture Annual Depreciation	Subscriber Costs	Subscriber Drop Equip. Annual Depreciation	Test Equipment	Test Equip. Annual Drop	Total Annual Depreciation
1	1378943	137894	186930	31155	3160	10534	179583
2		137894	211645	66429		10534	214857
3		137894	26040	70769		10534	219197
4		137894	27411	75338			213232
5		137894	28826	80143			218037
6		137894	30252	85190			223084
7		137984	31787	59333			197227
8		137894	33333	29614			167508
9		137894	34921	31095			168489
10		137894	36551	32618			170512

Figure 9b. Annual Depreciation Charges (All System Configurations)

Year	Single Trunk/Single Feeder	Dual Trunk/Single Feeder	Dual Trunk/Dual Feeder
1	179583	188781	256989
2	214857	224055	284801
3	219197	228395	288223
4	213232	222017	277577
5	218037	226822	281366
6	223084	231869	285345
7	197227	206012	264958
8	167508	176293	241526
9	168989	177773	242693
10	170512	279297	243895

Program Origination Expenditures[1]

The program origination budget was assumed to be $25,000 for the first year and three per cent higher in each succeeding year. This produces the following origination expenses:

Figure 10. Program Origination Expenditures

Year	Origination Expenses
1	25000
2	25750
3	26523
4	27318
5	28138
6	28982
7	29851
8	30747
9	31669
10	32619

Service Costs[2]

Service costs include the operation and maintenance of the plant and the personnel needed to install and maintain subscriber equipment. Its costs are derived from all of the elements shown in Table I, item D.

The costs shown in Figures 11a and 11b are for the ST/SF case in the first year of operation. The costs would remain the same for the DT/SF case but would increase slightly for the DT/DF case.

Office Expenditures

The final operating expense to be calculated is office operating costs. These are estimated in Figure 12a.

Operating expenses vary as a function of system configuration and ownership option. The nonprofit ownership option and municipal ownership option do not include sales tax in their estimates.

Annual office costs for the profit option are shown in Figure 12b.

[1]See *Cable Economics*, page 13.

[2]See *Cable Economics*, page 13.

Elements of a Pro Forma Income Statement[3]

As these series of calculations have shown, deriving estimates for system revenues, capital expenditures and operating expenses, although tedious, is not complex. With the basic estimates completed, the Pro Formas for the 18 combinations shown in Table 3 can be developed. The Pro Formas, in their simplest form, contain the following information on an annual basis:

Revenues — Operating costs —
Depreciation — Interest cost =
Net income before taxes —
Taxes =
Net income after taxes +
Depreciation =
Cash flow.

Interest Cost

The only element that remains to be estimated is the interest charge. This charge, however, varies from ownership option to ownership option and from system capability option to system capability option, and is determined by the following factors:

* The amount of money borrowed
* The time period over which it is borrowed
* The interest rate
* The annual repayment schedule.

In quantifying these factors in the analysis, there are certain historical guidelines and inferences that can be drawn upon. To begin with, it is reasonable to assume that the local officials, through the bond

[3]See *Cable Economics*, page 6.

Figure 12b. Office Expenditures (All System Configurations)

Year	ST/SF	DT/SF	DT/DF
1	205692	208080	226447
2	171498	171747	172466
3	129940	130190	131836
4	138386	138635	140258
5	147027	147277	148875
6	156548	156798	158371
7	165877	166127	167674
8	176411	176660	178179
9	188056	188306	189796
10	198747	198997	200457

Figure 11a. Service Costs
(Single Trunk/Single Feeder Option: First year of operation)

1.	Manager	$15,000	
2.	Chief technician	$12,000	
3.	Technician	$24,000	
4.	Installers	$28,000	
5.	Bench Technicians	$16,000	
	Total salaries	$95,000	
6.	Benefits (12% of salaries)	$11,400	
		$106,400	
7.	Headend maintenance	$ 2,250	
8.	Distribution maintenance	$ 9,200	($46/mile x 200 miles)
9.	Microwave maintenance	$ 1,039	(10% of microwave capital expenditure)
10.	Pole rental	$36,000	($180 per mile x 200 miles)
11.	Tower size rental	$ 600	
12.	Electrical power, headend	$ 700	
13.	Electrical power, distribution	$ 5,600	($28 per mile x 200 miles)
14.	Microwave importation	$100,000	
15.	Auto rental	$21,600	(9 autos x $2,400 per auto)
16.	Overhead, social security, etc.	$35,466	(Total salary + benefits ÷ 3)
		$318,855	

Figure 11b. Annual Service Costs (All System Configurations)

Year	Single Trunk/Single Feeder or Dual Trunk/Single Feeder	Dual Trunk/Dual Feeder
1	318,855	333,655
2	310,347	325,147
3	290,727	305,527
4	299,736	318,536
5	304,984	323,784
6	310,434	329,234
7	320,470	343,669
8	326,290	349,490
9	332,224	355,424
10	338,276	361,476

Figure 12a. Office Expenditures (Single Trunk/Single Feeder Option)

1.	Bookkeeper	$ 7,000	
2.	Clerks	10,000	
		$17,000	
3.	Benefits	$ 2,040	(12% of salaries)
4.	Rent	$10,000	
5.	Supplies and postage	$ 4,930	($1.35 per subscriber)
6.	Utilities	$ 2,000	(20% of rent)
7.	Contribution	$ 800	
8.	Dues, NCTA	$ 2,300	
9.	FCC fee	$ 1,096	(30¢ per subscriber)
10.	Professional services	$ 5,000	
11.	Billing & bookkeeping	$ 6,391	($1.75 per subscriber including first year conversion cost of 25¢ per subscriber)
12.	Promotion	$36,520	($10 per subscriber)
13.	Telephone	$10,000	
14.	Franchise fee	$14,025	(3% of total revenue)
15.	Bad debts	$ 4,208	(1½% of service income)
16.	Sales tax	$38,339	(4% of 60% of first year capital expenditures)
17.	Payroll tax	$ 6,572	(5% of total salaries)
18.	Property insurance	$ 4,473	(35¢ per $100 insurable value where insurable value = 80% of first year capital expenditure)
19.	Property tax	$31,948	(2% of first year capital expenditure)
20.	Entertainment	$ 2,250	(15% of manager's salary)
21.	Misc. insurance	$ 1,500	
22.	Licenses	$ 1,500	
23.	Misc.	$ 2,800	
		$205,692	

Table 6. Financial Feasibility Summary

Option	Ownership Form	Distribution System	Franchise area	Probability of Success (%)	Pass/Fail[a]
F-1	For profit ownership	ST/SF	Entire City	89	Pass
F-2	For profit ownership	DT/SF	Entire city	85	Pass
F-3	For profit ownership	DT/DF	Entire city	68	Fail
F-4	For profit ownership	ST/SF	One-half of city	32	Fail
F-5	For profit ownership	DT/SF	One-half of city	27	Fail
F-6	For profit ownership	DT/SF	One-half of city	11	Fail
F-7	Nonprofit ownership	ST/SF	Entire city	71	Fail (Pass)[b]
F-8	Nonprofit ownership	DT/SF	Entire city	70	Fail (Pass)[b]
F-9	Nonprofit ownership	DT/DF	Entire city	57	Fail
F-10	Nonprofit ownership	ST/SF	One-half of city	11	Fail
F-11	Nonprofit ownership	DT/SF	One-half of city	9	Fail
F-12	Nonprofit ownership	DT/DF	One-half of city	0	Fail
F-13	Municipal ownership	ST/SF	Entire city	77.5	Pass
F-14	Municipal ownership	DT/SF	Entire city	77.5	Pass
F-15	Municipal ownership	DT/DF	Entire city	57.5	Fail
F-16	Municipal ownership	ST/SF	One-half of city	12.5	Fail
F-17	Municipal ownership	DT/SF	One-half of city	12.5	Fail
F-18	Municipal ownership	DT/DF	One-half of city	0	Fail

[a]See page 15.

[b]See following discussion.

market, can borrow more money and at a lower interest rate than private, profitmaking owners. This is particularly true if a general obligation bond is used to obtain the funds. A general obligation bond is backed by the taxing power of the local government and not by the revenues of the cable system. The interest rate itself would hinge solely upon the bond rating of the government. It is doubtful if a general obligation bond would be used for the construction of the cable system. Instead, officials would probably issue a revenue bond backed by the revenue of the cable system and some additional revenue pledges if the system is not financially attractive. Such a revenue bond would increase the interest charges.

Next in "borrowing power" would be the for profit company, especially if it is a recognized multiple system owner. Finally, the "weakest" borrower would be the nonprofit corporation. This entity suffers from a lack of a cable management and operating experience and alternative sources of funds, thereby increasing the risk of the loan and, in turn, increasing the interest required.

All of the debt is borrowed on the day the system begins construction. In the profit and nonprofit case, the repayment schedule requires no repayment of principle until year 10, when the full amount is due. Interest payments are due at the end of each year. For the bond issue, repayments of principle begin as soon as the system starts showing positive net income. The final payment is due at the end of the fifteenth year. In summary we have the following:

Ownership	Interest Rate	Amount Borrowed
Municipal	5.5%	All of the capital requirement
For Profit	8%[1]	Two-thirds of all capital requirements (approx.)
Nonprofit	10%[1]	One-half of all capital requirements (approx.)

[1]With the prime interest rate currently at 11 3/4 per cent, the interest rates shown above might seem low. The prime rate does change over time and for the ten year time frame for which these numbers are developed, the actual average interest rate can be approximated by the amounts shown above. This is especially true if debt funds are borrowed from such long-term lenders as insurance companies. Such loans carry interest rates that are lower than the prime rate.

As one example of interest calculations, the single trunk/single feeder, for profit system shows an expected capital investment[1] of approximately $1.8 million. One-third of this amount is assumed to be stockholders equity, while two-thirds, or $1.2 million, is debt money.

At 8 per cent interest, the annual interest charges amount to 8 per cent of $1.2 million, or $96,000.

Pro Formas and Feasibility Results

With all of the estimates required in the Pro Forma obtained, the process of interpreting the results to determine financial feasibility can now be undertaken.

Table 6 lists the eighteen options considered in the feasibility analysis and summarizes financial feasibility.[2]

On the basis of these results, certain preliminary conclusions can be reached. The first is that dividing Cabletown into two equal franchises is not economically feasible. Neither zone has a population large enough to support a modern cable system, especially if significant local program origination is called for. The results of this analysis appear so convincing that even if additional sources of income such as pay TV were included, the overall results would not change. With justifiable reasons, the multiple franchise option can be discarded. This reduces the number of options from 18 to 9.

A second conclusion is that the dual trunk/dual feeder system is also infeasible. The additional capability that this option produces does not seem justified.[3] It is possible that additional revenues would increase the probabilities to the point where the investment is good, but this appears to be an expensive form of hedging against future development.

This issue is especially valid in the municipal ownership case. Because bond holders tend to be more cautious and conservative as a group compared with stockholders of for profit companies, public officials cannot afford to take large risks when issuing bonds. The failure to repay a cable bond holder has significant impact upon the government's future ability to raise debt.

In the for profit case, the capital requirement increases by 35 per cent from the dual trunk/single feeder case to the dual trunk/dual feeder case. For this reason, the dual trunk/dual feeder option is dropped from further considerations.

Of the remaining options, all appear financially reasonable. Although the nonprofit case does not pass the threshold of 75 per cent probability, it is close enough to this figure to warrant its inclusion. Small difference in probabilities are statistically insignificant and can be misleading.

By examining the remaining options, it can be observed that between the single trunk/single feeder option and the dual trunk/single feeder option, the probabilities of success do not significantly change. In fact, there is almost no discernible difference in probabilities between these two options.

If the analysis is correct, then there appears to be no reason to continue with the single trunk/single feeder option. The added capabilities of the dual trunk case more than justify the slight increase in capital costs. Thus, the major options that remain after the first testing phase — the feasibility analysis — are the dual trunk/single feeder designs for all three ownership options.

In narrowing down the field of options, the expected system revenues, the annual franchise fee, the capital required to build the system and the size of the bond issue have been determined.

In summary, the significant elements of each ownership option are:

1. For profit ownership
   - A. Interest rate = 8%
   - B. Size of loan = $1.2 million
   - C. Capital requirement = $1.85 million
   - D. Probability of success = 85%

2. Nonprofit ownership
   - A. Interest rate = 10%
   - B. Size of loan = $1.30 million
   - C. Capital requirements = $2.185 million
   - D. Probability of success = 70%

3. Municipal ownership
   - A. Interest rate = 5.5%
   - B. Size of bond issue = $2,091,910
   - C. Probability of success = 77.5%.

[1]Capital investment is defined as the amount of money a system owner must raise to build and operate a cable system. It is less than the total capital expenditures because when the system begins showing a positive cash flow, the cash flow is used to pay for the additional equipment.

[2]Selected complete Pro Formas are shown in Appendix, p. 31.

[3]For a discussion of a capability of a dual trunk/dual feeder system, see "Technology of Cable Television," *Publications Service*, 1973, Washington, D.C., Cable Television Information Center, p. 23.

STAGE 2. ELIMINATE CERTAIN OPTIONS

Earlier, following stage 1, on page 13, local officials decided not to eliminate any options at that time. But later, before the trade-off analysis and sensitivity analysis was undertaken, the study committee made an informal presentation to the council to determine if all of the ownership options should be retained. It was decided at this meeting that municipal ownership was no longer of interest to Cabletown and this option was dropped.

Thus, two options, dual trunk/single feeder design and profit or nonprofit ownership, remain from the original list of eighteen. The analysis can now begin to address what impact changes in the assumed values of the other options have upon feasibility.

TRADE-OFF ANALYSIS

In order to perform the feasibility analysis, a number of factors or options were held constant throughout the analysis. These options were fixed at some realistically assumed value and not permitted to vary. This was done so that the number of options that had to be initially analyzed was reduced to a reasonable level. Now that the reduction process has been completed, the fixed options can now be permitted to vary over the range of local interests.

The purpose of this type of analysis, which is called trade-off analysis, is to vary the previously fixed options, until these changes begin to affect the financial feasibility. The value these options have just before the feasibility is affected represents the upper limit the value can take on. For example, it was initially assumed that the program origination budget was set at $25,000 per year. If this could be increased to $75,000 per year without affecting the viability of the two remaining viable options, and franchising authorities have a plan for utilizing this budget, Cabletown could then make this higher budget a nonnegotiable part of its franchise.[1] This type of trade-off analysis is referred to as testing option against profitability. Trade-off analysis should test combinations of options against probability. If, to continue with the previous example, an increase to $75,000 in the program origination budget were possible, the study committee might want to determine whether an increase to $50,000 in the origination budget and an increase in the franchise fee to 4 per cent simultaneously might also be possible. Since most franchise decisions consider more than one option simultaneously, the financial analysis should be capable of doing the same thing. It should be noted that this type of analysis is not used to test the validity of the underlying assumptions of the analysis. Such a test of assumptions is called a sensitivity check and will be addressed in the following section.

The first step in a trade-off analysis is to define both the options that should be analyzed and the range of values for these options. Again, the number of possible choices and the range of values for each choice is essentially limitless. For Cabletown, the study committee had decided to focus upon four major options:

1. Francise fees
2. Program origination budget
3. Subscriber rates
4. Construction requirements — aerial vs. underground.

Such options as construction schedule, interconnection with other systems, increased technical standards, decreased or free installation charges, additional free drops at local government locations, etc., could — and in real use of the model should — have been tested. However, the trade-off analysis for the four options listed above is sufficient to illustrate how such a concept may be applied. The range of values selected for testing are shown below. These ranges represent extreme variations, and in actual practice each range would include a number of intermediate values.

Option	Range
Franchise fee	
% of gross revenues	3 → 5
Program origination	
equipment ($)	75000 → 150000
annual budget ($)	25000 → 75000
Subscriber rates	
annually ($)	60 → 72
Construction	
requirements	All underground → All aerial

[1] It should be noted that this type of analysis is somewhat artificial. It may be that local officials have no desire to change origination budgets. In that case, any other option may be substituted for origination changes and the procedure would remain the same.

Single Trade-offs

Utilizing the original data that was developed for the feasibility analysis, each variation was individually tested against the profitability of the dual trunk/single feeder, for profit system. The trade-off analysis for the nonprofit case was not performed. The case was dropped, not because it was infeasible, but rather that its results would follow the for profit case and would not add any significant amount of information to this report. In a real examination of cable feasibility, trade-off analysis would be performed for both the profit and nonprofit options.

The summaries of the financial feasibility of the first set of trade-off analyses is shown in the following table:[1]

Table 7. Trade-off Analyses (Set 1)

Option	Probability of Success (%)	Pass/Fail[a]
T-1	82	Pass
T-2	70	Pass
T-3	79	Pass
T-4	21	Fail

Key: T-1 Changing franchise fee
T-2 Changing program origination budget
T-3 Changing subscriber rate
T-4 Changing construction requirements

[a]See page 15.

Of these trade-offs, only the all underground case appears to be infeasible. While the probability associated with the increase in the program origination budget does not pass the feasibility test, it can still be considered successful. If the increase in the program origination budget is effectively applied in terms of quality programming it can be expected to increase the number of subscribers. This increase in expected revenue would be sufficient to raise the probability of success to beyond the 75 per cent level. At this stage in the analysis, it appears that the system could support increases in either origination or franchise fees or a decrease in the subscriber rate.

[1]Because the Pro Formas for the trade-off analyses are essentially the same as the feasibility examples, only the summaries of such analysis have been included here.

All of these trade-offs change the capital requirements needed for construction and operation of the system. In the original case, the capital requirements were $1.85 million with a total debt of $1.2 million. The new capital requirements are:

Franchise fee — $1.86 million — Debt remains at $1.2 million

Program origination budget — $1.97 million — Debt increases to $1.3 million

Subscriber rates — $1.948 million — Debt increases to $1.3 million

Underground construction — $5.113 million — Debt increases to $3.4 million.

The changes are due to the following reasons:

— In the franchise fee change, the Pro Forma shows slightly higher operating expenses and slightly lower net incomes. This requires a slight increase in the capital needed to build and operate the system.

— The origination change increases annual depreciation charges and annual operating costs.

— The change in subscriber rates increases the final penetration from 48.5 per cent to 54.9 per cent. Additional converters are needed for these new subscribers, thus increasing the annual depreciation charges. In addition, many of the operating costs are estimated on a per subscriber basis. Hence, an increase in subscribers would also increase the operating costs.

— Underground construction significantly increases capital expenditures and thus the annual depreciation charges. There is, however, a slight reduction in operating costs because an all-underground system eliminates the need for pole rental expenses.

The trade-off analysis can now examine the impact that combinations of individually feasible options would have on overall financial feasibility.

Trade-off of Option Combinations

These remaining options can be combined into four distinct sets of combinations as seen in Table 8a. Summary statistics for these combinations are shown in Table 8b.

Table 8a. Option Combinations (Set 2)				
	Franchise Fee	Capital Expenditures	Operating Expenses	Subscriber Rates
Trade-off T-5	5%	$150,000	$75,000	$60
Trade-off T-6	5%	$150,000	$75,000	$72
Trade-off T-7	5%	$ 75,000	$25,000	$60
Trade-off T-8	3%	$150,000	$75,000	$60

Table 8b. Trade-off Analyses (Set 2)		
Combination Option	Probability of Success (%)	Pass/Fail[a]
T-5	56	Fail
T-6	66	Fail
T-7	73	Pass
T-8	63	Fail

[a]See page 15.

In this particular set of runs, only the trade-off involving changes in franchise fee and subscriber rates would be considered successful. Since all of the other runs involved changes in origination, the study committee felt that $150,000 for origination equipment and a $75,000 yearly origination budget was more than the system could support.

These three combinations were rerun with reduced origination requirements. The new origination costs were. $125,000 for capital expenditures and $50,000 for annual operating expenses. These results are shown in the table below.

Table 9. Option Combinations (Set 3)				
	Franchise Fee	Capital Expenditures	Operating Expenses	Subscriber Rates
Trade-off T-9	5%	$125,000	$50,000	$60
Trade-off T-10	5%	$125,000	$50,000	$72
Trade-off T-11	3%	$125,000	$50,000	$60

While the probabilities did increase, only option T-10 (increased franchise fees and increased origination) could be considered successful. The results could be summarized in the following manner:

1. If both fees and origination expenses are increased, but subscriber rates are decreased, the system cannot be expected to be feasible
2. If both franchise fees and origination expenses are increased, the system can still be feasible
3. If the franchise fee is increased and the subscriber rates decreased, the system can still be profitable
4. If origination expenses are increased while subscriber rates are decreased, the system cannot be profitable.

The basic description of the system, at this stage of the analysis, is shown in Table 10.

Table 10. Basic System Design Following Trade-off Analyses

Franchise fee	Five per cent of gross revenues
Type of construction	All aerial construction
System configuration & capability	Dual trunk cable/single feeder cable with converter
Ownership	Profit or nonprofit
Number of franchises	Entire city—one franchise
Basic subscriber rate and origination expenses	Either $6.00 per month, $125,000 of origination equipment and $50,000 annual origination budget; or $5.00 per month, $75,000 of origination equipment and $25,000 annual origination budget

Choosing between origination expenses and subscriber rates is not an economic decision. It involves an analysis by public officials of what the system's ultimate uses and objectives are to be. The economic analysis shows that choosing one or the other of these two options has no significant impact on feasibility.

SENSITIVITY ANALYSIS

With the trade-off analysis completed, the determination of options which are possible has been made, and it would appear that all that remains is a decision by local officials as to what options they will request.

There is, however, one additional analytic procedure that should be included in the financial analysis. All of the elements of the Pro Forma were developed using some basic assumptions about cable television demand and penetration, interest rates and the amount of money that can be borrowed to build the system. In a sense, these assumptions represent the most likely possibilities.

But what would happen to the overall results if the estimates were incorrect? The prime interest rate, which is the rate at which banks lend money to their biggest customers has fluctuated widely in the past few years. Is it realistic to assume it will remain at the level used in the analysis — eight per cent — over the ten-year period in which the projections take place? Another area of uncertainty is that of penetration estimates. There are very few truly urban systems in operation at present. Many of these systems show smaller penetration than was originally estimated. If the penetration estimate is incorrect, what would be the impact of this error on financial feasibility? Obviously, if penetration were underestimated, all of the probability measures would increase, making good investments even better investments. But if the number were overestimated, how much would it affect financial feasibility?

Here is where sensitivity analysis is useful. It attempts to show the impact of major changes in the financial environment by testing specific options (or sets of options) against profitability with one or more major assumptions being changed at the same time. This type of testing (for example, changing penetration estimates by plus or minus 10 per cent) also enables officials to determine which proposals are either optimistic or pessimistic.

The franchising authority is protected against pessimistic projections (and, in turn, proposals that offer insufficient services) because officials know how the cable system should perform under the most likely set of circumstances. Optimistic projections should also be identified, for if these estimates do not occur, promised services might not be delivered.

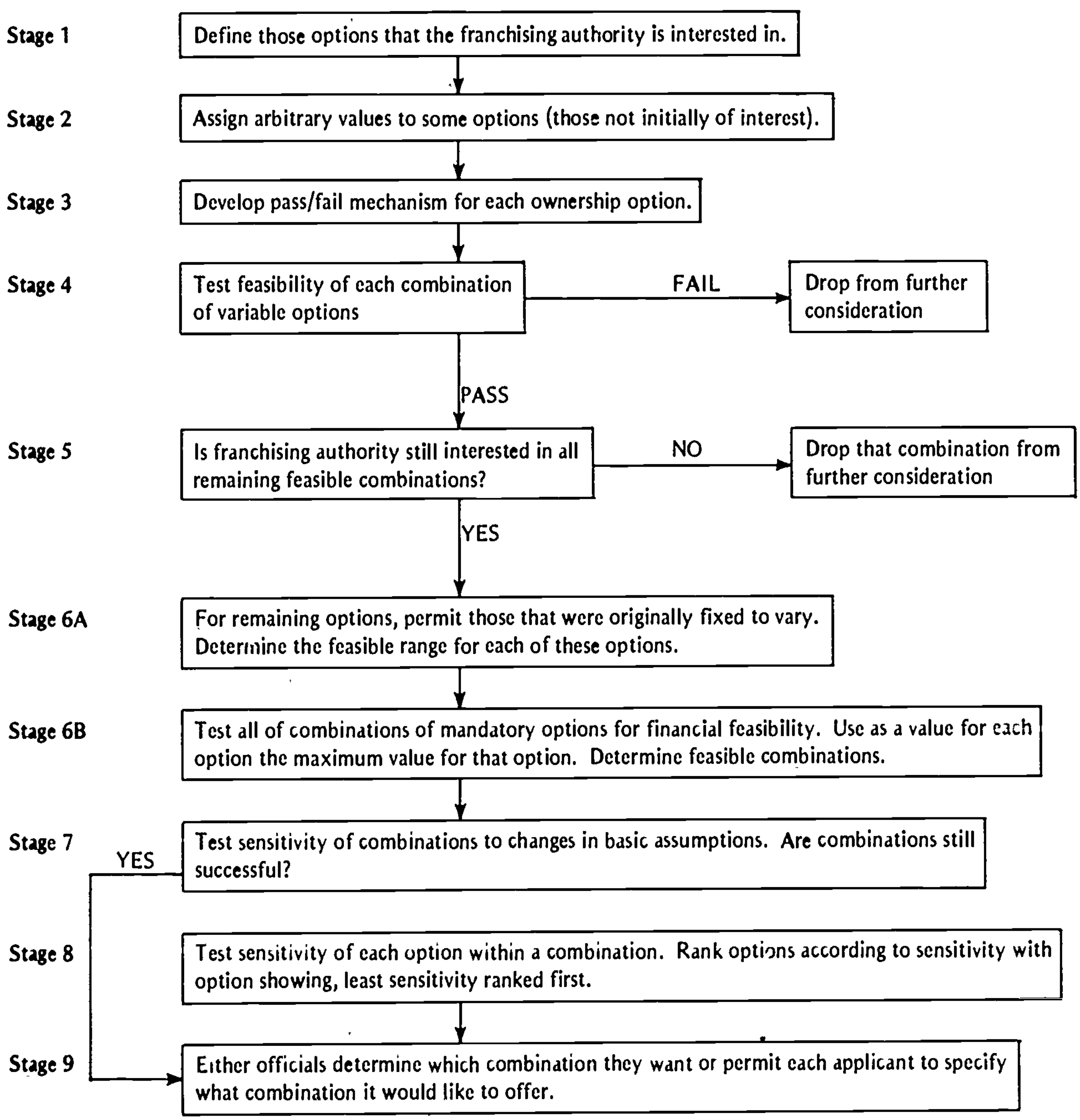
Summary

In the first section of this chapter, a flow chart of the decisionmaking process was developed (Figure 3). In succeeding sections, this flow chart was expanded, clarified and revised into a financial flow chart. While each part of the analysis was discussed in some detail, an overall review of the entire process might be useful to tie together some of the "loose ends," and to illustrate what the revised flow chart would look like (see Figure 13).

The process begins with the determination of what options and alternatives local officials should consider. This typically ranges from ownership choices, design choices and franchising considerations, to subscriber rates, construction techniques and origination budgets (Stage 1). The list of options and alternatives is divided into two categories — those options of immediate interest to the franchising authority and those not of immediate interest. The options that are not of immediate interest might be those that would either always be present in the system, e.g., subscriber rates, construction techniques and origination budgets, or those already decided upon, e.g., the franchising authority is only interested in a dual trunk/single feeder system. Specific values are assigned to these options and a feasibility analysis is undertaken for those remaining options (Stage 4).

Before the analysis can be undertaken, a mechanism must be developed to spell out what constitutes a feasible alternative or an infeasible

Figure 13. Revised Financial Flow Chart



alternative. Since this standard varies from ownership form to ownership form, separate mechanisms must be developed for each ownership alternative (Stage 3).

After the first feasibility analysis is completed, officials should review the results to determine if certain passing options should be eliminated because of lack of interest (Stage 5).

Those options remaining are now tested for the second time in the trade-off analysis. Under the first series of retests, previously tested options are now held constant and those options which were assigned initial values are permitted to vary in turn, one at a time, from their initially assumed values that just make the system feasible (Stage 6A). This produces an acceptable range for each individual option.

The second part of the trade-off analysis tests combinations of options which vary over their individual feasible ranges. If, for example, origination can vary from a base level of $50,000 for equipment and $25,000 annually for operating expenses, to $150,000 for equipment and $75,000 for operating expenses, and franchise rates can vary from eight per cent to five per cent of gross revenues, will the combination of $150,000 of origination equipment, a $75,000 origination budget and a five per cent franchise fee be financially feasible? The results of Stage 6B is a set of feasible combinations.

Before officials can select a final combination of options, a sensitivity analysis is undertaken (Stage 7). The feasible combinations are retested against large and small changes in the basic assumptions. If the combinations still prove successful, officials must either choose from among the combinations to select the one they want, or permit each applicant to select the combination it wishes to bid upon (Stage 9).

If, however, the combinations do not prove successful after the sensitivity analysis, each of the options within a combination could be tested separately against changes in the basic assumptions (Stage 8).

Thus, the overall procedure is an attempt to identify combinations of options that would be financially successful if some of the underlying assumptions proved invalid. These combinations become the franchising authority's minimum requests for cable television service. Local officials should provide for this evaluation process to take place regularly over the life of the franchise. If the system turns out to be more successful than the analysis indicates, a means should be developed to permit the locality to obtain more services. Or, if the system is less successful than estimated, this same procedure could permit the franchising authority to waive some of its original demands.

The premise behind the analytic procedure discussed in this chapter is that those local governments currently studying cable television want to obtain all of those services from a cable system that an operator can afford to supply. This implies that the franchising will not make unreasonable demands and that the applicants will not promise to supply unrealistic services in order to obtain the franchise. In general, most applicants will have undertaken feasibility analyses of their own proposals. They will know what the system can and cannot support. In order to make the selection phase more meaningful and balanced, however, local officials, who must regulate the system in the end, should also determine the financial feasibility of cable service in their jurisdiction.

The procedure developed to analyze Cabletown is only one way of helping public officials to make correct choices. This analysis, as has been noted, does not make the choices for the local government. It merely shows what options or combination of options are feasible. The specific selection of options must be made by local officials on the basis of local needs and desires.

The determination of feasible options is, however, a repetitious and time-consuming process. The three-step process of feasibility testing, trade-off analyses and sensitivity analyses requires a knowledge of cable in order to be successful. In some cases, necessary talent may be available within government, while in others, outside consultants may be required. In either event, the costs associated with this type of analysis can be recovered from the applicants through the use of an application fee.

CONCLUSIONS

The hypothetical city of Cabletown has just completed an extensive financial analysis. In following this process, several important conclusions about the use of such an analysis in the study phase of local cable TV development can be developed.

The first and most important conclusion is that no analysis — however thoroughly performed and exhaustive — replaces the need for ultimate decisions to be made. Many factors must be considered before any final cable decision is made. The financial analysis is only one part of this process. Although such an analysis can help focus on the feasibility of the cable system and its component options, it does not address the fundamental needs or concerns of the locality. The analysis assumes that only those options that are profitable will be considered. But depending upon their importance, local officials may want to underwrite or fund certain options — even if these options are not profitable. The financial analysis, in this case, would not only show the feasibility of such an approach but also the extent to which the government must underwrite its involvement.

A second conclusion is that the three-step process of feasibility/trade-off/sensitivity analysis need not always be employed. While each step adds to the amount of information accumulated, the analytic process could be terminated after each step. For example, if the franchising authority has already addressed the issue of what options should be included in the system and has already made the selections then the trade-off analysis need not be performed. The feasibility analysis could be used either by itself or in conjunction with the sensitivity analysis to test the feasibi'ity of the franchising authority's choices.

A third conclusion is that no analytic model or analytic process for cable is ever really complete. At best, the process tries to approximate what would happen under the best of all circumstances. For instance, it is possible for good personnel to change a poor system into a profitable system and for poor personnel to make a good system look bad. The efficiency and quality of the staff cannot be analyzed in the model. In a similar manner, construction delays and negotiation over pole rights — both of which affect overall profitability — are also beyond the scope of most models. Thus, while most models do attempt to measure what would happen in the real world, the day-to-day real operational problems which will always be present cannot be totally analyzed.

Next, the impact of additional revenue sources has not been addressed here. Although many systems are testing the feasibility of additional sources of revenue such as pay TV and data processing, the ultimate impact of these services is still unknown. While they can, in the short run, be expected to add additional revenues, their long-term impact is still uncertain. If these sources of additional income were certain, the basic economics of cable would drastically change: Marginal systems could become financially attractive and good systems could be very profitable. At the present, the unknowns outweigh the knowns, and these revenue sources were not included in the analysis. This is a conservative approach to cable economics but, at this time, the most realistic approach to follow. If, and when, the future of these sources of revenue become assured, the officials should reexamine the economics of cable service to determine if additional services could be obtained.

Finally, the use of financial analyses need not be limited to feasibility analysis.[1] It can be used to help determine who shall operate the system, by examining the financial strengths and weaknesses of the individual applicants.

It can also be used in analyzing the implications of alternative buy-back ordinance provisions or in addressing the question of rate regulation. In addition, if the ordinance requires annually audited financial statements from the operator, the original Pro Formas can be modified each year to determine the up-to-date financial picture of the system.

The usefulness of financial analysis is furthered with a proper understanding of what such a technique can and cannot realistically be expected to accomplish. When used properly, it is a powerful aid in the continuous process of decision making; when used incorrectly, it essentially serves no useful purpose.

[1]See *Cable Economics*, Section II for a description of the components of financial analysis.

APPENDIX

FIGURE A-1
PRO FORMA INCOME STATEMENT
(OPTION F-1)

For Profit Ownership
Entire City
Single Trunk/Single Feeder Distribution System
8% Interest Rate
15% Rate of Return

YEAR	1	2	3	4	5	6	7	8	9	10
PENETRATION	18.2	37.8	39.1	40.4	41.7	43.0	44.4	45.7	47.1	48.5
SUBSCRIBERS	3652	7788	8297	8833	9396	9988	10609	11260	11943	12657
CAPITAL EXPENDITURES	1597480	211645	26040	27411	28826	30285	31787	33333	34921	36551
REVENUE	340808	671884	657324	699666	744187	790953	840031	891486	945384	1001790
OPERATING EXPENSES	549547	507595	447190	465439	480149	495964	516198	533448	551950	569643
DEPRECIATION	179583	214857	219197	213232	218037	223084	197227	167508	168989	170512
INTEREST PAYMENTS	96000	96000	96000	96000	96000	96000	96000	96000	96000	96000
NET INCOME	-251847	-76215	-54632	-39002	-25999	-12529	15914	49155	66791	86129
CASH FLOW FROM OPERATIONS	-72264	138641	164564	174229	192037	210555	213142	216664	235780	256641

FIGURE A-2
PRO FORMA INCOME STATEMENT
(OPTION F-2)

For Profit Ownership
Entire City
Dual Trunk/Dual Feeder Distribution System
8% Interest Rate
15% Rate of Return

YEAR	1	2	3	4	5	6	7	8	9	10
PENETRATION	18.2	37.8	39.1	40.4	41.7	43.0	44.4	45.7	47.1	48.5
SUBSCRIBERS	3652	7788	8297	8833	9396	9988	10609	11260	11943	12657
CAPITAL EXPENDITURES	1686560	211645	26040	27411	28826	20385	21787	33333	34921	36551
REVENUE	340808	671884	657324	699666	744187	490953	840031	891486	945384	1001790
OPERATING EXPENSES	551935	507845	447439	465689	480398	496213	516448	533697	552199	569892
DEPRECIATION	188781	224055	228395	222017	226822	231869	206012	176293	177773	179297
INTEREST PAYMENTS	96000	96000	96000	96000	96000	96000	96000	96000	96000	96000
NET INCOME	-257872	-81128	-59545	-43700	-30697	-17227	11217	44457	62094	81431
CASH FLOW FROM OPERATIONS	-69090	142927	168850	178316	196124	214642	217229	220751	239867	260728

FIGURE A-3
PRO FORMA INCOME STATEMENT
(OPTION F-3)

For Profit Ownership
Entire City
Dual Trunk/Dual Feeder Distribution System
8% Interest Rate
15% Rate of Return

YEAR	1	2	3	4	5	6	7	8	9	10
PENETRATION	18.2	37.8	39.1	40.4	41.7	43.0	44.4	45.7	47.1	48.5
SUBSCRIBERS	3652	7788	8297	8833	9396	9988	10609	11260	11943	12657
CAPITAL EXPENDITURES	2371900	166872	20531	21612	22728	23878	25063	26281	27534	28819
REVENUE	340808	671884	657324	699666	744187	790953	840031	891486	945384	1001790
OPERATING EXPENSES	585102	523364	463885	486112	500797	516586	541194	558416	576889	594553
DEPRECIATION	256989	284801	288223	277577	281366	285345	264958	241526	242693	243895
INTEREST PAYMENTS	136000	136000	136000	136000	136000	136000	136000	136000	136000	136000
NET INCOME	-331387	-141586	-120008	-104012	-90467	-76428	-53103	-23117	-5303	14217
CASH FLOW FROM OPERATIONS	-74397	143215	168215	173566	190898	208916	211855	218409	237390	258112

FIGURE A-4
PRO FORMA INCOME STATEMENT
(OPTION F-7)

Nonprofit Ownership
Entire City
Single Trunk/Single Feeder Distribution System
10% Interest Rate
10% Rate of Return

YEAR	1	2	3	4	5	6	7	8	9	10
PENETRATION	18.2	37.8	39.1	40.4	41.7	43.0	44.4	45.7	47.1	48.5
SUBSCRIBERS	3652	7788	8297	8833	9396	9988	10609	11260	11943	12657
CAPITAL EXPENDITURES	1597480	211645	26040	27411	28826	30285	31787	33333	34921	36551
REVENUE	340808	671884	657324	699666	744187	790953	840031	891486	945384	1001790
OPERATING EXPENSES	511208	502516	446565	464782	479457	495237	515435	532648	551112	568766
DEPRECIATION	179583	214857	219197	213232	218037	223084	197227	167508	168989	170512
INTEREST PAYMENTS	130000	130000	130000	130000	130000	130000	130000	130000	130000	130000
NET INCOME	-479982	-175489	-138438	-108348	-83306	-47368	-2631	61330	95283	132510
CASH FLOW FROM OPERATIONS	-300399	39367	80759	104885	1 30	165716	194596	228839	264273	303022

FIGURE A-5
PRO FORMA INCOME STATEMENT
(OPTION F-8)

Nonprofit Ownership
Entire City
Dual Trunk/Single Feeder Distribution System
10% Interest Rate
10% Rate of Return

YEAR	1	2	3	4	5	6	7	8	9	10
PENETRATION	18.2	37.8	39.1	40.4	41.7	43.0	44.4	45.7	47.1	48.5
SUBSCRIBERS	3652	7788	8297	8833	9396	9988	10609	11260	11943	12657
CAPITAL EXPENDITURES	1686560	211645	26040	27411	28826	30285	31787	33333	34921	36551
REVENUE	340808	671884	657324	699666	744187	790953	840031	891486	945384	1001790
OPERATING EXPENSES	511457	502765	446814	465031	479706	495486	515685	532897	551361	569015
DEPRECIATION	188781	224055	228395	222017	226822	231869	206012	176293	177773	179297
INTEREST PAYMENTS	130000	130000	130000	130000	130000	130000	130000	130000	130000	130000
NET INCOME	-489429	-184937	-147886	-117382	-92340	-66402	-11665	52296	84249	123476
CASH FLOW FROM OPERATIONS	-300649	39118	80509	104635	134481	165467	194346	228589	264023	302773

FIGURE A-6
PRO FORMA INCOME STATEMENT
(OPTION F-9)

Nonprofit Ownership
Entire City
Dual Trunk/Dual Feeder Distribution System
10% Interest Rate
10% Rate of Return

YEAR	1	2	3	4	5	6	7	8	9	10
PENETRATION	18.2	37.8	39.1	40.4	41.7	43.0	44.4	45.7	47.1	48.5
SUBSCRIBERS	3652	7788	8297	8833	9396	9988	10609	11260	11943	12657
CAPITAL EXPENDITURES	2371900	166872	20531	21612	22728	23878	25063	26281	27534	28819
REVENUE	340808	671884	657324	699666	744187	790953	840031	891486	845384	1001790
OPERATING EXPENSES	528176	519359	463392	485593	500251	516013	540593	557785	576229	593861
DEPRECIATION	256989	284801	288223	277577	281366	285345	264958	241526	242693	243895
INTEREST PAYMENTS	190000	190000	190000	190000	190000	190000	190000	190000	190000	190000
NET INCOME	-634357	-322276	-284292	-253504	-227430	-200405	-255520	-97825	-63538	-25967
CASH FLOW FROM OPERATIONS	-377368	-37475	3931	24073	53935	84939	109438	143701	179155	217927

FIGURE A-7
PRO FORMA INCOME STATEMENT
(OPTION F-13)

Municipal Ownership
Entire City
Single Trunk/Single Feeder Distribution System
5.5% Interest Rate

YEAR	1	2	3	4	5	6	7	8	9	10
PENETRATION	18.2	37.8	39.1	40.4	41.7	43.0	44.4	45.7	47.1	48.5
SUBSCRIBERS	3652	7788	8297	8833	9396	9988	10609	11260	11943	12657
CAPITAL EXPENDITURES	1597480	211645	26040	27411	28826	30285	21787	33333	34921	36551
REVENUE	340808	671884	657324	699666	744187	790953	840031	891486	945384	1001790
OPERATING EXPENSES	500983	482359	426845	443792	457131	471508	490234	505903	522750	538712
DEPRECIATION	179583	214857	219197	213232	218037	223084	197227	167508	168989	170512
INTEREST PAYMENTS	102297	109538	110607	105185	98138	89169	78041	65260	53692	44665
EXPECTED OUTSTANDING DEBT AT YEAR-END	1859950	1991610	1897780	1774500	1614410	1414420	1184320	975205	811777	696447

FIGURE A-8
PRO FORMA INCOME STATEMENT
(OPTION F-14)

Municipal Ownership
Entire City
Dual Trunk/Single Feeder Distribution System
5.5% Interest Rate

YEAR	1	2	3	4	5	6	7	8	9	10
PENETRATION	18.2	37.8	39.1	40.4	41.7	43.0	44.4	45.7	47.1	48.5
SUBSCRIBERS	3652	7788	8297	8833	9396	9988	10609	11260	11943	12657
CAPITAL EXPENDITURES	1686560	211645	26040	27411	28826	30285	21787	33333	34921	36551
REVENUE	340808	671884	657324	699666	744187	790953	840031	891486	945384	1001790
OPERATING EXPENSES	501233	482609	427094	444041	457381	471758	490484	506152	522999	538962
DEPRECIATION	188781	224055	228395	222017	226822	231869	206012	176293	177773	179297
INTEREST PAYMENTS	107497	115055	116231	111123	104394	95755	84999	72217	60114	49771
EXPECTED OUTSTANDING DEBT AT YEAR-END	1954480	2091910	2003950	1886860	1733270	1540120	1310080	1091600	904449	772400

FIGURE A-9
PRO FORMA INCOME STATEMENT
(OPTION F-15)

Municipal Ownership
Entire City
Dual Trunk/Dual Feeder Distribution System
5.5% Interest Rate

YEAR	1	2	3	4	5	6	7	8	9	10
PENETRATION	18.2	37.8	39.1	40.4	41.7	43.0	44.4	45.7	47.1	48.5
SUBSCRIBERS	3652	7788	8297	8833	9396	9988	10609	11260	11943	12657
CAPITAL EXPENDITURES	2371900	166872	20531	21612	22728	23878	25063	26281	27534	28819
REVENUE	340808	671884	657324	699666	744187	790953	840031	891486	945384	1001790
OPERATING EXPENSES	517952	499202	443673	464603	477926	4992285	515392	531041	547867	563808
DEPRECIATION	256979	284801	288223	277577	281366	285345	264958	241526	242693	243895
INTEREST PAYMENTS	148357	156654	158952	156865	153390	148094	140872	131806	120446	106960
EXPECTED OUTSTANDING DEBT AT YEAR-END	2697400	2848250	2814080	2757490	2667350	2540650	2381950	2179590	1937620	1705750