

Cost-Effective Video: A Taxonomic Decision-Model for Media Selection

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The increased growth rate of video or nonbroadcast television use in business and industry (e.g., Brush & Brush, 1973; Barwick & Kranz, 1975; Cathcart, 1976; Brush & Brush, 1977; and Gruebel, 1979) has occurred, for the most part, without systematic analysis of costs and benefits and cost-effectiveness in the decisionmaking process. Barwick & Kranz (1975), for example, suggest that not all video decisions can be explained by rational processes; that video has some of the earmarks of a fad and part of its popularity can be attributed to its being the "in" thing. Brush & Brush (1977) found a new category of respondents in their most recent survey, *former* users who could not cost-justify their video operation after several years of program production and distribution. Gruebel (1979) found that one insurance company is now a former user because they "bought some equipment which was completely out-of-date before we really found a use for it." Only 12.6 percent of the total user respondents to Gruebel's survey indicated they had a formalized cost-analysis/cost-justification system, but it was questionable whether any of these organizations were actually measuring cost-effectiveness.

In view of a major investment of dollars in video, it would have been reasonable to assume that some kind of costs and benefits analysis would be performed prior to making the decision to purchase the video package. Lately, top management apparently has come

to realize that communications—namely, television services—within an organization must, like every other aspect of the business, be a *managed* function (e.g., Brush & Brush, 1977). To provide guidance in this direction, we have developed a decision-model for the potential user of video. In addition, present users also can ascertain with this decision-model whether or not they are using video cost-effectively.

Cost-Benefit Analysis

A cost-benefit analysis consists of examining the *incremental costs* of various alternatives (costs directly related to each alternative) and comparing these costs with the benefits derived from each alternative. The alternative with the highest *net benefit* (benefits minus incremental costs) represents the best choice. However, because many of the figures generated in this type of analysis are estimates, the potential user should be aware that alternatives with small differentials in net benefits are more or less equal choices.

Decision-Model

The decision-model has been developed in the format of a taxonomy (Figure 1). To select media, some systematic way must be found to compare costs and benefits. A taxonomy is a classification scheme. Previous taxonomies in biology and zoology, education, and accounting (e.g., Simpson, 1961; Bloom, 1956; and Freedman, 1975) were used to compare relationships and nonrelationships of phenomena just as the present taxonomy can be used to compare incremental costs and benefits of media alternatives.

Reviews of research on media selection and instructional design (e.g., Campeau, 1974; Allen, 1971) reach similar conclusions regarding the need for a taxonomic approach to the problem. Previous media taxonomies have

been useful to such decisionmakers as engineers and media practitioners, teachers, instructional designers, and textbook illustrators (e.g., Bretz, 1971; Gropper & Glasgow, 1971; Fleming, 1967; and Tosti & Ball, 1969). Clark (1975) constructed a taxonomy of media attributes for research purposes.

The taxonomy divides the decision-model into a number of components: (1) *purpose(s)* for using video; (2) *alternative ways* of achieving purpose(s); (3) *cost variables* for each alternative; (4) *incremental costs* for each alternative; (5) *benefit variables* for each alternative; (6) *benefits* of selecting a particular alternative; and (7) *net benefits* of each alternative.

Purpose

It is necessary to set well defined goals before the decision to purchase a video or alternative package. Media consultants agree on this point without exception. Brush & Brush (1977) advise that setting goals is always a good place to start. Barwick & Kranz (1975) described the mismanaged organization with undefined goals: "The organization blunders into video operations without knowing what it wants to achieve, or if video is the right tool to effect that achievement. In many cases, a film or filmstrip could do just as well with far less investment. Without defined goals, there is no rational basis for evaluation. The video operation becomes difficult to defend at budget time. . . ." (p. 9).

Video has been used for a variety of purposes that can broadly be defined as educational. Television programs have been developed for proficiency upgrading, training and job skills, sales training, safety, sales meetings, and promotional/product demonstrations, management communications, employee orientation and news, management training and development, community and public relations, and the like. Regardless, the starting point of the decision-model is that the potential user

These other combinations include: live presentation with audiotape, live presentation with slides, live presentation with audiotape and slides, live presentation with filmstrips, live presentation with audiotape and filmstrips, live presentation with video, and live presentation with film.

Live presentation refers to the presentation of educational material by a teacher (an expert in the field), or some other professional. When the presentation of educational material is in combination with other media but the person in charge of the media serves an auxiliary function, the presentation will be considered media-only.

Because educational material may be presented without face-to-face communication by an expert in the field, other alternatives include: audio-only, audio-tape and slides, audiotape and filmstrips, video-only, and film-only.

Cost Variables

The cost variables for each alternative include annual costs of production-distribution-reception and service. These cost variables have been categorized regardless of cost types; that is, without considering whether these costs are fixed, variable, recurring, non-recurring, or joint (shared with other projects). Production-distribution-reception costs include: equipment (hardware), programming (software), distribution, labor, and overhead. The costs of service provided by technical support staff (e.g., engineers) do not involve software, but include: hardware, distribution, labor, and overhead.

These cost variables are interrelated. For example, production-distribution-reception costs of hardware and the subsequent servicing costs of alignment and testing equipment depend on degree of sophistication or the desired program quality, location of the audience, size of creative and technical support staff, and the allocation of space for providing media services. In turn, these costs are related to time factors built onto each variable (e.g., amortization schedule for hardware).

Production-distribution-reception

The hardware cost variable for production-distribution-reception has three dimensions: (1) selection of medium; (2) technology specifications for achieving purpose(s); and (3) time factor. Not only may costs vary from one alterna-

tive medium to another, but within a selected medium. For example, 35mm film equipment is considerably more expensive than 16mm film equipment, which in turn is considerably more expensive than the Super-8 or 8mm format. Similarly, broadcast-quality color cameras are considerably more expensive than light-weight black & white porta-paks; audio consoles equipped for sound mixing cost considerably more than playback-only audio equipment; and so on. The medium selected should represent a balance between technology specifications necessary for achieving purpose(s) and available funding. Moreover, costs should include expenses for maintenance and repair and the manufacturers' amortization schedule for hardware. Any tax effects of purchasing equipment (e.g., investment tax credit) should be deducted from production-distribution-reception costs.

Software costs should represent total, average, or specified annual costs of the completed program(s) for one or more receiver(s). The software cost variable has two dimensions: (1) product; and (2) time factor. The completed program or product may require certain expenses in preproduction, production, and post-production other than hardware, distribution, labor, and overhead. These include: materials (e.g., costumes, props, set pieces), talent (e.g., "on-camera" performers, models), outside services (e.g., photographic laboratory processing and printing, film-to-tape or tape-to-film transfers, time-base correcting, video dubbing), and the like. The time factor, which should be consistent with that of other cost variables and figured on an annual basis, includes the number

organizations "network" their programs to a variety of locations) provided there are reception capabilities at designated locations. Film can be projected at a central location, which would require the intended audience to travel, or it can be projected at multiple locations, provided there are at least as many projectors and program duplicates as locations. Regardless, the costs for viewing/listening (e.g., projectors, screens, video receivers/monitors) and program duplicates (e.g., film prints, videocassette dubs) should be figured into this cost variable. Travel requirements during the specified time period also should be figured into the cost of distribution. This includes the cost of distributing presenters to multiple locations of the intended audience, the cost of bringing the intended audience to a central location for viewing/listening, and cost of trainees' time or loss of productivity while attending the program. Such overhead as running costs (e.g., electricity, telephone charges, videotape, and film stock) should not be figured into distribution costs.

The costs of labor include: full-time media staff (e.g., producers, directors, camera operators, production assistants), part-time devoted to media services by other corporate staff (e.g., artists, managers, supervisors), and freelance personnel (e.g., "on-camera" talent, artists, graphic designers, writers, outside producers). Normal employee benefits should be included in the costs for all full-time media staff.

Overhead costs include space allocation and development, in addition to the various running costs of production-distribution-reception (e.g., tape

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of completed programs, the length of time the product is expected to last (physically), the length of time the message is expected to last (before it is outdated), the number of times the product is expected to be used (access), the average size of the audience each time the product will be used, and the necessary length of time required to produce and update the product.

Distribution costs vary with the medium selected and location of the intended audience. Video can be wired, microwaved, or sent by satellite (some

stock—audio and video, film stock—still prints and slides and motion pictures, headphones, electricity, telephone charges, materials).

Service. The hardware cost variable for engineering service has two dimensions: (1) technology specifications and (2) time factor. The technology specifications for service are dictated by the technology specifications for production-distribution-reception. Costs should include expenses for maintenance and repair (or "back-up" servicing equipment) and the manufacturers'

amortization schedule for hardware. Any tax effects of purchasing equipment should be deducted from service costs. Service alignment and test equipment necessary for AV/video operations might include: time-base correctors (TBCs), oscilloscopes, digital circuitry.

Like distribution costs for production-distribution-reception, distribution costs for engineering service vary with the medium selected and location of the intended audience. Regardless, the costs for maintenance of viewing/listening equipment (other than hardware, labor, and overhead) should be figured into this cost variable. If engineers (or other technical staff hired for the purpose of servicing production-distribution-reception hardware) are required to travel during the specified period under study, these costs also should be figured into distribution costs.

The costs of labor include that of all technical staff hired for the purpose of servicing production-distribution-reception hardware, whether employment is full-time for the media operations, part-time, or on a free-lance or consulting basis. Normal employee benefits should be included in the costs for all full-time technical staff for the media operations.

Overhead costs include space allocation and development, in addition to a variety of running costs (e.g., spare parts, audio and video cables, extension cords, workbench tools).

Incremental Costs

Incremental costs are those costs directly related to the particular alternative. Costs that remain constant regardless of alternative are not relevant to the decision. Thus, for example, the depreciation cost of the office building that serves as corporate headquarters or executive salaries that remain the same regardless of the medium selected are not relevant costs.

Incremental costs can be readily ascertained after all cost variables for each alternative have been determined and computed. In doing so, however, these annual incremental costs should be compared during a specified time period or finite number of years (i.e., based on either the predicted life of the mediated program, the manufacturers' amortization schedule for production-distribution-reception hardware, or some arbitrary number of years for study). Then, discount these annual incremental costs back to the present at the

cost of capital or interest rate, so that all incremental costs are at the present value.

Benefit Variables

The benefit of media selection would be cost-effective message(s) that the receiver(s) can understand and act upon as desired by the organization (minimum standards of performance need to be determined). There are a number of important benefit variables in determining whether or not the message(s) would be cost-effective. These include: types of messages/objectives; the benefit or dollar value of the increase in productivity for one receiver performing a task or series of tasks at some minimum standard of performance, or realizing objectives in some other predetermined way; audience size (the number of receivers of the messages); the percentage of those receivers performing the tasks or realizing objectives; and the percentage of tasks performed or objectives realized.

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The type of message component includes objectives so that systematic evaluation of performance can be made. Messages may have any one or more of a variety of purposes (see Figure 1) and may deal with such elements as technical information, abstract concepts, emotions (e.g., conflict management), rote memorization, or any combination of these elements. Different message types and elements may require different methods of evaluating performance.

The benefit of one receiver performing a task or series of tasks at some minimum standard of performance, or realizing objectives in some other predetermined way, is the dollar value of the increase in productivity. For some larger corporations, this data is already available.

The audience size involves the known or estimated number of receivers of the messages during a specified time period.

The percentage of those receivers performing the task(s) or realizing objectives is equal to the number of those receivers performing the task(s) divided by the number of receivers of the message(s).

The percentage of tasks performed is equal to the number of tasks performed

divided by the number of tasks that the organization would like the intended receivers to perform after viewing/listening to the messages.

Benefits

Measuring the benefits of each alternative is perhaps the most difficult part of this and any cost-benefit analysis. Benefits may have to be determined *ex ante* or *ex post*, depending on whether the organization is considering the purchase of a media package for future use or evaluating an existing package for cost-effectiveness. *Ex ante* determination of benefits would be appropriate for the former, *ex post* evaluation for the latter.

Ex ante, measure benefits by determining the worth or dollar value of the increase in productivity for one receiver performing a task or series of tasks at minimum standards of performance and multiply that figure by the number of receivers who have viewed/listened to

the same or similar messages using another medium (i.e., dollar value, 1 employee trained \times audience size). Then multiply that figure by the percentage of those receivers who performed the task and again, by the percentage of the task(s) performed (i.e., dollar value, 1 employee trained \times audience size \times % of employees trained \times % of task(s) performed).

Compare this result with that of multiplying the worth of one receiver performing a task or series of tasks at minimum standards of performance by the number of receivers who will view/listen to the same or similar message(s) using the media package being considered for purchase; then, further multiplying that figure by the *estimated* percentage of those receivers who will be able to perform the task(s), and again, by the *estimated* percentage of the task to be performed.

Because the percentage of receivers performing tasks at minimum standards of performance and percentage of the task performed are based on estimates, these percentages should be presented as ranges (e.g., 75 percent - 85 percent). The resulting benefit also should be presented as a range.

Hypothetical Example of *ex ante* Approach

Company A currently uses a live presentation with slides to train its employees, but the company is considering the purchase of a video package to replace this method of training. Company A must first determine the effectiveness of live presentation with slides.

There are 100 employees involved in Company A's training program. Company A makes the following determinations regarding effectiveness:

20% of employees trained at effectiveness level of 90-100%

50% of employees trained at effectiveness level of 70-80%

20% of employees trained at effectiveness level of 40-60%

10% of employees trained at effectiveness level of 10-35%

Company A also determines that the value of an effectively trained employee is \$10,000 for each of the next five years. The cost of capital (interest rate) is 10%. Therefore, the range of benefits can be determined as follows:

$20\% \times 90-100\% \times 100 \text{ employees} \times \$10,000 = \$180,000 - \$200,000$

$50\% \times 70-80\% \times 100 \text{ employees} \times \$10,000 = \$350,000 - \$400,000$

$20\% \times 40-60\% \times 100 \text{ employees} \times \$10,000 = \$80,000 - \$120,000$

$10\% \times 10-35\% \times 100 \text{ employees} \times \$10,000 = \$10,000 - \$35,000$

Range of Benefits = \$620,000 - \$755,000

Company A must then determine the present value of the range of benefits since benefits accrue to the company for the five years. Assuming that benefits are received during the five-year period, the present value of the range of benefits is determined as follows:

$\$620,000 \times 3.7908$ (present value of annuity at cost of capital for five years) = \$2,350,296

$\$755,000 \times 3.7908$ (present value of annuity at cost of capital for five years) = \$2,862,054

Present Value of Range of Benefits = \$2,350,296 - \$2,862,054

The resulting range of benefits then can be compared to the incremental costs of a live presentation with slides; the difference between the benefits and incremental costs is the net benefit or net loss.

Company A must then determine *ex ante* the net benefit of video. The determination can be compared with the net benefit of a live presentation with slides; the alternative with the highest net benefit represents the better choice. However, determination of the best choice requires that all other media alternatives for achieving purposes be compared for benefits. It may be possible to obtain benefit determinations from other organizations in the same or related industry that use media alternatives (e.g., audiotape with slides).

Ex post measure benefits in the same way as *ex ante* and compare benefits for each media alternative, except that determination of effectiveness is based on actual past performance or observation of present on-the-job performance. While estimates would not have to be made regarding the percentage of those performing the task(s) at minimum standards of performance and the percentage of the task(s) performed, observation itself reflects an estimate (although such an estimate stands to be more precise than that of *ex ante* methods). Therefore, *ex post* findings also should be presented as a range.

In *ex ante* and *ex post* measurements of benefits, find the benefits for each

year based on the dollar value of the increase in productivity (either estimated based on the probability assumption that the benefit is equal to increase in productivity or based on past data). Determine the benefits for the same finite number of years used in determining incremental costs and discount benefits using the same cost of capital or interest rate.

Net Benefits

The net benefit of media package is determined by subtracting incremental costs from the benefits. However, because the benefits should be presented as a range, the resulting net benefit also should be expressed as a range.

The next step would be to compare incremental costs and benefits for each media alternative; the medium with the largest net benefit should be selected. The resulting ranges provide useful comparative, although not precise, measurement for users and potential users to analyze and select media packages in the decisionmaking process. Alternatives with small differentials, or any overlap, in net benefits would indicate more or less equal choices.

Discussion

The decision-model has been developed in the format of a taxonomy so that costs and benefits can be systematically compared. However, the potential and present video user should be aware that each component of the decision-model contains varying degrees of uncertainty.

In the first component, for example, the varied purposes for using video present problems in the measurement of benefit variables (e.g., performance of task, dollar value of the increase in productivity for one receiver realizing objectives in some predetermined way). The problems differ in magnitude for each purpose. Thus, it would be easier to measure benefit variables for a training program (measuring the performance of specific tasks) than such other video messages as employee orientation and news, community and public relations, and management communications (measuring attitudes, image, and style).

Determining alternative ways of achieving purposes is limited by the inability to pair media with message types; that is, selecting the medium most suitable for conveying the message. Previous research is inconclusive (e.g., Anderson, 1972) and intuition of media specialists may not be accurate.

The cost variables component is subjected to uncertainty created by changing prices and unavailable information necessary for production-distribution-reception and service decisions. For example, manufacturers' suggested prices and specifications do not include some of the information necessary in deciding to purchase the products of one manufacturer or the other (e.g., manufacturers claim life expectancy of videotape depends partly on storage conditions but do not specify temperatures and humidity, each manufacturer has its

own copyrighted formula of chemicals used in the making of videotape but does not specify either chemicals used or such test results as the number of "passes" in playback before videotape depreciates other hardware). Furthermore, most reports of business and industry use of television suggests that videotape can be erased and re-used as often as practical needs require (e.g., Barwick & Kranz, 1975; Brush & Brush, 1977). However, there are those who disagree (e.g., Kelly, ITV engineer at University of Illinois in a personal interview, 1978) because re-used videotape can damage recorders and playback machines and therefore, this practice should be reflected in amortization schedules and service costs.

The benefit variables component does not account for either media attributes or individual differences of receivers. Moreover, there may be relevant attributes of media that *interact* with individual differences to effect learning (e.g., Salomon, 1970; Clark, 1975) and this interaction is not considered in the decision-model.

Receivers' *access* to messages also is not considered in the decision-model. The ability of receivers to review and study messages may be a function of the medium selected; consequences of access would be reflected in benefit variables, benefits, and net benefits.

In the sixth component, inefficiency in performance or test scores can be quantified and added to costs of labor and to either the costs of training new personnel or retraining those who scored poorly, although it would be difficult to determine whether the fault lies with the media package, the message, the receiver, or some other variable in the communication process.

Incremental costs and net benefits are affected by the uncertainty of other components discussed above.

Summary and Conclusions

Selecting media for cost-effective use requires systematic analysis of costs and benefits in the decisionmaking process

Video, in particular, represents a major investment of dollars and must be a "managed" function within the organization. The decision-model has been developed in the format of a taxonomy to provide guidance in the direction for potential and present users of video, although it can be used in the selection of various alternative media packages.

The starting point is setting well-defined goals. Other components of the decision-model—cost variables, incremental costs, benefit variables, *ex ante* or *ex post* benefits, and net benefits—then can be determined. The net benefits represent benefits minus incremental costs and should be expressed as a range.

Because each component contains varying degrees of uncertainty, the decision-model should be viewed as nothing more than a guide.

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