QUANTIFYING THE BENEFITS OF A NEW GENERAL AVIATION AIRPORT: A RETURN ON INVESTMENT APPROACH

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Summary

This paper examines a return on investment approach for comparing the benefits and costs associated with an airport investment, as an alternative to traditional benefit cost methodologies. It provides background information on the rationale for the construction of a new general aviation airport in the Phoenix area; points out the weaknesses in benefit-cost methodologies that are used to justify such a project; and explains the application of a return on investment approach. The airport investment is viewed in terms of its contribution to net social welfare, rather than from an airport advocacy or purely local perspective.

Introduction

The purpose of this paper is to demonstrate the application of a return on investment methodology in assessing the need for a new general aviation airport. To facilitate the analysis, a case study of a proposed new general aviation facility in the Phoenix metropolitan area will be examined.

The basic premises upon which this analysis rests are:

- To maximize the net social welfare, it is necessary to optimize the allocation of scarce resources. This entails making investments that yield the greatest return.

- Airport construction is only one of a broad range of investment options which offer net societal benefits. Therefore in this analysis, the benefits and costs of airport investment will be gauged in terms of their contribution to society as a whole.

- The fact that an airport does not yield a reasonable return on investment, or even fails to cover its costs, does not necessarily preclude its construction. It simply means that the local government sponsor will need to determine whether the airport is of high enough priority to warrant subsidization.

This paper is organized into four major sections. The first section provides the background information on the need for a new airport, and makes assumptions about the scope and utilization of the facility. The next part of the paper examines the traditional benefit-cost methodology that is used to justify construction, and points out its weaknesses. The third section explains the use of the return on investment approach as an alternative means of measuring benefits and costs. The last section of the paper draws conclusions on the application of the return on investment approach, as well as the feasibility of new airport construction.

Background

In 1979, the Maricopa County Regional Aviation System Plan projected a severe shortage of airport facilities in the Phoenix area, and recommended the expansion of existing airports and the construction of new ones to accommodate anticipated demand. In addition to new runways at Mesa, Chandler and Buckeye, the plan proposed a new full service replacement airport on the west side and two training strips on the east side.

Concurrent with the completion of the plan, Apache Junction, a rapidly growing community east of Phoenix, expressed an interest in sponsoring the construction and operation of a new general aviation airport. Because the implementation of any regional aviation plan rests upon the availability of willing airport sponsors, the community's interest was supported by both state and metropolitan area officials. Apache Junction proceeded to hire a consultant to undertake a site selection study, determine initial airport development requirements, and analyze the financial feasibility of such a project. The study recommended a particular site for the development of a general utility airport which would ultimately be expanded to serve a basic transport role. It was assumed that initial airport construction would be completed in 1984.

While the Regional Aviation Plan and Apache Junction Site Selection and Master Plan Study (1) suggest a "need" for constructing a new airport on the east side of Phoenix, neither provide any real economic justification. The fact that capacity shortages presage the development of a new airport does not necessarily mean that such an investment represents the most productive use of local resources. In order to determine whether a new facility is warranted, the following analysis will examine procedures for comparing the net benefits of an investment with its costs.

It should be emphasized that although the analysis draws upon information furnished in the Apache Junction Plan to facilitate the compilation of needed data, the case study airport is a hypothetical facility. It differs from the proposed Apache Junction site because it is only developed to general utility standards (capable of handling aircraft under 12,500 pounds). This is consistent with the fact that three existing airports on the east side of town have proposed lengthening their runways to basic transport standards (accommodates business jets up to 60,000 pounds); and that the construction of an additional basic transport facility nearby may not be warranted.

Traditional Benefit-Cost Methodology

The purpose of developing a benefit-cost analysis is to compare the present dollar value of anticipated net benefits resulting from a proposed investment with its costs. Where the measure of benefits exceeds costs, the investment is normally considered viable.

In theory the net benefits that a new general aviation airport offers can be expressed in terms of the following formula:

$$B/C_a = \frac{B_a + B_u + B_c}{C_a}$$

Thus the benefit-cost ratio of constructing a new airport is equivalent to the sum of the net benefits to the airport operator (B_a), the airport user (B_u), which includes pilots and their passengers, and the local community (B_c), divided by the cost of constructing the airport (C_a). All benefits and costs are discounted to present value to allow uniform and legitimate comparisons.

Benefits to the users are equated with the value gained as a result of the enjoyment of airport services. This value includes the prices that users actually pay for the airport services, as well as that increment of value between the prices paid, and the prices that they would be willing to pay. The user fees paid are equivalent to the minimum value that the airport user places on the service. Any additional value that he or she derives from the service is a benefit beyond the price paid, which is referred to as consumer surplus.

Two problems arise in attempting to quantify B_u based upon prices paid. First of all, whereas consumer surplus may exist, there is no precise method of measuring it. Second, because the prices airport users pay are also equivalent to the revenues that the airport operator receives, aggregating these benefits would lead to double counting.

Another method that has been utilized to estimate user benefits is to determine the time savings realized from travelling by air from a given airport rather than using an alternative facility or an alternative means of transportation. Many studies attempt to estimate those time savings, and then place a dollar value on an individual's time to compute monetary benefits. The problem with this procedure is that it is difficult to accurately quantify the time savings that will be realized since assumptions must be made about the traveller's origins and destinations, and the alternative mode that will be used. Additionally, because of the substantial variation in the type of individuals using the airport, it is also difficult to determine the average value of an individual's time.

Another shortcoming is that the time savings advantages that the pilots and passengers realize are normally reflected in the user fees they pay, which are captured in the airport operator's revenue streams. Thus attempting to incorporate the dollar value of time savings would result in the double counting of benefits.

The third category of benefits, benefits to the community, are the direct and indirect employment impacts resulting from the construction of the airport. Direct employment impacts stem from the number of employees and associated payroll required to operate and maintain the airport. A major fallacy which often arises when attempting to measure these impacts is that the greater the number of jobs and value of payroll associated with the airport, the larger the net benefits. This, however, is inconsistent with the fact that the jobs and salaries reflect a cost of doing business, and greater costs sacrifice efficiency and undermine the viability of the enterprise.

Indirect employment impacts are reflected in the jobs created by industries established or relocated to the area as a result of the existence of the airport. In attempting to quantify these impacts, it is important to define the geographical area for which they will be measured. From a purely local perspective, industries which relocate from another part of the state generate benefits. From a state and federal perspective, however, these would be viewed as a mere redistribution of benefits. Because benefit cost analyses are normally conducted by individuals who have a local perspective, the benefits quantified may reflect distributional rather than net gains.

A problem with estimating the indirect employment benefits derived from constructing the airport is that most analysts fail to deduct the indirect benefits that would be generated by an alternative investment. Thus the benefits measured are not <u>net</u> benefits. However, since there is no way to accurately estimate the number of jobs and level of salaries that would be created by a hypothetical alternative investment, attempts to deduct for other employment effects would be difficult to operationalize.

Because of the problems inherent in quantifying the benefits of a particular investment using the traditional benefit-cost methodology -- double counting, failure to deduct opportunity costs, tendencies to count redistribution as net benefits, and the inability to quantify certain benefits -- its application results in distortions and leads to a misallocation of resources. From the analysis above it is evident that the only portion of the benefit-cost formula that can be implemented is that part which deals with the benefits to the airport operator in terms of net income. Since the net income generated by an airport is a measurement of the value that users place on the enjoyment of airport services, net cash flows (revenues less expenses or R-E) over the life of the project may be substituted for $B_a + B_u + B_c$ without sacrificing the theoretical validity of the formula.

It must be recognized that the benefits measured by net cash flow will be considered very conservative since consumer surplus and intangible benefits are generated by most investments, even if they cannot be accurately measured. However, since this conservatism can be applied across the board to all uses of capital as evaluated in return on investment analyses, the comparison of resource utilization options will be both simple and equitable.

<u>Return on Investment Approach</u>

In order to utilize the newly derived formula,

$$B/C_a = \frac{\Sigma\ R-E}{C_a}$$

for comparing the costs and benefits of the case study general aviation airport, it is necessary to estimate the future revenue streams generated by the airport, the cost of operating and maintaining the facility, the appropriate discount rate for converting future cash flows to present value, and the cost of constructing the airport.

The revenues generated by the airport are derived from fees charged for the usage of its facilities. User fees include fixed based operator leases, terminal building rentals, hangar rentals, tie-down fees, and fuel fees. The rates should be determined by the demand for airport facilities in order to maximize total revenues. However, failure of nearby airports to charge fees which cover fully allocated costs may impede efforts to set reasonable charges. In this analysis it is assumed that as the demand for airport facilities increases and the pressure for local governments to become more efficient intensifies, user fee levels will approximate market levels.

Airport expenses include those costs associated with the operation and maintenance of the facility. These are typically categorized as administration, maintenance, utilities, and supplies. A survey of airports in the Phoenix area was used to approximate these costs.

Table 1 displays the annual airport operating revenues, expenses and net income in 1981 dollars. By limiting the case study airport's functional classification to general utility, costs associated with maintenance and utilities are minimized, although some revenues associated with larger aircraft usage are also sacrificed. The principal reason for limiting the scope of construction is to minimize the capital investment costs.

Table 1 reveals that the sum of the annual differences between airport revenues and expenses over a 20-year period, yields a net income of $4,322,224 in 1981 dollars. In order to make

Table 1. Revenues, expenses and net income (1981 dollars).

Year	Revenues	Expenses	Net Income
1982	-	-	-
1983	-	-	-
1984	42,600	32,500	10,100
1985	169,800	86,000	83,800
1986	192,800	86,500	106,300
1987	211,300	87,500	123,800
1988	288,900	112,613	176,377
1989	306,280	114,075	192,205
1990	332,215	115,538	216,677
1991	416,430	126,825	289,605
1992	416,430	126,825	289,605
1993	416,430	126,825	289,605
1994	416,430	126,825	289,605
1995	416,430	126,825	289,605
1996	485,190	157,700	327,490
1997	485,190	157,700	327,490
1998	485,190	157,700	327,490
1999	485,190	157,700	327,490
2000	485,190	157,700	327,490
2001	485,190	157,700	327,490
	$6,537,275	$2,215,051	$4,322,224

Source: Apache Junction Airport Site Selection and Master Plan, October, 1981. Figures have been adjusted to reflect the reduced scope of the airport.

Future cash flows more meaningful, the net income figures should be adjusted to account for inflation. Based on current trends, the inflation rate is assumed to be 10 percent and 9 percent in 1982 and 1983 respectively, and 8 percent each year thereafter. (See Table 2 for inflation adjustment.)

Once the net income has been determined, it is necessary to select an appropriate discount rate to adjust future cash flows to reflect present value. The discount rate should be equivalent to the cost of capital based on current market conditions. Since the case study airport will be financed solely by bonds, a review of general obligation bonds for comparable communities, and revenue bonds for airport facilities should be assessed. Interest rates obtained from Moody's Municipal Bond Index, may then be modified to take into account the relative risk of the proposed capital investment, versus alternative investments.

Tht discount rate derived in the above manner, in this case 15 percent, consists of three components: a real rate of interest, estimated by economists to be approximately 3 percent annually; an inflation premium assumed to be 8 percent; and 4 percent reflecting the risk premium assigned to the particular investment option. By utilizing a discount rate equivalent to the market cost of capital, the social opportunity costs of the investment are considered. Table 2 depicts the inflated net income and the application of the discount factor used to determine the present value of those cash flows.

> "The advantage of using a discount rate that incorporates real interest, inflation and risk, is that it makes this analysis applicable to any other potential or actual alternative investment. This is an improvement over standard benefit-cost methodologies

Table 2. Discounted cash flows.

Year	Net Inc. 1981 $	Infl. Rate	Infltd. Net Inc.	Disc. Factor*	Present Value
1982		10%		.870	
1983		9		.756	
1984	10,100	8	$ 13,080	.658	$ 8,607
1985	83,800	8	115,476	.572	66,052
1986	106,300	8	160,513	.497	79,775
1987	123,800	8	202,042	.432	87,282
1988	176,377	8	310,766	.376	116,852
1989	192,205	8	365,766	.327	119,605
1990	216,677	8	445,271	.284	126,457
1991	289,605	8	642,633	.247	158,730
1992	289,605	8	694,183	.215	149,249
1993	289,605	8	749,498	.187	140,156
1994	289,605	8	809,736	.163	131,987
1995	289,605	8	874,317	.141	123,279
1996	327,490	8	1,067,945	.123	131,357
1997	327,490	8	1,153,420	.107	123,416
1998	327,490	8	1,245,444	.093	115,826
1999	327,490	8	1,345,329	.081	108,972
2000	327,490	8	1,452.746	.070	101,692
2001	327.490	8	1,569,004	.061	95,709
					$1,985,003

* Assumes 15% cost of capital discount rate

Source: Apache Junction Airport Site Selection and Master Plan, October, 1981

which either fail to recognize or distort the element of risk when assessing government projects. The fact that the government may be able to borrow at lower interest rates is not a true measure of reduced risk. Rather it is an indication of the fact that the risk of revenue shortfalls is shifted from the investment project to the general taxpayer. Use of the market rate of interest overcomes this shortcoming and produces a true social opportunity cost comparison." (2)

The last item in the calculation of the benefit-cost ratio using a return on investment approach is the computation of the cost of airport construction. In order to minimize costs, the case study airport is only developed to general utility standards. This is considered more cost effective than providing 3000 feet of additional runway to accommodate sparse operations by large aircraft.

The general dimensions of the airport and major facilities upon which construction costs are based are shown in Table 3. It is assumed that the airport usage will grow from 70 based aircraft and 56,000 operations to 175-200 based aircraft and 163,000 operations during the twenty year period.

Since construction occurs in three phases, it is necessary to adjust future construction costs to reflect inflation and then discount those costs to present value. Costs of phase 1 construction are assumed to be equitably distributed over the 1982-1983 period; phase 2, over the 1986-1990 period; and phase 3, over the 1991-1995 time period (see Table 4).

Table 3. 'Airport development requirements.

Land:	300 acres
Runway:	4600 x 75
Parallel Taxiway	4600 x 40
Navaids	VOR, VASI, REIL
Lighting	MIRL, MITL, Threshold, Lighted wind indicator, beacon
Hangar & Hangar Apron	180 miscellaneous types depending on aircraft storage requirements.
Parking Apron	300,000 square feet
Terminal Building	10,600 square feet
Auto Parking	281 spaces

Source: Apache Junction Site Selection and Master Plan Study, October, 1981.

The benefit-cost ratio may now be derived and is equivalent to the present value of the net benefits $\Sigma(R-E)$ or \$1,985,003, divided by the present value of airport construction costs, \$4,982,549. This yields a benefit cost ratio of 0.4.

A benefit-cost ratio of less than one, generally signifies that the investment is not warranted. The net income generated by it is insufficient to cover the initial construction costs and the cost of capital from a broad societal perspective. However, prior to rejecting the construction outright, it may be worthwhile to perform a sensitivity analysis in which assumptions are modified and their impacts on profitability gauged. For example, if the cost of capital declines, the present value of cash flows may be bolstered enough to push the benefit cost ratio above one. Similarly, if the level of traffic forecast to use the airport increases from the projected 163,000 operations to 250,000 operations, and additional revenues may make the airport investment viable. On the other hand, if the discount rate utilized is too low or the traffic projections too high, the construction of the new airport may become less attractive than already suggested by the benefit-cost ratio.

Another approach to modifying the ratio is to examine ways to increase revenues and minimize costs. While the airport operator should charge the highest user fees the market will bear, excessive fees may discourage usage and actually reduce total revenues. The ability to minimize airport operating costs is limited because of the fact that fixed costs account for a large portion of the total operating budget. For example, a three-man administrative staff will probably be needed regardless of the usage and scope of the facility.

The greatest prospect for cost savings lies in reducing initial airport construction costs. Decreasing the width of the runway and utilizing less expensive airport equipment than that dictated by Federal Aviation Administration (FAA) standards can generate substantial cost savings. Although FAA construction specifications may preclude such cost-effective measures, the FAA has been known to grant waivers relieving sponsors of the obligation to comply with airfield dimensional requirements.

Even if the sensitivity analysis and attempts to bolster revenues and decrease costs fails to push the benefit-cost ratio above 1, the construction of the facility may still be undertaken -- at least from a local perspective -- if the intangible benefits it offers the community warrant its subsidization. As mentioned previously, the ratio derived through the return on investment approach is a conservative estimate of the net benefits of an investment, because it does not include consumer surplus benefits and other impacts which exist but defy quantification. Thus, a benefit-cost ratio less than one may warrant the construction of the facility.

Conclusion

This paper has demonstrated that the shortcomings in traditional benefit-cost methodologies produce distortions and lead to a misallocation of resources. The use of net income as an indicator of the benefits generated by an investment is a much more accurate method for judging the relative merit of an array of potential construction options.

The application of this return on investment approach has resulted in the conclusion that the hypothetical airport construction is unwarranted from a broad societal viewpoint. However, had a local perspective been used, the investment would have yielded a benefit-cost ratio greater than one. This is principally due to the fact that only the local sponsor's share of airport construction costs would have been used in the denominator of the benefit-cost ratio; and a lower discount rate would have been used, reflecting the interest rate on local general obligation bonds, rather than the true market cost of capital.

Table 4. Airport costs discounted to present value.

Year of Construction	Total Costs 1981 $	Infl. Rate	Inftd. Costs	Disc. Factor*	Present Value Costs
1982	1,982,750	10%	2,181,025	.870	1,897,492
1983	1,982,750	9	2,377,317	.756	1,797,252
1984		8		.658	
1985		8		.572	
1986	217,116	8	327,845	.497	162,939
1987	217,116	8	354,333	.432	153,072
1988	217,116	8	382,558	.376	143,842
1989	217,116	8	413,172	.284	117,341
1990	217,116	8	446,173	.247	110,205
1991	284,184	8	630,604	.215	135,580
1992	284,184	8	681,189	.187	127,382
1993	284,184	8	735,468	.163	119,881
1994	284,184	8	794,578	.141	112,035
1995	284,184	8	857,951	.123	105,528
					$4,982,549

*Assumes 15% cost of capital discount rate

The major conclusion of this paper is that techniques for measuring the benefits of government investments are subject to manipulation, and generate benefits that vary with the investor's perspective. The return on investment approach offers a much more consistent approach for evaluating a series of investment options whether they are airport related or not.

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