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THE ECONOMICS OF RESOURCE-SHARING NETWORKS

BRUCE ROYAN

"We have always known that heedless self-interest was bad morals; we now know that it is bad economics" (Roosevelt, 1937)

In common with other Newly Industrialised Countries (NICs), Korea is fast becoming an Information Economy. And if information is being treated more and more as a tradeable commodity (Rochell, 1985), it is increasingly important that librarians should study economics in so far as they affect libraries (Cummings, 1985), and especially in so far as they affect the trading of this commodity; the sharing of this resource (Carrigan, 1988).

Now I cannot give you a crash course in Economics in the hour or so at my disposal, and I wouldn't be qualified to do it anyway. And I will not give you an assessment of the potential for library resource sharing in Korea since that has been very adequately done already (Ede, 1989). What I will try to do is to give you a series of tastings of economic techniques and concepts as applied to examples of resource sharing, and in particular to resource sharing in library networks.

For your hors d'oeuvre, I will offer a selection of two types of Resource-Sharing. The main course will be based on my experiences with the Singapore Integrated Library Automation Service (SILAS) and will contain quite a meaty presentation of how to judge the economic efficiency of resource sharing on such a scale. For dessert, we look from an economic viewpoint at some further library resource sharing activities. And as a final savoury titbit we have a discussion of one of the problems of costing resource sharing activities with a view to charging for them. Bon appetit!

TWO TYPES OF RESOURCE-SHARING

"Cooperation may not be easy, but it sure beats the alternatives" (Dwyer, 1986)

There are two broad types of Resource-Sharing. Organizations may pool their resources to achieve a common goal or one organization with a unique resource may decide to share it with others.

Organizations may agree on a scheme of resource-sharing to achieve economies of scale. For example, in the mid 70s a group of libraries in Scotland got together to buy a computer and develop a network and a library automation system that no one library could at that time have afforded on its own (Royan, 1978). The problem with such cooperatives is that they tend to fall apart unless some central agency can be jointly set up to run them.

Sometimes, a library setting up a system for its own purposes, nevertheless decides to network its services to other libraries
In order to bring in a contribution to its running costs. Such was the case with MERLIN, the British Library's Machine Readable Library Information Network (Royan, 1976). The problem with such networks is that the host institution may be accused of acting in its own interests rather than those of its client libraries.

These two types of resource-sharing networks can also be seen in non-library applications, and outside the public sector. In the private sector, resource-sharing networks tend to be called Interorganizational Systems (IOS). The international bankers' funds transfer system SWIFT and the international travel agents' system SITA are two examples of our first type of IOS (Langdale, 1984). Both are run by "IOS facilitators", that is, firms which act as intermediaries between their various client organisations.

Cash (1985) describes the other type of IOS, which is operated by one of a number of competing suppliers in an industry, and which serves its competitors as well as the industry's buyers. An example is United Airlines' APOLLO airline reservation system. APOLLO has a near-monopolistic dominance (75% of travel agents) in some parts of the USA, and this gives United control over which of its competitors can participate in online reservations, as well as exclusive access to statistics on its competitors' fares, flight occupancies and market share. Cash concludes that such an IOS can shift the balance of power between supplier and buyer and also allow the operator unfair advantage over its competitors.

SILAS: A COST BENEFIT ANALYSIS

"... the price of everything and the value of nothing" (Wilde, 1892)

One IOS, which I hope readers will believe to be rather more benign than the above example, is the Singapore Integrated Library Service, SILAS. SILAS is described in detail elsewhere (Lai, 1988). In summary, it is a national bibliographic source and resource-sharing tool currently providing some 35 institutions with online access to more than 5 million titles of books, serials and audiovisual materials from all over the world, 10% of which already have Singapore holdings recorded for them.

It is probable that some form of charging system will eventually be devised for SILAS. The matter is still under discussion but the eventual system is likely to be simple to administer, set to recover the direct costs of providing the service, and structured to encourage usage beneficial to the national information network. In the meantime, SILAS is centrally funded as a public good, and usage of SILAS is free of charge. This has prompted one commentator from another Asian country to suggest that SILAS is "an expensive experiment".

This is perhaps a little unfair. The Government Committee on Project Expenditure (COPE) which approved the project in 1984 is
noted for its lack of rigour. Furthermore, for the latter part of FY 87, the project was subject to the scrutiny of the Internal Systems Audit Section of the National Computer Board (NCB) during which time a full Cost-Benefit Analysis (CBA) was performed according to the new NCB guidelines (National Computer Board, 1987). The analysis concluded that in addition to the intangible benefit of improved access to the library resources of the nation, SILAS would result in annual tangible benefits of $1,432,000 for an annual project cost of $1,174,000, giving net tangible benefits of $258,000 per year.

The "Meccano set of economic techniques" used to reach such a conclusion has its critics (Mishan, 1984), but it does have the advantage of being a widely accepted means of comparing alternatives, or of gauging the economic efficiency of a single project or service. Some of the main techniques and concepts are therefore discussed below.

Sunk Costs Costs which have already been incurred at the time of an evaluation, cannot be recouped whatever its outcome, and are therefore considered to be 'sunk'. Sunk costs are usually left out of the evaluation. In the case of the SILAS CBA, it was decided to act as if the analysis were taking place at the time of the COPE decision in 1984, rather than in 1987. Thus the costs of the consultancy study and other work leading to the COPE paper were treated as sunk costs, but costs such as that of the WLN software for SILAS (purchased before 1987, but after 1984) were included in the analysis.

Economic Life Each of the assets of a computer project is assumed to have an economic life, after which the cost of replacing it has to be met, eg the economic life of a microcomputer, is set at just 4 years. The salvage value of assets at the end of their economic lives is assumed to be zero.

Constant Prices and Present Value The possibility of future inflation is ignored when estimating future costs and benefits. On the other hand, the reality that cash today can be invested and is therefore worth more than cash at some future date, is dealt with by discounting all cash flows back to present values using standard nominal discount factors.

Annual Equivalent Having brought each cost and benefit back to present value, it is then possible, by applying the appropriate annuity factor, to establish what the annual equivalent of this cash flow is. For example, the cost of SILAS workstations was estimated to be $210,000 in year 2 plus $672,206 in year 3. Applying discount factors (taken from a table) the present value of these two costs is $201,846 plus $633,433; that is $835,279. But these items only have an economic life of 4 years, so applying the appropriate annuity factor (from another table) the annual equivalent cost is found to be $219,365.

The purpose of all this is to measure the economic efficiency of the project by bringing all costs and the cash value of every benefit onto a common basis so that they can be compared. If the
benefits outweigh the costs the project is said to be economically efficient. The only real problem: how to put a cash value on all of those benefits?

PUTTING A CASH VALUE ON BENEFITS

"Money don't get everything, it's true, but what it don't get, I can't use" (Gordy, 1959)

From the CBA point of view, it would have been easier if a charging system for SILAS were already in place. Most of the benefits would be in terms of estimated cash revenue, and the calculations would have been relatively easy. As it is, the benefits that were actually identified, and the way in which cash equivalents were estimated for them, may be of interest to librarians involved in similar exercises.

There are two broad categories of benefit: tangible benefits, which can be measured in cash terms, and intangible benefits, which cannot. It is of the utmost importance in these exercises to render as many of the predicted benefits as possible in tangible terms. Only the tangible benefits will be included in the final comparison of annual equivalent cash flows which is the main criterion of economic efficiency. To be sure, the decision-maker always has the right to say "In my judgement the intangible benefits that are predicted for this project are worth the net costs", but it is very much easier to say "this project has been shown to yield net tangible benefits".

There are four categories of tangible benefit. Increase in revenue (IR) would have been the easiest to quantify, had SILAS had a charging system. Actual Cost Reduction (CRA) is potentially the most dangerous of the categories; it signifies savings (normally manpower savings) which can actually be realised. There is a tendency when attempting to justify projects to be on the optimistic side in estimating the extent and the timing of any savings. All estimates should in any case be evaluated during a Post Implementation Review (PIR) which has to be completed within 6 months of implementation, but CRA estimates may result in deleted posts, whether the work is actually saved or not. In one case known to the author a library predicted a particular course of action would save 26% of the staff. The posts were deleted on the predicted implementation date. The remaining staff had tremendous difficulties keeping up with the daily workload on an unfamiliar system and with severely reduced numbers. If staff cuts can be offered it is important that they should be timed for a suitable period after implementation, to allow for the inevitable teething troubles and settling in. This is perfectly acceptable within the CBA cash flow format. Nominal Cost Reduction (CRN) relates to savings of actual costs which cannot however be realised. For example if the one professional staff of a small library spends half her time cataloguing, and it is expected that resource sharing will reduce this to one quarter of her time, this is a tangible saving (she now has a quarter of her time extra for other professional
activities, eg user service) but it is not realisable (one quarter post cannot be deleted).

The final tangible benefit and indeed the only one that SILAS claims to offer, is Cost Avoidance (CA). SILAS offers some 5 CA benefits. The greatest of these is the ability to handle an expected intake of some 60% more titles with no increase in the number of cataloguing staff. This estimate was based on figures compiled in 1985 for the 1984 intake plus the expected increase for each SILAS library over the following 5 years. Like every other element of the CBA it had to be compared during the FPR with what actually happened. Fortunately, the promised Cost Avoidance was more or less achieved. It does appear that the SILAS libraries catalogued some 55% more titles in 1988 than they did in 1984, with a 7% reduction in full time equivalent cataloguing staff. To establish the cash value of this increase in cataloguing, the number of books catalogued was simply multiplied by the cost of cataloguing one book. There are two basic techniques of establishing a cataloguing cost (Leung, 1987); bottom-up (analyse and time each element of the cataloguing process) or top-down (divide the number of titles actually catalogued by the number of cataloguers in post). The CBA figure of $14.97 per title was derived from a bottom-up technique.

It may be argued that the increase in the number of titles catalogued would have happened whether there was a SILAS or not, and that the same number of cataloguers would have coped somehow, SILAS or no SILAS. Both these statements may be true, the latter possibly because of what this author likes to call "Parkinson's Law of Cataloguing":

"The number of descriptive elements and access points in any catalogue record expands so as to fill the time available for its completion" (after Parkinson, 1958).

Nevertheless, it is also true that in 1984 this massive increase in workload was predicted, and SILAS was proposed as the means of coping with it without compromising standards.

A second CA benefit was a reduction in cataloguing backlogs (Share, 1986). Working on 1984/85 figures a projection was made that the implementation of SILAS would reduce backlogs in the first 20 participant libraries by a total of some 40,000; equivalent to 3 months intake. The annual equivalent value of this benefit was based on the interest that would have had to be paid if the libraries had taken out loans in order to buy the books 3 months earlier and gain similar improvements in currency.

The next CA benefit dealt with the provision of additional access to library's catalogues, both in terms of extra sequences and in terms of additional service points where they might be consulted. The provision of extra access has indeed happened; one library now provides catalogue access from some 700 terminals, but again it might be argued that with the provision of local systems this would have happened anyway. It was however expected that no-one would object to a modest claim that 5 of these extra access points could be attributed to SILAS. These were then costed on
the basis of a hypothetical manual system, ie photocopying and filing 5 extra copies of each catalogue card.

A fourth CA benefit was the provision of an online union catalogue. This was costed on the basis of one extra copy of the fictitious 'card catalogue' plus one Library Technician to answer phone calls and search it.

The final CA benefit was to do with cooperative acquisitions, or at least with informed decision-making at the acquisitions stage. It was assumed that half of one percent of the purchase decisions of SILAS libraries might be altered by the available information that particular expensive or marginal texts were already available in other SILAS libraries. This was expressed as a saving of opportunity costs on the basis of spending available funds on books unique in Singapore rather than duplicate holdings.

There are also four categories of intangible benefit; to the Civil Service (BC), the Public (BP), the Organisation (BO) and the Nation (BN). However important such benefits might be, since they could not be expressed in cash terms they were not included in the all important cash flow comparison referred to above.

The paragraphs above have described the economic analysis of a typical bibliographic resource-sharing network. But shared cataloguing is not the only resource-sharing activity, although it may be regarded as an enabling tool for some of the others. The next section considers other library resource-sharing activities, from an economic viewpoint.

THE ECONOMICS OF INTERLENDING

"Neither a borrower nor a lender be.
For loan oft loses both itself and friend ..." (Shakespeare)

Once a library network is available to tell enquirers online both which libraries have a particular item and whether it is worthwhile asking to borrow it, the number of interlibrary lending (ILL) requests is likely to increase. In these circumstances, the larger libraries may fear that they may lend more books to other libraries than they themselves borrow (Lovesy, 1981). In the US, there is some dissent between the "net borrowers" and the "net lenders", (Heitshu, 1988) with the latter even using the term "resource rape" to describe the phenomenon (Kittle, 1986).

It is possible to quantify the disadvantages of a net loan in economic terms:

- The processing of the loan can be costed. (Note however that if the loan request came as a result of a network search the item's call number will already be quoted, eliminating the need for a local catalogue search to be costed in).
The risk of losing the item while on loan can be quantified. If the probability of loss is 2% and the replacement cost of the item is $100, the "cost" of this risk for decision making purposes is $2.

The reduction of service to a library's own patrons can be factored in. This would be a function of the probability of the item being demanded while on ILL, and the utility to the reader of the item being available on demand.

Against these costs there are some benefits which could be argued for the net loan:

- They increase the utilisation of the library stock, helping to justify the money spent on it and increasing the benefit to the nation.
- They provide a channel for requests that might otherwise go direct from the prospective reader to the lender; an exception condition likely to be more costly than ILL itself.

Nevertheless the economic impact of an increase in interlending is causing increasing concern (De Gennaro, 1986). The argument has been made that fees should be charged for ILL (Stuart-Stubbs, 1984):

- To generate revenue so as to recover the processing costs or purchase more items for the collection.
- To serve as a measure of value.
- To ration demand.

Sweetland and Weingard (1986) have demonstrated transaction fees do not have an appreciable effect on the total level of interlibrary loan traffic, and are perceived as an equitable means of raising the money to pay the cost of resource-sharing. However, this argument has less relevance in these countries where many libraries still operate on the Vote Accounting system inherited from Colonial times, under which any revenue obtained from ILL fees would not be available for library use but would go straight back to the Treasury (Wicks, 1988). Many other arguments, less pragmatic but possibly more altruistic, have been put forward against charging for interlibrary loans (Richardson, 1984).

In any case, it is difficult to predict who the net lenders and net borrowers in the system will be. One recent study (Abbott, 1986) indicated that when 20 libraries were linked in an electronic ILL network, the six largest libraries, previously net lenders, became net borrowers as more of the small and medium libraries shared the interlending load. It is premature to come to a final conclusion as yet, but first indications are that much of the more specialist material that makes up the bulk of ILL requests is just as likely to be held by a small library as a large one, and indeed may be held only by a small library in some cases. Thus the increased knowledge of holdings made possible by network access may even decrease the number of ILLs for some
libraries and will certainly decrease the number of abortive ILL requests for material they do not hold.

Perhaps in the future, libraries will encourage use of networks and discourage ‘blind tries’ by charging, as Columbia University does, for ILL requests for material they do not hold (Thompson, 1980). This is akin to certain motels that charge buffet guests for any food taken but uneaten; a radical but effective way of reducing waste!

"... And borrowing dulls the edge of husbandry" (Shakespeare)

There is a tendency to forget that, when photocopying and postal charges are taken into account, the applying library is also involved in costs for interlibrary loan, even where there is no formal fee (Smith, 1983). It is conventional wisdom to assume that in times of budget cuts libraries cancel serial subscriptions, buy less books and make more interlibrary loan requests, but a 10 year study of 12 universities in the UK shows that, with the exception of some technological institutions, this is not the case (Burch, 1987). It is as if, at times when budget cuts were affecting acquisitions, they were causing restrictions on interlibrary lending, also.

White (1987) actually goes so far as to suggest that making ILL requests should be considered, not as an emergency, ad-hoc activity, but as part of the normal Acquisition process. For periodicals the ILL is not a loan at all, but a supply of photocopies, and even for books, ILL can be better considered a form of temporary acquisition. Permanent acquisition would cost more initially, but the costs would not be repeated for each future use. White claims that such a system would work, and work efficiently, so long as the requesting library is willing to pay the true costs of each transaction as perceived by the supplier.

Without re-entering the 'fee versus free' debate, let us end this discussion by examining some of the problems of establishing what is a "true cost" for charging purposes.

COSTING AND CHARGING; HOW TO RECOGNISE OVERHEADS

"Is it a bird? Is it a plane?" (Superman, 1938)

It is a relatively straightforward thing to measure the cost of an activity, in terms of the materials (stationery etc) consumed and the manpower used. For example in Singapore, up-to-date formulae for staff costs, taking into account salary, National Wage Council Allowances (NWCA), Non-Pensionable Annual Allowance (NPAA), leave, Central Provident Fund (CPF) and Skills Development Fund (SDF) contributions, are maintained by the Management Services Department (1988), and may be consulted electronically on their bulletin board. For conversion to an hourly rate, all Singapore civil servants are assumed to work 180 hours per month.
If the purpose of the costing is to establish charges on a cost-recovery basis however, the direct cost approach may not go far enough. There are many costs (administration, accommodation, depreciation of assets, equipment maintenance and replacement, utilities etc) which though not directly attributable to any one activity, represent major unavoidable expenditure for the institution. Surely it is only fair that a proportion of these overheads should be added, to establish the full cost of an activity that is going to be charged for? In fact this is the approach used by many traditional private firms, and has been adopted, and in most cases works well, in public service organizations also.

Its rigid adoption could lead to misunderstandings and missed opportunities in resource-sharing situations however. As we have seen, some government departments share spare capacity on their computer resources with others. In general, they are all expected to be charging for these services, according to full cost guidelines (CSCP, 1988). In some cases, when the full costs of overheads have been allocated, the charges may be so high that the costs to the user would be greater than using a commercial bureau or buying an in-house machine. If such users pull out, the overheads will still have to be paid for, but the spare capacity will no longer be utilized.

To give a more concrete example, a large American resource-sharing network decided some years ago to increase its revenue by licensing its software to other networks. Over the next 4 years its average revenue from this source was US$237,000 pa and in the fifth year it brought in another US$209,200. Was the licensee programme a success? Conventional wisdom would answer, No. That US$209,200 was achieved in return for direct expenditure of US$121,278. Overall, the network estimated that its annual overheads were exceeding its direct costs, and had decided to allocate overheads at a rate of 108% of direct expenses when estimating the full costs of any programme. Looked at this way, the US$209,200 was achieved at a total cost of US$252,524, a loss of US$43,524. Yet since the revenue brought in exceeded the incremental cost of achieving it, the programme was, after all, making a net contribution towards the fixed costs of the network, of US$87,922. If the licensing programme had not been in operation, the fixed costs would still have been incurred, but the contribution would not have been realised.

AND FINALLY ...

"If all economists were laid end to end, they would not reach a conclusion" (George Bernard Shaw, Attributed)

We have viewed several resource-sharing activities from a number of economic viewpoints. There is just one more to go, and that is - what we are doing here today! In a sort of orgy of recursion, here am I discussing the fact that discussing resource-sharing with you is a form of resource-sharing itself...
And of course the economic angle is, how much is all this costing? In an apposite if pessimistic article, De Gennaro (1977) has suggested that the staff time spent in talking about resource-sharing may be costing more than any benefits derived from it! But that was 13 years ago, and the technological tools for resource-sharing are much more highly developed nowadays. Perhaps because of this, I sense a new feeling that RS is an idea whose time has finally come. Even Philip Bryant (1988), for years a sort of professional cynic on such matters, is saying it:

"It seems to me that, where exhortations for altruism may not have been totally successful in the past, there is now recognition that a greater degree of collaboration is in everybody's interests ... we can all 'win' a little!"

So perhaps I can finish this paper by quoting an older, and mellower, De Gennaro (1984):

"In the future, the excellence and usefulness of a library will be measured not only by the size and quality of its own collections, but also by the range of resources that its staff is able to deliver to users by conventional and electronic means from a growing variety of sources. Usage will no longer be limited to what a library has, but to what it can provide."
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SUMMARY

This paper introduces some economic techniques and concepts as applied to examples of resource-sharing, and in particular to resource-sharing in library networks.

Two broad types of resource-sharing are discussed with examples, followed by a detailed case study of cost benefit analysis of the Singapore Integrated Library Automation Service (SILLAS). This is followed by a consideration of InterLibrary Lending from an economic viewpoint, and the paper is rounded off with a discussion of one of the problems of costing resource-sharing activities with a view to charging for them.