DOCUMENT RESUME

ED 270 035 HE 019 349

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TITLE Effective Prototype Costing Policies in Research Universities: Are They Possible?

PUB DATE Apr 86

NOTE 18p.; Paper presented at the Annual Meeting of the American Educational Research Association (70th, San Francisco, CA, April 16-20, 1986).

PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.

DESCRIPTORS Case Studies; *Cost Effectiveness; *Experimental Programs; *Financial Policy; Higher Education; Patients; *Program Costs; Psychiatric Services; Psychological Services; *Research Universities; School Accounting; *Teaching Hospitals

IDENTIFIERS *Prototypes

ABSTRACT

Policy problems of prototype costing at research universities are discussed, based on a case study of a clinical treatment prototype program at a research university hospital. Prototypes programs generate reproducible knowledge with useful applications and are primarily developed in professional schools. The potential of using costing prototypes and characteristics of research universities that affect costing systems are considered. The case study involved a cost effectiveness study that used longitudinal microdata to track the effects of treatment. Experimental clinical treatment was provided for children at a major research university medical center. The children were observed for clinical symptoms (e.g., aggression, depression) at the time of admission, discharge, and followup. The clinical program was effective despite, not because of the university's internal management. Weak institutional integration caused by the highly decentralized university structure compounded the problems generated by concern for external compliance. Isolated departmental subcultures created conflict instead of cooperation, leading to higher transactions costs and diminishing productivity. (SW)

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HE 019 349

Effective Prototype Costing Policies in Research Universities: Are They Possible?

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Program Costing Links to Strategic Planning

This paper examines the policy problems of prototype costing at research universities. Prototypes, as defined here, are programs or projects that generate reproducible knowledge with useful applications and are primarily developed in professional schools For example, clinical treatment programs in medical centers and software development programs in engineering school have contributed to the productivity of their respective professions Nevertheless, the individual success of a particular program is often insufficiently linked to the longer term success of the university that sponsored it

Current accounting policies impede universities' strategic planning because their costing structures are driven by external funding compliance instead of internal efficiency. Consequently, the recent movement to encourage serious strategic planning is unlikely to succeed because university accounting systems cannot provide either accurate information about costs or appropriate links between costs and outputs

University accounting policies are externally centered because funding sources carefully monitor expenditure compliance Research universities and external funding sources focus on systematic monitoring of expenditures Such policies limit the university's productivity because they do not provide integrated data for planning Until research universities begin to restructure their financial information gathering, processing and reporting systems, their internal management will remain weak Such shortsightedness impedes a research university's strategic planning and restricts its capital seeking opportunities

This paper limits its consideration of program costing to prototypes Policymakers, especially at the state level, are currently showing increasing interest in reproducible university research that can increase capital and/or labor productivity. While most attention has been given to high technology, other kinds of prototypes can be analyzed

The case study examined in this paper investigated a clinical treatment prototype program at a research university hospital A detailed cost effectiveness study used longitudinal microdata to track the effects of treatment The clinical program was effective despite, not because of the university's internal management Weak institutional integration caused by the highly decentralized university structure compounded the problems generated by concern for external compliance Isolated departmental subcultures created conflict instead of cooperation, leading to higher transactions costs and diminishing productivity

The Prototype Environment

As the American economy shifts toward services, research universities may provide "greenhouses" or "incubators" in professional schools to increase the effectiveness of field practice This type of approach has been developed for technical and scientific products created by research universities (McClure 1986, Sobol 1980; Mansfield 1983) Universities provide an appropriate context for developing prototypes that increase the productivity of public and private services When these models prove effective, they can be "spun off", creating more cost effective services in the economy

More than 65% of the American GDP is in the service sector Over the next decade that share is expected only to increase; thus service sector productivity will become increasingly important (Feldstein 1980; Rumberger 1984) Research universities, with their professional school links to the service economy, may help spur economic growth in that sector Increased investments in university based prototypes that contribute to service sector productivity may provide significant private and public returns.

The university provides an appropriate culture for prototype development because it is an information-rich environment This setting reduces risks for the development of new practices by lowering the experimentation costs usually associated with research At a university with a well-developed research infrastructure, there is a wide variety of experts, computers, libraries, equipment, professional contacts and students Prototype developers in an information-rich setting can more quickly identify potential program failure and move toward correction This helps lower the marginal costs involved with investment in new programs

Theoretical work in university prototype development, **especially in finance** and **organizational** development, is almost nonexistent despite its increasing centrality in university strategic planning Research universities have until recently tended to avoid direct involvement in the arena of private sector development The genetics controversies at Harvard and Stanford serve as examples. University research, primarily defined as "basic", implies only serendipitous connections with economic growth (Thomas 1981). Managerial attention focuses on the attraction of inputs, primarily from federal agencies with only tangential interest in output returns to economic development Neither the funding agency nor the university have specific incentives to monitor returns on their investments by contribution to economic growth Rather, the emphasis is on the contribution to agency mission

Unfortunately, while this attitude may benefit both agency and researcher in the short term, it may actually impede national economic growth in the longer term. If, for example, national resources are invested in university research that contributes through traditional academic dissemination, to international instead of national capital accumulation, then national investments in university basic research can lead to returns for international economic competitors. Over time, investors seeking less leaky returns to national economic development would eschew university investments

Currently, much of the university research and economic development debate has focused on the manufacturing sector, particulary high technology (Magaziner and Reich 1983). Connections among university research, the service sector and economic development connections has been almost nonexistent Without reliable cost information, cost effective prototypes will be difficult to develop Universities use "funds accounting" systems that make actual program costing almost impossible. The recent cost effectiveness literature has not focused directly on prototypes within research institutions (Chambers and Hartman 1981, Levin 1983; Mishan 1971, Ray 1984). University prototypes have unique characteristics that render the complex costing process almost impossible under current management of information systems

Costing Prototypes Potential

A university setting can provide a resource-rich environment for experimental programs, serving as an "incubator" for projects that could not survive in the economy without initial support (McClure 1983) New types of medical treatment programs, alternative training projects, and original methods for cost effective professional practices are examples of prototypes that can benefit from a sheltered environment While the overhead costs for such programs are likely to be very high, there are distinct advantages to nurturing an original program in a setting that provides access to other researchers and facilities Such facilities can probably lower failure costs for the development of the prototype.

Theoretically, a prototype incubator has the advantage of having integrated support structures One of the best examples is the clinical practice setting at university medical centers Its fluid, dynamic environment shortens the response time required to correct research problems. This constant interchange of research and practice can lead to more effective treatment programs This resource rich environment is expensive because it supports the costs of experimental uncertainty. For example, a patient trying an experimental drug might be able to receive emergency treatment for an unanticipated reaction These high initial costs, however, can produce substantial long term savings if the professional community adopts the prototype Moreover, prototype cost effectiveness cannot be measured strictly by its experimental client outcomes The increased productivity generated by a successful program can be spun out into the community creating a significant multiplier effect In the longer term, this approach can make major contributions to economic development (Reynolds and Gaspari 1985).

Prototypes are investments for future returns and generate high experimentation costs Without intense support levels, prototypes are likely to fail They are the leading edge of a learning curve that assumes lower costs once effective routines have been established A prototype can be considered successful if it can be "spun off" at substantially lower costs For example, a new clinical treatment program might absorb high initial costs, but if successful and adopted by a large share of hospitals, it could increase the profession's productivity

Prototype costing is an enormously difficult task For example, the problems of cost overruns in prototype development point to the uncertainty in estimating costs and returns Even retrospectively, the analysis is no less thorny It is almost impossible to separate unique development costs from costs attributable to the potential spinoff. For example, a prototype often has a champion a person with special talents who is determined to make the model work There is no generally accepted method of costing that effort's value, which usually far exceeds the champion's salary. The costs of experimentation that lead to lower cost future routines also cannot be broken out easily it is a problem of entanglement endemic to a university research setting Direct and indirect costs blur as experimentation requires a relatively seamless web of support Prototype costing is especially susceptible to record keeping vagaries

Experimental models also produce unanticipated consequences in the initial planning stages Uncertainty breeds high costs. Within a research university, different levels of staff have different costing agendas program staff track client services and research accountants monitor third party payer requirements In corporations producing the same product over a period of years, relatively sophisticated cost tracking routines can coordinate diverse financial record keeping. These financial systems can then be used to support strategic planning

Research universities, however, are highly decentralized and produce prototypes, not products Planning generally comes from individual or small team efforts and not from centralized strategies. This "job shop" approach creates an episodic financial tracking system that can provide great flexibility for decentralized support but discourages systematic, coordinated and timely project costing procedures for at least five reasons

First, integrated, cost tracking systems can take years to develop because efficiency is derived from established routines University research projects usually don't last long enough to develop routines subject to careful program costing Second, the experimental nature of most university research creates a dynamic environment that does not lend itself to development of efficient routines. Returns to efficient routines will accrue to the economy and not the university

Third, careful program costing procedures are expensive, requiring adequate support personnel and technology to coordinate a variety of financial data demands. External funding sources have attempted to impose either corporate or governmental accounting models on research institutions without recognizing their inherent structural differences This has led to the neglect of logistical support required for sophisticated cost tracking systems Fourth, research universities share the same technical constraints to effective program costing that plague their corporate and governmental counterparts Large, integrated, relational data bases are still experimental, rendering cost effective analyses that provide decision support for strategic planning superficial

Finally, research universities, despite recent calls for increased strategic planning, have not developed integrated, internal decision support systems External funding sources have preferred to negotiotiate episodic grants and contracts on an individual or team basis, rather than on a long term institutional basis. This strategy weakens the internal efficiency of the university for at least two reasons. First, it produces roller coaster resource flows that wreak havoc with planning Second, monitoring and compliance systems demanded by external funders shift the central planning focus from institutional productivity to regulatory compliance. Given current research grant and contract procedures, effective university strategic planning is an oxymoron

These caveats are important to avoid inappropriate conclusions As future technology becomes more flexible, both grantors and grantees should be willing to invest in integrated costing systems. As they do, the development, maintenance and costing of institutional planning structures should become an integral part of project negotiations In this way all parties can agree on 1) what will be costed, 2) how technical systems will be supported and 3) how costing procedures will be tied with a) project outputs, b) with university strategic planning and c) with future impact on economic development.

Case: Costing a Treatment Prototype

Measurement of prototype effectiveness requires more refined accounting than third party monitoring The clinical treatment program in the following study was one of the first attempting to link both actual treatment costs with outcomes measured longitudinally (Scherl 1985) The program, however, was seen in isolation, and its cost effectiveness was considered independently of the university's planning effectiveness.

The program studied was an experimental clinical treatment for children at a major research university's medical center between 1974 and 1980 An individualized treatment program was designed for each patient A population of 105 children, most of them inpatients, were treated during the study Both inpatients and outpatients recieved comparable treatment. Detailed records were kept on treatment types, lengths and costs While the program continued past 1980, significant changes in the treatment design rendered later data noncomparable. The children were observed for eight clinical symptoms at three times during the study admission, discharge and followup The symptom categories were: aggression, tantrums, negativity, self-stimulation, anxiety, hyperactivity, depression and self abuse

Cost data were collected from the hospital's administrative staff and from the clinical program's records and were divided into two main categories The first consisted of the overall per diem costs provided by the central accounting office. The second consisted of the treatment costs kept at the site by the clinical program staff These cost categories were divided into three subgroups inpatient and outpatient costs, actual treatment days versus billed days, and length of stay Actual treatment days differed from billed days because children could still be inpatients but not receiving direct treatment from the clinical program. Treatment costs were further subdivided into eighteen types of treatment, each with primary and supervision costs Primary costs were the direct face-to-face costs of the clinical team Each treatment team incurred supervisory costs within the clinical program Overhead costs were fully absorbed through percentage allocations

Changes in clinical variables measured effectiveness at discharge and at followup. Followup sessions were scheduled up to two years after discharge Improvement indicators were derived from independent observations made by parents and psychologists Two separate indicators (psychologist followup and parent followup) and a combined indicator using both were constructed. The discharge data indicated substantial improvement. The followup data showed regression in some cases. This was expected, because children were discharged into less restrictive family settings

Data quality is a perennial problem for cost effectiveness studies Prototype costing in research universities is notoriously loose and this program was no exception, even with the microdata Different techniques for calculating overhead costs varied by up to a third, a problem endemic to research university hospitals that results from both complex external reporting demands and underinvestment in staff and technology

The best method for costing a prototype is to compare it with a direct spinoff program. This is more effective than comparing it to an existing model because such a model lacks initial development costs In 1978, there was an attempt to spin off an independent program from the study program. Unfortunately, the spinoff was abandoned when the hospital's neighbors successfully protested a zoning change. The spinoff would have provided similar treatment without the university's high overhead cost

Arresting this mature development left the program with no direct spinoff for measurement during the 1974-1980 study period Estimates indicated the spinoff would have cost about one-half less than the research university project, a commendable cost reduction for a project ready to leave the greenhouse Although the program did not generate a direct spinoff during the study period, extensive dissemination services were provided by the clinical faculty Extensive program documentation indicated the program affected both national and international practice

Without a direct spinoff for comparison, an alternative treatment program was used as a cost control group, albeit with distinct caveats First, there was no direct method for measuring prototypes against existing treatments Second, until universities move to financial systems that systematically cost and compare prototypes, the analyst must use blunt tools to remain honest

The control group consisted of roughly 50 children from a local school with a population matching the profile of the children in the clinical treatment program Longitudinal data were collected on observations of the same set of eight symptoms.

Costing Prototypes Conflicts and Realities

While the formal costing procedures contributed to the measurement of effectiveness, a second important consideration was the attitude of the different actors toward each other Indeed, the concern for external compliance mitigated against internal coordination A major problem was the lack of coordinated evaluation data The external environment immediately beyond the department's interests shaped both data collection and organizational behavior (Chaffee 1982; Perrow 1979; Pfeffer 1978) This led to weak internal integration The highly decentralized structure of the research university discouraged the tight integration of support requisite for successful prototype development

During the program period, both the clinical staff and the administrative office kept detailed records, but many of them were neither computerized nor coordinated with other financial tracking records in the hospital Data collection procedures clearly reflected the values of their designers

The clinical staff identified with both their patients and their grantors, characterizing themselves as advocates fighting for resources within a hungry and unresponsive hospital bureaucracy They measured the time spent treating children directly in the program When faced with substantial indirect charges, they discounted their relative value. For them, the primary criterion for value was client attention

The administrative staff focused on the fiduciary concerns of third party payers and on their immediate superiors Their data systems reflected their criteria for value, producing data that was difficult to compare with the clinical data. They, quite rationally from their perspective, measured indirect costs according to the compliance demands of external payers They were inundated with diverse sets of demands from federal, state and private payers Their minimal staff would have been incapable of designing and monitoring internal management systems that could have integrated clinical and administrative costs.

Both the clinical and the administrative staff were highly competent but responded to different values. The clinical staff was most concerned with client service and resource distribution while the administrative staff targeted efficiency and monitoring Neither group felt they were working together to produce specified outcomes This mutual misunderstanding eventually developed into mutual disrespect The clinical staff believed the program's high overhead costs did not contribute to client welfare, the administrative staff believed that the program was not "carrying its own weight" Neither side had access to accurate, detailed information about the program's cost effectiveness despite elaborate record keeping on both sides

Strategic management requires comparable and integrated data bases to support allocation decisions The absence of integrated data collection significantly weakened attempts to evaluate program effectiveness Presumably, this was not an isolated case Indeed, it is far more likely that this is the standard scenario at most research universities If so, most are unprepared to act in a coordinated way to take advantage of opportunities to demonstrate the contribution of their research prototypes

Results

The cost improvement relationships in the case were measured through a series of oneway ANOVAs to determine the strength of the relationship The F tests with some exceptions were weak but in the expected direction, this was anticipated, although the program F tests were stronger than those of the control group. The very nature of the experimental prototype model would suggest that client improvement indicators could not easily capture the program's complex, dynamic environment and impact. Nevertheless, one clear and consistent finding supported the concept that high quality improvement levels were related to high program costs. Higher levels of program investment produced higher returns in outcomes, meaning that cheaper was not more efficient This indicates success for this prototype, because at the time of its creation, there were doubts these children could make sustained improvement In a world where regression can be the norm, even a "no change" indicated improvement over the alternative of neglect.

The F tests that compared outcomes with total direct and indirect program costs were higher than the tests that compared outcomes with direct costs Both ratios, however, were more significant than the control group

The first table compares the ANOVA mean costs of symptom improvement (as measured by psychologist observations) across total and treatment costs Only those who exhibited a particular symptom were included in that statistic The control group showed no significant effects The group with clinical depression symptoms was dropped beause there were only three members in the cell With the exception of the self abuse category the F ratios were higher for the total costs than for the direct costs. The total cost variable indicated the contribution of indirect costs to the treatment program

Table 1: SYMPTOM IMPROVEMENT

	M:TOTAL	M:TREATMENT$
AGGRESSION		
F RATIO	(3 073)****	(1 880)***
TANTRUMS		
F RATIO	(1 122)*	(907)
NEGATIVITY		
F RATIO	(1.528)**	(1 293)*
SELF STIMULATION		
F RATIO	(1 668)***	(1 606)***
ANXIETY		
F RATIO	(615)	(191)
HYPERACTIVITY		
F RATIO	(.209)	(104)
SELF ABUSE		
F RATIO	(1 199)*	(1 771)**

**** significant at 02 level/ *** signficant at 05/**significant at 10/*significant at 20

The second table measures the ANOVA means for improvement levels between the total costs and the control group costs IQ was used as an accepted, standard assessment measure for this type of clinical program

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Table 2: I.Q. LEVELS

	CLINICAL TOTAL COSTS	CONTROL . ᵔOUP C. STS
DISCHARGE		
F RATIO	(4.74)*****	not appli
FOLLOWUP		
F RATIO	(1 952)***	(1 04

*****significant at .01 level / ***significant at 05

The graph in the appendix shows the overall distribution of program costs in constant dollars (without inflat:.n) The largest share (47%) went for general overhead expenses Second was the category of direct department expenses (41%) that is, the clinical program staff's salaries and fringe benefits. A small share of the costs were taken by di..ect department nonlabor expenses (6%), this included the program's equipment, research dissemination and other direct program expenses

Implications for Policy

The study confirms the data collection problems that currently impede effective prototype costing It also discovered that the weak internal efficiency of the university produced unintended consequences for the administration and the clinical staff. The differences in operating assumptions created unnecessarily high transactions costs. Staff members on the clinical practice side perceived they were adversaries of staff members on the hospital accounting side. That perception was, to some extent, reciprocated These assumptions resulted in competitive, not cooperative, strategies

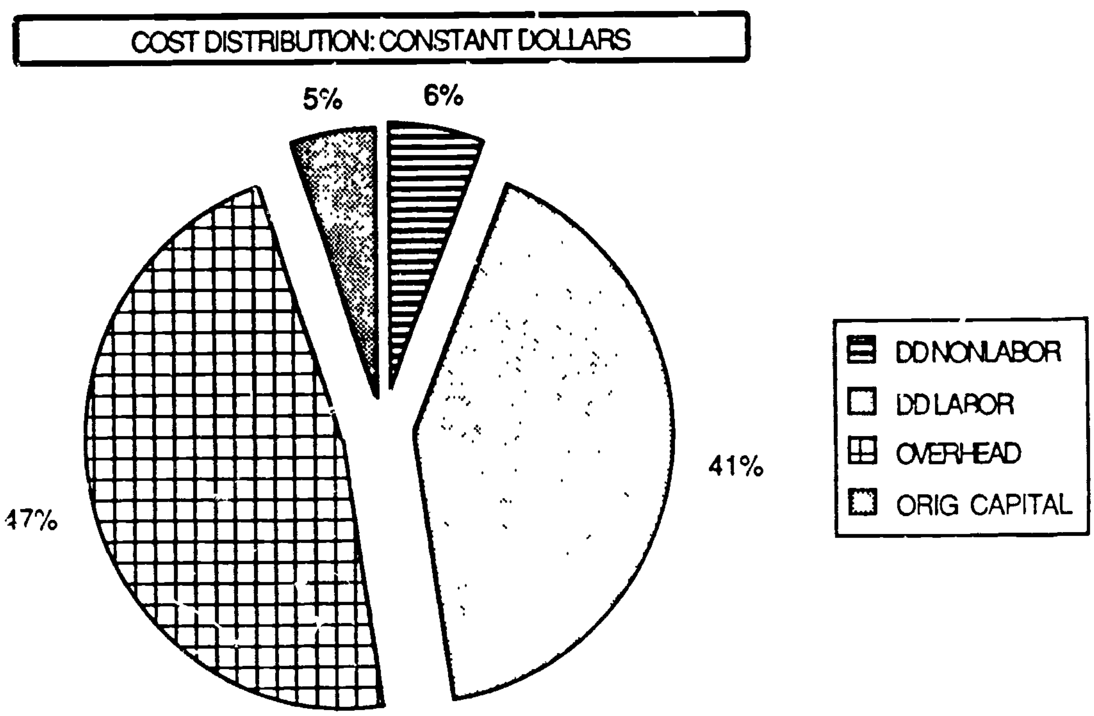
Both operated from different sets of cost effectiveness assumptions about the prototype. The clinical staff perceived the program as a service to children who would otherwise remain in custodial programs They perceived the objective of resource allo.ation under this set of assumptions as the direct treatment of needy patients The clinical staff was not pleased with the growing administrative overhead charges levied by the hospital for indirect support that cut back their discretionary resources They viewed the cutbacks as constraints on their professional productivity

The administrative staff, on the other hand, perceived the program as an additional responsibility for the hospital They perceived the objective of resource allocation as the hospital's continued survival. The administrative staff was not pleased with the high costs of the program They saw the cutbacks as a way of checking mushrooming treatment costs Consequently, the organizational planning was inadvertently but pathetically ineffective Neither group acted as partners in a team effort They were held apart by divisive values.

The problem of differential operating assumptions leading to competition instead of cooperation is not unique to the prototype The highly decentralized research environment allows little opportunity for coordinated strategic planning The absence of a coordinated costing plan for the prototype at the time of its inception created high information and transactions costs for groups within the university who were required to cooperate for the success of the program

This resulted in less effective management than more cooperative strategic planning might have produced In the future, university research administrators should consider an integrated prototype costing component when they negotiate both with researchers and with external funding agencies Under these conditions, clinical or training programs would include a formal program costing plan that would first identify direct and indirect services, and tie them to outcomes Data collection methods should be specified in the contract to ensure an efficient resource allocation toward the program's objectives. The plan would state program goals, clarify the mix of direct and indirect services to be targeted for the program, provide specific cost indicators, and delegate responsiblity for records management and support

This will be no small task on the slippery slopes of funds accounting systems. A reexamination of the large share of indirect support services costed through flat percentage allocations might be in order because external funding agencies and third party payers are increasingly concerned about linking overhead costs to outcomes and performance objectives Resolution of this problem may have to wait for more efficient relational data base management systems Effective prototype costing may be possible, but it will require substantial investment by all parties involved before the university's high internal transactions costs are lowered and its internal effectiveness strengthened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