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Fund Allocation Formula Analysis: Determining Elements for Best Practices in Libraries

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ABSTRACT

The purpose of this study was to determine whether common elements in fund allocation formulas could be used to articulate "best practices" for fund allocations in academic libraries. Methodology involved a meta-analysis of published articles and Internet sites in which 75 fund allocation formulas were presented. Of the 75 formulas, 28 usable examples were analyzed to determine if there were any statistically significant elements within these formulas that could be identified, as well as to determine the degree of correlation for each component identified in the usable set. Findings are presented in this article, as well as implications for further research.

Keywords: Fund allocation formulas, collection development, acquisitions, libraries, material budgets

INTRODUCTION

Economic scarcity is one of the persistent problems with which libraries have had to deal, and limited funds to purchase library materials is firmly the rule, not the exception. In arenas where funds are scarce or limited such as libraries, allocating materials budgets must be based on some perception of fairness, particularly where there are competing human interests, such as academic departments each having a need for library materials to support teaching and research in a variety of subjects and disciplines. Schad wrote (1978), "There is no real choice between whether or not to allocate [library materials budgets]" (p. 330). Some form of budgetary allocation takes place, whether intended or not. All libraries allocate funds in some manner, whether the process is formal or informal. The critical point is whether or not there is a rational basis for determining who gets what, to support the perception of fairness.

Budd and Adams (1987) surveyed 357 libraries, out of which only 40.6% were using allocation formulas for distributing material funds. Other libraries that participated in the survey relied on historical information, meaning their allocation decisions were based on how funds were spent the previous year. However, Martin (1995) warned that "Librarians preparing budget requests should not rely solely on history and expect to continue business much as before" (p. 24). Allocations based on historical expenditures alone have become suspect as the most effective way to distribute resources in times of economic scarcity. Some of the dynamics now evident in the contemporary fund allocation arena include such considerations as rates of spending (some selectors spend faster than others), university-wide budget cuts of which libraries must pay a share,

leveraging of the monographs budget against serials inflation rates, and so on. Martin (1995) indicated that the use of allocation formulas should be aimed at helping a library keep its collections “alive and responsive to current need” (p. 69).

The purpose of this study was to determine whether common elements in published fund allocation formulas could be used to articulate "best practices" available for fund allocations in libraries. To this end, methodology was used to determine if there were any statistically significant components within these formulas from which a best practice could be identified, as well as to determine the degree of correlation for each component identified in the usable set.

LITERATURE REVIEW ON FUND ALLOCATION FORMULAS

Fund allocation formulas for library materials budgets have been featured in American library periodicals since the early 1900s. Such formulas have served as a means for academic libraries to apportion their materials funds in an equitable way to support teaching and research needs across the curriculum. A number of authors on allocation formulas and collection development in books such as *Guidelines for Collection Development* (Perkins, ed., ALA, 1979) and *Guide to Collection Development and Management Administration, Organization, and Staffing* (Munroe, Haar, & Johnson, Scarecrow Press, 2001) have written about the goal of equitable distribution of funds to meet programming needs. Brownson (1991) indicated that an initial rationale for this goal was mostly political, compounded by demands for accountability. At one time, the funds were typically distributed to individual academic departments within colleges and

universities to purchase materials. Thomas (1987) noted that since the 1960s, control over spending has reverted back to libraries, with most of the selection being done by librarians. The importance of good collection development skills became vital in the seventies and eighties as the ill effects of budget limitations began to be felt. Allocation formulas were created to offset the political tug of war created by competing departmental funding requests by making the process of fund allocation less subjective, and by becoming an essential means for ensuring the cost effectiveness of materials purchases.

Factors Included in Allocation Formulas

An evaluation of factors included in allocation formulas led McGrath, Huntsinger, and Barber (1969) to initially determine that the three most important factors were the number of books used per department, the number of users, and the materials cited by graduate students in theses from that department. Six years later McGrath (1975) updated this analysis to conclude that circulation and costs of materials were the most crucial. Pierce (1978) used multiple regression analysis to determine that department size (based on total number of majors) was the variable most likely to predict departmental library use. Yunker and Covey (1980) looked at number of users in a given department and cost of materials in the associated field. Cubberley (1993) pointed out that looking at allocations compared to the total number of publications available was more useful than just comparing allocations between departments. More recently, Munroe, Haar and Johnson (2001) suggested that funding for each segment of the collection "should be

consistent with its relevance to the library's mission and adjusted for the variability of publishing activity and the cost of materials" (p. 10).

Criteria Previously Considered

Budd and Adams (1987) published results of their survey on fund allocation formulas used in libraries. Subsequently, Budd (1991) did an expanded literature review on the topic. Both articles reported on common elements used in creating allocation formulas, although the selection and combination of those elements remained unique to individual institutional needs. The most frequently cited factors in the Budd and Adams survey were number of students (or number of student credit hours), cost of materials, number of faculty, circulation by department or subject, number of courses offered by a department, and number of students majoring in a department or subject. Often these factors were assigned different weights for graduate students, student credit hours, majors, and circulation.

Other investigators emphasized the importance of context within the university. Martin (1995) suggested that libraries look at the college or university investment in various departments or programs to determine institutional priorities. Goyal (1973) created a formula for ranking departments based on the importance society attaches to the work of a department, the importance the university gives to the work of the department, and the reflected importance based on the size of the department. He then went on to extrapolate that one can assume the importance society attaches to the work of a department and the importance the university gives to the work of the department are

equivalent and will be reflected in size, so size (as determined by numbers of students and staff) is all one needs to determine departmental allocation rankings. Rather than just suggesting specific empirical factors, McPheron (1983) proposed a reliance on subject specialist expertise in determining allocations. Additionally, there may be other relevant, non-quantifiable information such as expected growth and change within programs that might need to be considered when establishing allocations, such as suggested by Senghas and Warro (1982).

Fund Allocation Formulas: Reality or By Proxy?

Sweetman and Wiedemann (1980) pointed out that the determination of formula factors often ends up being dependent on what data are available. Their literature review presented more than 43 different variables mentioned in previous articles. They specified the need to include three broad categories: an indicator of demand for library materials, an indicator of the availability of materials to purchase (supply), and an indicator of the cost of those materials. Sweetman and Wiedemann (1980) stated that "a library seeks to measure by proxy what it cannot measure directly" (i.e., what its users want), and “this search for efficient proxy variables is really what the literature on allocation formulas is all about” (p. 269). As Schad (1978) said earlier, “a formula or model is only useful to the degree that it reflects accurately the realities of any situation” (p. 330). This study, then, synthesizes the proxy elements of fund allocation formulas, to consider whether a sample of libraries adopt similar protocols in an attempt to reflect reality.

METHODOLOGY

A three-step methodology was used for this study. First, a meta-analysis was conducted similar to Sweetman and Wiedemann's (1980) review of published articles to ascertain the variables related to fund allocation formulas in previously published library literature and other sources available on the Internet. Second, a usable sample was established. The criteria for selection into the usable sample were 1) publication through a peer review process, and 2) a clear recommendation of formula factors. Some of the sources included a mathematical expression of the full formula and some did not. Third, factor analysis similar to that which was used by McGrath, Huntsinger, and Barber (1969) in their efforts to create a fund distribution formula was used to determine the frequency of the factors, as well as whether significant correlations existed between the factors using Pearson's R.

FINDINGS AND DISCUSSION

The initial meta-analysis (step one) revealed 75 various formulas, from which 28 published sources were selected as a usable sample (step two, see Appendix A). The years of publication for the 28 selected sources spanned from 1965 - 1996. Two of the sources (7%) were from the 1960s, eleven (39%) were from the 1970s, ten (36%) were from the 1980s, and five (18%) were from the 1990s (See Table 1).

Sixteen of the formulas (57%) were created by libraries for their specific use, while the remaining twelve (43%) were presented as models for potential consideration

by any library. Nineteen out of the 28 sources (68%) had authors who were working at public universities in the U.S. at the time; three (11%) were at private U.S. universities, four (14%) were at universities outside of the U.S., one (3.5%) was at a non-university academic organization, and one (3.5%) was at a corporate library.

The 28 sources were examined and, after categorizing certain elements to reduce redundancy, a total of 23 different formula elements were identified. Similar terms such as “enrollment” and “number of students” were considered synonymous, for example. These elements were then entered into a spreadsheet with each of the 23 formula elements assigned a separate column and each of the 28 sources (expressed as library settings) assigned a separate row. Where a source formula included a given element, the column was coded "1," and where an element did not appear in a given source formula, the column was coded "0."

Factor Analysis and Establishing Broad Categories

Next, the frequency of the factors was established and a two-tailed analysis was conducted using Pearson's R to ascertain whether any significant correlations existed between factors (step three). Factor frequency revealed equal preference for including "cost" (price of materials) and "enrollment" (numbers of students) in fund allocation formulas. Both of these factors were included in 16 out of 28 formulas (57%). The next most often used element was "use" (circulation) with a frequency of 14 out of 28 formulas (50%). The rest of the factors were included less than half the time, with the

next highest being "number of faculty" (10 uses or 38%). The frequency of the next factor dropped to 7 (25%) and proceeded downward from there (See Figure 1).

The types of elements included in fund allocation formulas fell roughly into one of four broad categories: 1) "historical" or reliance on past practice, 2) "demand" meaning an indicator of internal demand for library materials, 3) "supply" meaning information related to the available supply of materials, and 4) "weighted" or a weighting in favor of some element over another. The top two frequently used factors (cost and enrollment) reflected a supply and a demand typology respectively, while the next two highest (use and number of faculty) both reflected demand typologies (See Table 2). Table 2 also lists the mean and the standard deviation for each element. The average mean for all elements combined indicated a normal distribution (average mean = 0.1613).

Further Factor Analysis Using Person's R

Pearson's R resulted in a table of correlation coefficients (See Table 3). For a sample size of 28, significance at the 0.01 level is shown when coefficient values are equal to or greater than +/-0.479. Ten pairs of factors (elements) were positively correlated at this significance level, with correlations of between +0.707 and +0.519. Significance at the 0.05 level is shown with coefficient values equal to or greater than +/-0.374. Seven additional pairs of factors (elements) were correlated at this significance level.

The correlations between some of the factors appear to indicate which elements are related, or likely to be found within the same fund allocation formula. Positively

correlated pairs included “credit hours” and “graduate versus undergraduate”, “inflation” and “subjects published”, “faculty needs or wants” and “scope of existing collection”, “number of faculty” and “graduate versus undergraduate”, “formats” and “inflation”, “formats” and “faculty research”, “credit hours” and “number of faculty”, and “credit hours” with “publication output”. These pairings, all at the 0.533 significance level or higher, suggest that the fund allocation formulas used in this study are highly faculty- and student-centered (See Table 4).

Analysis of the frequencies also revealed that the following five variables, despite their frequencies, did not pair significantly with any other element when Pearson's R was applied: "courses" (F5, frequency = 7), "library or university goals" (F12, frequency = 3), "interlibrary loan" (F11, frequency = 2), "other weighted factors" (F23, frequency = 2), and "honor students" (F10, frequency = 1). This is an interesting finding considering that many fund allocation managers may intend to take into account such things as the library's obligation towards interlibrary loan, specific courses being taught, and university goals, but these data show that such is not the case, at least for the formulas in this sample.

Other factors positively correlated at +0.400 or higher ($p > 0.05$) but with a lower frequency of use include "scope of existing collection" (F15, frequency = 4), "faculty needs or wants" (F9, frequency = 2), "subjects published" (F20, frequency = 2), "inflation" (F17, frequency =1), and "faculty research (F22, frequency = 1).

It was not surprising to find that more than half of the formulas included a factor for the cost of materials. The reason most often given for the importance of including this factor was that material prices vary widely between disciplines; the same dollars

would not buy as many medical books, for example, as English literature commentaries. A fair allocation must therefore take that difference into account. A number of authors considered it fundamental, only differing on how that information should be calculated (i.e., collected from published averages or actual expenditures).

This study also revealed significant inclusion of student enrollment in the allocation formulas. The main reason for its popularity may be the ready availability of enrollment information from the university and the trust the university places in those figures as evidenced by their use in other calculations. Since much of university funding comes from student tuition, distributing funds proportionally to the subject areas based on the number of students is very defensible, as well as consistent with other university practices.

Inclusion of use statistics can be seen as an attempt to quantify the level of need for library materials by relying on past need as a predictor of future need. In both the article by Sweetman and Wiedemann (1980) and the book by Martin (1995) the authors caution against sole reliance on circulation figures, yet half of the sources included in this analysis considered use a significant variable to include. Since potential use may be the most difficult aspect to calculate, inclusion of multiple demand factors is certainly justified.

The inclusion of the number of faculty could be seen as either politically motivated or as a means for factoring in faculty use. Mulliner (1986) raised the question of whether this information is a duplication of other subject-related factors such as student credit hours. Universities often adhere to a set ratio of number of faculty per number of students so that including one also addresses the other, but this may not always

be the case. Faculty members also often generate a large number of purchase requests. Sometimes those materials are meant to directly support instruction and classroom assignments; sometimes the materials support faculty interest in a topic that may or may not end up being incorporated into a course.

While the most frequency used fund allocation formula elements in the sample were "enrollment" (number of students), "cost" (price of materials), "use" (circulation), and "number of faculty", further analysis identified elements that were statistically significant and, therefore, potentially the most useful for "best practice" development. Implicated for future research are the elements of "credit hours", "publication output", "graduate versus undergraduate" students, "programs", "faculty needs or wants", "scope of existing collection", "formats", "inflation", "faculty research", and "subjects published."

CONCLUSION

Previous deliberations on the topic of fund allocation formula development have included several elements, such as number of students, cost of materials, number of faculty, and number of courses offered by a department, to name but a few. Further contemplation over time took into account such factors as the specific context within a university and institutional priorities. In the final analysis, precision is elusive, because libraries seek to measure by proxy what they cannot measure directly. This study sought to add to the body of knowledge by adopting a methodology to synthesize the proxy elements of fund allocation formulas and to consider which of these elements are

noteworthy for libraries developing their own allocation formula for the local setting.

This meta-analysis looked at 75 fund allocation formulas of which 28 usable examples were analyzed to determine if certain elements within these formulas occurred with greater frequency than others. The most frequently used factors in the formulas were enrollment/number of students, cost/price of materials, use as measured by circulation, and number of faculty. It was not surprising to find that more than half of the formulas included a factor for the cost of materials. Significant inclusion of student enrollment figures was also not unexpected. Equally important a finding was that half of the sources included in this analysis considered use/circulation to be important to their formulas. Since potential use may be the most difficult aspect to measure by proxy, the use of multiple demand factors (i.e., both enrollment and circulation) is certainly justified. Other elements, while utilized less frequently than these four, also recurred in a third of the formulas, including the number or nature of offered courses, academic programs, research budget or output, and faculty publication output.

If the past is any predictor of the future, then inclusion of the four most frequently employed formula elements identified here is highly recommended for local fund allocation formula development. This does not necessarily imply, however, that one need *only* include these four elements. The correlation apparent between other pairings of elements in this study suggests a need for further research to determine the impact of these additional factors. Budgets are dynamic, not static, and the challenge for every library is to create an allocation formula that best incorporates the aspects most important to the specific institution.

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Appendix A. Sources of Formulas Used in Study

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Table 1. Sources by Type of Institution and Year of Publication

Type of library	1960s	1970s	1980s	1990s
Public U.S. University	1	6	7	4
Private U.S. University	--	2	1	--
Non- U.S. University	--	2	2	1
Non-University Academic	1	--	--	--
Corporate	--	1	--	--

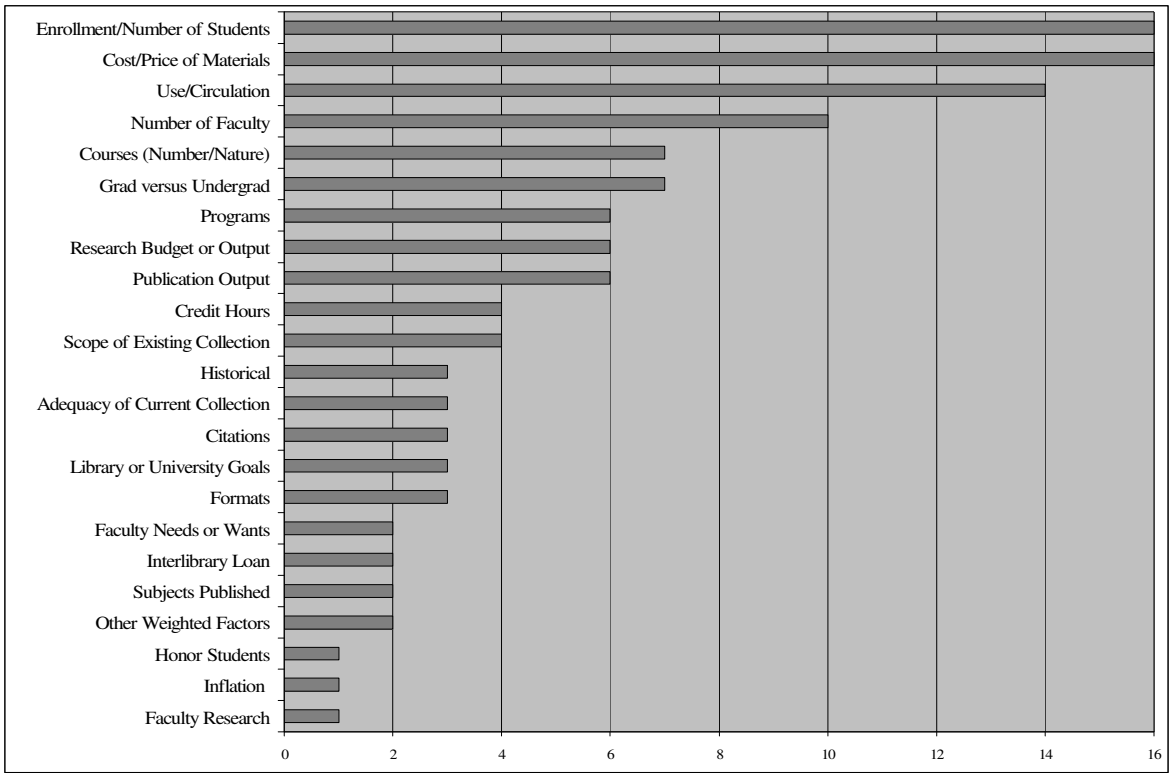

Fig. 1 Elements by Frequency of use

Table 2. Elements Found in Fund Allocations by Frequency (N=28).

Factor	**Type**	***f***	**Mean/S.D.**
Enrollment/Number of Students (F7)	Demand	16	0.571 (0.503)
Cost/Price of Materials (F19)	Supply	16	0.571 (0.503)
Use/ Circulation (F3)	Demand	14	0.500 (0.314)
Number of Faculty (F8)	Demand	10	0.357 (0.487)
Courses (Number/Nature) (F5)	Demand	7	0.250 (0.440)
Grad vs. Undergrad (F21)	Weighted	7	0.250 (0.440)
Programs (F13)	Demand	6	0.214 (0.417)
Research Budget or Output (F14)	Demand	6	0.214 (0.417)
Publication Output (F18)	Supply	6	0.214 (0.417)
Credit Hours (F6)	Demand	4	0.142 (0.356)
Scope of Existing Collection (F15)	Demand	4	0.142 (0.356)
Historical (F1)	Historical	3	0.107 (0.314)
Adequacy of Current Collection (F2)	Demand	3	0.107 (0.314)
Citations (F4)	Demand	3	0.107 (0.314)
Library or University Goals (F12)	Demand	3	0.107 (0.314)
Formats (F16)	Supply	3	0.107 (0.314)
Faculty Needs or Wants (F9)	Demand	2	0.071 (0.262)
Interlibrary Loan (F11)	Demand	2	0.071 (0.262)
Subjects Published (F20)	Supply	2	0.071 (0.262)
Other Weighted Factors (F23)	Weighted	2	0.071 (0.262)
Honor Students (F10)	Demand	1	0.035 (0.188)
Inflation (F17)	Supply	1	0.035 (0.188)
Faculty Research (F22)	Weighted	1	0.035 (0.188)

For Table 3 see attached file: Fund Allocation Formula Analysis Table 3.

Table 4. Correlations and Significance Levels, Using Pearson's R.

Paired Elements	Pearson's R	F Code Pairing
1. Credit Hours + Grad vs. Ugrad	0.707**	F6, F21
2. Inflation + Subjects Published	0.694**	F17, F20
3. Faculty Needs or Wants + Scope of Existing Collection	0.679**	F9, F15
4. Number of Faculty + Grad vs. Ugrad	0.602**	F8, F21
5. Formats + Inflation	0.556**	F16, F17
6. Formats + Faculty Research	0.556**	F16, F22
7. Credit Hours + Number of Faculty	0.548**	F6, F8
8. Credit Hours + Publication Output	0.533**	F6, F18
9. Number of Faculty + Programs	0.519**	F8, F13
10. Scope of Existing Collection + Formats	0.518**	F15, F16
11. Scope of Existing Collection + Faculty Research	0.471*	F15, F21
12. Use/Circulation + Enrollment	-0.433*	F3, F7
13. Historical + Enrollment	-0.400*	F1, F7
14. Historical + Cost	-0.400*	F1, F19
15. Citations + Cost	-0.400*	F4, F19
16. Research Budget or Output + Formats	0.382*	F14, F16
17. Adequacy of Current Collection + Research Budget/Output	-0.382*	F2, F14

** p > .01, * p > .05