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Article

The Use of Value Engineering in the Evaluation and Selection of Digitization Projects

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Abstract

Objective - The authors describe a simple and effective tool for selecting digitization projects from competing alternatives, providing decision makers with objective, quantitative data.

Methods - The paper adopts the value engineering methodology for the selection, evaluation and ranking of digitization project proposals. Project selection steps are described. Selection criteria are developed. Digitization costs are presented as an equation. Project value is determined by calculating projected performance of digital collections based on the established criteria over cost.

Results - Scenarios are presented that evaluate and rank projects based on an evaluation of performance criteria and cost. The communication and use of rating criteria provides

selectors with information about how proposed collections are evaluated. The transparency of the process output is easily communicated to stakeholders.

Conclusion - Value engineering methodology provides a tool and a process that gives decision makers a set of objective, quantitative data upon which selection of digitization projects is based. This approach simplifies the selection process, and creates transparency so that all stakeholders are able to see how a decision was made.

Introduction and Background

Value Engineering (VE), sometimes referred to as Value Methodology, provides business and other organizations with a structured methodology for evaluating product or strategic options and a formula that can be used to measure, rank and compare options. The methodology is taught in project management and industrial engineering programs and used within Total Quality Management (TQM) and business process reengineering (Value Engineering). The concept calls for several steps of project planning such as information gathering, determination of performance measurement, analysis of other options (brainstorming), ranking of ideas, and a comparison of options. The key steps of quantitative ranking and comparison of options is accomplished through the development of performance criteria measures, ranking performance according to those established measures and determining project costs. Value is then defined according to the ratio of Function or Performance over Cost (Pearsall & Eng). This is mathematically displayed as:

Value = Performance / Cost

Performance has a different meaning in different contexts. In this article, performance refers to the relative significance of digitized information to internal and external users, the uniqueness of the digitized information and the relative exposure that results. Costs include staffing, copyright permissions and equipment expenditures. Value increases as a result of performance improvements or cost decreases - often accomplished through elimination of wasteful or unnecessary practices.

Measuring the ratio of performance to cost results in a quantitative representation of the estimated value of potential digitization projects. Quantitative representation is useful in a setting in which resources are limited and there are competing collections proposed for digitization. Using the quantitative measures that result from the calculation of the equation, each project's value is ranked and compared against others. The highest-ranking project has higher priority over those ranked lower. The communication of the results to interested parties ensures that communication barriers are decreased and the selection process is more transparent. Hays finds that using quantitative measures can increase communication (Hays 125).

The effectiveness of applying the VE methodology in academic libraries is sparsely documented. Pershing and Krutulis adopt the Mudge matrix VE model (Mudge 174-183) to determine salary equity in academic libraries. They find that the methodology "worked extremely well for Indiana University even though it was not designed for that particular use or environment." Bick and Sinha apply VE in the evaluation of journals and find that it provides an objective measure for

identifying journal value in support of subscription and cancellation decisions.

The methodology is also applied in curriculum development and review and provides "a formal way of closing the feedback loops at all programmatic levels from the course level to the objective level" (Gershenson, Hailey, Batty and Phillips 140). Other uses of VE are recorded in the health-care field. For example, Jakhanwal & Singh describe the use of VE to justify the cost of cataract surgery.

This article presents a stepped approach that libraries can utilize when selecting projects for digitization. It discusses the creation of performance and cost criteria that can be used to determine the overall value of competing digitization projects. The model provides transparency to the selection process and more fluid communication within libraries regarding the selection of digitization projects. Example scenarios illustrate the entire process from the calculation of performance for sample projects to the ranking of the sample projects.

Steps in the Selection of Digitization Projects

Selection steps are helpful for administrators to consistently apply standards and select appropriate groups of materials for cost-effective digitization. In VE, project participants and decision-makers engage in a process that is broken into a structured sequence of steps (Value Engineering). Project selection steps, adapted from the formal VE process, include:

A. Examination and initial review of information provided in digitization project proposals. In order for the project proposal to be effective, it must be accurate and informative particularly in regard to the criteria upon which it will be judged. Project proposals must be a collective effort and written in consultation with all stakeholders, including subject experts. Proposals that lack information may be sent back with suggested improvements.

B. Determination of digitization costs. The project proposal must include a realistic estimation of production costs. Cost determination must be coordinated with appropriate departments within the institution to ensure accuracy.

C. Measurement of expected performance. The project proposal must demonstrate its capability to reflect and support the academic standards of the institution according to teaching and research trends. The performance should be in line with the library's collection development policies, library, departmental and institutional strategic plans and mission statements. Performance and cost are the two factors that determine the value of a digitization project.

D. Presentation of scenarios. Project proposals should be compared with each other using written scenarios that illustrate the potential value of the projects.

E. Final measurement and ranking of projects. Discussion of proposed projects may precede measurement and ranking by each member of the administrative team. The persons who proposed the projects are informed of the decision and given copies of the measures and rankings.

Determination of Digitization Costs

In order to justify the expenditure of fiscal and human resources on digitization activities, many libraries engage in cost analyses to determine how much it costs to digitize materials. Libraries also determine costs to enable more accurate customer charging for digitization work. The

Michigan University Library documented the full range of digitization costs in "The Making of America IV: The American Voice, 1850-1877" project. They aggregated costs into broad categories according to the steps undertaken in the digitization process (University of Michigan Digital Library Services 8).

The British Library identified costs associated with item digitization in terms of a "life-cycle model" that also identified the outlay of all costs within the digitization workflow" (Shenton 11). To determine the total cost to complete the digitization of an item or a collection of items, they proposed the use of an equation that adds the cost of specific tasks, from selection through preservation.

This article further develops the cost variables provided by the British Library by considering additional tasks required within the digitization workflow including the cost of server space and obtaining copyright permissions. Costs unique to digitization projects such as equipment that is not likely to be used for anything other than the particular project have also been added.

A sample of the project may be digitized to determine the amount of time required to complete the project. This also helps to ensure that all aspects of the digitization, including all of the preparatory work, is accounted for and that the cost analysis is accurate. Based on the sampling and time estimates, total salaries and benefits for each person with any responsibility for the completion of the work can be considered and accounted for. Other infrastructure costs such as staff training, software or equipment are not considered as project costs because of their anticipated utility for other projects. Adding all of the variables together enables an institution to compute the total cost of digitization and making a collection available.

Cost of digitizing a collection of materials and making the collection available is expressed as follows:

C = sel + ipr + cop + cons + ret + cap + qc + met + pres + web + mgt + stor + x

C	Total cost of digitizing a collection of materials and making it available online
sel	Selection
ipr	Checking of intellectual property rights
cop	Obtaining copyright permissions
cons	Conservation check and remedial conservation
ret	Retrieval, reshelving, debinding, rebinding, material preparation
cap	Capture of digitized items
qc	Quality assurance of digitized items
met	Metadata creation
pres	Preservation of digitized items
web	Website creation and graphical design
mgt	Oversight, supervision, management
stor	Storage of digitized items
x	Additional costs unique to the project not otherwise represented

Measurement of Expected Performance

Performance criteria must measure the degree to which the digitized collection meets an institution's strategic goals, reflecting the academic standards and subject interests of the institution. The criteria must also reflect the expected impact, accessibility and usage of the materials to be digitized and measure the degree to which the collection is used in the teaching and research of the institution. The National Information Standards Organization recommends guidelines for building quality digital collections (National Information Standards Organization, A Framework), many of which are included here. For

example, NISO recommends that a digital collection needs to follow an existing documented collection development policy.

The criteria listed below serve as an example of performance criteria. Individual institutions may revise these to their own specifications or devise their own to align with their collection development policies. The criteria must represent what is important to the respective institution. The performance criteria are offered here as an example: significance of content to internal stakeholders (IS); significance of content to external stakeholders (ES); uniqueness of content (Uniq); exposure (Exp).

Total expected project performance is expressed as follows:

P = ((2*IS) + ES + Uniq + Exp)*100

Significance of content to internal stakeholders is multiplied by 2 to reflect the relative importance of this criterion at most institutions. The total of each criterion is multiplied by 100 in order to normalize the data. Other institutions should consider the importance of each criterion to their institution and weight them accordingly.

Significance of Content to Internal Stakeholders

Clearly, if a collection lacks value to the university's stakeholders, digitization should not be pursued. Significance of content to internal stakeholders (IS) is the degree to which a collection, once digitized, supports the immediate and long term research and teaching needs of the institution, the expected usage of the collection by university students, faculty and staff, and the degree to which the digitized collection supports the university's strategic plan. (Table 1)

Significance of Content to External Stakeholders

A highly successful digital collection is of interest to researchers and users outside of the university, as a greater good in support of life-long learning, information discovery and research. This criterion measures the expected usage of the collection outside of the university and the degree to which the collection supports the university's particular subject niche within the global, digital learning environment.

Subject specialist librarians are pivotal to the preparation of digitization proposals not only because of their familiarity with the research that is conducted in their colleges but also because of their broader knowledge of the content of their subject areas, with their own library's collection and other collections. The subject specialist librarian should be able to determine the significance of the collection to internal and external users. In order to identify what content would be most useful to have digitized, the subject specialist librarian may also choose to conduct focus groups and surveys prior to the writing of the proposal.

The degree to which a digital collection contributes to the codification of a discipline's knowledge is measured within this criterion. (Table 2)

Uniqueness

In 2004, Google launched its ambitious project to digitize 30 million books, partnering with prestigious academic institutions (Quint). The US Government's Printing Office is in the process of digitizing all federal government documents (GPO's Digitization and Preservation Initiatives). These large scale digitization efforts, along

Criterion	Definition	Rating Scale	Unit of Measure/Quantification
Significance of Content (Internal)	A measure of the significance of knowledge encoded in the resources to the institution.	5	Significant information related to the institution's areas of focus. Meets the current and long-term research and teaching needs of the institution. Has great current and historical importance. Supports the university's strategic plan.
		4	Significant information related to general teaching and research trends of the institution. Has current and historical importance.
		3	Significant information related to general teaching and research trends of the institution. Lacks either current or historical significance.
		2	Not directly related to the teaching and research of the institution. Lacks either current or historical significance to the institution.
		1	Not related to the teaching and research of the institution. Lacks both current and historical significance to the institution.

Table 1. Significance of content to internal stakeholders

Criterion	Definition	Rating Scale	Unit of Measure/Quantification
Significance of Content (External)	A measure of the significance of knowledge encoded in the document and its related subject disciplines known to be of interest to external researchers.	5	Significant information of great current and historical interest to researchers outside of the institution.
		4	Significant information of current and historical interest to researchers outside of the institution.
		3	Significant information lacking either current or historical interest to researchers outside of the institution.
		2	Minor significance to researchers outside of the institution.
		1	Lacks significance to researchers outside of the institution.

Table 2. Significance of content to external stakeholders

Criterion	Definition	Rating Scale	Unit of Measure/Quantification
Uniqueness of Content	A measure of the uniqueness of the material included in the collection to be digitized and the likelihood of it being digitized elsewhere.	5	Content is held uniquely by institution and extremely unlikely to be digitized by another institution or government agency.
		4	Content is rare and unlikely to be digitized by another institution or government agency.
		3	Content is held by less than a dozen libraries and is unlikely to be digitized by another holding library, institution or government agency.
		2	Content is held by hundreds of libraries and is likely to be digitized by another institution eventually.
		1	Content is held by hundreds or more libraries and is already in the process of being digitized.

Table 3. Uniqueness

with those of Microsoft Live, Yahoo!, Internet Archive, the Million Books Project and others, all suggest that a significant percentage of the world's literature written in English will be publicly available electronically in some form within ten years.

Despite these tremendous collective undertakings, many unique institutional resources such as original photographs, archival materials, gray literature such as university technical reports and conference proceedings, and other unique or rare institutional resources remain to be digitized. This criterion measures the relative uniqueness of a collection and the likelihood of it being digitized elsewhere. (Table 3)

Exposure

The exposure criterion measures the degree to which the digital collection garners the institution positive recognition and press. The criterion also assesses the potential for the digital availability of the collection to result in grants and other funding. (Table 4)

Example Scenarios

The following four digital collection project scenarios and rankings illustrate how the VE process helps measure, rank and prioritize digitization projects. All costs presented are in US dollars. In order for proposals to be ranked consistently, the person who proposes a project for digitization should be familiar with the criteria. The exercise is most useful when comparing projects of a similar size with similar costs.

Because of the use of cost as a divisor, projects that are smaller and that cost significantly less money than other projects

Criterion	Definition	Rating Scale	Unit of Measure/Quantification
Exposure	A measure of the amount of positive press and exposure that is likely to result from digital availability of collection.	5	Stature of university greatly enhanced. Likely to receive widespread national and international attention upon project completion. Likely to result in future grants and collaborative opportunities.
		4	Likely to receive regional and national attention. Likely to result in future grants and collaborative opportunities.
		3	Likely to receive some regional and limited national attention. Likely to result in smaller regional grants.
		2	Likely to receive limited regional and no national attention. No potential for receiving future grants based on collection digitization.
		1	Likely to receive no attention outside of the institution.

Table 4. Exposure

under consideration will have a higher ranking bias. Therefore, when projects of disparate size are compared, institutions may wish to calculate cost as a separate consideration and rank projects according to the performance criteria alone. To rank projects independent of cost, in the example scenarios listed below, institutions would compare the performance totals for each project and costs separately.

Project A is a collection of 1500 original plant specimens and the accompanying original descriptions of the specimens. The specimens are essential to the study of the botanical history of the region. The specimen collectors, many of whom are prominent botanists in the region, authored the accompanying descriptions that appeared in research journals. The specimens are entirely unique. Bringing the type specimens together with the descriptions is unique among type specimen digitization projects from around the country. The institution's strategic plan identifies the management of natural resources as a focus and strength.

Project B is a proposal to digitize 100 documents pertaining to a variety of cherry developed at and marketed by a department of the university since the 1980s. There is minimal research available pertaining to this cherry variety owing to the fact that it is a patent-protected crop. Little is known about it outside of the institution. The cherry is potentially important to the state economy, and the department plans to export the cherry variety nationally and globally. Digitizing the documents could assist in marketing the cherry and provide exposure for the work of the developers of the crop. The documents include technical reports produced by the department; and, while they are well known and widely used within the department, they are largely unknown outside the department.

Performance Criteria	**Performance (P)**	**Cost (C) in thousands**		**Value (V)**
Significance (Internal)*2	8	25		
Significance (External)	5			
Uniqueness	5			
Exposure	5			
Total Performance	**23**			
Total Performance Score (multiplied by 100)	2300			
	2300	25	P/C=V	**92**

Project A

Performance Criteria	**Performance (P)**	**Cost (C) in thousands**		**Value (V)**
Significance (Internal)*2	4	20		
Significance (External)	5			
Uniqueness	5			
Exposure	3			
Total Performance	**17**			
Total Performance Score (multiplied by 100)	1700			
	1700	20	P/C=V	**85**

Project B

Performance Criteria	**Performance (P)**	**Cost (C) in thousands**		**Value (V)**
Significance (Internal)*2	2	15		
Significance (External)	5			
Uniqueness	1			
Exposure	3			
Total Performance	**11**			
Total Performance Score (multiplied by 100)	1100			
	1100	15	P/C=V	**73**

Project C

Performance Criteria	**Performance (P)**	**Cost (C) in thousands**		**Value (V)**
Significance (Internal)*2	10	20		
Significance (External)	5			
Uniqueness	5			
Exposure	3			
Total Performance	**23**			
Total Performance Score (multiplied by 100)	2300			
	2300	20	P/C=V	**115**

Project D

Project C is a proposal to digitize a collection of classic ghost stories authored by prominent authors such as Joseph Sheridan, Le Fanu, Henry James and Edgar Allan Poe. While most of the stories have already been digitized, this project also digitizes literary criticism of the stories. The primary users are students in the English Department. The university offers a graduate degree in English Literature that graduates five to ten Master's degree students per year. The literary criticisms will be widely used by scholars around the world.

Project D is a proposal to digitize 1100 special reports published by the university's Agricultural Experiment Station from the mid 1950s to the present. Beginning in the 2000s the reports are available online. The library is discussing a project with the department to house these reports in the university's institutional repository. Digitizing the older documents provides access to the entire run of the series online. Most of the publications are cataloged but remain difficult to find. Scanning and providing keyword searching of the documents dramatically increases their availability and strengthens the library's collections in this area.

Conclusion

As libraries increase their digitization efforts, many of the same selection principles applied in the selection of print materials are used to select digitization projects. Other considerations, such as campus politics and budgetary issues, may also enter into project selection decisions. Because of the sometimes large-scale and high cost of digitization projects, library administrators should select projects carefully according to established criteria.

Value Engineering is a structured thought process that assists administrators in the selection of significant and unique content for digitization that enhances the stature of the university, using established criteria in the ranking of projects. The use of the Value Engineering methodology as a tool and process provides decision-makers with objective, quantitative data upon which selection decisions can be based. The use of established rating criteria provides selectors with information about how their proposed collection will be evaluated. Finally, the transparency of the process output is easily communicated with stakeholders.

Works Cited

Bick, Dawn and Sinha Reeta. "Maintaining a High-Quality, Cost Effective Journal Collection". College & Research Libraries news 52.88 (1991): 485-49.

Gershenson, John K., Christine E. Hailey, J. Clair Batty and Warren F. Phillips. "Application of Value Engineering Techniques in Curriculum Development and Review." International Journal of Engineering Education. 18.2 (2002): 140-150.

Government Printing Office. "GPO's Digitization and Preservation Initiatives." 27 Sept 2006. 21 Mar 2007 <http://www.gpoaccess.gov/legacy/index.html>.

Hays, Robert H. "Qualitative Insights from Quantitative Methods." Using Logical Techniques for Making Better Decisions. Ed. Douglas Dickson. New York: Harvard Business Review, 1984. 124-139.

Jakhanwal, S.P. and Singh, G.B. "Application of "Value Engineering" to Rationalize the Cost of Cataract Surgery in Eye Clinic at Tata Main Hospital." Journal of the Academy of Hospital Administration 13.2 (2001). 29 May 2007 <http://www.indmedica.com/journals.php?journalid=6&issueid=20&articleid=164&action=article>.

Mudge, Arthur E. Value Engineering: A Systematic Approach. New York: McGraw-Hill Book Company, 1971.

National Information Standards Organization. "A Framework of Guidance for Building Good Digital Collections." 2004. 12 Aug 2006 <http://www.niso.org/framework/Framework2.html>.

Pearsall, Mike and P. Eng. Project Performance Measurement. 2004. Value Engineering, Ministry of Transportation. 11 Nov 2006 <http://www.scav-csva.org/postconf2004-mp/CSVA%20Track3/Track%203-4%20Oct%2026%20Pearsall.pdf>. Available from author of this paper.

Pershing, Gwendolyn and Mary Krutulis. "Using a Value Engineering Technique to Determine Salary Equity among Academic Libraries." Library Administration & Management 10.4 (1996): 240-245.

Quint, Barbara. Google and Research Libraries Launch Massive Digitization Project 2004. 10 Oct 2006. <http://newsbreaks.infotoday.com/nbreader.asp?ArticleID=16307>.

Shenton, Helen. "Developing Life Cycle Models at the British Library – Work in Progress." Digital Preservation Forum. 2002. 8 Oct 2006 <http://www.dpconline.org/graphics/events/presentations/pdf/LifecycleDPC.pdf>.

The University of Michigan Digital Library Services. "Assessing the Costs of Conversion: Making of America IV: The American Voice 1850-1876." July 2001. 25 May 2007 <http://www.umdl.umich.edu/pubs/moa4_costs.pdf>.

"Value Engineering." Wikipedia. 11 Nov. 2006. Answers.com 19 Mar. 2007. <http://www.answers.com/topic/value-engineering>.