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STRATEGIES FOR PRIORITIZING OPERATIONAL EXPENSE AT K-12 EDUCATIONAL FACILITIES

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Abstract: Annually the United States allocates approximately ten percent of the primary and secondary educational budget, or roughly $50B U.S. Dollars, to the maintenance and operations of the nations educational infrastructure. Prior academic research initiatives suggest the physical qualities of the built environment can directly impact the performance of students learning within that space. Furthermore, strategic improvements to the educational infrastructure may also have a positive influence on contributing factors that enable student achievement, including teacher effectiveness, performance, and retention. The impact of providing well maintained educational facilities has been shown to improve student standardized test scores by anywhere from five to seventeen percentage points. While the built environment can have an effect on the students' performance, many schools in the US are currently facing financial constraints prohibiting the maintenance and necessary upgrades to their academic infrastructure. Currently, there is not a thorough understanding of the managerial philosophy and subsequent method of prioritizing spending in support of plant maintenance and operations at K-12 educational facilities. This research utilizes a mixed-method approach of qualitative structured interviews in combination with quantifiable data on annual spending and student academic performance targeting a representative sample of academic school districts in the state of Arizona. The outcome of the research will document existing asset management strategies. More specifically the research explores the extent to which current asset management strategies consider student scholastic achievement when prioritizing spending. The findings from this work will help to guide future research to develop a structured decision support tool, enabling K-12 administrators the ability to more effectively prioritize spending and thus permit the greatest benefit to student learning.

Keywords: Facilities Management, Return-On-Assets, Education, Performance, Structured Interview

1. INTRODUCTION

The role of Facility Maintenance and Operations within the context of a larger organization is traditionally an enabling function. Facilities are one of many business operations within an organization supporting the stated objectives and mission statement governing the actions of that business or organization. It is therefore reasonable to expect the process of prioritizing work and allocating spend attributed to the facilities maintenance and operation align with the fundamental objectives of the parent organization, thus having a measurable impact on the performance of that organization. Management of a real estate portfolio indirect expense spend, facility maintenance and operations as a cost contribution, ultimately factors into that organizations performance as measured by Return-On-Assets. However, the ability to

prioritize facility maintenance for the benefit of an institution or government agency, where a metric such as Return-On-Assets is not an indicator of success, posses a unique set of challenges.

This research explores the decision-making process for Facility Maintenance and Operations spending through the lens of K-12 education in the state of Arizona. Prior academic research has attributed teacher and student satisfaction of educational facilities with the academic performance of the school (Earthman 2002). Additional studies have linked the performance of specific building systems such as indoor air quality, natural lighting, and the quality of architectural finishes as having a direct impact on student performance. Environmental attributes such as these secondarily influence indirect performance factors such as teacher retention and student absentee rates (Haverinen-Shaughnessy, Moschandreas, and Shaughnessy 2011; Ariani 2015; Schneider 2002). A correlative study of student academic performance and facility maintenance expenditures in support of K-12 education in Arizona over a five-year period suggest there is essentially little if any relationship between facility expense and the academic performance of the student (Table 1).

Table 1: Correlation of facility maintenance indirect spend and student performance 2010 - 2015

2010-15	*$/GSF*
$/GSF	
Math	0.28559399
Science	0.1531182
Reading	0.09614371
Writing	0.14614075

2010-15	*$/Student*
$/Student	
Math	0.13891664
Science	0.03765724
Reading	0.02901154
Writing	0.01415351

The apparent lack of correlation may suggest academic facilities have little impact on student performance. However, the data may also suggest there are opportunities to better leverage maintenance and operation expense spending, enabling those benefits to learning prior research has associated with the academic environment. Therefore, this work aims to identify the current decision-making process(es) that are involved for prioritizing K-12 facility maintenance and operation indirect spending. To achieve this objective, a qualitative research study of K-12 Facility Administrators was conducted to assess the managerial approach to facilities and to better understand this perceived phenomena.

2. BACKGROUND

A study by the American Society of Civil Engineers (ASCE) estimates the price tag for infrastructure remediation for the United States' K-12 educational facilities exceeds $270B U.S. Dollars (ASCE 2013). The ASCE's assessment of existing conditions may not accurately depict the collective will of the public to adequately fund the maintenance of educational facilities, nor does it reflect the nations collective visibility to the problem. Across the United States plant maintenance and operations expense spending in support of K-12 educational facilities approaches fifty-billion dollars annually, representing approximately 10% of the overall educational expense (National Center for Education Statistics 2016). Furthermore, attention to the nations school facility conditions have been extensively detailed in the American Federation of Teachers "Marshal Plan" and again in the US Department of Educations "No Child Left Behind" research (Mendell and Heath 2004).

A common metric used to assess the condition of school facilities in North America is some version of the "facility condition index" commonly referred to as an FCI score (OECD 2000). FCI establishes a standardized approach to measuring the physical condition of facilities by applying a formal account of required corrective maintenance versus the estimated replacement cost of the asset (Uzarski and Grussing 2008; D. "Dana" Vanier 2001). The calculation offers a quantitative assessment for enabling the strategic prioritization of work. Determining an FCI score will alert the facility manager should the cost of ongoing maintenance exceed the cost of replacement. The FCI will not provide an acceptable process for prioritizing work. In fact, within the field of institutional facility maintenance and operations, it would seem there is an absence of minimum facility management guidelines or requirements which can be used by academic districts as a decision support tool for Facility Administrators. Furthermore, academic districts may lack a measure of quality and performance outcomes of facility management practices employed by the Facility Administrator and department staff.

3. METHODS

This research employs a mixed methods analysis to understand the current approach to prioritization of indirect expense spend at K-12 educational facilities. A quantitative analysis of the Plant Maintenance and Operations spend and student academic performance was measured over a five-year period. A qualitative analysis of the decision structure was then used to better understand the key factors in prioritizing facility operational expense spending by the district. The interview based qualitative research study was conducted and written in accordance with a hermeneutic phenomenological (*The SAGE Handbook of Qualitative Research* 2008) perspective. This method of understanding enabled the researchers to better appreciate the role of the senior Facility Director and the responsibility of allocating and prioritizing indirect expense spend in support of the organizations primary objectives.

3.1 Study Participation and Collection

A total sample population of eight academic districts were selected for the study based on purposeful sampling. Before the interviews began, participants reviewed and agreed to an informed consent form in accordance with the study's IRB. Study protocol paired the researcher with a district participant, a Facilities Director or a position of equivalent responsibility, as identified by the Arizona School Facilitates Board. All participants were administrative overhead roles having the responsibility of managing their districts overall real estate portfolio. Moreover, all participants self-identified as Assistant Superintendent or Facilities Director, meaning the process of establishing the operational expense budget and prioritizing indirect expense spend was within their professional scope at the district.

A questionnaire was completed by each participant prior to the qualitative interview. The responses to that questionnaire provided a baseline from which to measure the managerial approach, asset management strategy, and relevant facility maintenance and operations experience of the participant and academic district. Relevant data regarding the districts real estate portfolio that directly or indirectly contributes to the cost contribution of Plant Maintenance and Operations was captured in the questionnaire including gross square footage under roof, acreage, annual indirect facility expense, use of technology and the average age of the educational buildings.

The research interview focused on the process by which facility indirect expense spend is prioritized and the ability of that spend to influence student academic performance. A primary expectation of the study was to gain an understanding of how daily work is prioritized by the district. Once a baseline understanding was conveyed, the interview questions targeted the following areas:

- Organization: headcount, organizational structure, roles and responsibilities
- Performance Metrics: key performance indicators, requirements of the district, success parameters, benchmarking, and rounds and readings of equipment.
- Budgeting: budgeting process, expense tools, definition of Capital Expense, and out sourcing of work.

The structured interview was audio-recorded with the verbal consent of the participant in accordance with the IRB. All interviews were later transcribed for the purpose of analysis.

3.2 Data Analysis

The theoretical basis for the research employed a phenomenology analysis method. Moustakas (Moustakas 1994) method of analysis of phenomenological data provided a consistent and structured method to assess the role of the Facility Director and the process by which work is identified and prioritized with each of the participants interviewed. The process of analyzing the interview transcripts included the following measures.:

- Coding of all statements relevant to the prioritization of work and the measurement of performance
- Codes (meaning units) were then clustered to form themes
- Meaning units and themes were synthesized to form contextual descriptions
- A revised narrative, capturing the interview and transcript, was constructed based on the descriptions as authored by the researcher.

Prior to coding, accuracy of the original transcripts was validated by a second researcher. Initial codes were then shared with the research team to verify the accuracy and structure of the coding. Final coding aligned to Strauss and Corbin's (Corbin and Strauss 1990; Strauss and Corbin 1998) process producing selective and central themes.

4. RESULTS

Of the eight academic districts selected for the research, six districts agreed to be interviewed for this paper. Each participant had more than fifteen-years professional experience in Facility Management, although two participants had been in their current role with the district less than two years. Two of the participants held college degree's unrelated to Facilities Management. One of the participants held certification in Facilities Management. The following summary captures the textural themes and categories the participants conveyed regarding the prioritization of work in the maintenance and operation of the academic districts real estate portfolio utilizing information and specific examples from the data set.

4.1 Asset Management

K-12 educational spending in the state of Arizona has declined in each of the past five years, representing approximately 22% of the state budget in 2010 then declining each year to 18.3% in 2015 (National Association of State Budget Officers 2016). At present, Arizona ranks 47th nationally in terms of K-12 per student funding (National Center for Education Statistics 2016). As the funding for necessary capital improvements and ongoing maintenance to existing educational facilities declines, implementation of an effective life cycle asset management strategy has become increasingly important.

The use of Computerized Maintenance Management Systems (CMMS) is a widely accepted best practice in the management and operations of facilities (Sapp and Scientific 2009; D. "Dana" Vanier 2001). CMMS systems are used to record an asset, tracking ongoing preventative, predictive, and corrective maintenance to that asset for the purpose of measuring and reducing long term costs. When used correctly, a CMMS application enables the facility manager to reduce the life cycle asset management costs associated with the facility capital assets while extending the usable life of those assets(D. J. Vanier 2001; D. "Dana" Vanier 2001). Each of the districts interviewed for this research utilize a CMMS to some degree. Of the CMMS systems in use at the districts, School Dude™ was the most widely adopted CMMS platform. However, several of the districts utilized more than one CMMS application. Each of the districts interviewed utilized a CMMS to generate and track work orders. Beyond that, the use and realized value of the CMMS system appears to vary widely.

The ability of any CMMS application to serve as an asset management tool is dependent on the assets being uploaded to the tool. Inputting the asset to the tool requires the manufacturer's information to include make, model, serial number, acquisition costs and in-service date. Of the six districts interviewed for the research, two districts confirmed that all relevant assets have been loaded in the district's CMMS. Given the feedback provided by each of the districts, it was not clear if those districts utilized the CMMS to generate reports specific to the asset or if the assets were managed in accordance with the CMMS to maximize the usable life of the asset. At a minimum, doing so would require that all facility maintenance work orders specific to that asset were logged and tracked in the system. Specific to work orders, one district stated they "*prefer*" a call in lieu of a work order. A second district stated "*they* (the technicians) *are supposed to be logging it* (work orders)" when asked about the use of the CMMS in managing work orders.

In summary, the academic districts participating in the study were unable to speak to or provide documentation detailing a process, procedures, or standards regarding the implementation, use, and structure of the CMMS employed by the district. Each of the districts utilized preventative, predictive and as necessary "run to fail" asset management strategies. With respect to a life cycle asset management strategy and how decisions were prioritized at the district to maximize the functional life of the asset no clear direction was provided. Despite the apparent lack in continuity, several of the districts claimed to use their CMMS as a method of measuring their districts performance against the performance of neighboring districts.

4.2 Performance Metrics

Performance metrics establish minimal acceptable service levels and identify key indicators necessary to evaluate service levels and implement targeted change. These metrics are integral to the continual improvement of an organization (Weber and Thomas 2005). The rigor of continuously seeking to improve through the implementation of strategic, cost effective processes enables an organization to maximize the value of their collective contribution to the parent institution. The delivery and execution of greatest value is then achieved through the implementation of knowledgeable, peer based, benchmarking in cooperation with internal and external stakeholders (Magd and Curry 2003). Furthermore, the management and operations of facilities as enabling organizations, must be viewed strategically whereby the prioritization of work and a corresponding metric of success aligns with the overall core objectives of the educational institution. The process of continual improvement specific to the management of facilities then becomes an ongoing initiative, evolving with the changing needs of the academic districts (Varcoe 1996; Pitt and Tucker 2008; Arash Shahin and M. Ali Mahbod 2007).

A goal of the research was to better understand how an academic district measures a Facility Director's performance. Additionally, the Facility Directors were asked how they would internally define success. This line of questioning was addressed in terms of operational reports, both internal and external, defined by key performance indicators. Prioritizing the needs of the student above all else was a common theme among all of the academic districts participating in the study. The collective response to questions regarding the use and application of performance metrics was subjective, as no district was able to point to specific examples of performance indicators in use by a district or internal to their department. When asked to reference any Key Performance Metrics (KPI's) or equivalent measures of performance specific to Plant Maintenance and Operations used at a district or school level, one district responded "*they* (the district) *don't come to us and say this is what we expect, other than keep it running*." The response provided by other districts to that same question was simply "*I can't think of any*" and "*No*".

The ability of the districts interviewed to prioritize work orders also appeared to lack a formalized process, warranting additional investigation. Of the districts participating in the study, one district referenced a color coding system intended to prioritize facility maintenance work orders. However, there was no documentation provided regarding that system to support the department's position. When asked of the districts method to prioritize work orders one district stated "*Work orders over 90 days we review on a monthly basis*". Of the districts interviewed, only one district spoke to an expectation to close out work orders in a given time frame. That district also spoke to open work orders as being tied to Capital Improvement projects requiring additional approval within the district.

The ability of the Facility Maintenance and Operations department to strategically target areas of improvement, justifying a prioritization of work, is dependent on a system of measuring operational performance against key performance indicators or an equivalent metric. A common theme communicated by each of the districts was an overall lack of strategic oversight and absence of a performance metric assessment.

4.3 Prioritization

The purpose of this research was to better understand how academic institutions prioritize spending for facility maintenance and operation. To this end, the process of developing a clear and detailed budget is of critical importance when identifying a strategic area of improvement and allocating the resources to influence a prescribed and measurable change. Each of the districts interviewed for this study were asked about the role of the Facility Maintenance organization in the creation of the maintenance and operations budget. A key finding of the research is that only one of the districts played an active part in the development of the districts budget. However, all of the districts interviewed were subject to a Top Down allocation of annual budget with minimal opportunity to influence the annual Maintenance and Operations budget.

The Facility Maintenance and Operations budget is conventionally categorized as Capital and Operational expenditures. For the purpose of this study, Capital costs were defined as out of scope. Operational expenditures were then further defined as non-controllable (taxes, utilities, depreciation) and controllable

(indirect spends, headcount, consumables, maintenance methods and means). Reviewing the data, as communicated by the states Auditor General, a measurable gap was apparent at each of the districts with respect to the Plant Maintenance and Operations accounting cost code. One district reported annual operational expenditures for Facility Maintenance at approximately $27M U.S.D. when in fact the Facility Director's budget as provided by the district fell somewhere between $1.8 and $2M U.S.D. annually for a district of approximately five million gross square feet. Similar gaps were present at each of the districts interviewed for the study. Given the financial constraint, and the absence of a bottom up budget, the ability of the Facility Director to strategically influence measurable change through the prioritization of work appeared to be fundamentally compromised.

5. DISCUSSION

Having completed the initial interviews, all participating district representatives mentioned the importance of supporting the needs of students in their daily site facility roles. Conversationally, prioritizing the academic and social needs of the students was second only to providing a safe environment. When asked how daily activities were in fact prioritized, one Facility Director responded by stating:

"*We are proactive, predictive, and prescriptive*." Anonymous Facility Director

The messaging conveyed by each of the district participants essentially echoed this sentiment, effectively communicating a confidence in their ability to manage facility maintenance and operations while having an overall command of the district's real estate portfolio. An informal system of goals and objectives was in place at the districts whereby the facility operations staff strived to close-out work orders, provide routine maintenance of facility equipment, while identifying opportunities to enhance the student experience. This goal was summarized by one district as providing an academic environment the student will want to come back to.

Although the participants discussed the importance of goal setting based on the district's budget, there were few processes, procedures, or metrics in place to measure progress against, close-out of, or in fact baseline for the stated goals and objectives of the district. A key finding of the research was the apparent lack of process or procedures, which may enable the prioritization of work at the district. A consistent message provided by the participants was a daily reactive assessment to the challenges presented that day. It was this element of unpredictability, which offered Facility Directors a measure of job satisfaction. It is the same component of unpredictability that appears to be a primary defensive mechanism to establishing written procedures. Aside from what tracking may be done through the CMMS with respect to work orders, the lack of process documentation appears to be prohibiting the district from establishing a baseline performance expectation.

A secondary finding of the research, requiring additional investigation, was the perception each district conveyed regarding the unique nature of their work. The evolution of the academic system in Arizona has resulted in the formation of more than two hundred academic districts throughout the state. This does not include Charter districts, which have recently gained in prominence in the state. As stated, the districts were selected by a process of purposeful sampling, resulting in a relatively homogenous population. However, when questioned regarding the quality of space, capability of facility maintenance workforce, or administrative strategy each district conveyed a level of superiority which served to effectively negate the perceived need to measure intra- or inter-district performance levels. When asked of the organizational structure employed by the district, one Facility Director's response of "*a carpenter is not a Carpenter*" conveyed a belief the Carpenters employed at that district were in some way materially better than those used for carpentry services at other districts. This sentiment of having an exceptionally skilled workforce was shared by most of the districts, with each district expressing a belief that their management best utilized the technicians. Despite the perceived unique nature of each district, the services provided, relative age of the facility, and organizational structure of the Facility Maintenance and Operation teams were not apparently different.

Finally, the lack of quantitative performance metrics appeared to constrain each of the districts in the study. Although each of the districts claimed to actively track their departments' ability to close work orders, none of the districts interviewed for the study provided a dashboard or equivalent assessment

tool. The apparent lack of rigor with respect to the CMMS has served to undermine the departments credibility when lobbying the district or the state's School Facilities Board for capital grant funding. Capital grants require a narrative history of the compromised asset to include prior expense spending specific to the asset.

5.1 Further Research

This study represents the first phase of a three stage graduate dissertation intended to better understand how institutional real estate portfolio's prioritizes work, determining how the process of prioritization aligns with the intended mission of the parent organization. On going research will address the development of a scalable decision support tool and the metric by which to assess the impact of that tool. Facility Maintenance and Operations, as a profession, has traditionally focused on meeting the needs of the asset. The purpose of this study is to refocus facility maintenance on the product provided and or the service(s) rendered. The resulting cost contribution of indirect operational expense would then factor in the organizations overall Return-On-Assets.

As this is the first phase of an on-going anonymous study, results of the qualitative survey have not been made available to the participating districts. Going forward results will be made available to both the participating districts and the Arizona School Facilities Board preserving the anonymity of the study.

5.2 Limitations of the Study

A total of eight districts were selected for the study based on population demographics, district size and K-12 structure, providing a representative sampling of the population of the state of Arizona. Furthermore, each of the districts chosen for the study are unified districts, responsible for grade levels kindergarten through grade twelve. Although the sample consists of approximately one third of the Facility spend and an equal percentage of the student population in the state, the sample may not however reflect each districts approach to Facility Maintenance and Operations. Academic districts not selected for the study include rural districts and those districts which may be influenced by external factors shown to have negative effects on student performance such as poverty and higher rates of unemployment (Coleman and Others 1966; Fowler 1991).

A secondary perceived limitation of this interview may be the Arizona School Facilities Board (ASFB). Students FIRST (Fair and Immediate Resources for Students Today) was signed into law July 1999, establishing building adequacy guidelines standardizing acceptable levels for existing and new school facilities. The engagement by the ASFB in identifying and networking contacts within the districts may influence the participation of those districts and the quality of information provided by the district Facility Directors.

6. CONCLUSION

The stated purpose of the research was to understand how the work associated with facility maintenance and operations is prioritized and how that strategic prioritization enables the stated objective of an institution. The research was conducted through the perspective of K-12 academic districts within the state of Arizona and therefor findings of the study may not apply to all institutions. Given the financial commitment, it would seem reasonable to expect a return on investment to include a quantifiable method of strategically tailoring the impact of indirect expense associated with the real estate portfolio. If prior research is accurate, such metrics would make the district that much more competitive. Based on the findings of this research it appears there is no standardized or formal process of prioritizing work, internal to a district or between districts. Furthermore, there appeared to be no clear connection between the expectations of facility maintenance and operations and the successful education of the student, as prior works would suggest is possible. The lack of formalized process or procedures, to include quantifiable metrics, would indicate there is no mechanism or method for improvement in place at the districts participating in the study.

A reading of the interview transcript would indicate each of the facility directors sincerely values their role in providing students a safe, comfortable, and effective learning environment. However, as academic

districts further constrain the facility maintenance and operational budget it becomes increasingly important that Facility Directors have written processes and accepted service level metrics in place. Having a written process aligned to the stated goals of the academic district establishes and memorializes a facility maintenance and operations plan. Establishing a baseline service level of performance is an integral component of that plan. From this datum value creation may be measured, offering opportunities for corrective action. Based on the data, it is premature to assess the value academic districts place on the role of facilities nor can the current means and methods of facility management be demonstrated to effectively meet the needs of the district. What the research has identified is a lack of formalized processes and procedures governing the management of facilities and the prioritization of work. The development of processes and procedures specific to the decision-making strategies require further research.

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