INVESTIGATING DELIVERY, PROCUREMENT AND CONTRACTING RELATIONSHIPS IN HEALTHCARE FACILITY CONSTRUCTION

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ABSTRACT
In the United States, there is currently significant growth in the construction of healthcare facilities. This healthcare construction boom is driven by multiple factors including population shifts within the U.S.; aging facilities which no longer meet modern operational practices and efficiencies; and significant shifts in building code requirements. The last major healthcare construction boom occurred in the U.S. when design-bid-build delivery systems were the norm. The implications of healthcare facility capital being used inefficiently have resulted in some healthcare facilities, which are needed, being financially unobtainable.

The following items are discussed (1) current results from an ongoing study focused on the optimization of the healthcare facility acquisition process; (2) briefly existing construction industry studies upon which potential optimization are based; (3) the results achieved to date; and (4) present the future research tasks. The paper also identifies primary challenges relative to the healthcare construction benchmarking of delivery, procurement and contracting methods to allow further effective research. To date, a framework for data collection has been identified, and during a preliminary study, several potential relationships to broader construction industry studies have been defined, such as delivery and construction time. The effort to date has identified the fundamental data elements which must be defined in healthcare projects to effectively compare this specific project type to existing construction industry studies, and to further investigate the relationships between delivery, procurement, and contracting to achieve a more optimal process.

KEYWORDS: Healthcare, delivery, procurement, contracting, integration, and optimization.

INTRODUCTION
Currently in the United States, there is significant growth in the construction of healthcare facilities. This healthcare boom is driven by multiple factors ranging from population shifts within the U.S., aging facilities which no longer meet modern operational practices and efficiencies to significant shifts in building code requirements such as CA SB 1953 in California relating to seismic requirements (Carpenter 2004). The last major healthcare construction boom occurred in the U.S. during the 1960’s and 1970’s, when design-bid-build (DBB) delivery systems were the norm (Carpenter 2004; Sanvido and Konchar 1999).

If collectively the healthcare industry (owners, planners, designers and contractors) can optimize the current process to effectively reduce costs by even a minimum of one percent there is a potential to save $100’s of millions in facility capital investments currently planned. One percent alone in California’s projected 10-year healthcare facility capital investment would save approximately $300M (Dauner 2004). This is one state alone. Nationally, the implications of

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healthcare funds being used inefficiently mean that entire healthcare centers and facilities, which are needed, will be financially unobtainable.

From 2002 to 2003 there was a 10.7% increase in construction spending on hospitals across the U.S. Additionally, there was a 15% spending increase for medical office buildings during the same period (Census 2003). According to the US Census Bureau (2003), the total hospital construction market segment was almost $14 billion. One of the contributing factors discussed above is the shifting population in the United States. These shifts, with the exception of the major metropolitan areas, are generally from north-east to the south-west.

![Figure 1. Projected Average Annual Rate for Natural Population Increases per 1,000, 1995-2025 (Census 2003)](image)

Previous AEC Studies

One survey conducted on over 2,000 healthcare projects noted the following primary influencing factors for healthcare system construction today as (1) operational efficiency, (2) population-based needs, (3) aging facilities and (4) consumer demand (Carpenter 2004). While specific research focused on the healthcare market is limited, there is a breadth of work related to the construction industry as a whole. Sanvido and Konchar (1997; 1999) identified in their study a general conclusion that within the U.S. construction industry 6% of the total costs can be saved and delivery times can be reduced 33% by selecting the design-build delivery method on many projects. This idea is supported by an earlier study in the United Kingdom by Bennett et al. (1996) However, while these studies are strongly supportive of design-build (DB), Ling et al. (2004) have argued that the DB method may not be the best performance choice in all cases. It is important to note that this list is not meant to be comprehensive, but instead representative of some quantitative investigations of related research conducted within the architecture, engineering and construction (AEC) industry.

The purpose of the preliminary and ongoing research is to determine the relationship of different types of delivery, procurement and contracting methods to successful outcomes in healthcare facility projects. Research specifically looking at the healthcare sector has not yet demonstrated which correlations exist in these methods to yield a higher potential for project success. The goal is to provide structured research looking at these relationships.

RESEARCH METHODOLOGY

The overall acquisition strategy elements, sometimes broadly referred to as project delivery, examined within this study include delivery, procurement and contracting methods. While delivery method is sometimes used within the AEC industry to represent broader
attributes, within this research it is specifically limited to the organizational structure (DBB, DB, CM @ Risk, etc.) used within the project’s acquisition strategy. Previously conducted studies in the US, UK, and Singapore which analyzed the broader AEC industry provided constructive guidance for the preliminary work conducted within this healthcare facilities study.

First, the preliminary work included the development of a detailed project questionnaire. The questionnaire was pre-tested on one owner, one construction manager and one subcontractor. This pre-test identified information that is generally and more readily available; as well as project information which is less attainable. The final questionnaire included over 80 questions targeting information addressing delivery, procurement, and contracting methods used; along with attributes of the team selection process.

Second, the questionnaire was used to collect data for healthcare projects by using the question form developed in step one. This questionnaire was used in structured interviews with owners, designers, construction managers, and contractors. Additional data was also collected from organizational databases when possible. All collected data was logged, however few projects had complete data sets from the original detailed questionnaire. Those projects for which complete detailed data sets were achieved required the collection and validation of information from multiple entities involved in the project process (owners, owner’s representatives, designers and builders).

The preliminary work collected data in twenty-two states within the US as well as a limited amount of data from overseas healthcare projects. While the overseas data sets were kept to apply to later research they were not used in the results discussed later due to their limited number.

Finally, an analysis was conducted to investigate the relationships between project delivery methods and overall project success. The data was further analyzed by healthcare occupancy type, project size (both cost and square footage), new versus repair, and delivery, procurement and contracting methods where applicable. Important relationships identified through this analysis are presented in this paper. The preliminary research had incomplete information on procurement and contracting methods to present any significant results relating to these elements. It is important to note that this research is continuing and additional information will be required to draw additional conclusions.

PRELIMINARY RESEARCH RESULTS

The results from the preliminary healthcare data collection are discussed here; however the primary value at this stage is the insight it provides toward the ongoing research effort and its associated roadmap ahead. The effort helped to refine a data set requirement for effectively comparing the independent variables of delivery, procurement and contract methods in healthcare projects to a dependent variable of project success operationalized through analysis of associated cost and schedule growth.

The preliminary dataset includes 71 healthcare projects from 6 different healthcare systems (two designers, six owners, and three builders) with a project type as shown in Figure 2. The distribution of delivery methods used on these projects is presented in Figure 3.

One observed result during the preliminary work is the broadly defined usage of certain delivery methods and fundamental lack of coherency in how the terms are used. It was observed that established delivery methods, such as design-bid-build, were more commonly defined such that most people in the industry would agree with its classification. Conversely, delivery methods which are seen as alternatives to DBB, such as design-build (DB), had much broader
definitions. One example was strong disagreement as to whether or not design-build-bridging solutions should really be classified as design-build. Another owner interviewed reported various projects using the design-build delivery method, which upon further inspection indicated the actual application was a cross between construction manager (CM) at risk and DBB solutions.

When DBB was used as the delivery method, the only observed variation from a strict sequential DBB structure was to incorporate a “fast tracked” approach, where the owner maintained separate contracts between designers and builders and awarded segments of work prior to completing the entire project design.

Some results seen in the preliminary work followed previous broad AEC industry studies. For example, construction speed, sometimes referred to as intensity, increased as the size of the overall project and contract increased (see Figure 4). Additionally, DB delivery speed (time from design award to substantial completion of the building) was 29% faster than DBB. Average construction speed (time from construction award to substantial completion) was 32% faster for DB than DBB. Average construction cost growth for DBB for new and repair (renovation) hospital projects was on average 16% and 11%, respectively. For medical office buildings (MOB) or business occupancy classified healthcare facilities the cost growth was 6% and 9% for new and repair, respectively. This difference was generally attributed in hospital buildings to large scope changes on new projects. It should be noted that some more recent projects were seeing cost growth in the 25%-40% range, which was a significant impediment to healthcare system facility programs.
Another observation from the data collection phase was that there is a general lack of a cross-system healthcare construction benchmarking dataset against which claims of increased performance could be measured. One example was seen with multiple healthcare systems navigating state regulatory approving departments for design. An alternative delivery method being presented as a means to increase review and approval time had no baseline beyond individual opinion (which varied significantly) against which to validate such an outcome. The preliminary research looked at state data over a 10 year period and assisted in providing a valid benchmark against which the actual results could be evaluated (Figure 5).

While interviews with various owners, designers, and builders in the healthcare industry sector indicated agreement that there is room for the process to be optimized, the means to get there is not as widely certain. The best methods for the associated pieces of the puzzle to help improve the healthcare sector AEC industry are still largely founded in traditional methods; whereas alternative solutions which yield more consistent success are argued on the basis of individual experience and bias versus broader multi-organization research and analysis. Of the owners, designers, and builders interviewed one general consensus was that ultimately the owner needs to buy into, conceptually and monetarily, alternative solutions if the healthcare AEC sector is going to significantly change. The designers and builders can influence such change, but ultimately the primary drivers will be the owners. In discussions with various owners about pre-existing AEC industry studies, it was commonly pointed out by those familiar with these broader studies, that a general argument to the validity in the healthcare sector is that these studies lacked healthcare project representation.

**Challenges in Data Collection**

Challenges were observed which provide insight and guidance for future efforts. Cost data on the DB facilities was more problematic because definitive cost data seemed to lag behind substantial completion and due to discrepancies between owner and DB contractor numbers on the project costs. Design-Assist and CM at Risk were not large enough datasets to present meaningful averages at this time.

Upon inspection and discussion with owners, designers and builders, some method classifications were found to be more oriented toward marketing differentiation versus distinct method differentiations that could be commonly agreed upon. This was valuable towards refining the continuing research, because it identified a need to develop a method for objectively
classifying the various methods to ensure analysis integrity. Further, this lead to the conceptualization of a ratio scale for level or degree of integration to help define the delivery method and it’s metric as an independent variable. This integration index would be a potential tool to evaluate conceptual ideas to improve the overall acquisition strategy relationships and limit bias or inconsistent classification, especially within delivery method.

Survey length was also a noted challenge. While an exhaustive survey to gain data on a project for analysis is desirable, the ability to collect this data from any one source is limited. The time required to collect all data on an exhaustive and lengthy survey may make it infeasible to collect sufficiently large datasets for the targeted research topic. The research must also be balanced with the practicality of available information and time on the part of the project participants.

The challenges can be addressed if the research is focused and data is collected in a consistent format with readily available information. As research in this sector is conducted it will allow for further work on specific subsets, such as ancillary or trauma centers, however initial research will be focused on the healthcare sector as a whole.

FUTURE RESEARCH

Table 1 presents a generalized overview of some of the primary entities involved in a project throughout its lifecycle from development or conceptualization through building operations. This is presented in broadly defined ordinal levels for two primary reasons. The first is that the degree of knowledge for any group will vary depending on the individual knowledge of specific employees. Secondly, delivery methods with more integrated attributes are by design intended to propagate and share knowledge of the lifecycle variables to improve results based in part on broader collective understanding by interacting with the respective subject matter experts. The concept presented in Table 1 reflects in ordinal terms those entities of the team that possesses the knowledge of a specific stage or skill set. This is one argument of need for more integrative/concurrent design processes in order to optimize project success; however the hypothesized benefits have yet to be supported for healthcare construction from structured research.

![Table 1: Project Lifecycle Knowledge Base](image-url)
The primary objective is to examine the fundamental relationship of delivery, procurement and construction methods to controlling the original healthcare facility contracts’ cost and schedule. The intent of the initial research was to focus on a market sector within AEC that has limited research and analysis in these fundamental relationships across multiple health systems. Further the structure presented is targeted at attainable efforts which move from idiographic analysis to more rigorous stochastic research approaches.

There are many challenges involved in attaining a more stochastic approach, however with the contributions of owners, designers and builders, this research is moving forward. Additionally, the healthcare market sector currently has a larger than normal project pool to draw from providing a current opportunity for this research effort to be effective.

Defining the metric of delivery method for a project on a ratio scale with respect to degree of integration provides the additional benefit of allowing the opportunity for more rigorous stochastic multivariate analysis than would be afforded through nominal classifications. Further, this approach addresses possible construct validity issues relating to classifications based on marketing and individual opinion, or even possible use of multiple delivery methods. The increasing presence of multiple delivery, procurement or contracting methods on a single project requires a potential shift in the paradigm of how projects are analyzed (Miller et al. 2000). The ongoing research is developing the metrics which would be used relative to healthcare projects, such as the integration metrics. One example of a metric to measure degree of integration achieved is the point of inclusion. When were specialty engineers, prime contractors and subcontractors brought into the process, planning, design development, design completion, etc.? (Measured in percentage of months from design contract award relative to total design time.)

One of the first steps in the overall research is to field a benchmarking tool which allows multiple healthcare systems to securely post project data. In turn the individual data contributor can compare their data against the average of the entire collection of data. This will allow health systems to collectively develop much needed broader benchmarks in their facility programs. Further this concept supports the strongly established continual process improvement requirements of healthcare accreditation organizations, such as JCAHO®. Relative to the continual process improvement functions for the capital facility investment programs seen during the preliminary work, if present at all, most were considerably less formal than that of the rest of the healthcare organization.

Jackson et al (1994) provides a robust overview of AEC industry benchmarking efforts through 1994 indicating substantial examples for effective benchmarking in the AEC industry. Lee et al (2005) note the top 15 most represented project types within the CII database with the fifteenth representing only 19 projects. This provides further evidence that there is a lack of healthcare sector benchmark data with which to compare current studies and thus the need for its establishment. Even with a lack of existing healthcare sector benchmarking, Costa et al (2006) provides further discussions on lessons learned in AEC benchmarking through 2005 to assist in guiding this first step in the future research. The benchmarking is a step towards the primary research presented.

The ongoing research will focus on collecting data sets with a minimum of the following primary information. The ratio scale with respect to integration characteristics will be a subset of the method classification noted. Each will require data at an original point (defined as the point of the contract award) and at a final/actual date (such as substantial completion or actual occupancy date).
Additional data for further study could be extensive, however the availability of such data across healthcare projects in the preliminary work was found to be largely inconsistent. One primary correlated factor seen in other broader industry studies is that of contractor safety (Bennett et al. 1996; Konchar 1997). Additionally other factors may provide mediating or moderating effects for further study.

CONCLUSIONS

The AEC industry has made significant strides in looking at project delivery, procurement and contracting methods used, and their associated outcomes to project success. A very distinct market sector, healthcare facilities, has seen little or no representation in these studies. Much of this market sector utilizes traditional methods common during the healthcare facility construction boom over forty years ago. While alternative methods are used throughout the AEC industry, the healthcare sector has been slow to adopt these methods due in part to a lack of supportive research relating to the results they produce on healthcare projects. The current market prominence of healthcare construction growth provides both the interest and need for research in this market sector across multiple healthcare systems.

Preliminary research has been conducted to establish a fundamental roadmap for the efforts forward, including the identification of needed benchmarking, and further fundamental data focus to allow the investigation of the relationships of delivery, procurement and contracting to overall project success outcomes. The implications related to the goal of optimizing the healthcare construction process are significant and contribute even more broadly to relief and reconstruction efforts worldwide.

REFERENCES


