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Long Term Benefits of Building Commissioning: Should Owners Pay the Price?

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Abstract

This research paper explores the long-term benefits of building commissioning and the persistence of benefits over time. The lack of a strong financial business case has led to a slow uptake of the practice within the building industry. The purpose of this paper is to examine the background of building commissioning and its benefits, determine whether an initial investment by a building owner will result in cost savings and long term benefits, and provide an unbiased perspective on the value of building commissioning.

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Introduction and Background

“The long-term life-cycle benefits of commissioning far outweigh the short-term up-front investments, as borne out by many documented case studies, both in the public and private sector building and facility infrastructure.” [1]

Public agencies such as the Department of Veterans Affairs were among the first to adopt building commissioning as common practice and they still comprise the bulk of the industry today. Since commissioning is not commonly practiced internationally, the United States remains the leader in the use of building commissioning with many commissioning agent companies, professional organizations, and published research and guidance. Despite the growing popularity of commissioning in the public sector, it is still far from standard practice in private industry. Many factors have contributed to the slow uptake of the practice within the industry, the most important of which is a lack of a strong financial business case. In the time since building commissioning was introduced to the construction industry nearly four decades ago, building owners have sought information on the benefits and cost effectiveness of the practice [2]. There are many publicly available case studies and research papers which have been published on the topic, many of which attempt to quantify the benefits of commissioning. This research examines the background of commissioning and its benefits to building owners and whether the benefits of commissioning persist over time.

Commissioning: Ships to Buildings

The concept of commissioning is taken from the ship building industry which has been using commissioning to ensure the readiness of ships for decades. This quality assurance process is an essential aspect of ship building primarily because the risk of loss of life is high for a ship at sea. It is critical that the systems and equipment on the ship function as designed and that all operation and maintenance personnel are thoroughly trained prior to use of the ship. Because the risk is high, the rigorous quality assurance process of commissioning justifies the expense. The concept of commissioning began to be applied as a building construction quality assurance process during the environmental movement of the 1970s and 1980s as an energy saving measure, and gained a great deal of momentum in response to the energy crisis of the 1970s. Throughout the 1980s and 1990s building commissioning became more common, especially in public sector projects. In the decades that followed, commissioning committees were formed to create guidance on the practice and articles began to appear in trade journals. In addition to these early efforts, the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) and the California Commissioning Collaborative have published widely recognized guidance for building commissioning. One of the largest advances for building commissioning is its incorporation into the Leadership in Energy and Environmental Design (LEED) certification [3]. Building commissioning is now common practice for building projects in the public sector and is also very popular among some private owners, especially those interested in obtaining LEED certification. As evidence of its increased visibility, building commissioning even has a Wikipedia page [4].

The U.S. federal government has contributed significantly to the development of the building commissioning industry. In 1994 Executive Order 12902 mandated that all federal buildings utilize commissioning for quality assurance of building systems [3]. In 2007, Executive Order 13423 – Strengthening Federal Environmental, Energy, and Transportation Management reinforced the 1994 order and requires that Federal Agencies ensure new construction and major renovations include building commissioning in the contract requirements (VA, 2013). Each federal organization has implemented this order in various ways. The Department of Veterans Affairs Commissioning Manual states the following drivers for conducting building commissioning, “In addition to the performance needs of healthcare and mission critical facilities, another factor driving demand for commissioning is a desire to obtain certification through the LEED program and the Green Globes program. These rating systems have been developed to improve energy efficiency and environmental performance in buildings – and commissioning is a pre-requisite for LEED certification and a requirement for Green Globes” [1]. The US Government Services Administration (GSA), the Navy Facilities Acquisition Command (NAVFAC), and the US Army Corps of Engineers (USACE) have also published guidance which incorporates the requirement for building commissioning into their contracts. Just recently, the USACE published an Engineering and Construction Bulletin which requires the monitoring of commissioning performance after project completion [5]. Most of the technical research on building commissioning has been done by government organizations such as the US Department of Energy, State Universities, and the California Energy Commission.

Commercial Buildings and Commissioning

In the 21st century, the built environment is becoming increasingly complex. High performance energy efficient buildings are touted by owners and net-zero buildings are being constructed by both public and private owners. Building systems in particular have grown in complexity in that they now often incorporate an electronic Building Management System (BMS) which allows for the control of heating, ventilating, air-conditioning, and refrigeration systems as well as lighting, fire suppression, alarm, and security systems. These control systems produce real-time data which allow the building owner to monitor the system performance [6]. As buildings have become more complex, the need for more sophisticated quality assurance measures has increased. Building commissioning helps fulfill this need by ensuring that the building systems are installed, tested, and are operating as designed. “Building commissioning brings a holistic perspective to design, construction, and operation that integrates and enhances traditionally separate functions. It does so through a meticulous “forensic” review of a building’s disposition to identify suboptimal situations or malfunctions and the associated opportunities for energy savings” [2]. Building commissioning can vary widely in scope depending on the type of building, budget constraints, and owner preferences. The commissioning agent, who is normally a third party hired by the owner to conduct the commissioning process, can be involved in the project as early as pre-design or as late as construction completion. For most new construction projects, the bulk of the commissioning effort will occur towards the end of the project after the building mechanical, electrical, and HVAC systems have been installed and tested by the respective subcontractors. While the general contractor, along with their subcontractors, are ultimately responsible for the quality of the installation and testing of the building systems, a commissioning agent can provide an unbiased analysis of the installation and hopefully detect any issues which would cause operation or maintenance problems in the future. Any deficiencies found by the commissioning agent are normally communicated to the general contractor for resolution prior to occupancy by the building owner.

A building which has never been commissioned but is already occupied and operational can be retro-commissioned if problems with the building systems arise or if the owner is seeking additional energy savings. In this case a commissioning agent is hired to inspect the system, analyze available building metering data, and in some cases conduct testing in the field to understand the operation of the systems. The commissioning agent will then provide a report to the owner with suggested improvements. It is usually up to the building owner and operations and maintenance staff to implement the improvements. The 2009 Building Commissioning report authored by Evan Mills of the Lawrence Berkeley National Laboratory (LBNL) includes a graphic (Figure 1) which effectively presents the commissioning and retro-commissioning processes [2].

Despite the permeation into the federal project landscape, commissioning is still relatively uncommon. Industry practitioners admit that the uptake by building owners has been slow, possibly due to the lack of knowledge about the commissioning process combined with a lack of financial business case [2]. Also, an unwillingness to invest in an independent third party to conduct validation, start-up, and system certification instead of leaving this responsibility to the designer or contractor installing the system can deter owners. This sentiment was expressed in an Engineering News-Record article on building commissioning where the author stated “...many in our industry can’t believe that we have to pay extra to make sure our capital projects actually “work.” While modern building systems are more complex, it would seem that hiring quality architects, engineers, contractors or construction managers and subcontractors would be enough to ensure that your new building operates efficiently and effectively” [7]. This point has been made by building owners nationwide who are equally frustrated with the increase in the cost of capital improvements and the need to spend additional funds to hire a commissioning agent to back check the work of the designer and contractor. The commissioning industry will need to present a solid case in order to overcome this attitude, if the industry is to expand in the future.

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