

Reengineering Management of Construction Projects

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Abstract

The traditional way to manage construction projects has been challenged by the actual social economic needs to deliver a project with higher quality, lower cost and in a short period of time. However, industry is unable to delivery projects under those criteria. Historically, the industry experiences continuous higher price, continuous decline in productivity and extremely high levels of waste. This paper discusses the levels of price, waste, and productivity that historically the construction industry is experiencing and proposes three concepts to change the actual management process of construction projects. The concepts are: design-build concept, Building Information Modeling (BIM) concept, and Lean Concept.

Key Words: change, project management, design-build, BIM, Lean

1. Introduction

Construction business is under pressure to change radically its traditional way to manage construction projects in order to survive the actual social-economic environment needs. Traditionally construction projects are managed under the concept of divisibility of work and actions allocated in specialized departments favoring lack of communication, fragmented teams, segregate knowledge, individuality, and total lack of trust.

The new order calls for the concept of integration in which all work and actions are in perfect symbiosis, generating clear communication, integrated teams, contributions of knowledge, collectivity and trust. There are enough evidences showing that the traditional process to manage construction must be adjusted in order to survive economically in the near future.

There are at least three new concepts that are successfully tested in new projects that will force construction enterprises to shift from tradition into project integration. In my opinion the main drives for this change are the advent of the design-built concept, the development of the Building Information Modeling (BIM) concept, and the need to incorporate more value and less waste into construction projects known as lean concept.

This paper will discuss the levels of price, waste and productivity experienced by the construction industry and discusses three possible ways to overcome variations.

2. Continuous Price Increase

It is well documented in the literature that the services provided by the construction industry has a historical trend of continuous increase in cost per unit of service provided along the years. The Census Bureau computed the price index for the construction industry from 1964-2010 showing a positive slope from 25 up to 225 as shown in Figure 1.

A study from Harvard University (2004) indicates that the mean price of a house in year 1950 was \$59,575 and in year 2000 it jumps to \$ 138,601 which represents 132.6 % increase in price using year 2000 dollar value for the same type of house.

The construction industry usually offers several justifications for this trend aiming to find reasons for its failure outside of their business, in place of looking inwards into their core business to find what is wrong. New regulations, new code requirements, new customer requirements, and project complexity, are usually the main causes appointed. Successful service business practices shows exactly the reverse trend of the construction industry practices, in which the unit cost of services has a historical trend to diminish over the time with an associate increase of value in their deliverables. One classical example of this is the electronic industry in which the unit costs are in continuous decline with an associated increase in value over the time.

Technological breakthroughs seem to be the main drive to burst productivity and reduce unit price of services in a competitive market. However, the construction industry adopts not to take advantage of this drive, preferring to follow their old traditional style to manage projects. This preference to follow traditions and be adverse to new technologies and new ways to organize contract administration of their business is evidence that the construction business prefers to drive in the wrong direction of technological advances in management, showing difficulty to move out of its comfort zone.

Some construction enterprises already move out of its comfort zone throughout the incorporation of new concepts, however the majority are still managing construction projects under the old traditional way.

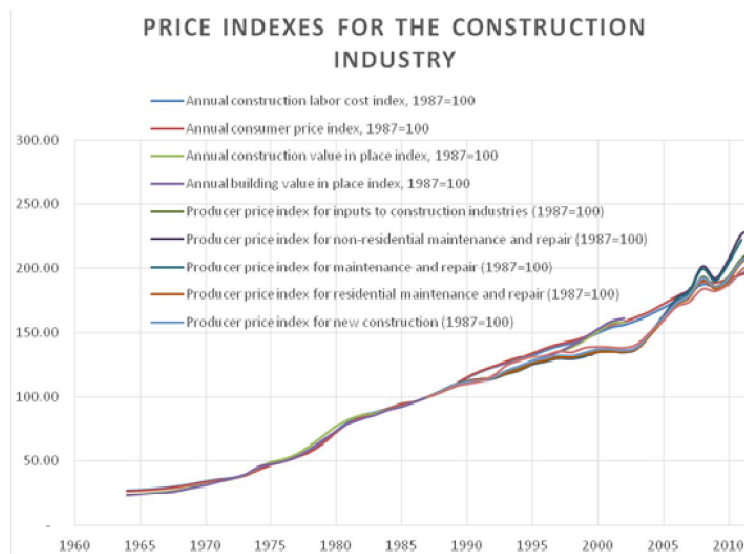


Figure1- Construction Price indexes for 1964-2010. Source: Census Bureau

3. Waste

The level of waste observed in the construction business is astronomical. Miller et al (2009) cites SMART alliance™ which estimates that more than 50% of the cost of a building is waste, and The Engineering News Report estimate that out of \$1.288 trillion of construction volume in the United States 50% of that cost is attributed to waste. In other words, owners are paying for two buildings and are receiving one. It is really unique that a business with this level of inefficiency is surviving over the years. According to Lapatner (2007) the justification of this phenomenon is due to the use of asymmetric information associated with the lack of integration and lack of strong intermediaries between owner and contractors that forces owners to accept the status quo of the business. For Miller et al (2009) the justifications are due to the lack of trust, collaboration and sustainability observed in the business that generates extra costs.

4. Productivity

Low productivity in the US construction industry is a chronic problem observed for a long time. Back in 1983 the report of the Business Roundtable entitled *More Construction for the Money* identified 9 obstacles blocking productivity and offered 225 recommendations for overcome the obstacles found around the areas of project management, planning, communications, supervision, personal and manpower practices, NRC (2009). However, the problem has not been fixed. This is strong evidence that low productivity is a natural outcome of the traditional way to manage construction process. For this reason, the traditional managerial process must be changed.

According to the U.S. Department of Commerce, Bureau of Labor statistics the construction industry shows a continuous decrease in productivity at the same time that nonfarm productivity industry doubles its productivity during the period of 1964 up to 2012. The linear trend shows a -0.32 % per year decline for construction with one accumulated value of -15.34%, while the trend for nonfarm industry shows a positive 4.06% per year as indicated in Figure2.

According to Teicholz(2013) the causes for poor labor productivity that have not improved over many years is well known to practitioners, however they are resistant to change. Poor productivity is related with the lack of integration of design and construction, poor collaboration among team members and poor use of data, based largely on paper documents produced by a highly fragmented team. Lapatner et al (2007) cites a study made by The National Institute of Standard and Technology showing the loss of \$1.2 billion/year in lost productivity due to the inability to manage and communicate project data electronically. He also states that “Contractors often hire low-skilled workers because they confuse labor rate with labor cost. In other words, they do not understand that productivity is the key not wages.”

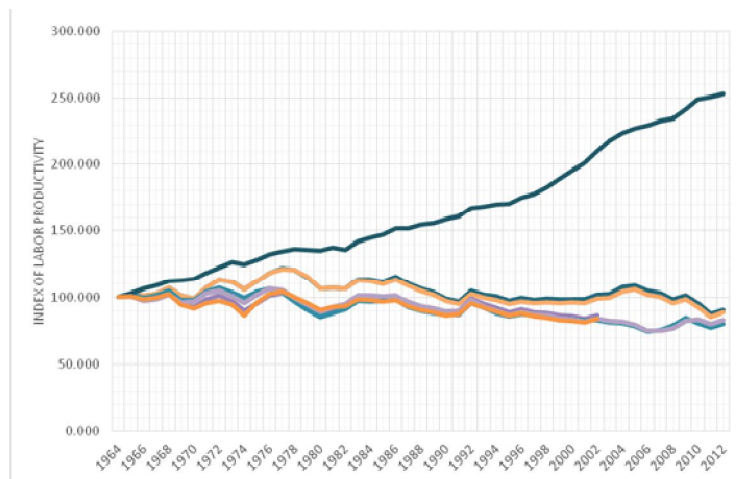


Figure 2-Construction Productivity, 1964-2012 versus productivity of nonfarm industries.

5. What Is Wrong?

What is wrong with my business? This is the question that Toyota managers addressed in 1930 when they visit Ford and GM. They discovered that US auto line produced 9,000 units per month, while Toyota would make only about 900 units per month, and Ford was 10 times as productive, Liker(2004). After an introspective analysis of its production process Taiichi Ohno, a Toyota executive, identified seven areas of waste generation and concluded that they are absorbing resources without creating value, and to resolve this he developed a new management concept around the principle “How humans can work together to create value” later known as lean thinking, Womack and Jones (2003).

The Toyota scenario in 1930 resembles the same scenario of the US construction industry today, both facing high levels of waste, high price, low productivity, and disintegrated teams. Based on these evidences of poor performance Toyota revolutionized its production process changing from a traditional into a modern one that is the benchmark for the automotive industry today. The main point is the change of management process; for this reason the construction industry should consider to change its construction management process in order to increase competitiveness in the market.

Other evidence that the traditional construction process is not adequate to meet all the market requirements is the rapid growing of the design-build concept in the administration of construction projects. In a short period of time (15 years), it reached a market share of 40%, Tyler (2010) Figure 3. The curve is showing a trend to increase market share in the near future. DBIA predicts that by 2015 it will reach a market share of 50%. The author estimates that the future market share will reach a balance at the levels of: 80% design build and the remaining 20% of the market will be shared by the CM and traditional design-bid-building management processes.

It is time to start a change in the management process of construction projects to acquire a competitive advantage and best serve the market today and in the near future. Three concepts are suggested to be incorporated in the construction managerial process. They are: 1) Design-build concept, 2) BIM concept, and 3) Lean Concept.

Project Delivery Method Market Share for Non-Residential Construction

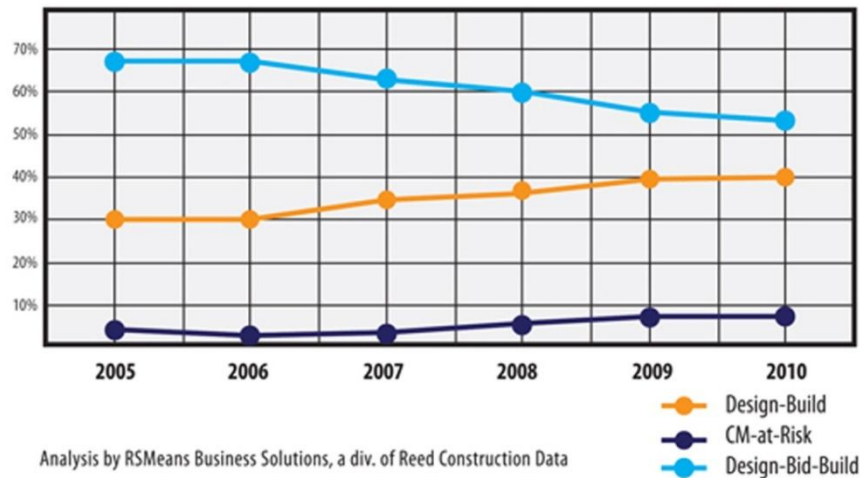


Figure 3- Market share data: top line DBB, middle line DB, bottom line CM at risk

6. 1st Shift-Design-Build

Design-build concept brings back the concept of the Master Builder into our days; it brings back integration in the construction process; Soares(2012), reduction in costs CII; (1997), DBIA (2013), Build (2010), increase in collaboration; Build (2010), less waste; Tyler (2010), trust ;Soares (2012), besides other benefits identified by contractors that are using the design-build concept such as: singular responsibility, quality, time savings, reduced administrative burden, early knowledge of construction costs, improved risk management, everybody on the same team, total accountability, continuity, expertise, professional guidelines, involvement, the best kind of communication is open honest and frequent, and no change orders.

7. 2nd Shift- BIM Concept

BIM concept also brings back the concept of the master builder though data integration and provides a way to link and exchange the information back and forth, as well as a structure that allows the information to interact. According to Miller et al (2009) your firm is late in the game if it is not converting 100 % to a 3D world. With BIM there is no interpretation, no shop drawings, and no submittals. It provides automated quantity takeoffs with material cost and labor estimates. BIM is a collection of tools, process, and cultural mindset. According to Teicholz (2013) productivity can be improved if data base can be handled electronically, but is too early to measure the impact of BIM on labor productivity. But over the coming decade, as it becomes more widely used, the impact should be seen.

8. 3rd shift- Lean Concept

The most powerful tool to eliminate waste and increase value is the lean concept. Miller et al (2009) cite the studies of GeogeZettel showing that 50 % of the construction worker's time is waiting. Taking too much material or more than needed components to the site is waste. Rework is the major source of waste, and can be accounted for up to 10 % of the cost of a conventional project. Lean thinking aligns process, lean has a potential to transform project management, and lean is a system to support trust and integration. Miller et al cites 17 lessons learned by a construction manager after studying lean concepts which provide a good synthesis of the benefits lean concepts can deliver.

1. Lean aims for predictability of workflow and not for optimizing productivity of each component.

2. Lean works to improve relational interaction to reach outcomes; it does not focus on outcomes as a means to drive activity.

3. The customer determines value, and that value clarifies through the project. Value is not fixed at the outset. Lowest upfront price does not equate to lowest final cost or best value.
4. Doers determine how and when work is done instead of centralized planning pushed through a critical path.
5. Quality is built in at the front end instead of inspected and repaired at the back end.
6. Lean focuses on variability throughout the process. Traditional project management is only concerned about it at key milestones.
7. Lean creates an environment of transparency, whereas conventional projects don't ask or worse issues are ignored and/or covered up.
8. Incentive is based in the outcome of the project and not on individual completion of tasks.
9. Lean projects are networks of relationships built within an environment of people who feel committed to one another; and these commitments are not abstractions, like timelines and task lists.
10. Because incentives are shared, money can be shifted to changing priorities without penalizing anyone.
11. The client plays an active role in the project and does not delegate their role to a third part.
12. Sub-trades are recast as flexible players to the overall project, which averages talent and skills where they can make the best effect.
14. Design is an interactive process and requires options; it is not a predetermined path.
15. Design is a social activity that includes key stakeholders; and is not the exclusive activity of "experts."
16. Lean teams co-locate and interact regularly, not just when meetings are scheduled.
17. Work is a group endeavor, not a collection of independent efforts.
18. Lean uses systems theory to understand the nature and dynamics of projects instead of breaking a project into its individual parts.

9. Conclusions

The analysis of the data computed by the census bureau for the last 48 years indicates a positive 2% a year increase for price and a negative 0.32% decrease per year for productivity which represents a very significant net impact over the period of 48 years. The data found in the literature for waste in construction is 50% which represents a very heavy impact to be absorbed by the market. Another find is that constructors know the deviations on price, productivity, and waste experienced over the years, however they were unable to fix those deviations, which leads to conclude that the problem is in the design-bid-built (DBB) process used predominately to manage construction contracts. The lack of alternative processes to manage construction contracts seems to be the justification why DBB survived for a long period of time imposing owners to pay for negative variations in productivity and waste. The rapid acceptance of the design-build process with accelerated increase in market share is also a sign of client dissatisfaction with the traditional way to manage construction contracts. For these reasons it is concluded that the construction business is in transition to change radically the way to manage projects. It is time to move from disintegration into integration, it is time to reengineer the construction business.

The three proposed shifts discussed into this paper are already being used on successful construction enterprises that are experiencing high levels of profit and highest customer satisfaction. There is awaiting line of construction projects to be tackled in the market, waiting for qualified takers to lead projects. The market demands a construction system that can deliver projects with high quality, lower cost, and in a short time. If you think your company needs to be reengineered in that direction, make a decision and start educating your personnel in the areas of need. For a quick start my recommendations is the following:

- Regardless of the size of your company start digitalizing all data involved in the management of a project using BIM.

- Immerse in the concept of design build, train your personnel, and start merging design and construction under the base of trust.
- Train your people in lean concepts and develop state-of-art tailored for your business.

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