

# The Economic and Performance Impact of Job Order Contracting: A Survey of Public Universities

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Through two longitudinal studies with a group of owners in the state of Minnesota (400 tests over six years) and the US Army Medical Command (400 tests over four years), the client/buyer has been identified as the largest risk and source of project cost and time deviations. This has been confirmed by over 1,800 tests conducted over the past 20 years. The focus of this research effort is to analyze the economic and performance impact of a delivery process of construction called Job Order Contracting (JOC). JOC's strength is that it minimizes the need for the owner to manage, direct and control (MDC) through a lengthy traditional process of design, bid, and award of a construction contract. The study identifies the potential economic savings of utilizing JOC. This paper looks at the results of an ongoing study surveying eight different public universities. The results of the research show that in comparison to more traditional models, JOC has large cost savings, and is preferable among most owners who have used multiple delivery systems.

**Key Words:** Job Order Contracting, Delivery System, Procurement, University, cost savings

## Introduction

Over the past twenty years, the Performance Bases Studies Research Group (PBSRG), out of Arizona State University (ASU), has been researching the performance of the construction industry. The industry as a whole is drastically under-performing (CFMA, 2006; Chikuni, A, Hendrik P, 2012; Kashiwagi, D, Parmar, D, 2004; Leicht, R, et. al. 2015; Lepartner, B 2007; Ohrn, G. 2009; UK Construction Industry 2011). Approximately 2.5% of all global projects are delivered on time and on budget (PwC, 2009). Project inefficiencies are estimated to cost between \$15.6 and \$36 billion per year (Lepatner, B. 2007). A variety of delivery methods and solutions have been proposed to solve the non-performance issues of the traditional design-bid-build (DBB) process. They are as follows (Gransberg, D., et. al. 2006; Kashiwagi, D. 2015b; Konchar, M., Sanvido, V. 1998; Ohrn, G., 2009):

- Design-Build (DB),
- Construction Management at Risk (CM@Risk),
- Indefinite Delivery/Indefinite Quantity (IDIQ),
- Job Order Contracting (JOC),
- Time and materials (T&M)

Studies have attempted to identify the relative performance of the different approaches to delivering construction services. The Construction Industry Institute (CII) research team 133 study identified the design-build (DB) process as the most effective process and highly more effective than the design-bid-build (DBB) approach (Konchar and Sanvido, 1998). However, questions were asked about the validity of the research due to the differences in the types of projects being compared in the analysis. A follow-up study performed 17 years later by CII and the Charles Pankow Foundation (CPF), could not identify

which process was more efficient (Leicht, 2015; Knoch, 1998). Findings showed that combined contracts were faster, and cost and quality were driven by procurement and contracting. Findings also included:

1. The importance of early involvement of core team,
2. The high performance of qualification based selection,
3. The transparency in cost accounting,
4. Delivery methods alone do not dictate success,
5. The lines between delivery systems are blurred,
6. Owners drive success by selecting strategies that promote team integration and group cohesion

After studying 204 projects, the CII study concluded that if owners utilized expert vendors (through prequalification) and if the expert vendors and the owner work together as a cohesive group, the project has a greater chance of success. After the large number of projects that was studied in 1998 and 2015, the most effective delivery system depends on the owner's constraints and it is highly advantageous to utilize expert vendors who can work together. This supports another concept developed in 1991: the industry structure (IS) model shown in Figure 1 (Kashiwagi, D., Badger, W., 1991). The industry structure (IS) model identifies that poor performance occurs when the owner/client attempts to use management, direction and control (MDC) on the project to minimize project risk. High performance is when the client utilizes a vendor's expertise. In a Value Based system, the buyer selects a vendor based on expertise and value. This system allows a vendor to operate effectively within their own defined scope. The logical progression of the Industry Structure model states the following:

1. Owner/client management, direction and control (MDC) of a vendor increases the cost of the delivered service.
2. MDC of a vendor by the buyer minimizes the need of vendor's expertise and the buyer's utilization of the vendor's expertise.
3. MDC of a vendor increases non-transparency, cost and transactions, and decreases the value of expertise and the utilization of expertise.
4. The utilization of vendor expertise instead of MDC improves value, quality and minimizes cost.

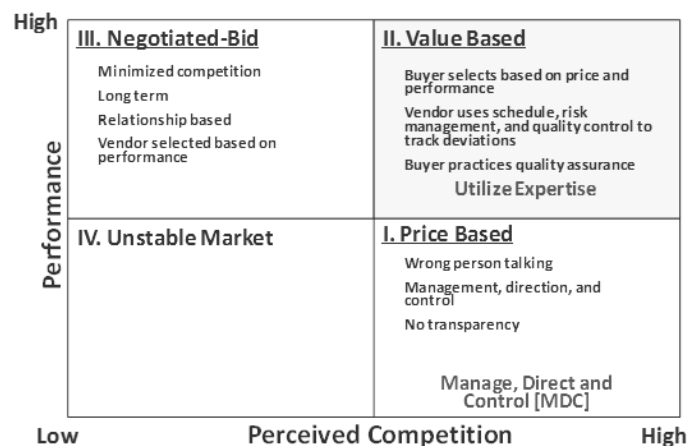


Figure 1 - Industry Structure

The Industry Structure model identifies that client/buyer management, direction and control of the vendor is the reason for poor performance. This does not differentiate between delivery models. It proposes that the more the client/buyer utilizes the vendor's expertise, the higher the level of resulting performance. This concept can apply to any delivery system or process. Therefore an optimal to help mitigate low

performance in the construction industry is to identify a delivery system that minimizes the need of the client/buyer's MDC of the contractor.

### *Job Order Contracting*

The Job Order Contracting (JOC) process was introduced over 20 years ago. JOC is an indefinite delivery, indefinite quantity (IDIQ) contract, which utilizes a unit, price book (UPB) and the JOC contractor coefficient that covers overhead, general conditions, and profit. A typical UPB has between 40,000 – 250,000 line items that cover almost every construction task. The JOC contract award is done competitively by comparing the contractors' coefficients (price) based off contractor overhead and profit. Once the contract is awarded, the projects are priced out using the UPB. Contracts are typically established for 1 – 2 years with up to 5 additional option years. One primary advantage of JOC is speed resulting from minimized procurement transactions. Fewer procurement transactions naturally result in lower MDC of the contractor, and lower overall project risk.

### *Challenge of Showing the Value of JOC Delivery System*

A challenge facing the JOC industry is the assumption that all projects are the same and thus the performance of JOC projects is comparable to traditional projects. This concept comes from the low bid award approach. The low bid assumption is that all vendors are "the same" and they all understand the "same thing" and perform in exactly the "same manner." A more recent approach to identifying value is the Information Measurement Theory (IMT) (Kashiwagi, D. 2015a). IMT is a deductive logic methodology that uses simple observations and common sense to understand and predict real world events. IMT proposed the following concepts:

1. Natural laws are not created, they are discovered. Natural laws were always there, in every space and time.
2. Every set of conditions based on a location and time is unique. Each set of conditions has a different set of characteristics that makes it unique. Unique characteristics include time, location, culture, organizations, resources, expectations, people's perceptions and physical conditions.
3. Unique conditions of the past have a relationship with unique conditions of the present.
4. Unique conditions of the present will have a relationship with the unique conditions of the future.
5. Everything that happens over time starts from one set of conditions and results in another set of conditions.

There are no "apples to apples" comparisons. IMT identifies that there are never two identical sets of conditions or events. In other words, every unique cause results in a unique effect. This concept, according to IMT, is called a natural law or an axiom of reality. Therefore, IMT proposes that every project, every vendor or contractor, and every client or user is different. Therefore, a supposition that assumes any two projects to be "identical" is fundamentally flawed and will lead to erroneous conclusions (Kashiwagi, D. 2015a). Common inaccurate "identical" project assumptions made in the delivery of construction services are as follows:

1. A specification can be written that represents an accurate perception in one person's mind and can be transferred to another person's mind with "exact precision."
2. A specification can be written that is understood "exactly the same" by different vendors.
3. Vendors have the "exact same" level of expertise, and therefore the lowest cost (price based award) vendor is the best value vendor.
4. A perception in one person's mind can be enforced to lead to the "exact same" perception in another person's mind.

5. The only way to prove that one delivery system provides a better value is by running two projects that are “exactly the same” and identifying which project had the more optimal results in terms of time and cost.

IMT introduces the concept that all entities and conditions are unique. When people assume that an “apples to apples” comparison can be made, the following may occur:

1. The false assumption requires a tremendous amount of work attempting to create and compare two identical set of conditions.
2. The results of two identical projects are difficult to validate and therefore the derived conclusions may have little effect in changing traditional practices.
3. Economic analyses, which attempt to compare “identical projects” in order to prove that a new concept is more advantageous, may be too difficult and may not have an impact on changing industry practices.
4. The industry may not be able to take advantage of new practices which may increase the value to buyers and expert vendors because of the inability to validate the value of the new practice using the inaccurate assumption of having “identical” conditions.

The implementation of JOC has not been widely accepted due to the reasons above. IMT provides a way to change the paradigm. IMT states that if decision making is required, it will be unlikely that change will be implemented. IMT suggests that dominant and simple information minimizes thinking and the need for decision making. The logical conclusion is the new process is of great value to the client and should be implemented.

### **Problem**

The IS model proposes that the client/owner/buyer may be the largest source of project cost and time deviation. By observation, the industry has had difficulty delivering construction services efficiently and effectively. Processes and approaches must be introduced that increase the probability of delivering services on time, on budget, and with higher quality. Information Measurement Theory (IMT) proposes that since every project is unique, it is difficult to conduct research using “identical” project comparisons that claim any new concept or proposal has the capability to improve the performance of the delivery of construction services. The traditional approach of comparing different types of delivery systems requires an “identical” project assumption. Therefore, attempts to analyze the performance of a non-traditional delivery system such as Job Order Contracting (JOC) would be met with inaccurate results.

### **Proposal**

In order to measure the performance of a unique methodology, namely Job Oder Contracting (JOC), this paper aims to take a simple and logical approach by examining the delivery of construction services as a supply chain issue. This aim will be achieved by measuring the current performance and satisfaction of the JOC system in the industry overall compared to the performance of more traditional methods. Instead of using “identical” project comparisons, the researchers will quantify the perspective of industry clients/owners.

## Methodology

This research intends to identify if the Job Order Contracting process could help the industry deliver construction projects more efficiently by performing the following preliminary research:

1. Identify the state of delivery of services (including services in other industries).
2. Identify cost impact of owner decision making, direction and control using case study test results.
3. Review the JOC approach and the past performance (time/cost savings) thereof.
4. Compare findings to the results of a JOC case study with eight university implementations of JOC.

### *State of Delivery of Services*

The most credible studies comparing the different delivery processes, Konchar and Sanvido (Konchar, M., Sanvido, V. 1998) identify that the prioritized order of performance is DB, CM@Risk and then DBB. Interestingly, the most efficient process had the least involvement of the owner. The authors propose that all three processes can operate with the same level of performance. The process structure is not the problem; the problem lies within the paradigm of identifying and utilizing experts for the design and construction (Kashiwagi, D. 2015b; Kashiwagi, D., Badger, W., 1991). This conclusion was reached through case studies in which all delivery methods were implemented, while minimizing the participation of the client/owner (Kashiwagi, D., Kashiwagi, J., 2013; Sullivan, K., et. al., 2007). These case studies show that when the expert vendor is more readily utilized, and transparency between parties is increased, time and cost deviations drastically decrease. The first of these case studies was a six year effort ran by the University of Minnesota and other state organizations. Note the following results (Kashiwagi, D., Kashiwagi, J., 2013):

1. The client/buyer was responsible for 95% of all project cost and time deviations (91% of cost changes and 73% of time delays).
2. Client satisfaction of the contractor quality was 100% and the average rating for performance of the contractor was 9.6.
3. Over 50% of the time, the best value vendor (highest past performance) had the lowest cost.

The second of these case studies was performed by the Army Medical Command (MEDCOM). MEDCOM's results are similar to the test performed in Minnesota showing that the owner/client initiated the majority of project deviations. The tests also show that as MEDCOM continued to move control of the projects to the contractors, overall project deviations decreased (Kashiwagi, J., 2013). The same results were also verified by the Dutch fast track project test in the delivery of \$1B of infrastructure repairs (Kashiwagi, D. 2013). The state of Hawaii roofing program shows that owner MDC was the source of costs and schedule deviations (DAGS 2002). The cost decreased, the profit margin increased, and the performance issues disappeared. The State of Arizona Department of Environment Quality (ADEQ) recently procured three projects using the same methodology; they found an administrative cost savings of over 96% (Kashiwagi, D., Kashiwagi, J. 2014). These results also are supported by the IS model which states that management, direction and control (MDC) by the owner is the major cause for poor performance and higher cost.

### *Cost of Management, Direction, and Control (MDC), by Owners*

The cost of MDC by owners is identified in several research projects:

1. University of Minnesota project manager saw his workload decrease by 90%. (Sullivan, K., et. al., 2007)
2. The Arizona Department of Environmental Quality selection process saw a savings of \$94K due to the efficiency of the selection process. A comparison of like projects saw the cost of professional services go down by 100% in some cases. (Kashiwagi, D., Kashiwagi, J., 2014)
3. The Arizona State University food services purchase of \$400M worth of food services saw a return of over 10% of the cost. The ASU networking contract saw a 15% drop in cost with dominantly higher performance. (Kashiwagi, J., 2013)
4. The State of Oklahoma saw a savings of 33% over the budgeted amount over 13 awarded projects. (Kashiwagi, J., 2013)
5. The Dutch fast track infrastructure projects saw a reduction of cost of 20%, and a decrease in construction time of 25%. (Rijt, et. al., 2011)
6. The Dallas Independent School District (DISD) saved 14% off their roofing cost by minimizing MDC. They also utilized the services of their worst performing contractor and received the highest performing roofing systems. They realized that their method of MDC was responsible for the previous poor roofing performance. (Kashiwagi, D., et. al., 2003)

The best value approach, which utilizes expertise of expert vendors, recorded a savings of 5 – 30%. The savings is due to the owner minimizing the use of MDC and utilizing the expertise of the vendors. The expert vendors are selected based on past performance and capability. The vendors and not the clients determine final scope and the means and methods. The savings are made due to the change in paradigm of the client in utilizing the expertise of the expert vendor to deliver services.

### *Job Order Contracting (JOC)*

Job Order Contracting (JOC) was derived from the Indefinite Delivery Indefinite Quantity (IDIQ) delivery system. The traditional JOC contract has the following characteristics:

1. Contractors are engaged early on to participate in the design and scope definition process.
2. Contractors compete for a contract by applying a coefficient to the unit price book. The contractor with the lowest coefficient wins the contracts. The coefficient captures the cost, general conditions, overhead, and profit.
3. The contracts set a minimum and maximum amount of work per year for each site in a multisite contract.
4. Contractors continuously receive task orders from clients.
5. If design work was necessary, the contractor can help manage the design process. Contractors also identify the different tasks and units, and apply their coefficient to calculate the total cost.
6. Owners have the option to extend the timeframe of a JOC.
7. Often, JOC consultants or service providers are employed by owners to facilitate their JOC contracting which includes an additional average consulting fee of 5% (PBSRG, 2014)
8. The contract contains a minimum and maximum dollar amount of job orders throughout the duration.

In the mid-1990s, a research effort identified JOC as a high performing delivery system (PBSRG 2014). Its strength was that the owners' procurement process was minimized, allowing a design build contractor to quickly design and construct the work. At an average 5% consulting fee, the JOC became an economically feasible way of doing the construction (PBSRG 2014). From 1994 to 1998, the Center for Job Order Contracting Excellence (CJE) examined the perspectives of facility managers on 62 different military sites. The results of the latest 1998 survey are shown in Table 1 (Kashiwagi et al, 1998).

Table 1

***Results of the 1998 CJE JOC Research***

	<b>CJE Memembers</b>	<b>Non-CJE Members</b>
Number of Owner Responses	62	30
Average Award Amount to Date	\$5M	-
Average Number of Total Task Orders	114	131
Percent of Satisfactory Projects	95%	90%
Percent of JOC Projects Completed on Time	82%	69%
Quality of Construction Rating	8.2	6.6
Quality of Drawings Rating	7.8	5.1

***JOC Performance Analysis at Public Universities***

In January 2015, the authors, in association with seventeen industry stakeholder organizations, commenced a research effort in order to measure the economic impact and performance of JOC across various industries. The goal of this effort was to be achieved by surveying clients and contractors with previous experience implementing JOC and other service delivery methods. The research was set to take place over the course of 2015. In July 2015, the authors coordinated with eight public universities (Purdue, Stanford, UC San Francisco, University of North Texas, The State University of New York, University of Arizona, and University of Illinois at Urbana–Champaign) who previously expressed interest in participating in the JOC research effort. These universities have a ranging experience with JOC and other delivery systems, thus capturing a sample of the specific market. Each of these universities were contacted individually and surveyed on their experience with JOC. Cumulatively, the universities have over 90 years of experience using JOC resulting in over \$700 million of project award amounts. Of these universities, 8 out of 8 expressed that they would highly recommend JOC to other organizations. The results of these surveys are shown below in Table 1. The most significant of the findings show that not only does JOC yield high client satisfaction, but it also results in 10 – 20% administrative cost savings compared to traditional methodologies. In addition to reporting on the overall satisfaction of JOC, 4 out of 8 universities provide a comparison between the performances of JOC to the traditional design-bid-build (DBB) methodology. The results of these findings show that JOC has a 12% greater overall average performance (budget and schedule combined) than DBB. Furthermore, JOC is shown to yield more transparency and a higher client satisfaction rating. The results can be seen in Table 2 below.

Table 2

**Comparing JOC Performance Metrics by University**

	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>	<b>H</b>	<b>Average</b>
Award Amount to Date (\$ Millions)	\$20	\$4	\$9	\$40	\$7	\$142	N/A	\$4.9	\$32.4
Years Using JOC	3	9	10	16	2	10	19	7	9.50
Number of Projects (Job/Task Orders) to Date	100	40	500	400	30	2200	N/A	32	471
Percentage of Unsatisfactory JOCs	10%	10%	5%	8%	0%	15%	0%	0%	6%
Average Administration Cost Savings Due to Using JOC	15%	N/A	20%	10%	N/A	N/A	13%	11%	14%

Table 3

## Average Performance Metrics of JOC Compared to DBB

	Job Order Contracting (JOC)	Design-Bid-Build (DBB)
Overall Satisfaction Rating (1-5)	4.30	3.50
Quality of Construction (1-5)	4.60	3.75
Level of Transparency (1-5)	4.70	4.00
Percent of Projects on Budget	94%	87%
Percent of Projects on Time	94%	82%

Universities were also asked to provide general feedback on their experience using JOC. They answered questions from a variety of topics regarding JOC cost savings, strengths, weaknesses, and implementation strategies:

1. *Cost Savings* - When asked in greater detail how JOC helps save money, all respondents unanimously agree that administrative time is decreased in utilizing JOC. It takes less time to evaluate bids proposals, less design time, and there is less project rework and scope reconfiguration all equating to greater cost savings.
2. *Strengths* - The underlying strengths of JOC are timeliness and contractor performance. All respondents report that in comparison, JOC takes less time in procurement and in delivery. Over half of the universities also mention that contractors selected through JOC are higher performing and easier to work with. Finally, JOC methodology provides greater transparency, since each contract must be accountable for reporting the progress and results of their task orders.
3. *Weaknesses* - Many respondents reported that the greatest struggle with JOC is applying it to their unique organizational needs or industry/local regulations. Some proposed that in order to mitigate this, they would like further education on JOC implementation or a full time JOC contracting liaison.
4. *Implementation Strategies* - Across the board, universities were unable to share implementation strategies in great depth due to the brevity of the survey. Many expressed that utilizing JOC methodologies was very simple and required little to no organizational change. Some identified that JOC facilitates better scope definition by allowing more contractor freedom. One respondent says that as a client, JOC allows them to release control of scope definition and instead answer questions on an ad hoc basis.

## Conclusion

Past research shows that the delivery of construction services has had poor performance due to high budget and schedule deviations. Case studies and 20 years of research has shown that 10 – 30% of all cost can be minimized if the client/owner/buyer minimizes their decision making, direction and control (MDC) and utilizes the expertise of high performing vendors. An ideal methodology would minimize the client's procurement process, only select expert contractors, and use a transparent system to deliver construction. The authors have identified the JOC approach as a methodology that effectively approaches this ideal system. Expert JOC vendors are able to minimize delivery time by cutting out procurement actions and decision making. In a case study of eight universities, clients were surveyed on their experience with JOC. The results of these surveys clearly agree with previous industry findings regarding high JOC performance and economic feasibility. The survey respondents report administrative cost savings of up to 20% and an average increase of project performance (cost/time deviations) of 12% compared to the more traditional design-bid-build method. In addition, the survey results suggest that from a service procurement and delivery perspective JOC is easier to use, takes less time, and gives more



responsibility and accountability to the contractors thus minimizing the need for client management, direction and control (MDC) which is the major source of project cost and time deviations. The findings regarding the performance of JOC in conjunction with the university case study lead the authors to recommend additional research in other industries which utilize JOC. The information provided herein is based on owner perspectives, the authors recommend additional research at the individual project level for more precise data.

The authors conclude that according to the fundamental conceptual nature of service delivery, whenever MDC is decreased and vendor expertise is better aligned, the overall project performance (lower cost, on time and higher quality) will increase. The study identified that owners that use the JOC program save on average 14%. Even if utilizing JOC consulting services, averaging at a 5% cost JOC a great financial decision (savings of 9%). In addition to cost savings, JOC creates a simpler, more transparent and efficient methodology for clients to work with construction vendors.. Although JOC may not be the only solution to industrywide poor performance, it is shown have great potential within the construction industry.

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