INTEGRATED PROJECT DELIVERY: A NORMATIVE MODEL FOR VALUE CREATION IN COMPLEX MILITARY MEDICAL PROJECTS

BY

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DISSERTATION

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ABSTRACT

Integrated Project Delivery (IPD) is a collaborative project delivery process that reduces waste and maximizes value creation by harnessing the expertise and experience of all relevant stakeholders throughout the design and construction process of a given project. The owner, designer, builder, and user integrate people, systems, business structures and practices into a project team to optimize collective value creation while maintaining balance of individual benefits. The research utilizes a Delphi survey method to (1) select and assess the relative importance of critical success factors for value-creation, and (2) use the selected factors as a basis for evaluating the effectiveness of three project delivery methods: Design-Bid-Build, Design-Build, and Integrated Project Delivery. Key concepts for the theoretical framework of the research include: a macro-viewpoint understanding of project delivery must be adopted to define and measure value-creation; a significant relationship exists between project goals and value-creation; perceptions of relative importance and success differ within the stakeholder groups, and Integrated Project Delivery logically provides a normative model to optimize the collaborative processes to account for the different stakeholder perceptions and provide maximum benefit of all. The research and Delphi panel of experts is centered on the U.S. Army's Integrated Design-Bid-Build (IDBB) pilot-projects which for the first time test Integrated Project Delivery on a large scale within Military Construction (MILCON) program.

To Richard Ray Dickason Jr., M.D., Ph.D.
...until we meet again, May God hold you in the palm of His hand. Vita, Dulcedo, Spes.

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LIST OF ABBREVIATIONS

%Rank	Fractional rank-order
A/E	Architect / Engineer: abbreviation for design team
AGC	The Associated General Contractors of America
AHP	Analytical Hierarch Process
AIA	American Institute of Architects
ASD-HA	Assistant Secretary of Defense for Health Affairs
BIM	Building Information Modeling
BRAC	Base Realignment and Closure
COE	(U.S. Army) Corps of Engineers
CSF	Critical Success Factor
DART	Dispute Avoidance and Resolution
DB	Design-Build
DBB	Design-Bid-Build
DBIA	The Design-Build Institute of America
DoD	Department of Defense
DOI	Degree of Interaction
DPW	Department of Public Works
ECI	Early Contractor Involvement
FAR	Federal Acquisition Regulation
IDBB	Integrated Design-Bid-Build
IPD	Integrated Project Delivery
IRP	Institutional Review Board
KPI	Key Performance Indicator
LEED	Leadership in Energy and Environmental Design
LEED AP	Leadership in Energy and Environmental Design Accredited Professional
MED MILCON	Medical Military Construction
MILCON	Military Construction
NAVFAC	Naval Facility Engineering Command
NGA	National Geospatial Intelligence Agency
NTP	Notice to Proceed
RFP	Request for Proposal
TMA	Tricare Management Activity
UFC	Unified Facilities Criteria
USACE	U.S. Army Corps of Engineers
USAHFPA	U.S. Army Health Facility Planning Agency
USGBC	U.S. Green Building Council
W	Kendall's Coefficient of Concordance

CHAPTER 1.

INTRODUCTION

1.1. Problem Statement

The traditional project delivery method is a fragmented linear process, where each fragment[1] is dependent on the substantial completion of precedent activities before the start of subsequent activity. The project delivery process is similar to the chain reaction of falling dominos. For example, construction start requires completion of a design. If the design domino does not fall, then the chain reaction is halted. Even when the design domino topples towards the construction domino, the chain reaction between design and construction is fragmented by the acquisition process: advertisement, bid, selection and award. These fragmentations, or gaps, that occur during the process timeline from initial concept until project completion, are problematic to the alignment and continuity of project goals between project delivery stakeholder groups.

The definition and interpretation of goals are relative to each stakeholder's personal interests for a given fragment throughout the project delivery process. Even if there is some measure of continuity of major project goals, there is no incentive for any party to be overly concerned about goals outside the scope of their separate project involvement. Collective rationality is not a burden imposed on a group's members. Traditional project delivery methods have evolved to maximize stakeholder utility within the framework of the fragmented process.

[1] Note: These "fragments" of the project delivery process are later defined in Chapter 4 as *micro-viewpoint* aspects of the project delivery process. Correspondingly, a *macro-viewpoint* encompasses all the micro-viewpoint phases such as concept development, design, construction, and operations by which overall project success may be measured.

The designer works to optimize design and the builder works to optimize construction. Each industry over time has naturally optimized itself within the context of the traditional project delivery framework. As long as the project delivery process is fragmented linearly, integration efforts such as constructability reviews and partnering are limited in their impact because they merely attempt to improve upon the existing sub-optimal process. Furthermore, sub-optimal is an Integrated Project Delivery process which does not achieve group utility.

As Weirich states, "A group may fail to maximize collective utility although each member maximizes utility individually". [2] For project delivery to successfully reach its potential for maximizing value-creation, the sum of each stakeholder's utility must be superadditive.[3] As such there is no more critical step than carefully establishing a project delivery team fully invested in a collaborative spirit. This is a major shortcoming of the traditional Design-Bid-Build project delivery process, where each side sees the other as a potential obstacle to successful project delivery. For this reason, the traditional method is sometimes derogatorily referred to as the 'Over the Wall' method to highlight separation of design and construction processes. The architect completes the design process, and then throws the completed design (figuratively) over the wall to an unknown construction contractor to build. The 'wall' is an inhibitor, a barrier, to collaboration and a primary cause of adversarial relationships between the design and construction professionals who have no formal relationship. The result is increased

[2] Paul Weirich, *Collective Rationality: Equilibrium in Cooperative Games* (New York: Oxford University Press, 2010), 60.
[3] Imma Curiel, *Cooperative Game Theory and Applications: Cooperative Game Arising from Combinatorial Optimization Problems* (Boston, MA: Klumer Academic Publishers, 1997), 2.

project cost and reduced building quality.[4] This inherent flaw in the traditional Design-Bid-Build process inhibits value-creation.

Another problem with the linear process of traditional Design-Bid-Build is you get so far down the road before a major conflict is identified too late to backtrack to the proper or optimal solution or fix. Invariably, compromises are made which may degrade, or at least make it more difficult to progress toward project goals. In isolation, each compromise may seem small and the best course of action to achieve the project goals at that time, but there certainly will be unknown consequence to the compromise. For example, a compromise made for the sake of ease of design may have an opposite effect on construction. Achievement of the project goals is what creates value, thus the necessity of compromises, however small, chip away at the ultimate value-creation of the project. In a linear process, the effects of each compromise are additively compounded, leading to a cumulative degradation to value-creation.

It is easy for each party along the linear, fragmented process to say they share the same project goals, but in fact, the actual separation of timelines, functions, and actions gives each stakeholder a unique and different perspective of the process in relation to their individual goals. For example, the contractor may be burdened by economic, political, meteorological, and other unforeseen realities during construction which the designer could not forecast during design. Decisions made early, in good faith, by the Designer to uphold the project goals become binding to subsequent players and in some cases become major barriers to attaining project goals. Maybe the builder has a better way, or the owner/user has a different expected outcome. Depending on the rigidity of the design and specification, the builder may have a narrow scope of variance in which to adopt means and methods to ensure true continuity of project goals. Thus, the Builder's

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[4] George Elvin, *Integrated Practice in Architecture: Mastering Design-Build, Fast-Track, and Building Information Modeling* (Hoboken, New Jersey: John Wiley & Sons, 2007). 234.

decisions can compromise both the design goals and/or the Owner's and User's goals diminishing overall value-creation.

Architects design space and place great value on the quality of space. To a construction contractor the space is free and it is the building components, features and systems which define the space and drive cost. This disparity is demonstrated by the typical difference between how architects and construction contractors measure net and gross building space. Architects typically measure based on factors of floor space while construction contractors measure from exterior limits of the building envelope. This may appear to be a minor discrepancy, but when applied to the order of magnitude of a large scale project the “minor discrepancy” may translate into multiple millions of dollars of difference between the designer’s and constructor’s unit cost estimates. This is only one example of the importance of having an integrated team where all stakeholders are on the same sheet of music from project inception.

Designers must try hard to predict the effects of the proposed design as much and as well as they can with the understanding that redesign or upkeep must follow.[5] A value of the IPD process is that the designer does not necessarily need to predict an effect of the proposed design. By having the construction contractor involved in early aspects of concept design, or even as early as programming, the designer has access, in many instances, to real-time feedback of what the effects will be. Designers are notoriously weak in establishing accurate cost estimates. Decisions made at the earliest phases of design based on the designer's best prediction of cost can send a project down a design development path from which there is no return. After reaching this point, there is no return and the best redesign and upkeep efforts become mitigation measures for a self-created and incurable problem. A key concept of an IPD process is to limit

[5] Michael Kyong-il Kim, "Countermodeling as a Strategy for Decision Making: Epistemological Problems in Design." (Ph.D. diss., University of California, Berkley, 1980), 13.

the designer's predictive variables for the purpose of maintaining continuity and alignment of project goals.

The purpose of any project delivery process is to attain the desired goals for which the project exists. Successful attainment of the project goals is intended to create value for the Owner and User, but also directly and indirectly creates value for other project stakeholders as well. In simple terms value-creation is the performance of activities to provide increased benefit. Value is a function of the output resulting from input of resources. In practice there is no simple definition of value, or value-creation, because assessment of benefit is sensitive to the perceptions of each beneficiary. Value is relative to the perception of each stakeholder in the project delivery process. Although there are many stakeholders involved in large, complex projects, this research focuses on four primary stakeholder groups: Owner, Designer, Builder, and User. It is logical to assume each of these four stakeholder groups have differing perceptions of relative importance of project goals and value-creation based on each group's unique, independent assessment of perceived benefit.

Hypotheses: Integrated Project Delivery (IPD) is more effective than traditional project delivery for achieving expected goals throughout the project delivery process, therefore providing a process which is more advantageous to value-creation.

1.2. Research Objectives

The objectives of this research are: (1) to define the relationship between project goals and value-creation; (2) to indentify critical success factors which key project stakeholders believe are important to project success and value-creation; (3) to establish the existence of significant differences between each stakeholder's perception of project success relative to self-interest and project-interest perspectives; (4) to establish the existence of significant differences between what critical success factors each project stakeholder group perceives as most important for value-creation; (5) establish a macro-view assessment of project delivery as a basis for evaluating project success; (6) demonstrate that Integrated Project Delivery is implementable by the project stakeholders; and (7) determine a normative model for project delivery of large complex military medical projects by comparing the effectiveness of design-bid-build, design-build, and Integrated Project Delivery methods to achieve the most important critical success factors.

1.3. Organization of Dissertation

Chapter 1 of the dissertation has provided an introduction and brief overview of this research. Chapter 2 defines Integrated Project Delivery and reviews its origin and evolution in an analytical and historical context of project delivery. Also introduced is the Military Construction context which provides focus for the research project, and the multi-party contractual relationships of IPD. Further explanations of IPD include significance, desirability, and the need for further study. Chapter 3 reviews the literature. Chapter 4 provides the theoretical framework of the research based on the relationship between value-creation and project goals, stakeholder perceptions and viewpoints from which to assess value-creation. Chapter 5 provides cross analysis between the qualitative survey research and case study field assessments. Chapter 6 provides the research method and describes in detail the modified-Delphi survey model used to categorize, collect and analyze the data. Three rounds of survey research were performed and Chapters 7, 8, and 9 report the results of each survey. Finally, Chapter 10 provides summaries of the work, contributions, and potential future research topics. All references are provided in footnotes, and a bibliography is provided after the appendices.

CHAPTER 2.

INTEGRATED PROJECT DELIVERY

2.1. IPD Overview

The design and construction industries struggle to define the term Integrated Project Delivery (IPD). The definition and interpretation of IPD varies among different people, organizations, or industries. To some, IPD is associated solely with the Design-Build project delivery method. Design-Build is one item in the toolbox for achieving an IPD process but not the only one. Interpretations of defining IPD are influenced by the "What's in it for me?" mindset. Or, what is the value of pursuing an integrated process? From each point of view (owner, designer, constructor, and other stakeholders) the relative value may in fact, or in perception, be vastly different.

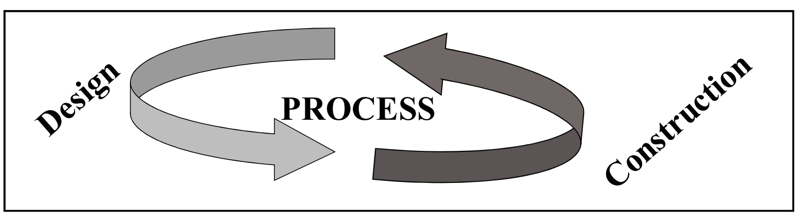

Figure 2.1. Design / Construction process relationship

The American Institute of Architects defines Integrated Project Delivery (IPD) as a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all the participants to reduce waste and optimized efficiency through all phases of design, fabrication and construction.[6]

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[6] The American Institute of Architects, *Integrated Project Delivery: A Guide* (AIA National & AIA California Council, 2007).

Historically, the master-builder naturally, and logically, integrated all aspects of project delivery through his single, comprehensive mind. Through millennia of hard earned lessons of trial and error, each generation of master builders passed on the art of building which resulted in the construction of great edifices and wonders of the world: the Great Pyramids, Greek temples, Roman aqueducts, and medieval cathedrals. These master builders conceptualized and designed their projects based on their comprehensive knowledge of materials and construction, and built them under their close/direct supervision. Since every aspect of the project, including both the design and the construction, was carefully orchestrated in a single head, the comprehensive approach of the master builder must have been the key to successful project delivery.

Why over the course of time has the process of project delivery disintegrated into separate professions of design and construction? This is an important question because one must understand the reasons for the disintegration of the project delivery process to form an argument for re-integration. There are a multitude of technological, social, political, and cultural factors which have contributed to how projects are delivered today. The early master-builders were the products of the *evolutionary* development of the art of building using common materials, tools, equipment, and labor practices. The explosion of science and technology in more recent times has resulted in *revolutionary* changes as to how projects are designed and constructed. The industrial revolution brought about unprecedented complexity and professional specialization to tackle the new challenges. New advancements in material science, engineering, and construction technology add to a body of knowledge that is seemingly too great for any one person to master. Likewise, the complexities of modern life demand that our designers and builders produce buildings with requirements increasingly more complex than ever before. Today's hospitals, airports, industrial plants, and all manner of high-technology facilities, built in a more strict regulatory and environmentally conscious landscape, provide unprecedented technical challenges to today's designers and builders. Thus, the project delivery process has fragmented, or disintegrated, into numerous sub-professions, not only between design and construction but also within each. These separate design and construction professions, where art and science are often at odds with each other, establish degrees of separation posing significant communication challenges to an integrated process.

The inter-relationship between the design and construction professions, as well as within the intra-relationships, are at best sub-optimal and at worst dysfunctional. Efficient communication between the designers and builders to orchestrate the myriad of project activities is paramount to successful project execution. Unfortunately, the process has evolved such that the communication moves primarily in one direction from designer to constructor. The designer attempts to communicate their design intent through drawings and specifications. At the point when the construction contract is awarded, the builder must interpret those static (and dated) drawings and specifications and apply them within the context of a dynamic environment which the designer may or may not have taken correctly into account. The process is inherently incremental and linear where decisions made early must rely on predictions of conditions that will exists during the later phases of the process.

Until very recently, the communication tools available to the design and construction professions have changed very little since the times of the master builders while the substance of communication became far more complicated. Projects relied on two-dimensional drawings and detailed written instructions (specifications) to communicate design intent. The laborious process of producing truckloads of construction documents created a project bureaucracy which further contributed to the complexity and complication of the project delivery process. Feedback of improvements or changes from the construction side of the process was limited by the ability of the designers to rapidly assess the comprehensive impact of a proposed design modification relative to the stage of design completion.[7]

New three and four-dimensional computer modeling and Building Information Modeling (BIM) applications make it possible for the first time for the designer and constructor to communicate in real-time throughout the design and construction process.[8] Finally there are tools available which afford the opportunity to adopt a non-linear method to integrate the project delivery process. As these tools are further refined, and even more advanced tools are invented, the capability of a new virtual-mind to comprehensively process of all aspects of design and construction for even the most complex projects becomes possible. Perhaps the time has come for the return of the concept of the master builder. Today's master builder is not an individual, but an integrated multi-party team of owner, designer, builder, and other related professions. Together these professionals form a master-team working together to provide a truly comprehensive project delivery process.

Typically design is a predecessor to construction. In isolation every task or activity requires design to translate an idea to a physical end state. At this fundamental level design always comes first. In a perfect world a perfect design would result in a perfect translation of the idea/design into a physical manifestation of the designer's intent. Of course, our world is not perfect, and many variables are encountered during the construction phase that requires change to the design. A few such variables are design errors or emissions; unforeseen site conditions; adverse weather conditions; social/political/legal/regulatory issues; market and economy

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[7] Michael Kyong-il Kim, ARCH 599 Report Feedback, Mkkim1@illinois.edu (University of Illinois at Urbana-Champaign, July 01 2009).
[8] Elvin, *Integrated Practice in Architecture: Mastering Design-Build, Fast-Track, and Building Information Modeling*.

fluctuations; and availability of labor, equipment, and materials. In general the concept of an integrated process is to integrate early collaborative involvement of the project builder into design development activities.

The complex nature of healthcare design and construction provides a great working laboratory to study the impact different project delivery methods have on successfully achieving project goals and creating value. Large, complex projects provide more opportunity for errors, omissions, and miscommunication than small, simple projects. Complexity magnifies sensitivity to the delivery method's impact on project outcomes where small errors have big consequences. Complex projects require a greater degree of effort and accuracy in execution of both design and construction activities. Complex medical projects provide a good platform to assess how different delivery methods impact the relationship between design and construction in different ways.

Only recently has the health care industry shifted from the long-held conviction that Design-Bid-Build (DBB) was the only appropriate method for executing a large, complex, medical project. A “perfect” 100% design informed by all manner of consultants, experts, and specialists was the only way to ensure the value of the design met the owner’s intent. A problem with the DBB solution is the length of time required to deliver the project. Military hospital projects would regularly take seven-plus years to progress from concept to operations.[9] At that point a “new” hospital was already obsolete by nearly a decade!

[9] U.S. Department of Defense, *Unified Facilities Criteria (UFC) 4-510-1 - Design: Medical Military Facilities* (Department of Defense, 19 November, 2009), 24.

2.2. Military Construction and Integrated Project Delivery

The research focuses on military construction projects exclusively. This section provides background for understanding the context of military construction (MILCON) in relation to private projects, and to how Integrated Project Delivery is approached in the MILCON program.

2.2.1. Public Sector versus Private Sector

It is important to highlight the differences between public and private project delivery because this study will focus on case studies in only one particular federal public sector -- U.S. Military Construction. An important distinction between public and private sector definition and implementation of an Integrated Project Delivery process is the level of contractual freedom and creativity the owner possesses in assembling the desired integrated team and project delivery process. Private project owners, through the contractual framework of offer, acceptance, and considerations usually have no external limitations on how they assemble their integrated project team. Private owners are at liberty to negotiate all aspects of the project delivery process with designers, builders, or any other contractors required for establishing their vision of an Integrated Project Delivery team. All aspects of schedule, quality, cost, and risk allocation are negotiable. Private owners are limited only by creativity, availability of private resources and qualified bidders.[10]

Unlike the private sector, the public sector is encumbered with a myriad of local, State, and/or Federal acquisition regulations and statutes enacted to help ensure proper stewardship of the public's resources. The public owner must negotiate contracts within the parameters of statutes and political policies. For example, Federal projects such as the case study projects are subject to requirements for providing for employment opportunities to disadvantaged minorities,

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[10] Justin Sweet and Mark M. Schneier, *Legal Aspects of Architecture, Engineering, and the Construction Process*, 1970, 8th ed. (Stamford, CT: Cengage Learning, 2008), 340.

women, people with disabilities, and disabled veterans; setting aside awards for small or disadvantaged business; ensuring workers are paid at local prevailing wages (Davis-Bacon Act)[11], and protection of American manufacturers (Buy American Act)[12] among many numerous other requirements which do not burden private projects.[13] Additionally, a public owner's project delivery process often is exposed to significantly more external stakeholders[14] as part of mandated public/community participation in the project development and vetting processes. Public projects are inherently political and exposed to bureaucratic risk often outside the control of the owners or end users of the projects. The public owner must work within the budgetary framework required to plan, program and publically fund all project costs. The typical bureaucracies of public sector projects make them less nimble than private sector projects. Multiple layers of authority distributed among multiple public agencies add transactional time and cost to public projects.

A benefit of studying public sector projects is that there are established project parameters which provide a level of normalization when comparing projects. It is difficult to make direct comparisons of projects because there are so many project variables such as site, location, time, and other aspects of planning, design, and construction. The uniform set of acquisition rules between projects allows sensible comparison between projects. The Integrated-Design-Bid-Build project delivery method, further discussed below, is a good example of one such public project delivery process.

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[11] The Davis-Bacon Act, as Amended *United States Code* § 40 USC Sec. 3141-3148 (1931, Amended 2002)
[12] The Buy American Act *United States Code* § 41 USC Sec. 10a-10d (2009)
[13] Sweet and Schneier, *Legal Aspects of Architecture, Engineering, and the Construction Process*, 390.
[14] John A. White, Marvin H. Agee, and Kenneth E. Case, *Principles of Engineering Economic Analysis, Third Edition* (New York: Wiley Publishing, Inc., 1989), 332.

In theory an optimal Integrated Project Delivery process has all parties (Owner, Designer, Builder, and User) collaborating from project inception through completion of construction. In practice for public sector projects, it is not feasible, due to rules and regulations, to fully integrate the design and construction process. For example Federal rules require separate procurement processes for design and construction services. The Brooks Act[15] requires that Architect/Engineer services be awarded based on qualifications rather than on lowest-bid. The rationale being that in regard to design it is not in the public's best interest to award design work to the lowest bidder. But, on the other hand, the Federal Acquisition Regulations require that construction services be awarded based on price or best value. It is, however, possible to work within the parameters of the existing public sector rules and regulations to establish a project delivery process as close as possible to the theoretical optimum for Integrated Project Delivery -- simultaneous start of both construction and design services.

2.2.2. Department of Defense Medical Military Construction (MED MILCON)

This study examines case study projects primarily from the Medical Military Construction Program (Medical MILCON) of the United States Department of Defense. The Medical MILCON program is a portion of the Congressional, Title X, military construction program (10 United States Code, Chapter 169 - Military Construction and Military Family Housing)[16] managed by the office of the Assistant Secretary of Defense for Health Affairs (ASD-HA). ASD-HA provides budgetary and policy oversight to the medical departments of the three

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[15] The Brooks Act: Federal Government Selection of Architects and Engineers *Public Law 92-582* (1972) (92nd Congress, H.R. 12807, October 27, 1972).

[16] Military Construction and Military Family Housing *Title 10 - Armed Forces United States Code* § Title 10 USC Chapter 169 (2009)

military services (Army, Navy, and Air Force).[17] Each of the services has a different approach as to how it executes planning and delivery of projects. However, they all link back to ASD-HA through their respective Surgeons General. By law the U.S. Army Corps of Engineers (USACE) is the contracting agent for the design and construction of projects in Army and Air Force areas of operations, and the Naval Facility Engineering Command (NAVFAC) is the contracting agent for projects in Navy area of operations. MILCON projects are all subject to the same Federal acquisition statutes and regulations. Each service's Surgeon General oversees an agency, bureau, or office which acts as owner's and users' representatives in the programming, planning, design, and construction of medical facility projects. There are easily four or five layers of corporate "owner-stakeholders" before adding the operational level (medical facility users) stakeholders, design team, and construction team to the overall project delivery team.

2.2.3. Integrated Design-Bid-Build (IDBB)

To overcome the limitations and challenges of Design-Bid-Build and Design-Build, and to adopt more integrated practices, the U.S. Army Corps of Engineers developed a hybrid project delivery method. This hybrid method executes an Integrated Project Delivery process within the established statues and policies governing the MILCON program. Integrated-Design-Bid-Build (IDBB), Figure 2.2, is a delivery process where separate contracts for A/E[18] and construction services are awarded concurrently to allow collaborative simultaneous design and construction activities to be executed. Two key aspects of the IDBB concept are early contractor involvement (ECI) and extension of A/E Title II Services.

[17] U.S. Department of Defense, *Unified Facilities Criteria (UFC) 4-510-1 - Design: Medical Military Facilities*.

[18] Architecture and Engineering Design Service Provider

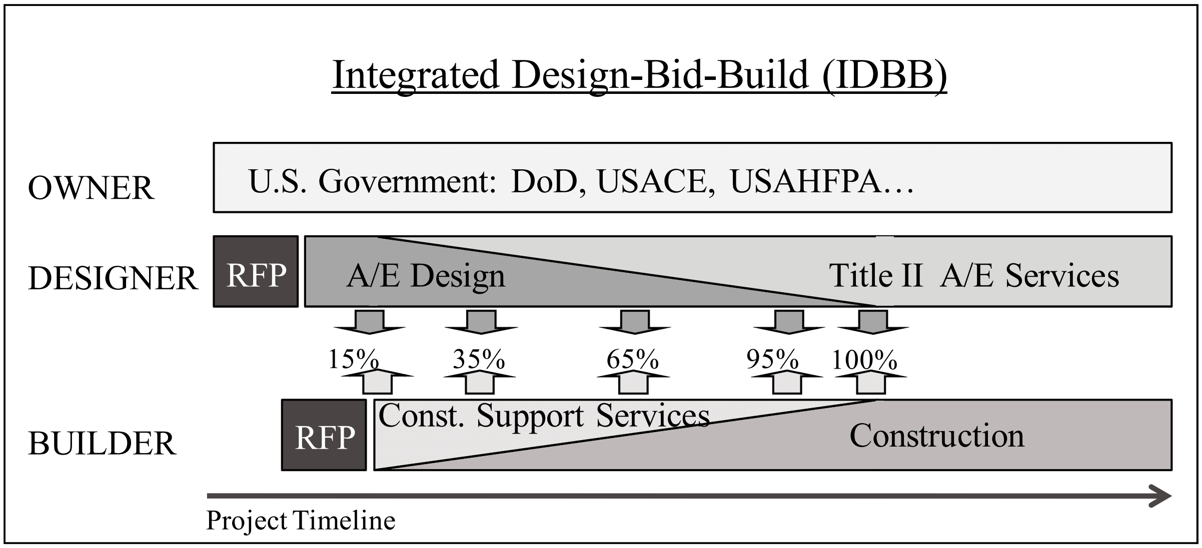

Figure 2.2. Integrated Design-Bid-Build (IDBB) concept

2.2.3.A. Early Contractor Involvement

Within the parameters of the Federal Acquisition Regulations a construction contractor is contracted for pre-construction services (non-Brooks Act services)[19] with an option for construction services. The purpose of the pre-construction services and early contractor involvement is to allow the construction contractor the opportunity to provide collaborative input to early stages of Title I A/E Services (plans, specifications, and design) and to eliminate the need to have a 100% completed design before awarding the construction contract. Because some level of minimal design must be completed in order to competitively bid construction services, it is impossible to simultaneously award the separate design and construction contracts. To provide enough project data in a Request For Proposal (RFP), a minimal level of comprehensive design must be completed to provide sufficient project data upon which construction contractors may bid. The COE sequences initial A/E design services to include RFP development. The A/E must immediately provide a minimal schematic concept design plus estimates for design data

[19] The Brooks Act: Federal Government Selection of Architects and Engineers *Public Law 92-582* (1972) (92nd Congress, H.R. 12807, October 27, 1972)

which normally would not be produced until further design development (See Figure 2.3) to allow construction services to be procured as early as possible.

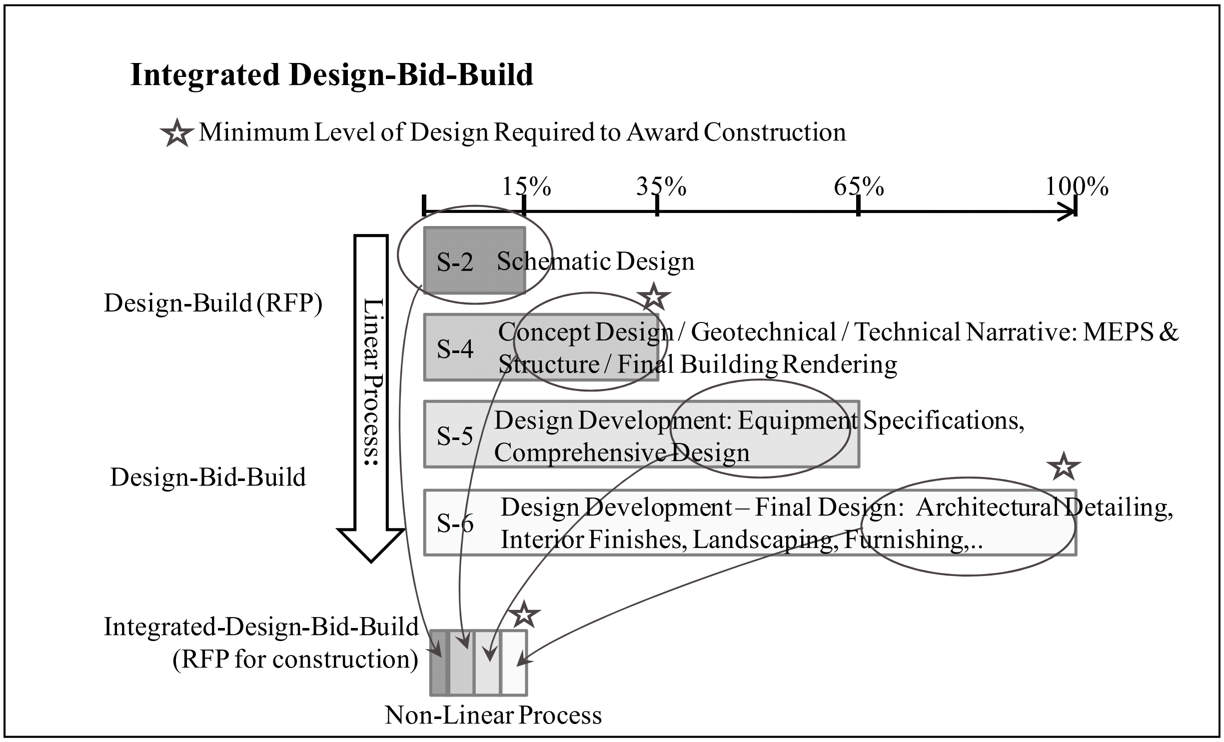

Figure 2.3. IDBB minimal design for Construction Bid

2.2.3.B. Extended A/E Services

In a traditional Design-Bid-Build process the construction contract is not awarded until after 100% completion of the design (Title I A/E services), after which the A/E may or may not provide Title II Services (inspection and/or observation) of construction operations, depending on the contract. Because IDBB overlaps the design and construction processes, Title II A/E services provide real-time feedback from the construction of early design packages which can be used to optimize or improve the quality of subsequent design packages.

The IDBB process differs from Design-Build (DB). The DB design process is linear with a break between the RFP concept design and continuation with the DB contractor's in-house design team after award of the DB contract. This arrangement is inherently inefficient, especially for complex projects, because there is no continuity between the separate RFP and DB design teams. Large, complex Medical MILCON projects have been executed almost

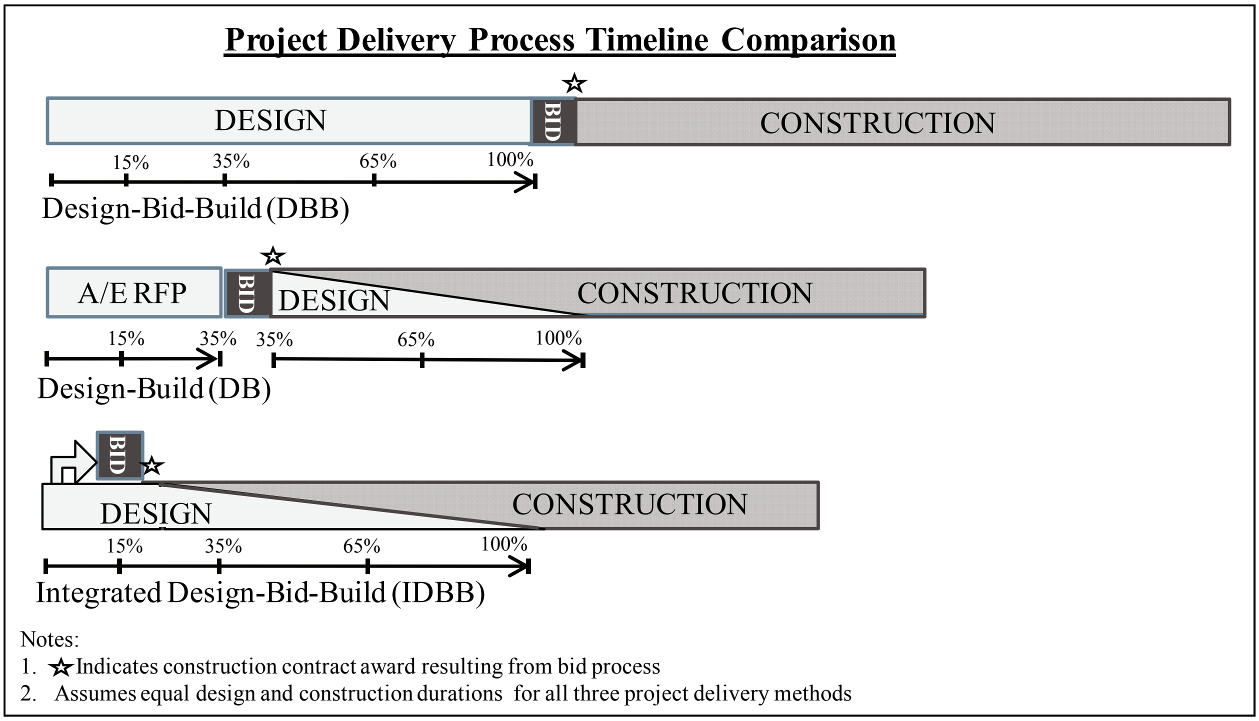

Figure 2.4. Project Delivery Process Timeline Comparison

exclusively using the traditional Design-Bid-Build project delivery method. USACE and NAVFAC were early adopters of the Design-Build project delivery method, but DB has historically played a minor role in the Medical MILCON program, reserved for smaller, less-complex projects such as renovations or smaller clinical facilities. IDBB is a multi-party contractual arrangement where the same A/E develops both the request for proposal (RFP) conceptual design, and is retained to complete all remaining design development in collaboration with the successfully bidding construction contractor. In a typical MILCON DB project a separate A/E is contracted to develop a concept design, typically to the 35% design-completion stage, as part of the RFP package (Figure 2.4).

2.2.3.C. IDBB Pilot-Projects

The IDBB process has been tested successfully on small scale projects by the Kansas City - District of the US Army Corps of Engineers. The early successes of the test projects resulted in Department of Army approval for a Pilot Program to utilize the IDBB process in support of Base Realignment and Closure (BRAC) projects to meet extremely aggressive project timelines for large complex project types. Under the BRAC Act of 2005, BRAC funded projects must be completed no later than 15 September 2011, and the Department of Defense recognized that the traditional project delivery methods would not be adequate to meet the statutory deadline for four projects of particularly large scope and complexity. The four projects selected for the pilot program include two each located at Fort Belvoir in the National Capital Area of Northern Virginia, and two located at Fort Sam Houston in San Antonio, Texas:

- The National Geo-Spatial Intelligence Agency's East Campus, Fort Belvoir, Virginia
- Fort Belvoir Community Hospital, Fort Belvoir, Virginia
- San Antonio Military Medical Center, Fort Sam Houston, San Antonio, Texas
- Battle Field Health Trauma Laboratory, Fort Sam Houston, San Antonio, Texas

Additional project information may be found in Appendix A: IDBB Pilot-Projects. This study primarily utilizes the large hospital projects at Fort Belvoir, Virginia and San Antonio, Texas as case studies to evaluate the integrated project teams and integrated processes role in enhancing value creation. Each of the hospital projects is highly complex with project scopes near or exceeding one million square feet and total project costs approaching or exceeding $1 billion each. Although the National Geospatial Intelligence Agency (NGA) project is not a medical facility, its scope and program is equally large and complex as the hospital projects. Members of the NGA project delivery team participated in the research survey.

2.3. Multi-party IPD Contract

Between 2007 and 2008 private industry had begun to adopt standard form contracts for multi-party Integrated Project Delivery. The American Institute of Architects (AIA) in 2007 published the first of such standard form contracts: C195™–2008 Standard Form of Single Purpose Entity Agreement for Integrated Project Delivery. The terms of the contract allow equitable sharing of risk and reward. Owner, designer, and builder collaboratively work together from the beginning to deliver the project based upon mutually agreed upon project goals and target costs.[20] In 2007 The Associated General Contractors of America (AGC) for the first time failed to adopt the AIA's standard from contracts, and established a competing standard form ConsensusDocs300 - Standard Form of Tri-Party Agreement for Collaborative Project Delivery.[21] Not surprisingly, the main difference between AIA and AGC's approach to multi-party IPD centers on which industry should dominate the process. The AIA document has the architect acting as the owner's agent throughout the IPD process from planning to construction, while the AGC document does not provide a significant role for the architect during the construction phase.

The private owner is at liberty to adopt and/modify any contract model he or she pleases and negotiate terms satisfactory to all parties. Public owners do not share the contractual freedom of their private counterparts. Public owners must work within the established policies, regulations, and laws which govern their capital investment programs. For the Military Construction (MILCON) case studies the U.S. Army Corps of Engineers (USACE) has adopted

[20] The American Institute of Architects, *Integrated Project Delivery: A Guide* (AIA National & AIA California Council, 2007).
[21] Phillip G. Bernstein and Martin Hague. "Integrated Project Delivery (IPD): Why Owners Choose Multi-Party." Webinar. Washington, DC: AGC of America (The Associated General Contractors of America), 2009.

an early contractor involvement (ECI) concept to work within the federal acquisition regulations.[22] Integrated Design-Bid-Build is a hybrid-variation of a very mature and time-tested contractual method. For some design and construction agents the bureaucracy compared to private sector work can be a strong disincentive to bid on public projects such the case-studies. For designers and builders with significant experience in the public sector, familiarity with the system can be an incentive to go along with the financial certainty of federally funded work.

2.3.1. Financial Incentive Structure

The primary contractual features of multi-party IPD are collaboration and equitable, shared risk/reward allocation. The rewards come in the form of financial incentives based on overall project cost performance. The intent of the incentive is to promote creativity and innovation by offering significant motivation to overcome the additional risk exposure which results from pursuing unproven design and/or construction means and methods. Private sector projects may be negotiated in any way agreed upon by the parties in regards to risk, reward, and financial incentives. The public case-study projects are governed under the Federal Acquisition Regulation (FAR)[23] which does allow limited incentives, but only under narrow specifications. FAR Clause 16.403 Fixed Price Incentive Contracts[24] and FAR Clause 52.216-17(d)(2)

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[22] U.S. Army Corps of Engineers. "Early Contractor Involvement (EIC)." In *Industry Workshop*. 7 March 2010. New Orleans, LA: U.S. Army Corps of Engineers, 28 January, 2009.
[23] *Department of Defense General Services Administration, and National Aeronautic and Space Administration*, *Cong.*, *Federal Acquisition Regulation (FAR) VOLUME II -- Parts 52, 53, & Index* (TITLE 48—FEDERAL ACQUISITION REGULATIONS SYSTEM 2005)
[24] 16.403 Fixed-price incentive contracts.
(a) Description. A fixed-price incentive contract is a fixed-price contract that provides for adjusting profit and establishing the final contract price by application of a formula based on the relationship of total final negotiated cost to total target cost. The final price is subject to a price ceiling, negotiated at the outset. The two forms of fixed-price incentive contracts, firm target and successive targets, are further described in 16.403-1 and 16.403-2 below.
16.403-2 Fixed-price incentive (successive targets) contracts.
(a) Description.

Application of the Incentive: *Establishing firm fixed price or final profit adjustment formula*[25] define the allowable limits for incentives.

The IDBB contract method allows for a series of successive targets where the contract is definitized at completion of major project packages or phases. The allocation of incentive payment is depicted in Figure 2.5. The incentive pool is created by the project delivery team's ability to deliver the project below the target price. The FAR provides an incentive range between minimum of 1% and maximum of 7.6% of the total initial cost. For a $500+ million project the financial incentive is quite significant ($5 million - $38 million range), but due to the regulatory limitations, the incentives are not as generous as what could be offered by a private owner.

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(1) A fixed-price incentive (successive targets) contract specifies the following elements, all of which are negotiated at the outset:
(i) An initial target cost.
(ii) An initial target profit.
(iii) An initial profit adjustment formula to be used for establishing the firm target profit, including a ceiling and floor for the firm target profit. (This formula normally provides for a lesser degree of contractor cost responsibility than would a formula for establishing final profit and price.)
(iv) The production point at which the firm target cost and firm target profit will be negotiated (usually before delivery or shop completion of the first item).
(v) A ceiling price that is the maximum that may be paid to the contractor, except for any adjustment under other contract clauses providing for equitable adjustment or other revision of the contract price under stated circumstances.
(2) When the production point specified in the contract is reached, the parties negotiate the firm target cost, giving consideration to cost experience under the contract and other pertinent factors. The firm target profit is established by the formula.

[25] Application of the Incentive *Establishing firm fixed price or final profit adjustment formula* Excerpt from FAR Clause 52.216-17(d)(2) "If the total firm target cost is more than the total initial target cost, the total initial target profit shall be decreased. If the total firm target cost is less than the total initial target cost, the total initial target profit shall be increased. The initial target profit shall be increased or decreased by *TBN* percent of the difference between the total initial target cost and the total firm target cost. The resulting amount shall be the total firm target profit; provided, that in no event shall the total firm target profit be less than *1.0%* or more than *7.6%* of the total initial cost." (*TBN*: To be determined by negotiation)

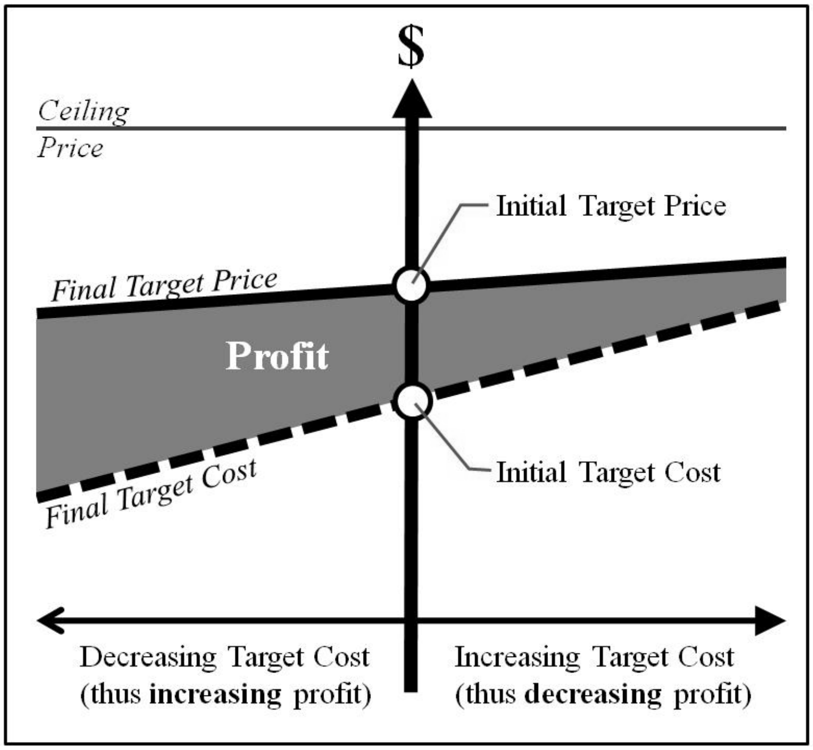

Figure 2.5. Incentive Profit Adjustment (USACE)

2.3.2. Increased Revenue Opportunity

Provisions for pre-construction services provides the builder with an a new, almost-zero-risk revenue source to improve the cash flow bottom line. The fee-based services allow for the construction agent to collaborate with the Owner and Designer at the earliest phases of project development. Payment is not tied to actual construction placement. Payment for pre-construction services start as soon as provision of the pre-construction service is authorized and notice to proceed is issued (NTP).

2.3.3. Contingency Structure

The owner provides contingency cost reserves for both design and construction services. Due to the risk of proceeding with limited design information it is important for the owner to carry appropriate levels of contingency funding as part of equitable risk allocation. Contractors may more competitively bid the work if they don't have to build in hidden contingencies into their price proposals.

2.3.4. Specification Philosophy

The Corps of Engineers, for one, is known for having voluminous stacks of very detailed, and often onerous, prescriptive specifications. Prescriptive specifications stifle creativity and innovation, and add cost to project delivery. A collaborative project delivery process is best served by maximum use of descriptive performance specifications. By communicating the owner's project requirements in as general terms as possible, the project team can creatively pursue innovative alternatives which may be unknown to the owner at the time the project requirements were developed. The best qualified, innovative designers and builders have little incentive to sign on to a project in which their creativity is limited by onerous, excessive detail of overly prescriptive specifications.

2.3.5. Contractual Incentives for Builder to Participate in IPD

The following will discuss key contract terms which provide incentive for a construction contractor to engage in IPD. Typically the terms below will be found in either the general or supplemental section of the contract.

2.3.5.A. Roles and Responsibilities

Clearly stating the collaborative roles and responsibilities of each party up-front, sets the tone for successful project execution. In IPD the owner concedes a level of control to his or her collaborative partners. The process requires more participation and associated resources from each party, but also affords the contractor more input and control during early design phases which could limit or restrict efficient employment of means and methods during later construction phases.

2.3.5.B. Risk Allocation

The more equitable allocation of risk in IPD is a great incentive for the construction contractor over more traditional methods where the owner directs as much risk as possible to the builder. The risk allocation is tied to each party's share of the incentive pool creating a situation where each party benefits more when the whole benefits. Risk is transparent and controllable.

2.3.5.C. Change Management

Theoretically an IPD project should have no changes do to the collaborative nature of the project delivery. Eliminating or minimizing changes allows more efficient execution of construction, and lowers transactional cost of administrative processing. The change order process is minimal. When there are changes they can occur quickly and smoothly.

2.3.5.D. Schedule/Time

Construction scheduling determines design schedule. The process adapts to optimize constructability. Role and responsibilities clearly state the timeline for processing any project documents which are required to facilitate construction placement.

2.3.5.E. Dispute Resolution:

Many projects adopt a Zero-Litigation contract clause as part of a multi-step dispute and resolution ladder with escalation up to binding arbitration or some other level short of litigation.

2.3.5.F. Building Information Modeling (BIM)

Unlike in traditional project delivery, the construction contractor and sub-contractors have the ability to participate in early model design rather than use BIM as a tool merely to identify and resolve conflicts and clashes after the fact. By designing in BIM, the contractor is able to complete rapid, accurate cost estimating.

2.3.5.G. Control & Influence

For contractors who always find fault with the design, they now have a seat at the decision table during the design process.

2.3.6. Overcoming Resistance to Change

Some aspects of IPD will serve as disincentives for some potential construction contractors to compete for projects. IPD requires considerable administrative involvement at all levels of project management. Financial control and cost reporting are paramount to successfully managing an integrated project. Earned Value Management is administratively burdensome and requires significant reporting from the field. The process can be very chaotic and greatly relies on strong communication and public relations skills. Personality conflicts and adversarial relationships have the potential to derail the collaborative process. Human resources planning and training is an important, but often overlooked aspect of collaboration.

Some smaller contractors and sub-contractors have resisted adopting BIM practices, because the technology required to collaborate may be out of reach for some otherwise highly qualified contractors and/or sub-contractors.

And finally some contractors will refuse to change practices. Although increasing in popularity and use, IPD is relatively new and few designers or contractors have experience participating in a fully integrated multi-party process. There is a significant learning curve to adapt to the administrative scope and speed required to keep communication open and transparent. Some of the common arguments against IPD are that the multi-party contracts have not been legally tested, or that the process creates contractual problems for the stakeholders.

The Design-Build Institute of America (DBIA) placed a multi-page advertisement in ENR magazine which railed against IPD for the reasons stated above, and added that DB is already an integrated delivery method. Obviously, DBIA has a vested interest in protecting market share for its membership, and has no interest in promoting a competing delivery method. It is true that DB is a more integrated approach than traditional DBB, but the exact same argument could have been made about the DB method 15-20 years ago when it was first entering the industry. Today Design-Build is highly successful and has established itself as the most used method for project delivery. At one time DB was untested and had to go through the same growing pains that IPD certainly will as the process is tested and refined with each pioneering project. There is always risk when applying new methods and technologies, but that does not excuse the need for seeking an improved process. While DB certainly may be the optimal project delivery for some projects, there are also projects which don't fit the DB model. The emergence of Integrated Project Delivery is based on the industry's response to demand for improved project delivery to overcome increasingly complex and challenging requirements.[26]

2.4. Significance

Even with a highly successful project there are significant efficiencies and improvements which may have been achieved through process improvement. Relying on post-occupancy-evolutions to assess project success and gain lessons learned does nothing to improve the project just completed and offers marginal value to the “next” project which develops with its own unique context, environment, and issues. Developing a normative model provides a proactive process for contemporaneous process improvement feed-back throughout the Integrated Project Delivery process. In today's economic climate it is imperative to find better ways to maximize value creation in our buildings. There is great potential for IPD to provide such an advantage.

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[26] Greg Howell and Will Lichtig, "Special Report: LCI Response to the May 5th, 2010 ENR Article, "Integrated-Project-Delivery Boosters Ignore Many Flashing Red Lights,"" 21 May 2010, Lean Construction Institute, 25 May 2010 <http://www.leanconstruction.org/ pdf/SpecialReportENR.pdf>.

However, the IPD process must be studied to validate that the intuitive, and often anecdotal benefits, are actual and justify the additional costs and effort of implementing IPD practices and process.

The goal of this research is process improvement. Because the Integrated Project Delivery process spans many disciplines, significantly design and construction, the focus of the research is how collaboration between these disciplines enhances value-creation. Where does the research fit in the discipline? It fits precisely at the intersection of design and construction where traditionally a designer's idea is translated by a builder into a physical object. The normally linear relationship will be studied from a non-linear perspective where the builder enhances design, and the designer enhances constructability thereby expanding the limits of the intersection between design and construction. A Win-Win-Win scenario, where the owner, designer, and builder all will be better off, lies in the contractual framework which binds the parties to the integrated, collaborative process. The terms of a well negotiated contract provide a roadmap to success for all parties. Further discussed in this section are aspects of the research topic which are significant to the field: risk allocation and dispute resolution; collaboration and communication; sustainable building practices; and motivation and incentive for value-creation. Aspects significant specifically to each party (Owner, Designer, Builder, and User) will be addressed separately.

2.4.1. Equitable Risk Allocation & Dispute Resolution

Sweet & Martin state the ingredients for dispute are the "Eternal Triangle" of Owner, Designer, and Builder.[27] The contractual relationship of the "Eternal Triangle" determines the risk profile of each project stakeholder. Equitable risk allocation is the single most important

[27] Sweet and Schneier, *Legal Aspects of Architecture, Engineering, and the Construction Process*, 85.

issue to optimizing collaboration between the multi-party entities of an Integrated Project Delivery (IPD) project. The time to address risk sharing is from the very beginning phases of the project delivery process.[28] Risk sharing may appear counter intuitive to an owner who is highly interested in protecting his or her investment. Unlike traditional Design-Bid-Build (DBB) where typically the owner attempts to transfer as much risk as possible to the contractor, the collaborative nature of IDBB is in alignment with Vega's principle of equitable risk allocation: "The general guiding principle of risk allocation should be that the different parties involved should seek a multi-beneficial distribution of risk. A dominant party that off-loads all project risks onto others is unlikely to enhance the chances for a successful outcome".[29] A project in which risks are distributed more justly also sets the stage for greater communication and interaction among the parties, resulting in more honest and productive negotiations when unforeseen conditions become apparent. Sharing project risk among a larger pool of highly experienced and knowledgeable team members results in a lowering of the contingency costs each member carries as overhead. By better balancing the risk allocation between the Owner, Designer, and Builder, the parties can more efficiently manage uncertainties.[30]

Equitable risk allocation also promotes innovation to the benefit of all parties. Risk analysis is critical to the decision process by which a designer and/or builder develop the plans, means, and methods to deliver the owner's building requirements. Each entity's business decisions are influenced by perception and analysis of risk when contemplating break-even

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[28] Feniosky Pena-Mora, Carlos E. Sosa, and D. Sean McCone, *Introduction to Construction Dispute Resolution* (Upper Saddle River, NJ: Prentice Hall, 2003), 47.
[29] Arturo Olvera Vega, "Risk Allocation in Infrastructure Financing," *Journal of Project Finance* 3, no. 2 (Summer 1997): 38-42.
[30] Pena-Mora, Sosa, and McCone, *Introduction to Construction Dispute Resolution*, 47.

points for individual financial considerations.[31] Lowering the risk profile affords more opportunity to introduce acceptable risk through innovative or unproven means/methods, thereby allowing more creative opportunities to be generated by the integrated collaboration.

Dispute Resolution and Avoidance Techniques (DART) are critical to the overall measure of success each entity achieves.[32] Issues or disputes which remain unresolved until after the project is completed result in claims.[33] If the contract does not address dispute resolution and claims management, it is likely the problem will not be settled internally between the project entities and litigation will ensue. Litigation risk adds significant cost to large, complex, or ill-defined programs. Parties to the contract will price their services to cover the costs of perceived risk. Not only does failure to address dispute resolution increase overhead costs, it also becomes a barrier to collaboration as each party must allocated resources to protecting themselves. The tremendous cost of litigation can easily outweigh all benefits received in an otherwise successfully managed project. Often the severe cost of litigation leaves even the adjudicated winner a financial loser.[34] As the saying goes, "in litigation everyone loses except the lawyers"! The best way to mitigate the costs of dispute and ensure success is to avoid disputes altogether.

The IPD process is designed to optimize collaboration, equitably share risk, and collectively address dispute resolution and avoidance. Bridging the design-build gap of traditional DBB project delivery overcomes a significant barrier to equitable risk allocation and

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[31] John A. White, Marvin H. Agee, and Kenneth E. Case, *Principles of Engineering Economic Analysis, Third Edition* (New York: Wiley Publishing, Inc., 1989), 372.
[32] Pena-Mora, Sosa, and McCone, *Introduction to Construction Dispute Resolution*, 45.
[33] Barbara J. Jackson, *Construction Management Jump Start* (Indianapolis, IN: Wiley Publishing, Inc., 2004), 186.
[34] Sweet and Schneier, *Legal Aspects of Architecture, Engineering, and the Construction Process*, 15.

dispute resolution/avoidance.[35] By eliminating the 'over-the-wall' barrier, IPD promotes trust and teamwork through better risk management and dispute resolution.[36]

2.4.2. Maximize Collaboration and Open Communication

Maximum collaboration and open communication is essential to all aspects of project delivery. Having all stakeholders on the same sheet of music throughout the project delivery process creates an overarching continuity of project goals and objectives. Each entity benefits from the open collaborative communication. The Owner is required to be more involved in the process than they normally would be in a traditional project delivery process. The Owner shares development of the program and vision with the Designer and Builder, and is able to receive continuous design validation and optimization throughout the process. Because theoretically there are zero non-discretionary change orders and a faster project completion, the Owner benefits from lower final project costs. An additional benefit to the Owner is the ability to re-invest incentive reward shares back into the project effectively buying more building for the same dollar. The re-investment of the owners' share of savings provides additional revenue to the Designer and Builder -- again a Win-Win-Win scenario.

2.4.3. Promote Sustainable-Building Design, Construction and Operations

Integrated Project Delivery provides the ideal framework for incorporating sustainable concepts throughout the lifecycle of the building from conceptual planning through user operations. The U.S. Green Building Council (USGBC) is the driving force in defining principles and characteristics of sustainable buildings. USGBC defines characteristics of sustainable building centered on a balance between environmental, social, and economic

[35] Pena-Mora, Sosa, and McCone, *Introduction to Construction Dispute Resolution*, 76.
[36] Elvin, *Integrated Practice in Architecture: Mastering Design-Build, Fast-Track, and Building Information Modeling*, 56.

prosperity.[37] USGBC's Leadership in Energy and Environmental Design (LEED) certification program defines sustainable characteristic of both buildings and the building process. Key areas include: Sustainable Sites, Water Efficiency, Energy Efficiency, Materials and Resources, Indoor Environmental Quality and Innovation in Design.

This study focuses on public projects, specifically Department of Defense Medical Military Construction (MILCON) projects. Public projects have significantly longer life-cycles than private projects. Since public buildings are expected to operate for fifty to one hundred years or more, they have much to gain from the benefits of sustainable building practices that provide a significant long-term value to the owner.

The Federal Government has mandated its own principle characteristics of sustainable buildings, based in large part on the USGBC's voluntary programs.[38] Executive Order 13423 signed by President Bush in 2006 directed that all federal agencies adopt sustainable design and construction practices for all new federal buildings and for major renovations of existing facilities.[39] The Interagency Sustainability Working Group comprised of leadership from all applicable federal agencies developed a uniform set of goals, objectives and principles for sustainable buildings. The federal goals include: reduce the total ownership cost of facilities; improve energy efficiency and water conservation; provide safe, healthy, and productive built environments; and, promote sustainable environmental stewardship.

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[37] U.S. Green Building Council, *Guiding Principles*. 2006, U.S. Green Building Council, 14 April 2010 <http://communicate.usgbc.org/usgbc/2006/08.15.06_guiding_principles/guidingPrinciples/>.

[38] In Collaboration with the Interagency Sustainability Working Group, Federal Energy Management Program, U.S. Department of Energy, *The Business Case for Sustainable Design in Federal Facilities* (2003)

[39] Title 3 - The President, Presidential Documents, Federal Register, *Executive Order 13423 of January 24, 2007 - Strengthening Federal Environmental, Energy, and Transportation Management* 3979, at 3979-23 (2007)

To support the federal goals the following five characteristics of high performance and sustainable buildings were published[40]:

1. *Employ Integrated Design Principles*.

> Federal leadership recognized that the use of collaborative, integrated planning and design is essential to realizing sustainable building goals. In traditional project delivery methods the focus is on production of specific products: a design and a building. There is no continuity of vision. Integrated practice, on the other hand, is a continuous collaboration from concept through completion of construction, and on into operations. Integrated practices offer the best opportunity to realize successful adoption and implementation of sustainable building principles.[41]

2. Optimize Energy Performance

3. Protect and Conserve Water

4. Enhance Indoor Environmental Quality

5. Reduce Environmental Impact of Materials.

The U.S. Army Corps of Engineers implemented an additional policy that all new construction projects will meet, at a minimum, all requirements for LEED Silver certification, and all design and construction teams under USACE contract must have LEED Accredited Professionals (AP) assigned to the project team.[42]

From an operational standpoint the concept of sustainable building goes beyond the physical and performance aspects of the building and site. The IDBB pilot-projects provide good examples of the need for sustainability of functional operations. The functionality and

[40] The Office of the Federal Environmental Executive, Interagency Sustainability Working Group, *Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding* (2006)
[41] Elvin, *Integrated Practice in Architecture: Mastering Design-Build, Fast-Track, and Building Information Modeling*, 213.
[42] Annette Stumpf, U.S. Army Corps of Engineers, "Army Sustainability Policy," in *Infrastructure Systems Conference: Building National Technical Competency*, April 16, 2010 (Cleveland, OH, July 21 2009).

operations of health care facilities are very sensitive to emergent technology and innovative medical practices. The building must be highly adaptable to sustain state-of-the-art medical care and implement best medical practices. Often this requires frequent reconfiguring of entire clinics and departments, or expanding to accommodate new equipment and protocols. Only a comprehensive integrated approach to design and construction will ensure a sustainable vision well into the future use of the building.

Sustainability in context of the building's surroundings is also important. Dr. Kim has developed the concept of a Meronic goal,[43] where the building must fit as a part of the whole surroundings. An integrated project team is best suited to partner with local communities and governments to ensure building sustainability in the context of community does not create less-sustainable conditions for others outside the boundaries of the construction site.

The proper time for the Owner to incorporate sustainable building principles is at first conceptualization of the project requirements, if not earlier. It is important for the Owner to integrate sustainability into his/her functional philosophy or concept of operations.[44]

Because many aspects of sustainable buildings are related to construction means and methods to reduce waste and improve efficiency throughout construction activities, it is critical to have the builder involved as early as possible. Contractor involvement at the earliest phases of design is a perfect means to ensure sustainable features in the design are not at odds with reality during construction. An example of this involvement is specifying a certain renewable/sustainable flooring material during design to gain two LEED points, then finding out

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[43] Michael Kyong-il Kim, 2011. File: Manuscript in Progress. Integrative Design of Buildings: Principles and Strategies. University of Illinois at Urbana-Champaign, Unpublished, Chapter 3.
[44] In Collaboration with the Interagency Sustainability Working Group, Federal Energy Management Program, U.S. Department of Energy, *The Business Case for Sustainable Design in Federal Facilities Resource Document* , at 2-17 (2003)

during construction that use of the specified "renewable" flooring material will actually net a loss of 3 LEED points because the means and methods required to install it penalize other aspects of sustainability (non-local material, requires adhesives which reduce air quality, etc...).

It is the responsibility of the owner to ensure that the terms of the contracts for both the designer and the builder include specific requirements for sustainable practices. A good example is the USACE contract requirement for LEED AP certification for project team members and that the completed building must meet minimum requirements for LEED Silver certification. The general conditions of the contract must specify the roles and responsibilities of each party in achieving the desired sustainable building goals.

The owner also must be careful that the requirements are not so specified in such a prescriptive manner as to prevent the project team from adopting creative design features, new sustainable materials, or innovative construction means/methods. Descriptive, performance specifications are best for communicating project requirements to the designer and builder in a manner which promotes creativity and innovation.

There are some cases where the owner may wish to specifically prescribe certain sustainable building features for symbolic or marketing purposes. Most aspects of sustainable buildings involve building systems hidden in walls and ceilings such as mechanical, electrical, and plumbing systems. Some sustainable features can be designed as signature architectural elements with high sustainable function. Examples include green roofs, water features which collect and utilize rainwater, or other features with which users and visitors may interact. In medical facilities it is becoming common to feature 'healing gardens' which are integrated into storm water management systems.

How to afford implementing sustainable design? In most cases intelligent design decisions can implement sustainable building principles at little additional project cost. In some cases sustainable practices result in lower first costs for projects. The significant selling point of sustainable buildings is the long-term economic benefit to all parties involved. An Integrated Project Delivery process provides a collaborative bridge to ensure continuity of sustainable goals throughout the project delivery process.

2.5. Arguments for IPD

There are two philosophical approaches an Owner can adopt to influence the Designer and Builders contract performance: the Carrot or the Stick.[45] The Stick method, common in traditional DBB projects and especially in public sector DBB projects, involves assessing penalties for non-performance. An example is liquidated damages (LD) assessed against a construction contractor (i.e. $1,000 dollars per day) for failure to meet a schedule deadline. The terms of the LD penalty is negotiated into the contract and becomes a risk (not necessarily equitably allocated) which the Builder assumes.[46] Ironically, despite the owner believing he or she is motivating the contractors' performance, in practice hurt their own self-interest because contractors will cover the risk at additional cost to the owner and pocket any and all associated savings when the project succeeds.

The philosophical approach most aligned with the collaborative nature of IPD is the "Carrot", or incentive. Collaboration may be greatly enhanced by negotiating contract provisions for shared incentives. The goal of the incentives is to motivate the contractors to maximize efficiency and increase productivity. Innovation requires contractors to assume the

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[45] Jackson, *Construction Management Jump Start*, 181.
[46] Sweet and Schneier, *Legal Aspects of Architecture, Engineering, and the Construction Process*, 577.

risk of using untested means and methods. Financial incentives help promote creativity by rewarding contractors who innovate.

Incentives allow the owner, designer, and contractor to all share savings created by successful project execution. Each entity is positively motivated to collaborate to the fullest to maximize profit for Designer and Builder, while at the same time providing the Owner with savings. A perfect Win-Win-Win scenario for the project team.

Integrated Project Delivery instills collaborative behavior through the employment of intelligently-crafted incentives. By diminishing the natural tendency of each entity to protect self-interest at the expense of the whole, and reinforcing project-centric behavior through incentives, IPD provides significant motivation for collaboration. As stated in a 2009 AGC publication, O'Connor writes, "While teamwork is built on trust, the IPD community is not altruistic. Incentives must be crafted so as to provide the real prospect of economic benefit for high performance".[47]   Incentives may not guarantee success, but establishment of significant, attainable incentives greatly increases the probability of financial success for high performing contractors. When all parties succeed, all parties benefit.

This research benefits from the application of each profession’s individual arts and sciences towards collaborative value creation. Due to the high costs of design and construction, even small improvements in the project delivery process have the potential to yield significant savings in time, money, and quality. This research is relevant not only to the design and construction industries but also to owners or organizations with significant capital investment programs. These savings provide benefit not only to the owner but to all parties in the project delivery

[47] Jr. O'Connor, Patrick J., *Integrated Project Delivery: Collaboration Through New Contract Forms*, Faegre & Benson, LLP (Minneapolis, MN: The Associated General Contractors of America, 2009), 19.

process. Therefore, in addition to significant academic contributions to the field, this study is also significant to professional practice on the project site.

2.5.1. The Owner

An important part of selling an Integrated Project Delivery (IPD) method is identifying which owners and projects types are viable candidates to fully realize the advantages and benefits which IPD has to offer. An IPD process will be highly advantageous to many, but not all, owners. It is important that the study clearly defines which owners and project types most appropriate for IPD.

Integrated Design-Bid-Build (IDBB) project delivery is unique to the Department of Defense's Military Construction (MILCON) program and has been developed as an IPD process within the parameters of the established MILCON (public sector) rules, regulations and statutes. IDBB, or enhanced-IDBB can serve all federal public owners well, and other state and local public owners where local acquisition regulations permit IPD. Although this study is focused on public sector projects (MILCON), the methodology is certainly applicable to private sector owners as well. Multi-party Integrated Project Delivery methods, such as IPD, require intense owner involvement which may not be ideal for all owners or project types.

Owners unsophisticated in the project delivery process may not be able to fully add value to a collaborative process for which they have little understanding. It is possible for such owners to hire outside consultants to act as the owner's representative for participation in the IPD process. Some small, non-complex (simple), or 'boiler-plate' projects will not warrant the investment of time and resources required of intensive owner participation in multi-party IPD. Owners unable or unwilling to fully commit to a collaborative multi-party IPD method may find the Design-Bid-Build (DBB) or Design-Build (DB) project delivery methods more appropriate for their situation.

Owners who have the most to gain from a multi-party IPD method are those who are: frustrated with traditional project delivery, and desire to actively participate in all aspects of the project delivery. These aspects are typically complex "one of a kind projects" with no standard design, require fast-track delivery, and are unclear on program and requirements. "They will know it when they see it", and are interested in maximizing value-creation.[48] These are the owners most likely to be influenced to adopt IPD based on the outcome of this study.

The content of this study, assuming the hypothesis is true, will sell the method to owners by demonstrating that IPD provides better value-creation than traditional project delivery methods for complex hospital projects. There are many critical success factors (CSFs) which contribute to overall project success and subsequent creation of value.[49] The importance of CSFs is weighted relative to the perspectives of the stakeholders (Owner, Designer, Builder, & User). This study will identify and analyze CSFs which project stakeholders use to define and assess project success. The CSFs will provide a framework by which to evaluate the relative effectiveness of different project delivery methods to successfully attain the most important project goals. Critical success factors an owner is most likely to be interested in include: owner satisfaction, cost performance, quality performance, time performance, and Innovation/ Improvement.[50] The results and statistical significance will be shown for all CSF.

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[48] U.S. Army Corps of Engineers, "Early Contractor Involvement (EIC)," in *Industry Workshop*, 7 March 2010 (New Orleans, LA: U.S. Army Corps of Engineers, 28 January 2009).
[49] D.K.H Chua, Y.C. Kog, and P.K. Loh, "Critical Success Factors for Different Project Objectives," *Journal of Construction Engineering and Management* 125, no. 3 (May/June 1999).
[50] John F. Y. Yeung, Albert P. C. Chan, and Daniel W. M. Chan, "Developing a Performance Index for Relationship-Based Construction Projects in Australia: Delphi Study," *Journal of Management in Engineering* 25, no. 2 (April 2009).

Demonstrating IPD yields higher measured effectiveness for value-creation compared to other traditional project delivery methods, especially for the CSF's the owner is most interested in, will make a strong case for owners to adopt an IPD method.

The MacLeamy Curve[51] provides a graphic representation demonstrating significant design advantages of IPD. Figure 2.6 –The MacLeamy Curve shows the inverse relationship between cost of design changes and ability to impact project outcome (cost & function) over the duration of the project delivery process. The thin-line represents the “good idea cut-off" point along the project timeline. As the project progresses, the ability to implement "good ideas" to improve the design, correct errors, or otherwise enhance value-creation becomes limited, while at the same time the cost of such changes, represented by the dotted-line, increases. The bold-

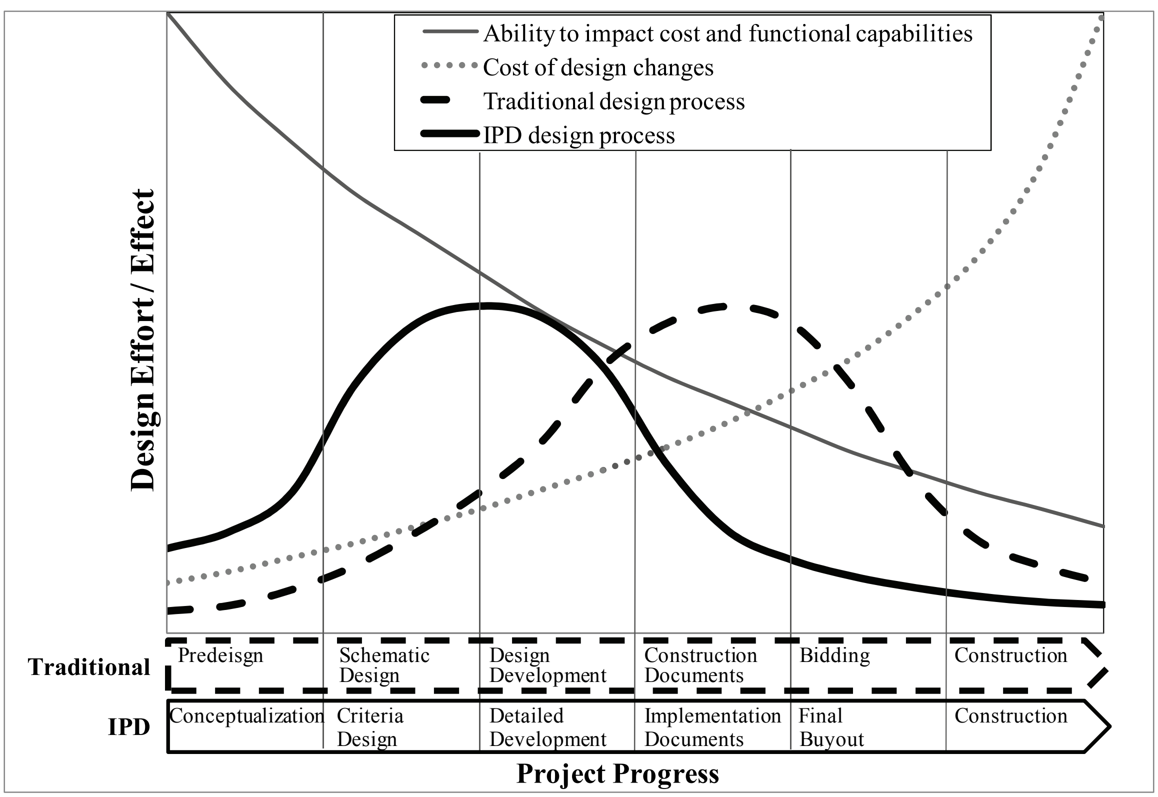

Figure 2.6. Depiction of the MacLeamy Curve

[51]The "MacLeamy Curve" illustrates the advantages of Integrated Project Delivery. Introduced in the Construction Users Roundtable's "Collaboration, Integrated Information, and Project Lifecycle in Building Design and Construction and Operation" (WP-1202, August 2004)"

line represents design activity for an IPD process compared to design activity for traditional project delivery methods represented by the bold-dashed-line. By frontloading collaborative knowledge and coordination the IPD process shifts the design curve left keeping all design activities under the "good idea cut-off" line and reducing the impact costs of design enhancements or changes over the course of the project delivery duration.[52] Conceptually the owner is able to reduce cost and increase quality of the design compared to traditional project delivery. The MacLeamy Curve advantage is especially significant for owners with complex, innovative projects with fast-track requirements, or for owners who don't have clearly defined program and/or requirements. By introducing the builder to the conceptual phase of early design the builder can collaborate with the designer to adopt the most efficient means and methods.

Finally, IPD puts the owner in control of the entire collaborative process. With the multi-party contractual arrangement of IPD the Owner maintains privity[53] with both the design and construction agents. By contrast, with a Design-Build (DB) method, one contract, the Owner may not be able to custom-build the optimal pairing of designer and builder to suit their project requirements. Although DB is a more integrated approach than traditional DBB, the owner does not have the same control of the design process as in the IPD method. Depending on the weighting and statistical significance the research observes, the results of the study may be interpreted by owners as demonstrating IPD as superior to both DBB and DB.

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[52] Stuart Eckblad, Zigmund Rabel, and Jim Bedrick, The American Institute of Architects, "Integrated Project Delivery: Putting It All Together," in *AIA 150 Convention 2007: Growing Beyond Green*, Integrated Project Delivery: What, Why, and How (San Francisco, CA: The American Institute of Architects - California Council, 2 May 2007), 21.
[53] Contractual Relationship

The implications of a value-creation approach of this study, although valuable to the design and construction industries, is even more so to the owner. The Owners and Users, unlike the other stakeholders, realize the impact of the success, or lack thereof, of the project delivery process long after final payments and contract closeouts with the design and construction agents have occurred. The Designer and Builder walk away with lessons learned to do better on the next project, but the Owner/User is tied to the lifecycle operation of the completed facility. Even if IPD produces only small improvements in value-creation for the Owner during the short-term of the project delivery process, the impact is magnified greatly when considering the macro-view, long-term impact additional value provides over the life of the facility.

2.5.2. The Designer

The Designer benefits from reduced predictive variables because the Builder provides instantaneous feedback of actual means and methods that result in fewer design errors and omissions. Improved design accuracy reduces Designer out-of-pocket design losses by eliminating the need to correct errors and omissions. The MacLeamy Curve discussed above is significant to the Owner, and the Designer as well. According to the Association of General Contractors the increased efficiency and accuracy resulting from IPD practices reduces the Designer's liability by up to 85%. The Designer benefits greatly from the resulting reduction in risk and also from better operational practices. An additional benefit to the Designer is the upside of increased fee potential due to extension of services provided.[54]

2.5.3. The Builder

The Builder typically assumes the greatest risk exposure when entering into a construction contract. Therefore, there must be significant incentive for a construction contractor

[54] Bernstein and Hague, "Integrated Project Delivery (IPD): Why Owners Choose Multi-Party."

to enter into any given project delivery method. Due to the complex nature of a multi-party Integrated Project Delivery (IPD) process, it is even more necessary to clearly delineate each party's roles, responsibilities, and requirements. The conceptual framework of the contract must have quality terms which provide a strong incentive for the design and construction agents to agree to the multi-party collaboration.

2.5.4. The User

Typically the Users are consulted in the planning and programming stages and actively participate in design reviews. Often the User requirements get lost along the way, or the requirements change during the project delivery process. In the healthcare industry, state of the art technology and practices rapidly evolve and change. The integrated process requires more in term of User participation because the linear and methodical design review process of traditional project delivery is replaced by a dynamic non-linear integrated design process. By having the User fully on board, the project team ensures long-term operational goals are part of the decision cycle as the project progresses. The User has a better means of ensuring that an operationally optimal facility is provided.

2.6. Need for Study

There has been little academic research published regarding Integrated Project Delivery. Where significant academic research has been conducted the focus has been on the tools which facilitate an integrated approach to project delivery such as project information processing, communication and sharing; technology advancements which support collaborative design such as Building Information Modeling (BIM); or the administrative complexities of multi-party contracts for collaboration.[55] Intuitively IPD appears to be superior to more traditional methods of project delivery, but few research studies focus on the value, or value-creation, of the IPD process on whole. There is much anecdotal evidence that IPD provides an owner with more value, but more substantive research is needed to explain how and why the IPD process creates value on a macro-level.

IPD increasingly is becoming a more recognized and popular method of project delivery across the design and construction industries. Although integration is not an entirely new concept, it is only in recent years that industry-wide attention has been given to the benefits of multi-party IPD. The American Institute of Architects was the first professional organization to attempt to address IPD multi-party contracts in 2007.[56] The Associated General Contractors of America (AGC) has recognized IPD as important to the future of the construction industry , but failed to endorse the AIA's new multi-party standard form contracts and has developed its own competing set of multi-party contract standard forms referred to as ConcensusDocs to address the IPD process.[57] The Design-Build Institute of America (DBIA), despite being one of the first professional organizations to promote an "integrated" approach to project delivery, has chosen to defend its single contract Design-Build process as superior to IPD. It is evident that there is not a common framework and understanding of the IPD process across the design and construction industries. Research which validates value creation concepts, goals, or practices has the potential to unify the industry and facilitate advancement of the industry's value-creation ability. The emergent nature of IPD across the design and construction industries calls for more research to validate and shape the evolution of IPD concepts to create equitable best value for all parties to

[55] Elvin, *Integrated Practice in Architecture: Mastering Design-Build, Fast-Track, and Building Information Modeling*.
[56] The American Institute of Architects, *Integrated Project Delivery: A Guide*.
[57] Bernstein and Hague, "Integrated Project Delivery (IPD): Why Owners Choose Multi-Party".

the IPD process. The U.S. military's IDBB pilot-projects are a pioneering effort in the use of Integrated Project Delivery practices for public sector projects. Careful examination of the experimental public foray into Integrated Project Delivery is essential for identification and justification for process improvements leading to better value creation and better stewardship of public resources. Although this study's focus is on military medical construction projects, the findings and applications are relevant to other project types both public and private.

CHAPTER 3.

LITERATURE REVIEW

3.1. Historical Overview

The history of the classic master-builder has been well documented by historians and even by their own writing. The earliest treatises and texts on architecture provide insight into both ancient traditions of the master-builder's comprehensive command of the entire project delivery process,[58] and the Architect's gravitation towards pursuit of the art of design separated from the art of construction.[59] As the schism between the designer and the builder has steadily widened over the centuries, literature mostly has ignored the gap between the two professions and little study has been devoted to bridging or closing the gap. Research and literature have focused primarily on the refinement of the art and science of project delivery within the paradigm of what has been known as the traditional project delivery method, Design-Bid-Build, or its derivatives.

3.2. Literature Specific to Integrated Project Delivery

At this time very little substantial literature specific to Integrated Project Delivery has been published. Due the emergent nature of the subject, the majority of published material has been limited to professional journals and conference papers. Both the design and construction industries have started forums for the exploration and development of Integrated Project Delivery and have published initial working-concepts of IPD which have sparked animated

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[58] Vitruvius, *The Ten Books on Architecture, 1914, translated by Morris Hickey Morgan (New York: Dover Publications, 1st Century B.C.).*

[59] Leon Battista Alberti, *On the Art of Building in Ten Books*, translated by Josheph Rykwert, Neil Leach and Robert Travernor (Cambridge, MA: MIT Press, 1402-1472), 442.

discussion within the respective industries and hopefully will help plant the seeds for serious academic research.

George Elvin's book, "Integrated Practice in Architecture: Mastering Design-Build, Fast-Track, and Building Information Modeling" published in 2007 is the first book devoted entirely to Integrated Practice. Elvin provides a good overview of integrated practice but mostly in the context of Design-Build project delivery or boutique-firms specializing in integrated practices. He identifies practices and tools which enhance integration and provide a framework for IPD.[60]

In 2007 the American Institute of Architects published "Integrated Project Delivery: A Guide". This document represents not only the design industry's recognition of the importance of IPD but served as a catalyst for dialogue and concept development within both the architectural community and the construction industry. The guide clearly states that it is a "working" document and intended to provide a forum for establishing and adopting common definitions and practices. An important change to the traditional DBB project delivery process and the more integrated DB process is the establishment of multi-party contract language, a more optimal project delivery process around the concept of IPD.[61]

James Pocock, in his doctoral dissertation, focuses on the degree of interaction (DOI) between stakeholders in the project delivery process. Pocock utilizes DOI to measure the level of communication between stakeholders, such as the architect and the construction contractor, in

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[60] Elvin, *Integrated Practice in Architecture: Mastering Design-Build, Fast-Track, and Building Information Modeling*.
[61] The American Institute of Architects, *Integrated Project Delivery: A Guide*.

collaborative process and compares it against project outcomes. He finds a direct correlation between DOI , as an indicator of project integration, and increased project performance.[62]

Dr. Michael Kim proposes a Teleology Hierarchy in building design where the comprehensive designer, through full understanding of project integration, utilizes seven principles for maximization of value-creation: Utility Value, Aesthetic Value, Constructability, Financial Value, Long-term Serviceability, Meronic Value (a term used by Dr. Kim to describe contextual value as part of a whole) and Global Sustainability. The means-end relationship is focused into five levels, from conceptual to completed design, where project goals and design objectives inform design characteristics. Because in large complex projects the primary domain for decision authority for each of the seven principles is shared among multiple-parties, this Teleological Hierarchy provides an interesting framework for assessing value-creation of the IPD process. [63]

The Associated General Contractors of America (AGC) in 2009 established an on-going, webinar based Integrated Project Delivery forum. AGC thus far has focused on the contractors' and owners' perspectives of IPD. Although AGC embraces the multi-party IPD concept, it has chosen not to adopt the AIA's standard form IPD contracts and has developed its own competing standard f contract form: ConsensusDOCS 300: Tri-Party Collaborative Agreement.[64]

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[62] James Bryant Pocock, "The Relationship Between Alternate Project Approaches, Integration, and Performance" (Ph. D. diss., Department of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign, 1996), 131.
[63] Michael Kyong-il Kim, 2011. File: Manuscript in Progress. Integrative Design of Buildings: Principles and Strategies. University of Illinois at Urbana-Champaign, Unpublished, Chapter 3.
[64] Bernstein and Hague, "Integrated Project Delivery (IPD): Why Owners Choose Multi-Party."

3.2.1. Research in Areas Relevant to Integrated Project Delivery

There are many areas relevant to Integrate Project Delivery, and due to the limited published literature directly relating to Integrated Project Delivery, it is necessary to understand the history, environment, technology and other factors which have shaped the project delivery process. A broad base provides perspective by which to view the concepts of Integrated Project Delivery and provides a framework for deductive reasoning. One must understand and gauge previous and current project delivery methods to establish benchmarks for comparative analysis.

Understanding the origins of the master builder and the inherently integrated nature od project delivery at that time is important. The foundation for the logic of Integrated Project Delivery lies with understanding these early influential authors: Vitruvius, Alberti, Filerete, Palladio, and others.[65,66,67,68] Their writings influenced design and construction for many centuries. Ross King's book "Brunelleschi's Dome" gives a rich account of the master-builders' work and all the stakeholders involved in what was at the time the most technically complex construction project to date.[69] From such literature many parallels to today's challenges to an Integrated Project Delivery process are observed.

Epistemology of Design. Authors such as Guach and Kuhn discuss concepts of paradigms in context of revolutionary change in science; these concepts also apply to revolutionary change in project delivery. The evolution of the project delivery process such as DBB, DB, and IPD can be viewed as paradigm shifts in the design and construction industry.

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[65] Vitruvius, *The Ten Books on Architecture*.
[66] Alberti, *On the Art of Building in Ten Books*.
[67] Andrea Palladio, *The Four Books on Architecture*, 1997, translated by Robert Tavernor and Richard Schofield (Cambridge, MA: The MIT Press, c1570), 436.
[68] Filarete (aka Antonio di Piero Averlino), *Filarete's Treatise on Architecture*, c1460, translated by John R. Spencer (New Haven: Yale University Press, 1965).
[69] Ross King, *Brunelleschi's Dome: How a Renaissance Genius Reinvented Architecture* (New York: Penguin Books, 2000).

(Gauch Ch3) Both Kim and Brown discuss integration principles within the context of comprehensive design.[70,71]

3.3. Conclusions from Literature

What is known?

- Much of the evidence that IPD is a superior method of project delivery is anecdotal; there has been little formal research.
- Leading design and construction professional organizations have both recognized a trend for rapidly increasing demand for IPD services.
- Leading design and construction professional organizations do not currently agree on how IPD multi-party contracting should be structured.
- Emerging technology and tools are minimizing the barriers to IPD.
- There is a premium cost to providing for IPD.

What is not known?

- Universally accepted definition of IPD.
- Value metrics for many aspects of the IPD process

3.3.1. Contribution to the Literature

The research provides a better understanding of how the IPD process creates value relative to other project delivery processes. The contribution to the fields of design and construction is the demonstration and defense of Integrated Project Delivery as a superior method of project delivery for large complex projects, a better understanding of value-creation, and a foundation for further study and advancement of the project delivery process. Potential of improved project value creation is very important to providing a better built environment for the

[70] Kim, "Countermodeling as a Strategy for Decision Making: Epistemological Problems in Design."
[71] Dale Ray Brown, "A Designing Image: Integrating Design, Planning, and Decision Theories with Cognitive Processes" (Ph. D. diss., Architecture, University of California, Berkley, 1992).

world in an economic climate that demands better, more efficient ways of doing business. The value-creation approach to studying the project delivery process will shed light on many aspects of the project delivery process which may be studied in the future, in more depth to further refine the project delivery process at micro-levels but with macro-level impacts. This study's research of the relationship between value creation and the Integrated Project Delivery process will argue for a normative model for optimal project delivery of large complex projects, and will serve as a platform for future literary contributions on the topic of IPD.

CHAPTER 4.

THEORETICAL FRAMEWORK

4.1. Introduction

Chapter four discusses the key concepts which provide have guided this research project from the very beginning. The reason for a better project delivery process is a desire to maximize value-creation. The argument is not that the traditional project delivery method or any other is bad, rather the argument is that there is always a better way. It is our nature to be innovators always striving to improve the status quo. The following provide the conceptual basis for the research approach and method:

- The relationships between goals and value-creation
- Stakeholder perceptions of relative importance and value-creation
- Macro versus micro viewpoints of measuring project success
- Logically superior effectiveness of Integrated Project Delivery
- Implementability

4.2. Relationship between Goals and Value-Creation

Relationship between goals and value creation, or more specifically the gap between goals established at earliest design conception and the ultimate value of the completed building in traditional project delivery methods, provides the framework by which to evaluate the effectiveness of Integrated Project Delivery to maximize value creation.

Goals change as the design progresses:

> *" In particular, Rittel with Webber (1973) points out that every design problem may be understood as a symptom of another problem, and therefore, the goal or goals of a design problem depend on the level of perception of the 'whole' at*

> *which the 'whole' is conceptualized. Furthermore, he says, whether or not a problem is worth solving depends on how it is going to be solved, as the side and after effects of certain solutions could be utterly undesirable. Yet the 'whole,' including the side and after effects, cannot be known until the designer works on the problem. Therefore, the goal changes as the designer moves along."*[72]

A value of an IPD process is limiting fluctuation of goals. It is critical to establish the integrated process at the time the "whole is conceptualized". All IPD stakeholders must contribute to the definition and selection of goals. If the IPD process does in fact limit the designer's predictive variables as discussed above, then there should be a corresponding calming to goal fluctuation and increased optimization of value-creation.

4.2.1. Perspective of Stakeholder Goals

Each participant in an Integrated Project Delivery process brings his/her own unique background of expertise and experience together in a collaborative process. Likewise each stakeholder brings their own agenda and extra-project goals. The professional qualifications for each stakeholder which make them best suited for the collaborative team also establish unique foundations from which each gains individual perspective of the risk, rewards, and requirements of the project delivery process. Each stakeholder in a collaborative, multi-party process will have different contractual obligations, scopes of work, deliverables, and associated goals. The rationale behind an integrated project delivery process is to optimize the process so that it maximizes benefit to all parties to meet their goals and a common goal. The result is to create a Win-Win scenario where individual strengths of each party mitigate other's weaknesses and thereby increases optimization of the overall project delivery process. The relationship between

[72] *Kim, "Countermodeling as a Strategy for Decision Making: Epistemological Problems in Design", 17.*

goals of each party of the Integrated Project Delivery team falls into two categories: (1) independent goals and (2) dependant goals.

This study seeks to identify which goal relationships between owner, designer, builder and user are most important to individual and overall project success. Project stakeholders are surveyed to identify which critical success factors they believe are most important. Because, project delivery is a dynamic and difficult to model process, there are many individual, discrete activities along the project continuum which lend themselves to optimization through modeling and study of game theory. Examples of some include bid strategy, resource balancing, and scheduling. Typically, game theory simplifies complex problems in order to facilitate a workable model or mathematical formula. [73] In the real-world, the project delivery process is highly complex, and the already dynamic process is further complicated by external forces such as volatile market conditions for construction materials, weather/natural disasters, and unforeseen site conditions. There are also social and political factors which can limit productivity or in a worst-case scenario shut down the project.

All of these factors require the project stakeholders to consider multiple conflicting objectives when making decisions individually and as a project team. Where there is a conflict between the stakeholders' objectives, a problem of value tradeoffs exists where the achievement of one objective is traded off against another objective. [74] For this reason it is important for the stakeholders to have an understanding not only of the objectives and goals of the project team as a whole, but also of each of the other stakeholders to allow for a more informed collaborative

[73] Elliott Mendelson, *Introducing Game Theory and Its Applications* (Boca Raton, FL: Chapman & Hall/CRC, 2004), 169.
[74] Ralph L. Keeney, Raiffa, *Decisions with Multiple Objectives: Preferences and Value Tradeoffs* (New York: John Wiley & Sons, 1976), 66.

environment, to better understand the framework of goals within the context of the project delivery team and the different types of goal relationships that exist.

4.2.2. Independent Goals

It must be recognized that each party in a collaborative process will most certainly have internal goals, or personal agendas independent of all other stakeholders. Such goals may be as basic as corporate survival and desire to maximize profit, or they might nest into a larger set of long-term organizational goals across a wide spectrum of projects and project types outside of a specific collaborative process. Independent goals do not impede the collaborative process or jeopardize or impede goals of other stakeholders, they do not have a negative effect on the project delivery process. And, they need not be fair or equitable when they are brought into the collaborative discussion.

4.2.3. Dependent Goals

In simplest terms dependent goals are akin to the old saying "You scratch my back, and I'll scratch your back". Not back-scratching in a quid pro quo sense, but in a way where supporting your collaborator's goal is necessarily beneficial to achieving your own party's goal. The network of dependant goals in practice is often much more complex than simple reciprocation between two parties. Often second, third, or greater order dependencies must play out to confer the desired benefit to the intended parties. These goals are very important to identify because they represent the key to a win-win collaborative interaction between parties brought together by the Integrated Project Delivery process. The establishment of a symbiotic relationship is not out of necessity when each party is in itself is capable of efficient and productive contribution to the success of project execution. Rather it is a means of achieving a higher level of optimization where the whole is greater than the sum of the parts. In the spirit of collaboration, dependent goals ideally should be fair and equitable to the parties involved. The dependency relationship between project stakeholders may be formal (contractual) or informal (partnering). For the purposes of this study, dependent goals are divided into the sub-categories of obligatory (intra) and discretionary (extra). These subcategories are relative to the collaborative framework of each party's formal contractual obligations.

4.2.4. Obligatory Dependant Goals

Obligatory goals are those dependent relationships which are clearly articulated in the general conditions and/or supplemental conditions of the contracts between the owner and the Integrated Project Delivery members. Unlike traditional DBB, the collaborative integrated process is dependent on non-linear interaction between the Designer and Builder. Design activities that would be solely the Designer's responsibility in a traditional DBB process are shared responsibilities in an IPD process. The Designer is dependent on the contractor's input and agreement on incremental design packages. Likewise the contractor is dependent on a synchronized and continuous flow of design packages to allow scheduled progress of construction. In game theory this concept is known as goal interdependence, a concept where no one group member can achieve his/her goal unless each other member achieves their own. [75]

The building owner provides the institutional mission and vision which establishes the stated end goal of what purpose a project is to fulfill. The mission and vision are directed goals (obligatory) which all participants must adopt to meet the needs of the owner and satisfy the terms of their individual contracts. Directed goals must be shared by all parties, in accordance with contract, to successfully execute the project delivery process. Beyond the owner mandated mission and vision, Dr. Kim identifies four levels of teleological hierarchy in building projects

[75] Morton Deutsch, *The Handbook of Conflict Resolution: Theory and Practice*, edited by Morton Deutsch and Peter T. Coleman (San Francisco, CA: Jossey-Bas Publishers, 2000), 42.

which identify goals of integrated design: Project Goals, Design Objectives, Required/Desired Characteristics, and Resulting Design itself. [76] Likewise for the integrated construction element, as in the IPD project delivery process, the Construction Objectives such as quality, time, cost, safety, as contractual requirements must be added to the inclusive list for both the designer and builder without affecting others outside of the project. [77]

4.3. Goals Define Value-Creation

Successful completion of goals is a requirement of value-creation. But, what are the values which result from design and construction of a building project? Classical definition of value stems from Vitruvius' Ten Books on Architecture where he listed firmitas, utilitas, and venustas as required qualities for buildings.[78] To Vitruvius structural soundness, operational utility, and aesthetic beauty are the values conceived by design and created by construction. Vitruvius provides what he believed to be the three categories of value created by a building. Firmitas, utilitas, and venustas are certainly important goals, yielding great value, but they are not all encompassing of modern requirements and realities. As Dr. Kim suggests there are additional aspects of value created by design and construction of buildings which Vitruvius did not consider: Economic Value, Constructability, Long-term Serviceability, Sustainability, and Contextual (Meronic) Value. [79]

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[76] Kim, Michael Kyong-il. 2011. File: Manuscript in Progress. Integrative Design of Buildings: Principles and Strategies. University of Illinois at Urbana-Champaign, Unpublished, Chapter 3.
[77] Michael Kyong-il Kim, *ARCH 525 Class Notes, Spring Semester 2003*, University of Illinois Urbana-Champaign
[78] Vitruvius, *The Ten Books on Architecture*, 331.
[79] Michael Kyong-il Kim, "What Would You Say Now, Mr. Vitruvius? Building Design Teleology, Then and Now," paper presented at the ConnectEd 2010 - 2nd International Conference on Design Education, 28 June - 1 July University of New South Wales, Sydney, Australia, 2010, 4.

4.3.1. Relationship of Goals

The formal and informal relationships that exist between each party to the Integrated Project Delivery process creates a framework through which both independent and dependent goals are formed and acted upon. It is this complex web of interrelated goals which creates

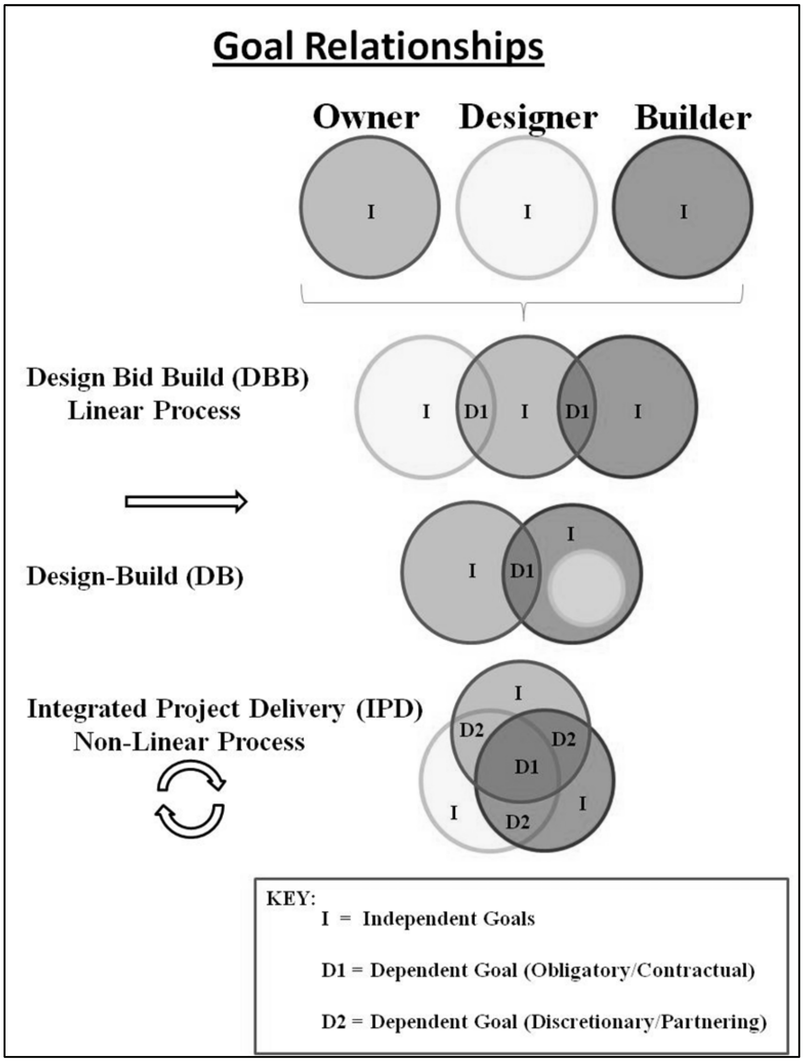

Figure 4.1. Goal relationships

desired value from the perspectives of each IPD team member. Figure 4.1 depicts each project team party (owner, designer, & builder) and the goal relationships for traditional Design-Bid-Build, Design-Build, and Integrated Project Delivery models. Areas depicted with the letter "I" represent each parties independent goals."D1" represents those goals which are formally defined by terms of the prime contract(s) between the owner, designer, and/or builder. Note that in the Design-Build project delivery process there is no privity[80] between the government Owner/User and the internal design element of the Design-Build contractor. In some rare cases the designer may be the prime contractor with an internal construction group or partner, but it is unlikely for a designer to be the dominate partner of a military Design-Build contract. The IDBB process has a similar contractual relationship as traditional DBB where the Owner holds separate prime

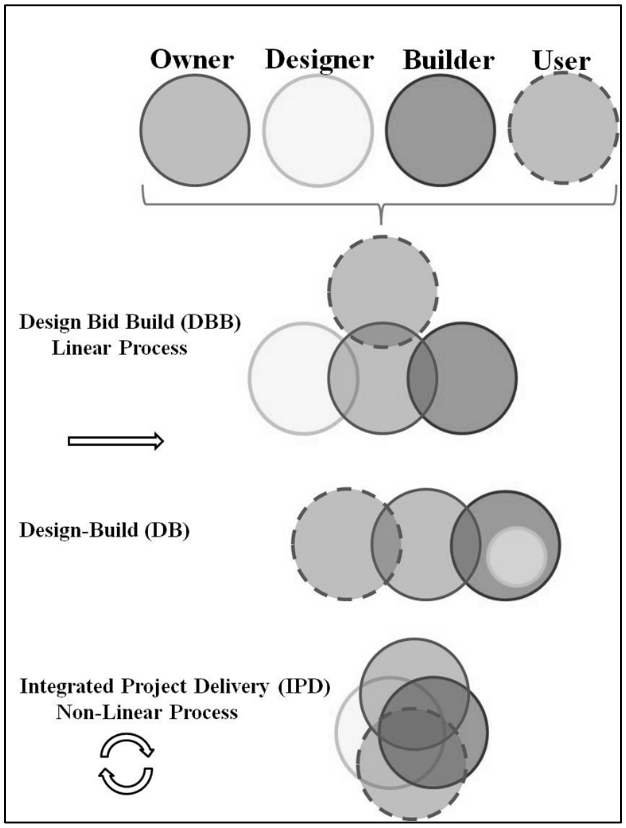

Figure 4.2. Users as part of the project delivery team

contracts with both the designer and builder. However, the terms of each separate contract stipulate integrated practice and shared project goals -- D1 obligatory contractual goals. The relationship is more complex but also affords more opportunity for D2 Discretionary/Partnering

[80] Sweet and Schneier, *Legal Aspects of Architecture, Engineering, and the Construction Process*, 54.

goals to be achieved through partnering for increased value-creation amongst compatible independent goals. It is this 'extracurricular' mutual goal support which may offer greater overall value-creation from the perspective of all parties involved. This research takes and adds the users group to the list of primary stakeholder groups as depicted in Figure 4.2.

4.3.2. Measuring Value of Goal Accomplishment

Over the course of the project delivery process there are many goals. Of the numerous goals, this study will categorize goals which will facilitate measurement of value-creation. Preliminary study surveying project stakeholders will be utilized to narrow the focus to the goal(s) in practice which the integrated project teams identify as most important to overall project value-creation. Later discussions in the research methods chapter will provide further details of how the research will be conducted.

Once a project goal is determined to be critical, it will be further analyzed in the context of value-creation. For example, constructability may be a critical project goal. In theory an integrated collaborative process would completely eliminate any errors in design communication between the designer and builder thus enhancing constructability. Elimination of design errors/omissions and contractor misinterpretation of design intent prevents costly change orders and delays to construction. The cause of change requirements is most often breakdowns in communication. Communication is a critical tool to breaking down collaboration barriers. Minimizing communication errors by increasing the degree of interaction among the parties increases collective value creation while maintaining balance of individual benefits.[81]

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[81] Pocock, "The Relationship Between Alternate Project Approaches, Integration, and Performance", 131.

4.4. Macro Viewpoint

Perceptions of project success vary by stakeholder. The Owner and/or other stakeholders may suffer losses, and from their perspective the project may have failed. However, from the User perspective the project may be an outstanding success. Or conversely in the short term the project may be an absolute success in terms of cost, schedule, and quality, but fail to produce the utility demanded by the users and customers. It is easy in a micro-context to define success or failure to meet project goals or objectives deemed critical, and overlook the overall sum of all other factors when assessing overall project value. It is natural to obsess over financial aspects of the construction phase of the project delivery process. In isolation there is nothing more important than the big three: cost, schedule, and quality. No doubt the reality of capital cost cannot be discounted. However, there are significant considerations often overlooked when assessing success at only a micro-level and ignoring the macro-level.

A problem with traditional project delivery methods and traditional assessments of project success is the failure to consider long-term impacts outside the micro-views of the design or construction phases of a project. In fact, the two most critical phases for assessment of value-creation and project success from a macro-level are completely outside the design and construction phases of project delivery. It is the conceptual phase and operational phase which define project success, and determine a measure of value-creation.

Ultimately, there are only two criteria for assessing project success. The first criterion is project completion. Either the project is completed or it is not. Relative success may then be assessed based on conditions of completion, or how well it was completed. The second criterion, after project completion, is satisfaction. A measure of how well the completed project meets the original concept in practice.[82]

Any project delivery method may successfully complete a project, and meet the minimal conditions for micro-viewpoint success and possibly satisfy original goals. When considering the macro viewpoint it is important to consider when and how the conceptual up-front decisions are made. Are the decisions informed by preconceptions of inherent limitations in the project delivery process? Are the decisions made with incomplete information? What was the accuracy of the assumptions and estimates?

The macro-viewpoint is defined by the two phases which bookend the project delivery process timeline. The conceptual phase and the operational phases are the alpha and the omega in determining project success. The points in between, the myriad of design and construction activities, form the basis for the micro-viewpoint of project success. The majority of the body of research into the project delivery process has focused on the micro-viewpoint in relation to the big three: cost, schedule, and quality. [83]

A problem with looking exclusively at the micro-view, especially within the context of the traditional project delivery method, is two-fold. First, the gaps between the conceptual phase, where goals which define the ultimate project success are established, subsequent design and construction activities are problematic due to (a) the lack of continuity between stakeholders and (b) often significant time lapse between conceptual decisions and project execution. The conceptual development team is at risk of inaccurate estimates/assumptions.

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[82] C.S. Lim and M. Zain Mohamed, "Criteria of Project Success: An Exploratory Re-Examination," *International Journal of Project Management* 17, no. 4 (August 1999): 245.
[83] Lim and Mohamed, "Criteria of Project Success: An Exploratory Re-Examination," 243.

Measuring "project success" purely from the micro-viewpoint may not tell the whole story. Often projects are grossly underestimated during conceptual phases, and decision makers bite off more than they can chew. Usually by making over-optimistic estimates of projected efficiencies, cost savings, or schedule durations. Think of the old saying... "If you want it bad, you'll get it bad". Such mistakes are an open invitation to opportunistic bidding, especially in a highly competitive bid environment. Opportunistic bidding is where a contractor low-bids knowing he/she can make up the difference in beyond contract rewards through change-orders and/or claims. [84] Opportunistic bidding may enrich one stakeholder, but diminishes the overall project value-creation.

In cases where over-optimistic, under-estimated conceptual decisions move forward to project execution, the design and construction phases have an up-hill battle that may or may not be won at the micro-level. Is it fair to gauge micro project success against flawed concepts? It is not fair when considering the conceptual mistakes that were made outside the control of subsequent stakeholders. A better way would be to measure success from a rectified benchmark of what the conceptual baseline should have been.[85] A better solution is to utilize an Integrated Project Delivery method to provide continuity of stakeholders throughout the entire process.

Often project success is viewed only from the micro-viewpoint. The micro-viewpoint relies on project completion criteria (cost, schedule, & quality related activities) to assess success. Lim and Mohamed argue that satisfaction criteria are what set apart the macro and

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[84] W. Lo, C. L. Lin, and M. R. Yan, "Contractor's Opportunistic Bidding Behavior and Equilibrium Price Level in the Construction Market," *Journal of Construction Engineering and Management* 133, no. 6 (1 June 2007): 409-16.
[85] Terry Williams and Knut Samset, "Issues in Front-End Decision Making on Projects," *Project Management Journal* 41, no. 2 (April 2010): 38-49.

micro viewpoints.[86] A macro-viewpoint takes into account how well the operationalized product provides outcomes which satisfy the conceptual goals which launched the project delivery process.

This research investigates the macro-view of the project delivery process. Adding the User stakeholder group to the collection of key project stakeholders is a necessary step in adopting the macro-viewpoint. As stated above, the macro-view of project success and value-creation emphasizes two phases in which the user stakeholder group is very importance: the conceptual phase and the operational phase. Additionally, the research will include factors preceding and transcending the design and construction phases of project delivery. This is the motivation behind including the *Process* and *Impact* categories of critical success factors along with the *Design* and *Construction* categories which are used to categorize the critical success factors in the round 1 survey to be discussed later.

4.5. Research Concept:

A detailed discussion of the research methods appears in Chapter 6, the following provides the conceptual basis for the research. The research investigates the effectiveness of Integrated Project Delivery to create additional value over traditional project delivery. Significant project stakeholders across the spectrum of the project delivery process were surveyed to get their thoughts on the project delivery process. The primary observation from the surveys was that each stakeholder group appeared to evaluate differently cost, benefit, and/or value from each of unique perspectives of owner, designer, builder, and user groups. To further investigate how the differing perceptions relate to value-creation and efficacy of project delivery a pilot survey was initiated and further developed into the research survey discussed in this

[86] Lim and Mohamed, "Criteria of Project Success: An Exploratory Re-Examination," 243.

dissertation. Value is assessed relative to important project goals which should be shared by all stakeholders in an integrated process.

The research takes a comprehensive look at the entire project delivery process from planning through construction through operations. Because the Integrated Project Delivery process is non-linear, a comprehensive approach is necessary to understand the dynamic interaction between design and construction agents. The broader focus enables a means to find hidden opportunities for additional optimization of the project delivery process, more so than if a narrower focus is taken. This study focuses almost exclusively on large scale healthcare projects, but also draws on lessons learned from one additional non-medical project of similar scope and complexity to provide a larger sample population. The complexity and significant design and construction challenges associated with planning, designing, and building healthcare facilities presents significantly more opportunities for process optimization than simpler or more routine facility types.

Although this study is not centered on *game theory*, a broad range of game theory principles was reviewed to provide a basis for understanding the impact which interrelation between project delivery stakeholder groups has towards goal attainment and ultimately value-creation. The game theory review raised the concept of evaluating each primary research question from the perspectives involved in collaborative games: the balance of attaining goals with a beneficial outcome for each partner and the group as a whole.

Goals are abstract general intentions which the parties, either independently or collectively, wish to achieve.[87] Typically the primary goals of project delivery center on cost, quality, and schedule. These goals in their broad context are not measureable. For example, each

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[87] Kim, 2011. File: Manuscript in Progress. Integrative Design of Buildings: Principles and Strategies. University of Illinois at Urbana-Champaign, Unpublished, Chapter 3.

party likely has a goal to be more profitable, and a strong desire to successfully accomplish this goal. Profit is easily quantifiable by measuring the positive gain after subtracting all expenses, yet measuring the success of accomplishing the goal to be more profitable is not easily quantifiable. The yardstick necessary to measures success is dependent upon subjective, qualitative assessments unique to each project stakeholder's perspective. There are many interrelated aspects of the project delivery process which impact the financial outcomes of each project stakeholder and its resulting measure of profitability. It is not possible to apply a specific measurement to open ended, abstract concepts such as a "goal to be more profitable". How much more profit equals success? Under what circumstances does minimizing loss of profit equal success? In some cases, although profit is a desired goal, there may be other goals which outweigh the pursuit of profit at all costs. It is possible one of the project stakeholders, although desiring short-term profitability, may have a more important long-term strategy where a loss leader[88] is more beneficial in the broad context of profitability outside a single project.

The example discussed above demonstrates how a clearly quantitative aspect of project delivery, the calculation of profit, is transformed into a more complex qualitative problem when attempting to define and measure project success from a macro-viewpoint. Qualitatively important aspects of project delivery provide even greater challenges to measuring success. Quality is an abstract concept dependent on subjective definition and interpretation. Unlike profit, there is no clear quantitative equation from which to define or derive quality. In the case of quality goals, the aspect of the quality to be measured and the yardstick by which it measures successful attainment are both qualitative and subjectively defined. Akin to the old adage "beauty is in the eye of the beholder", quality success as measured by attainment of even the

[88] Loss leader is a marketing concept where products or services are sold at a substantial discount, or loss, in order to generate future business leading to a larger net profit.

strictest adherence to plans and specifications may please the owners, designers, and builders, yet greatly disappoint users and customers if the plans and specifications were inadequate to begin with.

Schedule goals require the assessment of time related activities which rely on both quantitative units of measurement (hours, days, months or years) and qualitative aspects of time-scale (speed). The schedule estimates and evaluates the durations of all project activities based primarily on the subjective analysis of project requirements and resource allocation.

Goals themselves cannot be measured, but goals do provide a framework of components which may be measured. These components are called objectives. Objectives, unlike goals, are by definition specific, measurable, achievable, relevant, and time-based. Project objectives must be identified and weighted for relative importance, and then analyzed to determine how they may be effectively achieved. Measurement of objective accomplishment requires an unbiased specific yardstick, or metric by which actual performance may be compared. Different parties to the Integrated Project Delivery process may share the same objective, but assess success by different measures.

Success is relative to the perspective from which and by whom it is defined. There may be customary, or industry standard definitions of what success ought to be, but because success is a subjective concept there is no absolute measure of success. Any relevant and measurable definition of "what success is" will suffice. With parameters of success defined, the ultimate success or failure to attain each objective is determined by many project factors. Logically, the more complex a project is, the more it's potential for successful outcomes is impacted by a multitude of factors. The impact each factor has on outcomes varies greatly due to the complex interdependent relationships inherent in planning and completing design and construction activities. More important than the definition of success is the identification of the Critical Success Factors (CSFs) which have the greatest impact on objective outcomes. It is likely not feasible, and certainly not desirable to exhaustively measure all success factors. Identification and prioritization of CSFs allows weighted analysis of only those factors most important to determining the level of objective attainment in support of project goals.

It is difficult to measure the relative importance each CSF has in relationship to each objective. Other researchers have successfully demonstrated that an Analytical Hierarchy Process (AHP) may be used to meaningfully compare project factors across the range of stakeholders and associated CSFs.[89,90,91,92,93,94]

The first step towards measuring how well-off the project stakeholders are in terms of creating-value is to identify the critical success factors (CSFs) discussed above.

CSFs are identified by a panel of experts through the use of a Delphi method survey. Three rounds of Delphi surveys were conducted to gather data sufficient to support analysis of factors perceived as important to achieving of project success. The same Delphi panel of experts also provides an assessment of different project delivery methods to successfully attain the most important critical success factors.

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[89] Chua, Kog, and Loh, "Critical Success Factors for Different Project Objectives, 142-50.
[90] Yeung, Chan, and Chan, "Developing a Performance Index for Relationship-Based Construction Projects in Australia: Delphi Study", 59-68.
[91] Cindy L. Menches and Awad S. Hanna, "Quantitative Measurement of Successful Performance from the Project Manager's Perspective," *Journal of Construction Engineering & Management* 132, no. 12 (December 2006): 1284-93.
[92] Maria Kliniotou, "Identifying, Measuring, and Monitoring Value During Project Development," *European Journal of Engineering Education* 29, no. 3 (September 2004): 367-76.
[93] J.K Pinto and J.G. Covin, "Critical Factors in Project Implementation, a Comparison of Construction and R&D Projects," *Technovation* 9, no. 1 (1989): 49-62.
[94] Florence T.T. Phua and Steve Rowlinson, "How Important is Cooperation to Construction Project Success? A Grounded Empirical Quantification," *Engineering, Construction and Architectural Management* 11, no. 1 (2004): 45-54.

4.6. IPD: Logical Normative Model

4.6.1. Formation of the project delivery team

As noted earlier in Chapter 2, *game theory* research tells us that the formation of the project team to maximize group utility is extremely important.[95] Assuming incomplete information, the owner must consider the probability of each stakeholder's contribution to a successful outcome. There must not be a weak link in the chain. Group dynamics is of the utmost importance and weak-links in interpersonal skills or intergroup dynamics must be accounted for in the general condition for administration of the integrated team. The group must have the ability to rapidly address personality issues which become roadblocks to collaboration and cooperation. Stakeholder leaderships must be committed to maximizing group utility. For project delivery to successfully reach its potential for maximizing value-creation, the sum of each stakeholder's utility must be superadditive.[96] A primary assumption of the Integrated Project Delivery process is the creation of a 'superadditve' project team relative to value-creation where the whole is more important than the sum of its parts. Why shouldn't the benefits be shared with the other project stakeholders? To entice the best performers to engage in the quest for greater value-creation there must be some benefit to do so. Therefore the process must be designed as beneficial to all participants to be implementable.

A purpose of seeking a better process for project delivery is to maximize value-creation. Value-creation for whom? Certainly additional value-creation for the owner, users, customers, public, or anyone else who will utilize the facility during its life-cycle is of great benefit. Especially, for public projects funded by with public dollars. All stakeholders should reap the rewards for any real attainment of the theoretically maximized value-creation. The owner and/or

[95] Weirich, *Collective Rationality: Equilibrium in Cooperative Games*, 66.
[96] Curiel, *Cooperative Game Theory and Applications: Cooperative Game Arising from Combinatorial Optimization Problems*, 2.

users obviously will benefit from both short-term savings in project costs relative to the original project budget. However, the long-term benefit of lifecycle value-added cannot be ignored. For example, the case study hospital projects are facilities that will provide work environments for thousands of employees, contain complex resource intensive technologies and systems, and in the IDBB pilot-projects when operationalized will interface with more than 10,000 patients/customers per week. The operational costs of such facilities are immense. Any efficiencies or long-term benefit yielded from a more optimal project delivery process is highly desirable.

Which project delivery process best enables collaboration, and has a formal contractual framework to incentivize optimal collaboration where each stakeholder is compensated for foregoing self-interest (and assumed profit) for the overall, best-interest of the project? Logically Integrated Project Delivery, by definition, provides the answer to this question. IPD is a process designed around collaboration across the entire project delivery continuum.

4.6.2. Macro-Focused

Traditional Design-Bid-Build by definition fragments the project delivery process into separate micro-components of design and construction phases. Design-Build provides an improved, and more integrated approach, yet leaves room for additional optimization especially in public sector DB projects which require preliminary design services for adequate documentation to put an RFP out on the street. IPD's collaborative approach assembles the micro-level project phases and stakeholders: owners, design, construction, and users into a process that must adopt a macro-focus to achieve the desired collaboration.

4.6.3. Alignment of Goals and Objectives

Earlier in this chapter was a discussion about the relationship between goals, objectives and value-creation. Establishing that value-creation is the result of successful goal attainment, and likewise results from successfully achieving objectives, the matter of a superior project delivery method rests with establishing what project delivery method is most effective in attaining the most important goals and objectives which both define and determine value-creation. As discussed in section 4.4 above, it is the conceptual and operational phases of a project the determinants of value-creation. Two questions require consideration:

(1) What project delivery method is most effective in attaining the most important critical success factors related to value-creation?

(2) What project delivery method is designed to transcend the micro-phases of project delivery and provides continuity and alignment of goals and objectives from concept to completion and beyond?

Again there is a strong argument that Integrated Project Delivery logically is the most effective at addressing each of these questions.

4.6.4. Implementability

The final logical imperative for Integrated Project Delivery is its implementability. There is no value in IPD if it is only a good idea. Project stakeholders must believe that there is a rational basis for allocating resources for implementing an IPD process. Using a normative approach to evaluating the merits of IPD as compared to other established project delivery methods provides the framework by which project stakeholders may assess relative effectiveness, and infer implementability. More substantial proof that IPD is implementable is the successful completion of IPD projects. It has been done before, and there is desire to do it again. The IDBB pilot-projects are prime examples of Integrated Project Delivery in action.

4.6.5. Linkage to research

This research project is designed to test the logical conclusions that Integrated Project Delivery is the normative model for large complex military construction projects. The first four chapters of this dissertation have provided the background and theoretical framework for the argument that IPD is the normative model for value-creation. Chapter 6 will elaborate on the research method for providing evidence in support the logical conclusion.

CHAPTER 5.

IDBB IN PRACTICE

5.1. Introduction

The IDBB process is not perfect and hasn't been without its problems. It is after all a pilot-program to test Integrated Project Delivery in the context of military construction. Moreover, it is doubtful a more challenging application for the pilot-projects could have been chosen. The enormous scope and cost of the IDBB projects, coupled with the BRAC related fast-track schedule did not allow time for a deliberate entry into the process. As the four projects near completion the Owner stakeholder group already has implemented changes to the MILCON approach to Integrated Project Delivery. The IDBB pilot-projects have spawned the next batch of integrated projects which are now referred to as Early Contractor Involvement (ECI), and the lessons learned from those projects will in turn spawn the next alphabet-soup of Integrated Project Delivery acronyms.

It is clear from the survey results discussed in later chapters that key leadership believes an integrated approach is the most effective means of achieving the most important project factors. The leadership challenge remains how to best implement integrated practices into a regulatory environment not optimal for streamlining any process. The progress that has been made in the five years since initiating the IDBB pilot-projects has been impressive. The following is a brief summary of government reports related to the evaluation progress of the IDBB pilot-projects to date.

5.2. Time performance

Three of the four IDBB pilot-projects are on track to be completed on time or ahead of the 15 September 2011 BRAC deadline, including the two largest and most complex projects: The Fort Belvoir Community Hospital, and the National Geospatial Intelligence Agency's (NGA) New Campus East, both at Fort Belvoir, Virginia. The San Antonio Medical Center - North project is making good progress but is behind schedule by at least six months. It is very common for such large and complex projects to go over schedule when considering all the technology and systems which must be commissioned and certified for accredited hospital operations. The real work starts in a hospital after the enclosure is completed.

The Fort Belvoir Community Hospital is on track to start seeing patients in the new facility nearly 60 days prior to the 15 September 2011 BRAC deadline for project completion. Never in the history of the Army Medical Department has hospital as large and complex been designed and built in such a short time. Prior medical MILCON projects of similar size such as the Womack Army Medical Center at Fort Bragg, NC; Brooke Army Medical Center at Fort Sam Houston, TX, and Madigan Army Medical Center at Fort Lewis, WA typically took between two and three years to design and an additional four to five years to construct utilizing the traditional Design-Bid-Build project delivery method. The IDBB process eliminated at least two years off of the project delivery timeline.

NGA reports the project is on time and on budget. It is amazing to consider a $1.7 billion; 2.4 million square foot campus project to relocate nearly 9,000 workers is on track to be completed in a span of less than five years for both design and construction. To put the NGA project in perspective, an average of nearly a million dollars ($930,000) of construction had to be placed per day for every day over the five year duration of the project.

5.3. Quality Assessment: Fort Belvoir Community Hospital

In early 2009 an Armed Services Subcommittee was established by Congress to assess the project delivery performance of one of the IDBB pilot-projects and another DB project of similar scope and cost in the same geographic area. The subcommittee released its initial report, "Achieving World Class: An Independent Review of the Design Plans for the Walter Reed National Military Medical Center[97] and the Fort Belvoir Community Hospital"[98] in late November 2009. The report has identified performance variances between the IDBB project at Fort Belvoir, VA, and the Design-Build Projects at Bethesda, MD. The IDBB project was found to have produced a higher quality design to meet the congressionally mandated world-class standard for provision of military healthcare, and consideration incorporation of evidence based principles and features into the facility design. A significant challenge for both projects was the "moving target" of the definition of "world class". The IPD concept as discussed in section 2.5.1 (The MacLeamy Curve) allowed the project team to effectively incorporate required changes in design to ensure continuity of evidence based design goals and evolving expectations of "world class". The results of the congressional study support the hypothesis of this research study on at least one aspect of value-creation - perceived quality as benchmarked against project goals. The report was focused on congressional concerns of what the medical operational quality of the completed facilities would be, and if it would meet expectations to provide world class

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[97] The National Naval Medical Center in Bethesda, Maryland will be renamed the Walter Reed National Military Medical Center upon completion of the major addition and alteration projects underway there, and the closure of the Walter Reed Army Medical Center in Washington, D.C.

[98] Kenneth W. Kizer, Merrily McGowan, and Sheila Bowman, *Achieving World Class: An Independent Review of the Design Plans for the Walter Reed National Military Medical Center and the Fort Belvoir Community Hospital*, National Capital Region Base Realignment and Closure Health Systems Advisory Subcommittee of the Defense Health Board (Office of the Assistant Secretary of Defense for Health Affairs, 2009).

healthcare. Congress has mandated a marco-viewed focus of value-creation to ensure the long-term success operations of the newest military medical facilities.

5.4. NGA Campus East Lessons Learned [99]

It was noted in the NGA Campus East lessons learned report compiled between 2007 and 2011 that Integrated Project Delivery method was cited as possibly the only method capable of delivering the project on time. However, with no prior experience to benchmark the project against, the stakeholder perspectives varied about the extent to which integration was successful. (Note. the variance of stakeholder perspectives in practice validates the results observed from the survey data). It was noted that the design was already 35% complete when the construction contract was awarded. Stakeholders noted that an earlier start to the collaborative process would have been very beneficial to maximize integration. Stakeholders noted that the integrated process was more complex than traditional project delivery. Integrated Project Delivery was selected based primarily on the time performance requirement to meet the BRAC deadline.

Owner and User stakeholders state that they are highly satisfied with the IDBB process and not only would use IPD again if starting over, they would highly recommend Integrated Project Delivery to others.

5.5. Fort Belvoir Community Hospital Lessons Learned[100]

The author has been involved with this IDBB project from its inception in 2005 and continues to monitor progress of its process. The Base Realignment and Closure (2005)[101]

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[99] U.S. Army Corps of Engineers, *NCE Project Lessons Learned 2007-2011* Special Report (2011)

[100] Norfolk District, U.S. Army Corps of Engineers, *Fort Belvoir Community Hospital Lessons Learned Report Phase I: Pre-Design, Design, and Construction* (2010)

legislation imposed statutory project deadlines that could not be achieved by traditional methods. By necessity an Integrated Project Delivery process was selected to allow for hyper-fast-track construction. Construction started as concept designs continued to develop for a 1.3 million square foot, highly complex and technologically advanced military hospital complex. The construction contractor and architectural/engineering firm worked hand in hand to keep project process moving. It was highly chaotic and at more than a few times highly contentious, but the process functioned well and built momentum rapidly. The value added by such an integrated process became apparent at all steps. The ability to rapidly adjust design and project direction as each issue presented itself ensured project momentum was not lost.

5.6. Improving on IDBB

This research has demonstrated that Integrated Project Delivery is the most effective means of attaining the most important critical success factors in pursuit of maximum value-creation. The panel of experts providing the evaluation in this study came directly from the highest echelons of the project delivery teams responsible for the IDBB pilot-projects. Both the actual performance of the IDBB projects and the assessments from the panel of experts validate the implementability of the IDBB method. IDBB from a macro-level is a resounding success. This study did not focus on the micro-level aspects of the IPD or IDBB, but has ascertained that IDBB process may be improved by further increasing the level of collaboration. As explained in Chapter 2, there are many regulatory impediments to a fully Integrated Project Delivery method. USACE has already attempted to improve on IDBB by placing the focus on earlier contractor involvement in the design process. Recall from Chapter 2 that Federal Acquisition Regulations

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[101] Department of Defense, Office of the Secretary, Federal Register, *Base Closures and Realignments (BRAC); Notice* 28030 (2005)

requires competitively bid of construction services contracts separate from Title I A/E (Design) service. The IDBB process, and the later Early Contractor Involvement (ECI), method rely on provisions for allowing "Non-Brooks Act, Pre-Construction Services" to enable contractor participation early in the MILCON project delivery process. This workaround approach is highly sub-optimal, and severely limits the benefits of collaboration at the very time it has the most potential for maximizing value-creation.

There are many different perceptions of the success of IDBB within the owner and user stakeholder groups. A separate study is required to isolate and analyze the differences. The assessments seem to break down into two general groups of assessment: (1) the micro-viewpoint or (2) the macro-viewpoint. In the macro-view the assessments are overwhelmingly positive. The micro-viewpoint, however, is highly dependent on stakeholder perception of relative importance. Those who focus on only the construction phase in context of the usual way of doing MILCON business tend to have little good to say about IDBB, mostly because of perceived cost and value issues. These views may be valid in a specific micro-viewpoint context, but really must be seriously considered in the context of lifecycle value-creation. The utility of the completed facilities in the end will determine the level of value-created, and by all accounts there are no early indicators of foreseen problems with utility and functionality of the buildings.

Not every MILCON, or medical MILCON project will be appropriate for implementation of an Integrated Project Delivery method, but there will continue to be future requirements for extremely large and highly complex facilities where the traditional MILCON model is itself an impediment to value-creation. For such projects the acquisition rules must be revised to allow maximum collaboration within the Integrated Project Delivery process.

A sub-category of the MILCON program should be established specifically to address projects which may benefit the most from IPD. The acquisition rules must include exemptions and/or other provisions to enable a fully Integrated Project Delivery process. The only way such a change will be implemented is if the Owners and Users demand change. The Owners are responsible for selecting the project delivery method, and assembling the project delivery team.[102]

The U.S. Army Corps of Engineers is among the best in industry at project delivery, but are an agency purposely focused on the micro-details of the design and construction phases. They do not have a long-term stake in the operational function of the facilities once completed. The operational owners and users, the Tricare Management Activity and the U.S. Army Medical Department in the context of medical MILCON, are the dominate stakeholders in the phases that determine the value-creation.

As discussed in Chapter 4, Section 4, it's the conceptual and operational phases which bookend the project delivery process that defines and measure value-creation. As such the Owners/Users first must integrate their capital investment program fully with the operational planning and execution program as a first step towards optimization of the project delivery process.

[102] Barbara White Bryson and Canan Yetmen, "Why Owners Make The Difference," *ENR: Engineering News-Record* (New York), 02 August 2010, 80.

CHAPTER 6.

RESEARCH METHOD

6.1. Introduction

This study evaluates the value relationship between inputs and outcomes in the Integrated Project Delivery (IPD) process. A modified-Delphi survey method (explained in detail below) is first used to identify and evaluated critical success factors important to overall project value-creation. The most important critical success factors identified by the investigation then are utilized to evaluate the effectiveness of IPD relative to other project delivery methods: Design-Bid-Build, and Design-Build (DB), to successfully attain the desired outcomes for the various critical success factors. The research explores the differences and commonalities between the individual project stakeholders groups' perception of relative importance for each critical success factor. The relative importance will be explored from two perspectives which are an inextricable dynamic in any collaborative endeavor: "what's in it for me?" (*self-interest*), and "what's best for the project?" (*project-interest*). The dissertation research project employed a three round modified-Delphi survey to identify data for analysis that supports the Integrated Project Delivery approach. This section will describe in detail the concept and implementation of the survey method.

6.2. Survey Problem Statement

This research is based on the belief that the Integrated Project Delivery method may provides a framework for project delivery optimization by means not otherwise achievable by the inherent limitations of other established project delivery methods. By taking a larger, comprehensive and integrated approach to the delivery process, perhaps each stakeholder's competing interests can be addressed through process optimization to maximize value-creation through a more thoroughly collaborative process. For this research the major project stakeholder groups are defined as the Owners, Designers, Builders, and Users. There certainly are numerous more subgroups within the project delivery process and other important stakeholders external to the project team, but these four are the major stakeholder groups relative to the IDBB pilot-projects. The project delivery method which best allows for process optimization for both the project specific goals, and the self-interest goals of each of these stakeholder groups logically must achieve a higher level of value-creation optimization.

When considering the entire spectrum of value-creation, it is important to identify the different categories of value-creation on which the project delivery process has a significant bearing. *Design Performance* and *Construction Performance* are the two categories which receive the most attention both in practice and in research. Perhaps the quantitative metric analysis of the cost in terms of money, time, materials, labor, and other resources for design and construction contributes to its dominance as the measure of project success. However, design and construction *outputs* are not necessarily easily quantifiable in corresponding units of cost *input*. The *quality* of the building, rather than simplistic output of bricks and mortar (and building systems, equipment, furnishings, etc...) must be considered in the value equation for project delivery process. Market value of the physical bricks and mortar only reflect a portion of the output. The bricks and mortar must be coupled with the operational and functional quality of the building's intended use(s) to assess the output factor in the value equation. Quality output must include more than merely workmanship, materials, and systems. Quality in large part is the legacy which the project delivery team leaves behind after project completion. Unlike cost and schedule, the qualitative aspects of a building that contribute to long-term value-creation are not easily quantifiable, nor necessarily obvious to any member of the project delivery team, including the owner and user.

This project delivery research goes beyond the design and construction categories typically associated with defining value-creation. Two additional categories play an important part in determining value creation: (1) *Process* Performance and (2) Project *Impact*. Process alone has significant affects on cost and quality. Process factors into both the input and output of the value equation. *Impacts* are the important residuals of the project delivery process that endure long after the project delivery team declares victory and goes their separate ways. Some of the residuals affect the lifecycle value of the facility, while others such as professional reputation and long-term business relationships belong solely to the project stakeholders. To not consider these residual values into the overall assessment of value-creation fails to recognize relevant components of value important to each stakeholder group. *Process* and *Impact* have a great deal of influence on value-creation across the spectrums of the project delivery team stakeholders (owner, designer, builder, and users) over the course of the project delivery cycle, and long-term benefit/detriment to all stakeholders associated with the project. The capital investment costs of project delivery, as high as they may be, are fairly insignificant compared to the operational costs for many complex building types such as the IDBB case study projects. In many cases even short-term operational cost of only a few years dwarf the capital costs of the facility housing the operations. When considering the long-term facility costs along with other operational costs such as human resources, adapting for technology and regulatory changes, and maintaining customer satisfaction, the significance of the project delivery team's role in shaping long-term value-creation cannot be ignored.

Complicating the value-creation formula for project delivery is the concept of *quality*. Quality is a relative term, hence the importance of differentiation between quantitative and qualitative analysis in this research. In technical terms the quality of a building is determined by the plans and specifications of the design, and by the successful translation of design intent into a physical object by the builder. Quality is subject to interpretation not only in technical terms, but also in terms of stakeholder perspective. As with the old saying, "Beauty is in the eye of the beholder." The perception of the benefit is in the eye of the project stakeholder.

$$\boxed{\text{Value} = \frac{\text{Output}}{\text{Input}} = \frac{\text{Quality}}{\text{Cost}} = \frac{\textbf{Perceived Benefit}}{\textbf{Cost}}}$$

Figure 6.1 Perception in the value equation

Project delivery output in terms of quality is reliant on ***perceived benefit.*** From the vantage point of stakeholder perception the concept of value-creation becomes even more abstract. What value to whom, and according to whom? Project delivery is a complex, interrelated web of each project stakeholder's goals. Many goals are distinctly independent and internal relative to the project stakeholder. Other goals are fully shared amongst some or the entire group of project stakeholders. A single stakeholder may perceive benefit where all others perceive none. The hypothesis the Delphi survey corroborates is that Integrated Project Delivery provides a framework for both optimizing shared project goals, but also optimizing independent stakeholder goal attainment for the greater success of the project overall. The survey seeks to assess qualitative aspects and recognize the importance of lifecycle value-creation as a long-term consideration.

As discussed above, there are many aspects of project delivery that are easily quantifiable such as project cost performance, schedule performance, or physical placement of materials and building systems. Because many aspects of project value-creation are qualitative in nature, a method for assessing qualitative data from the project delivery process must be considered when assessing project value-creation. The qualitative assessment must take into account the perceived benefit of all project stakeholders, and the enduring impact beyond completion of the project delivery process. The survey provide a qualitative inquiry into relative importance project success factors based on input from a panel of experts representing each the Owner, Design, Builder, and User stakeholder groups.

The specific problem to be addressed by the modified-Delphi survey, and explained in detail below, is the multi-dimensionality of the project delivery process in regard to the project delivery team. The project delivery team is composed of distinct major stakeholder groups who influence the development, planning and execution of the project delivery process. The formal and informal relationships between the stakeholders are a complex web of intertwining goals and objectives which must be meshed in order to achieve overall project goals and objects. Optimization of the project delivery process to maximize value-creation should be the primary purpose of any project delivery method. While different project delivery methods may be able to successfully achieve overall project goals in regards to cost, schedule, and/or quality, this limited view of project success only tells part of the story. The missed, or not-identified, opportunities for additional optimization to the project delivery process may tell the rest of the story. One such potential opportunity for further optimization is based on consideration of each stakeholder's perspective(s) and interpretation of what success is. Comprehensively, overall project success is measured by the sum of each stakeholder group's performance, and is dependent on both project-centered interests and stakeholder self-interests.

An important concept of project integration is optimization through collaboration. Collaboration is best served by a full understanding of each other's position in a collaborative group. In a perfect world each stakeholder would share a common perspective of project goals and objectives, and fully agree on the definition of success. But, this is not a perfect world and it would be reasonable to assume there may be disagreement between a project stakeholder's self-interest, and the project-interest terms for which each party formally agrees to contractually. Within the four corners of the contract all parties are in agreement. In reality there may be significant "unspoken" disagreement. How could this be? It's a matter of perspective, interpretation, and relative importance. Each stakeholder's individual performance to achieve shared goals is significantly influenced by internal goals of self-interest.

Three rounds of surveys will address the problem discussed above by collecting data from a panel of experts to determine: (1) what critical success factors project leaders believe are most important for project success and by extension value-creation, (2) establish rank-order relative importance of the selected critical success factors, (3) ascertain if there is a difference between self-interest and project-interest for the stakeholder groups, and (4) evaluate the efficacy of different project delivery methods to achieve the selected factors. The survey focuses not only on each stakeholder's individual perspective, but also asks each participant to provide responses considering separately their "self-interest" and "project-interest" perspectives.

6.2.1. Survey Hypothesis

This section is not to be confused with the overall hypothesis of the dissertation; this section refers to the two hypotheses which are addressed in the survey as a supporting element of the overall research. The first hypothesis is that there is a difference between self-interest and project-interest for each project stakeholder. The second hypothesis is that Integrated Project Delivery is more effective than Design-Build, or Design-Bid-Build method for achieving important critical success factors. The relationship to the problem statement discussed at the start of this section centers on recognizing proof that differences, in fact, exist between a stakeholders 'self' and 'project' interests. The use of an appropriate survey model is very important to finding valid information from diverse stakeholders in the project delivery industry.

6.2.2. Survey Specific Literature Review

This section discusses literature particular to the formation of the survey. To determine an appropriate model for conducting this investigation a substantial review of the existing body of related published research was conducted.

Three particular published studies helped to inform and shape the methodology of the surveys: Edward Gibson, Giovanni Migliaccio, and James O'Connor's *Changing Project Delivery Strategy: An implementation Framework* published in Public Works Management and Policy Journal (January 2008) [103] ; D.K.H. Chua, Y.C. Kog, and P.K. Loh's *Critical Success Factors for Different Project Objectives* [104] and, John Yeung, Albert Chan, and Daniel Chan's

[103] G. Edward Gibson, Giovanni C. Migliaccio, and James T. O'Connor, "Changing Project Delivery Strategy: An Implementation Framework," *Public Works Management and Policy* 12, no. 3 (January 2008): 483-502.
[104] Chua, Kog, and Loh, "Critical Success Factors for Different Project Objectives", 142-50.

Developing a Performance Index for Relationship-Based Construction Projects in Australia: Delphi Study published in the Journal of Construction Engineering and Management [105] (May/June 1999, and April 2009 respectively). These three studies demonstrated that the Delphi method is a practical model for investigating qualitative aspects of the project delivery process in vastly different ways, but within a similar context as this study. The commonality of the studies is that each demonstrated how the Delphi process may be used to identify critical success factors, measure relative importance, and possible ways to interpret the results within the complex framework of the project delivery industry. From these examples the seed was planted for ideas on how to expand the Delphi method for more comprehensive approach to the multi-dimensionality of the project delivery process.

Also key to establishing the methodology for the surveys were Michael K. Kim's *Integrative Design of Buildings: Principles and Strategies*[106]*,* and lecture notes from several of his courses which in large part helped to form the basis for the themes, categories, and several critical success factors used throughout the survey.

6.2.3. Limitations

Nature of Project Delivery: No two projects or designs create the same value. Every project is exposed to unique variables and situations due to the environment in which it is executed. In practice, design and construction means and methods must be adapted, rather than replicated, to account for differing site conditions. Every design must create value specific to its unique situation. A significant variance between each particular project is unavoidable. This variance provides a challenge to providing meaningful comparative analysis between individual

[105] Yeung, Chan, and Chan, "Developing a Performance Index for Relationship-Based Construction Projects in Australia: Delphi Study", 59-68.
[106] Kim, 2011. File: Manuscript in Progress. Integrative Design of Buildings: Principles and Strategies. University of Illinois at Urbana-Champaign, Unpublished, Chapter 3.

projects. The following significantly mitigate the time constraints for successful completion of this study:

- All of the case study projects are part of the same overarching military medical construction program, and in most cases uniform project goals outside of programmatic functional differences.
- The case study projects are clustered around two geographic locations, Washington D.C., and San Antonio, TX. Within each geographic area nearly identical economical environments are assumed, providing a level playing field for comparison of project costs.
- Primary case study projects are all part of the same IDBB Pilot Program

Limited Body of Academic Research: Due to the very limited amount of published academic research directly related to Integrated Project Delivery, this study will have a significant dependence upon that material which is available at this time. Related or complementary research by necessity must be utilized where appropriate to fill gaps. Thoughtful and well reasoned deductive logic is necessary to frame the methodology of this research.

Limited Sample of IDBB Projects: Due to the emergent nature of IPD there is a relatively small body of IPD projects to study, either completed or in execution. Fortunately, IPD has been embraced by the current military construction leadership, and there are several significant projects currently underway which are utilized as a basis for the survey population, and for case study. All of the projects are scheduled to be completed at approximately the same time this study ends in August 2011.

Although the projects are not fully completed at the time of completing this dissertation, they certainly will be substantially complete. Substantial completion affords significant analysis of the measure of success towards completion of the project goals which provide the framework for this study. Additionally, in parallel, an independent government review will be ongoing and will provide an additional source of comparative data.

6.3. Survey Model: Modified-Delphi

The survey method used in this research is conceptually based on the Delphi method. The Delphi method is a process which seeks a consensus opinion of a small panel of subject matter experts through an iterative survey process. The Delphi method is an established and widely used survey process which seeks a consensus opinion of a small panel of subject matter experts through an iterative survey process. The Delphi technique was developed by the Rand Corporation in the mid 1950's as a means of "systematic solicitation and collation of judgments on a particular topic through a set of carefully designed sequential questionnaires interspersed with summarized information and feedback of opinions derived from earlier responses". [107]

A highly beneficial aspect of the Delphi method is the ability to establish a panel of experts over a wide geographic area. The method does not require participants be collocated or to interact directly with each other. For this research the Delphi method allows for the correlation of informed judgments across a wide range of subject-matter expertise to generate a consensus.

This research study modifies the typical Delphi method by establishing four distinct expert groups which then compose a larger, collective panel of experts. The modification is necessary to recognize the four primary stakeholder groups which contribute to the project delivery process. This investigation requires the expanded Delphi format to accommodate and

[107] Delbecq, Van de Ven, and Gustafson, *Group Techniques for Program Planning: A Guide to Nominal Group and Delphi Processes*, 10.

equitably represent the varying range of stakeholder expertise groups engaged within the comprehensive process of project delivery. The primary modification is the formation of a Delphi panel of experts consisting of four distinct stakeholder sub-categories to the project delivery process: Owner, Designer, Builder, and User stakeholder groups

The questions were developed around the concept of a three round set of internet-based surveys. This study was conducted using the internet-based survey services of QuestionPro (www.questionpro.com). The web-based surveys provided a platform for publishing the surveys, communicating with participants, and anonymously collecting participant responses.

6.3.1. Survey Sample

The Delphi process, unlike most survey methods, does not rely on a random sample or distribution based on a large sample size. The Delphi method requires a sharp focus on expertise, because it is *expert opinion,* rather than a large sample size which provides the significance behind the Delphi process.

The typical sample size for a Delphi study ranges between ten to thirty participants. Four or less respondents would be too few to adequately demonstrate significance of the desired consensus. As Delbecq et al. (1975) indicated, "the size of the respondent panel is variable. With a homogenous group of people, ten to fifteen participants might be enough". [108] A difference with the case of this investigation is the formation of multiple panels of experts. This investigation requires a larger overall sample size than a typical Delphi survey based on the minimum required size for each of the four sub-groups.

[108] Andre L. Delbecq, Andrew H. Van de Ven, and David H. Gustafson, *Group Techniques for Program Planning: A Guide to Nominal Group and Delphi Processes* (Glenview, IL: Scott, Foresman, 1975), 89.

This study approaches each stakeholder group as an independent Delphi group within the larger overall Delphi group consisting of all stakeholder groups. These project stakeholders will include the Owner's, Designers, Builders, and Users. The stakeholder population represents subject matter experts and highly regarded leaders in their respective fields. Access to this population is readily available due to the author's active duty military status and work experience. Significant professional working relationships already have been developed with many of the key individuals and organizations at each of the project sites

As modified, this study is a Delphi within a Delphi. Thus the minimum sample size is increased four-fold. The minimum range for this modified Delphi survey is between 32 and 40 participants. The goal for this survey is to have a minimum of ten respondents from each of the four stakeholder groups for the Round 1 survey, which would allow for an expected and acceptable attrition of respondents over the course of the remaining two surveys. Additionally, the Owner's stakeholder group consisting of a wide range of government agencies would ideally be slightly larger than the other stakeholder groups to adequately represent the most critical layers of authority from each of the many agencies (the Department of Defense, the U.S. Army Corps of Engineers, and the U.S. Army Health Facility Planning Agency to name a few) which comprise the role of the public/government project "owner". The sample sizes achieved for this study were 51, 42, and 40 for the rounds 1, 2, and 3 surveys respectively. Additional details are provided in the individual survey round sections below.

6.3.2. Survey Population

The survey population was limited to only the most qualified and experienced individuals with proven excellence in their respective professions. The focus of this research is to collect data about critical success factors (CSF) for project delivery of large, expensive and complex projects. The sample for the survey is limited to industry experts with significant experience with the U.S. Army's military construction (MILCON) program, and more specifically related experience with the four Integrated-Design-Bid-Build (IDBB) pilot-projects well under way at the time of this investigation.

Identification and selection of potential survey participants was centered on the executive level of the project delivery teams for the IDBB pilot-projects, and includes senior civilian and military professionals from the Owner, Designer, Builder, and User stakeholder groups. Contacts were gathered from discussions with the program directors of the various projects. Key project executives were then contacted about the proposed research project, and invited to participate in the study. All contacts voiced a strong interest in participating in the survey, but a few could not commit to participation due to business travel plans and workload.

The questions the survey asks are not directly related to assessment of the IDBB pilot-projects, but are meant to ascertain the expert opinion of the highly experienced professionals who have worked in all aspects of project delivery and different project delivery methods over the years with particular emphasis on large complex military construction projects (MILCON). Additionally the sample population has fresh experiences and opinions based on the lessons learned during their involvement with the IDBB projects over the course of several years (between 2005 and 2011).

The Owner's and User's populations include only senior military and civilian project executives directly responsible for the multi-billion dollar MILCON capital investment programs. The designer's and builder's populations include principle level executives of companies and firms which are among the largest, and most successful in industry. Based on the expertise, experience, and participation in the U.S. Army's Integrated Design-Bid-Build pilot-projects, the sample population of this research project is uniquely, and perhaps exclusively, qualified to evaluate the project delivery process in the context of MILCON mega-projects.

6.4. Procedures

QuestionPro (www.questionpro.com) provided the web-based survey platform through six months of contracted service. All survey development and administration was conducted by the author under the research direction of Professor Michael K. Kim, PhD. The internet-based surveys were conducted in two phases.

Phase one consisted of two rounds of surveys to select and assess relative importance of critical success factors for project delivery. Phase two consisted of a round 3 survey to further evaluate effectiveness of project delivery methods against the CSFs selected in survey rounds 1 and 2. Respondents were identified, as discussed earlier, as having a high degree of expertise and experience with complex military construction projects with an emphasis on medical projects. These participants were then contacted by telephone and/or electronic mail to determine if they would be interested in participating. A validated list of 56 potential participants, providing equal representation for each stakeholder group, was used to populate the email distribution list for the round 1 survey.

Summary of procedures:

- Literature Review
- Pilot study / interviews
- Develop Survey Questionnaire
- Survey of project delivery stakeholders
- Project Case Studies
- Data collection through military sources
- Evaluation of Data

6.5. Survey Overview

Detailed descriptions of the survey questions will be discussed later in each of the individual survey round sections. A brief overview of each survey's questions will be provided here as part of the conceptual overview. Complete copies of the surveys are found in the appendices C, D, and E.

6.5.1. Round 1

Email invitations with links to the web-survey were sent to 56 individuals out of over 60 contacted prior to the start the research. The first round survey was divided into two sections. The first section asked basic questions to validate respondent expertise for participation on the panel of experts: Stakeholder group, Years experience, Level of education, and Professional certifications. The second part of the survey asked the participants to evaluated ten listed critical success factors for each of the 4 categories of the project delivery process: (1) Design, (2) Construction, (3) Process, and (4) Impact. From each list of ten categories, each respondent was required to select the top-5 factors they believed most important for the category. The participants were required to evaluate each category two times, first from a *Self-Interest* perspective and then from a *Project-Interest* perspective. Additionally, survey participants were given the opportunity to select "Other" and include in their 'top-5 selections' one or more CSFs not otherwise listed. Frequency of selection is the measure of relative importance both overall and within each stakeholder.

The categorical breakdown ensures a representative sample of Critical Success Factors (CSFs) across the spectrum of the project delivery process are selected for further analysis in the subsequent Round 2, and Round 3 surveys. Otherwise, it is likely the distribution of selected CSF's in survey Round 1 survey might have centered around individual areas of a particular stakeholder group's interest, thereby narrowing the focus to stakeholder 'nodes' along the project delivery process timeline. The categorical approach forces the survey participants to take a broad approach in selecting critical success factors outside their normal centers of gravity.

The selection criteria for CSF to be further assessed in the round 2 survey was based on the rank-order percent (frequency based) of CSFs selected in each of the four categories from both the 'self-interest' and 'project-interest' perspectives. To clarify, the respondents picked a top-5 list from eight individual lists of ten critical success factors: 4 Categories evaluated form 2 perspectives equals 8.

Analysis and statistical testing is conducted on all eight groups of ten. The top 25% of rank-ordered factors were selected for further evaluation in survey round 2. Twenty-four critical success factors were selected out of the original forty for further evaluation.

6.5.2. Round 2

The second round used questions developed from responses to the first survey. Prior to the start of the round 2 survey each respondent was provided, via email, the results of the round 1 survey. The published results included listings of the relative importance rankings from each stakeholder group and self/project perspective. The round 2 survey also included an internet link to view the round 1 results before continuing with the round 2 survey.

Round 2 was greatly simplified from round 1. The sample group for round 2 was limited to only those respondents who participated in round 1. Therefore, there was no need to request any further validating demographic information. The survey included only a question to self-identify with a stakeholder group. The 24 critical success factors selected from each of the four categories (Design, Construction, Process and Impact) in round 1 were consolidated in a single list to be evaluated from both self and project perspectives. In some instances redundancy in critical success factors between categories was treated by consolidating to a single CSF for the round 2 list.

Round 2 asked the participants to rate each selected Critical Success Factor (CSF) on a 1 to 5 scale (1=least important and 5=most important). Once again the respondents were twice asked each question: once from the 'self-interest' perspective, and a second time from the 'project-interest' perspective.

The mean scores of each critical success factor were used to once again rank-order each CSF for relative importance. Rank-orders were established for each stakeholder group and perspective category. As in survey round 1, a top 25% ranking in any of the stakeholder groups was used as a selection criteria selecting overall important CSFs. The list of critical success factors that started at forty in round 1 was narrowed down to the thirteen most important, as assessed by the panel of experts, to be used in the round 3 survey.

Additionally in round 2 a comparison of inter-rater agreement between survey rounds 1 and 2 was made to determine if consensus had increased among the stakeholder groups and the larger panel of experts. As is reported later in the round 2 section, statistical analysis determined that increased consensus had been achieved. Based on the statistical significance, the iterative Delphi process for evaluating critical success factors was achieved 2 without the requirement for additional any rounds. Had the level of inter-rater agreement not improved between rounds 1 and 2, an additional round, or rounds would have been necessary. Fortunately, the panel of experts performed as expected.

Using the completed data from the rounds 1 and 2, detailed analysis of the differences between stakeholders, and perspectives is provided in the round 2 report.

6.5.3. Round 3

The sample group for the round 3 survey was the same as for round 2. Again, the respondents were provided with results of the previous survey prior to starting round 3. By this time the panel of experts has been provided data that demonstrates a clear difference between stakeholder groups. The focus in round 3 shifts from relative importance of factors, to using the 13 most important factors as a tool for assessing the effectiveness of different project delivery methods. At the start of the survey each respondent was asked to answer questions to validate their particular familiarity with the three project delivery methods (DBB, DB, and IPD). Each responded was asked to select on a scale of 1 to 5 (1. Not at all familiar, 2. Slightly familiar, 3. Somewhat familiar, 4. Moderately family, 5. Very familiar). The sample population was selected based on their broad experience in project delivery and as was expected most respondents answered in the range of high familiarity (3-5). Also as was expected, a couple of respondents in the User group, although experts in their respective areas, selected in the "not familiar at all" to "slightly familiar" range. The User stakeholder group is typically more focused on operational aspects rather than the nuts-and-bolts of project delivery. Two participants that responded with less than high familiarity were excluded from the survey analysis to ensure consistency within the response set.

On a side note, an oversight between rounds 1 and 2 was addressed by a separate questions unrelated from the rest of round 3. One critical success factor (Evidence Based Design) was selected in round 1 but was omitted in round 2. The respondents were asked to rate Evidence Based Design on the same scale as in round 2, and the results were amended to the round 2 data set. For the record, Evidence Based Design did not score high enough to be included in the final list of CSF's selected for round 3.

The main part of Round 3 asked the respondents to assess on a scale of 1 to 5 (1 = not effective at all, 5 = very effective) the effectiveness of three project delivery methods: Design-Bid-Build (DBB), Design-Build (DB), and Integrated-Project-Delivery (IPD) to achieve the selected critical success factors. The participants rated each project delivery method against each of the 13 critical success factors two times, from the self-interest and project-interest perspectives.

Analysis of the data includes rank-ordering of the efficacy each project delivery method for each of the CSFs by stakeholder group and perspective. The data was then aggregated and normalized by weighing for relative importance (determined in round 2). Tests were conducted to determine statistical significance of the resulting relative effectiveness scores.

6.6. Survey Instruments

The survey instruments containing the questions described above are provided in the Appendices. Each survey instrument was developed by the author in discussions with Dr. Michael K. Kim, committee chair and advisor, along with the other committee members.

The instrument for the Round 1 survey was reviewed by the committee and other researchers to establish initial validity. A limited pilot-survey was conducted from 06 December 2010 until 18 December 2010 among a small sample of survey population to provide data for review of the questions, format, and resulting data scale. The rounds 2 and 3 surveys were developed from the responses to the round 1, and were similarly reviewed for initial validity.

The design of the instruments seriously considered the sample population to maximize participation. The participants in this survey are extremely busy professionals at the tops of their professions and involved in several high-stakes mega-projects. Their time is at a premium, and as such the surveys were designed for simplicity and brevity. Each survey was designed to be completed in approximately 15 minutes, and refinement made during the pilot-survey testing resulted in average completion times meeting or exceeding the target.

Three primary measures are required for population validation, relative importance of critical success factors, and effectiveness of different project delivery methods to achieve critical success factor examples. Each of these measures will utilize the expert opinion of the Delphi panel(s), and are statistically tested using SPSS Statistics 18.

6.6.1. Validity Testing

The instruments (surveys 1, 2, and 3) were reviewed and tested for validity and reliability. Inter-class agreement was measured using Kendall's coefficient of concordance to validate consensus building and level agreement amongst the panel(s) of experts. Intra-class correlation utilizing Cronbach's alpha was used to test for reliability of the questions for the overall group as well as each stakeholder group.

Validation of the sample population, the panel(s) of experts, uses three criteria to evaluate the level of professional expertise in each participant's of expertise: (1) experience, (2) education, and (3) certifications. Additionally, each participant self-identified with a stakeholder group (Owner, Designer, Builder, or User) which indicates membership in a sub-panel within the larger overall panel of experts.

An important aspect when validating the results of a Delphi survey is ensuring the data represents a consensus among the panel of experts. Stated in simple terms, the results are only valid if it can be shown that there is an increasing degree of consensus through the iterative Delphi survey process. Each survey participant is considered a rater. For example think of a panel of judges scoring an event. Consensus is achieved by inter-rater agreement. One statistical method for measuring inter-class, or inter-rater, agreement is Kendall's coefficient of concordance (W). Kendall's W provides a way to assess inter-rater agreement among a small panel of three or more judges (appropriate for the Delphi method) using the mean rank orders of each rater's assessment of the cases. In the case of this survey rank-order analysis is more reliable due to the small sample size of the Delphi survey. Kendall's W is a coefficient where zero equals no agreement, and one equals perfect agreement among raters. Using non-parametric analysis in SPSS, Kendall's W was calculated for the overall panel of experts, and for each sub-panel of stakeholder group experts (owners, designer, builders, and users) to determine the level of consistency. The Kendall's W results from different rounds of surveys can then be compared to determine if the level of agreement increases, or not, from one survey to the next. In the case of this research project, the inter-rater agreement increases with each survey round. Results are reported in each individual survey section to follow.

Reliability, or intra-class correlation (differing from the "inter-class" correlation in the Kendall's W discussion above) is assessed using Cronbach's Alpha as a scale measure. Cronbach's alpha, a coefficient based on the number of cases, and a ratio of average inter-case covariance to the average case variance, and measures consistency when evaluating multiple raters on ordered category scales. [109] The measure of Cronbach's alpha is reported as a coefficient between zero and one, where zero is interpreted as follows: zero equals no reliability; less than 0.6 equals not reliable; 0.6 is the minimum level for a reliable scale; 0.7 is reasonably reliable; 0.8 is strongly reliable; 0.9 is very reliable; and levels approaching 1.0 (> 0.98) are potentially over reliable. For this study, minimum reliability levels were generally achieved in all three surveys. The surveys consistently scored high in reliability for the larger overall "panel

[109] J. Marilee Bresciani et al., "Examining Design and Inter-Rater Reliability of a Rubric Measuring Research Quality Across Multiple Disciplines," *Practical Assessment, Research & Evaluation* 14, no. 12 (May 2009).

of experts", there are some instances in the round #1 survey where individual sub-panel (stakeholder groups) failed to individually achieve the minimum reliability (Cronbach's alpha) score of 0.6. In the subsequent rounds two and three all measures of reliability exceed 0.6. Details of reliability are reported in the individual survey sections to follow.

In the Delphi process the typical major statistics for determining significance are the measures of central tendency: mean, median, and mode. In literature, median scores based on a Likert scale are favored.[110] When appropriate more rigorous statistical tests are used to provide a more robust argument for the superiority of Integrated Project Delivery. For example a Friedman test with post-hoc tests is used in round 3 to determine significance for the results of the relative effectiveness evaluations.

6.6.2. Confidentiality

Responses to the Delphi questionnaires were treated with complete confidentiality. The identity of participants of the Delphi Survey was not shared among other participants, and the surveys did not contain information that personally identified participants. All responses were completely anonymous. No ID key was used to link individual participants to survey results. Responses were categorized by participant's stakeholder group only. Stakeholder categories include: Owner/Owner's representative, Designer, Builder, and facility User. The participant sample included multiple individuals for each category from each of the case study projects. QuestionPro's (www.questionpro.com) "Respondent Anonymity Assurance" feature was enabled on each of the web-based surveys to allow the ability to track who has responded to the survey and who has not for the purposes of sending out reminder emails, and administration

[110] Chia-Chien Hsu and Brian A. Sandford, "The Delphi Technique: Making Sense of Consensus,". *Practical Assessment, Research & Evaluation* 125, no. 10 August 2007, 09 September 2010 <http://pareonline.net/pdf/v12n10.pdf>.

of the survey process; and for human subjects protocols ensuring that email identifications are not linked to the response data.

An informed consent agreement was included as the first page in all web-surveys. The informed consent agreement outlined the precautions taken to ensure confidentiality. Respondents could either accept the terms of the agreement or exit the survey. The survey could not be started without respondent agreement.

Confidentiality was an important consideration voiced by participants during the pre-invitation discussions. Several participants stated that they would participate only if the survey results were anonymous. Beyond protecting the interests of the participants, the anonymity of the surveys also increased the quality of the data yielded a enabling more critical evaluation among the various stakeholder groups. To maintain participant confidentiality, the dissertation refers to participants only by their stakeholder group and does not directly mention the names of the design firms, or construction companies with they are associated.

6.6.3. Institutional Review Board

This research project was reviewed by the University of Illinois Urbana-Champaign's Institutional Review Board and approved on 02 November 2010 (IRB Protocol Number: 11122). This research project was reviewed by the Institutional Review Board, Office of the Vice Chancellor for Research, University of Illinois at Urbana-Champaign in accordance with policy on human subject research. On 02 November 2010, the IRB determined that this research meets the criteria for exemption because (Category 2) online survey methods are used to assess perceptions of various experts regarding evaluation of various aspects of military construction projects, and (Category 4) because only retrospective analysis of construction project documents will occur. The Category 4 exemption limits analysis of project construction documents to only those produced before 02 November 2010. The exempt protocols of this research project are approved for a maximum of three years, ending on 01 November 2013. For further information on IRB requirements please visit the IRB website at http://www.irb.illinois.edu. A copy of the IRB approval letter is located in Appendix B.

CHAPTER 7.

ROUND 1 SURVEY REPORT

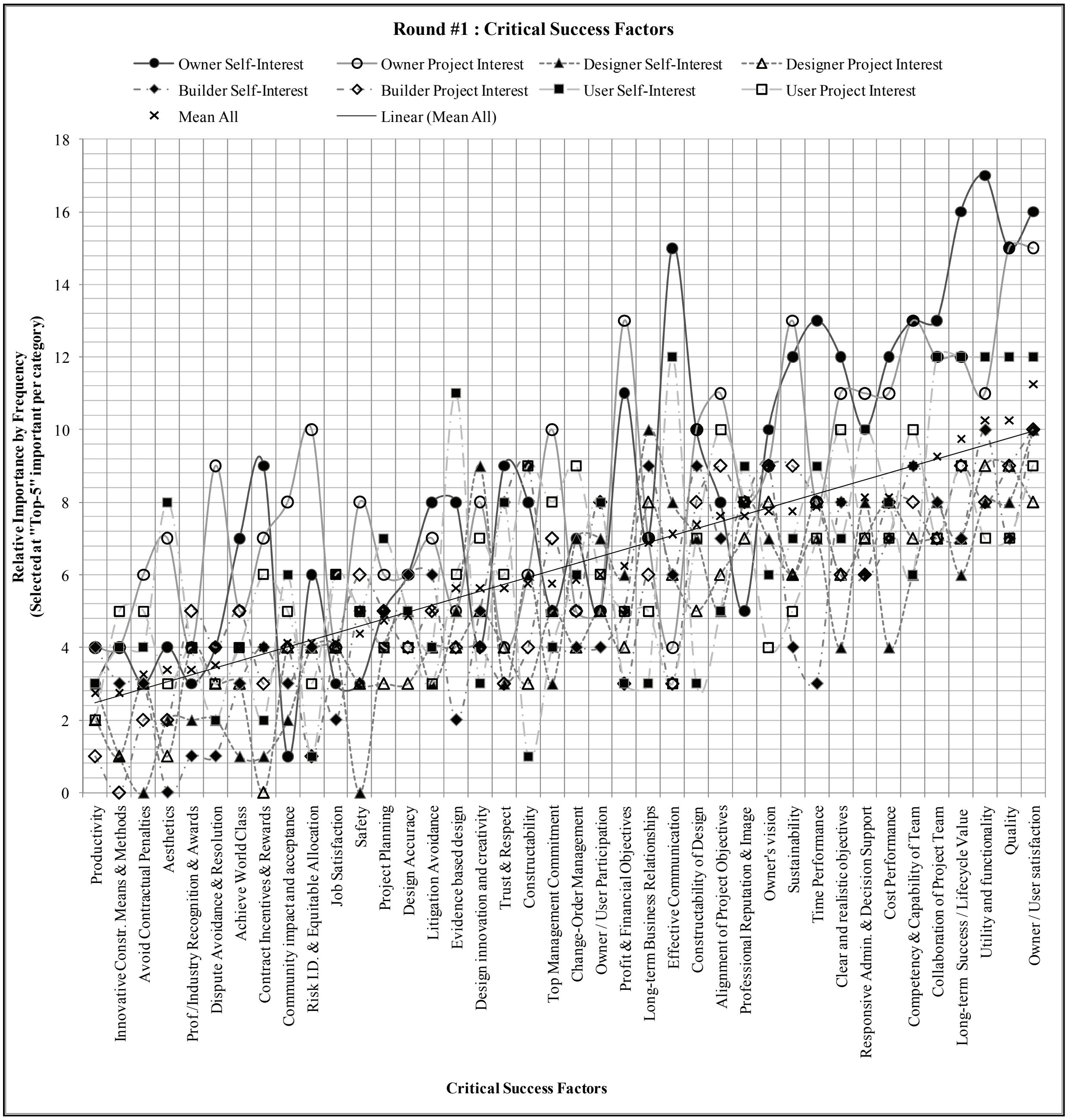


Figure 7.1. Survey round 2 overall data results

7.1. Introduction

The round 1 report presents data collected from the panel(s) of experts. Please note that analysis in round 1 is kept to a minimal level because the primary purpose is preparation for the second round survey where more detailed analyses will be conducted. Whenever possible charts tables and graphs are used to summarize the data and great effort was taken to graphically represent data and analysis whenever possible. One such example is the data summary on the first page of the report. Note the linearity of the response set in figure 6.1, an early indicator of agreement among the panel of expert when ordering the relative importance of the selected critical success factors. Figure 7.1. above gives a visual pre-view of the data to be discussed below.

Overview:

The round 1 report begins by stating the purpose of the survey, and administrative data before addressing questions and responses. Questions are addressed in the order they were encountered in the survey, and are immediately followed by response data when possible. Where repetitive questions are used to evaluate each of the factor categories separately the questions will be grouped ahead of the data and analysis.

The data and analysis for the round 1 is organized in the following order: sample data, participant validation, critical success factor data and evaluation, and finally a summary of round 1 findings. All sections of data and analysis will be prefaced by the survey question, or a summary of the survey questions, to be addressed in the particular section.

Data and analysis will be organized around the four categories used to represent different aspects of the project delivery process: Design, Impact, Process, and Impact. As discussed in research methods earlier in chapter 6, the four categories serve the dual purpose of simplifying the survey for the respondents, and providing the means of ensuring and selecting a broad range of factors across the spectrum of the project delivery process for further analysis in the round 2 survey. Additionally, within each of the four categories, the data and analysis is further sub-divided around the self-interest and project-interest categories as well.

Each categories' data set includes: frequency tables of the raw data, inter-rater agreement tables for validation purposes, intra-class correlation tables to test survey reliability, correlation matrices, and relative importance tables based on rank-ordering. The next to last section of the report will provide a summary and consolidation of each categories relative importance rank-orders. Any factor scoring in the top-25% (based on a fractional rank-order) of any stakeholder group's rank-ordered list will be selected for further analysis in the round 2 survey. Finally, the report concludes with a summary of round 1 findings.

Purpose:

The round 1 survey served two purposes. The first purpose is to validate the qualification of each individual participant to serve on the panel of experts. The Delphi method is dependent on the experience and expertise of the panel of experts voluntarily participating in this research study. The second, and primary, purpose of the round 1 survey is to select critical success factors for determining relative importance. From the selection of critical success factors and resulting determination of relative importance, the resulting data set is used to identify differences between stakeholder groups and their different perspectives: self-interest and project-interest. Successful completion of round1 provides both proof of concept for the study and a data set to establish the basis for the round 2 survey.

Administrative:

The round 1 survey was published to the website and invitations were sent to a total of 56 participants on 10 January 2011. Weekly email reminders were automatically sent to remaining participants until the survey was closed at 11:59 pm 35 days later on 14 February 2011. The invitations contained internet links to the survey website survey invitations were sent via email to a total of 56 participants. A complete copy of the survey instrument is located in Appendix C.

Participation Statistics:

- Invited: 56
- Started: 53
- Completed: 51
- Participation Rate: 91.1%
- Completion Rate: 96.2%
- Drop outs (after starting): 2
- Average Time to Complete Survey: 16 minutes

7.2. Round 1 Sample

Round 1 - Question 1: Stakeholder Group Identification

Which of the following categories do you best identify with? (Select only one): Design Team; Facility User or User's Representative; Construction Team; Owner or Owner's Representative.

The participation distribution is not perfectly equal between the stakeholder groups, but poses no problem to the validity of the Delphi survey process. Each stakeholder group is within the minimum required number of participants (more than 5). The owner stakeholder group may appear over represented at 33% of the total panel of experts, but that is not the case. Due to the

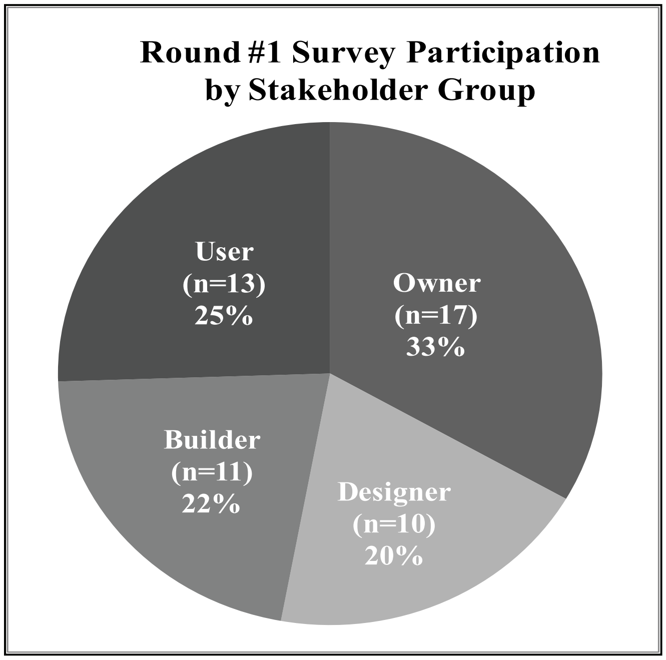


Figure 7.2. Round 1 survey participation by stakeholder group

Stakeholder Group (1)	Frequency (2)	Percent (3)
Owner / Owner's Representative	17	33.3
Design Team	10	19.6
Construction Team	11	21.6
Facility User / User's Representative	13	25.5
Total	51	100.0

Table 7.1. Round 1 survey participation frequency table

multiple government agencies which comprise the ownership group the sample set included invitations to more owner's than the other stakeholder groups. All comparisons are made between stakeholder groups as a whole utilizing normalized data. The 92% participation rate, as described in the administrative section above, was better than expected. The survey was designed to perform at a minimum of 70% participation, a consideration necessary given the busy schedules of the population sample.

7.3. Participant Validation

The round 1 survey participants were asked a series of questions to validate expertise and experience. All candidates were screened for a combination of professional certification(s), education level, and years of experience. Although education and professional certifications are important indicators of expertise, the greatest weighting was primarily placed on years of experience, and secondarily on a combination of education and professional certifications. Many of the participants, by virtue of years experience and age, began their careers when education requirements for professional certifications and licensures were much different than today. Likewise the career paths some of the most experience panel members provides a wealth of knowledge beyond any graduate level education. Based on the impressive range of qualifications, no respondent needed to be screened out to ensure integrity of the panel. None the less, the screening process was important for two reasons. First, and most important, the Delphi method is predicated on the qualifications of the participants who comprise the panel of experts. Even though only the most qualified individuals were invited to participate as members of the panel of experts, the validation ensured the credentials of the anonymous respondents matched up with the skill sets of the invited participants.

Round 1 -- Question 2: Professional Certifications

> **What are your professional certifications?** (Select all that apply): Registered Architect; Professional Engineer; Certified Design Professional; Certified Construction/Project Manager; Licensed Healthcare Provider; Not Applicable; Other (list if selected).

The owners' stakeholder group includes a broad range of professional certification which may be unique to sample population. Nearly all are either registered architects, professional engineers, and/or certified project/construction managers. These Owners are likely more

Professional Certifications														
Stakeholder Group		Registered Architect		Professional Engineer		Construction /Project Management		Licensed Healthcare Provider		Other			Not Applicable	
	N	n	%	n	%	n	%	n	%	n	%	Description	n	%
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Owner	17	4	24%	5	29%	3	18%	0	0%	6	35%	Fellow, American College of Healthcare Executives (x2); Master's Degree in Healthcare Administration; PhD; Engineer in Training (EIT); Project Management Professional: Certified Design Professional	4	24%
Designer	10	6	60%	3	30%	0	0%	0	0%	1	10%	LEED AP; Evidence Based Design Accreditation and Certification (EDAC)	1	10%
Builder	11	0	0%	4	36%	6	55%	0	0%	2	18%	LEED AP; Project Management Professional	3	27%
User	13	0	0%	0	0%	0	0%	9	69%	3	23%	PhD Architecture; Healthcare Administrator; American Institute of Certified Planners (AICP)	1	8%
Note: Some survey participants possess multiple certifications: group totals may exceed 100%														

Table 7.2. Professional certification frequency table

sophisticated than the average owner in knowledge of project delivery. The Users stakeholder group is comprised exclusively of healthcare professions. However, these healthcare professionals are not ordinary clinicians. These are doctors, nurses, and administrators who have specialized in representing or advocating for the medical operators throughout the planning, programming, and design of numerous large hospital projects. Some are professional nurse-methods-analysts who specialize in design of medical operations and translate the requirements into facility requirements and standards. Like the Owners stakeholder group, the User group is also a very sophisticated in project delivery.

The Builders and Designers are principle level executives at Engineering News Report (ENR) top-25 construction companies and design firms.

Round 1 - Question 3: Education

What level of formal education (related to your area of expertise) have you completed? (Select only one): Associates Degree or other training leading to professional certification; Bachelors Degree; Graduate/Professional Degree; Doctorate Degree; Not Applicable.

Educational Degree	Stakeholder Groups									
	Owner		Designer		Builder		User		All	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Associates	1	5.9%	1	10.0%	0	0.0%	0	0.0%	2	3.9%
Bachelors	2	11.8%	4	40.0%	4	36.4%	0	0.0%	10	19.6%
Graduate	11	64.7%	5	50.0%	7	63.6%	9	69.2%	32	62.7%
Doctorate	3	17.6%	0	0.0%	0	0.0%	4	30.8%	7	13.7%
Totals	17	100%	10	100%	11	100%	13	100%	51	100%

Table 7.3. Participant education frequency table

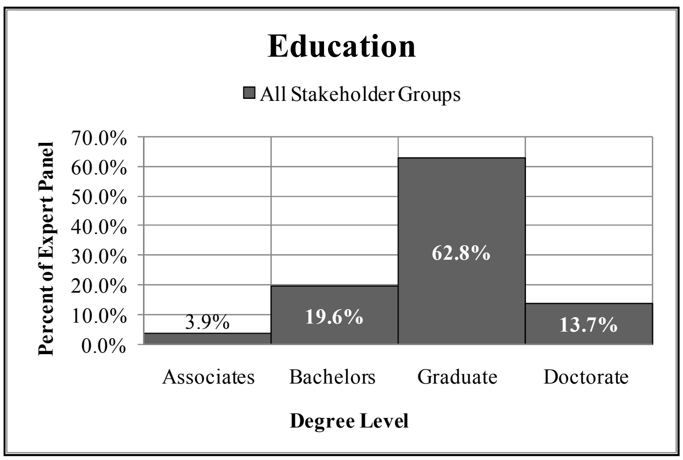


Figure 7.3. Education histogram

Overall the group is highly educated with over 82% possessing advance degrees above the bachelor level. Education is only one measure of expertise. For example, the two individuals who responded as having associates degrees also have more than 30 years experience each. Many professionals who started careers in the same era as these individuals attained professional certifications prior to the current degree requirements for professional registration as and architect or engineer. Based on cross analysis of experience and professional certification there is no cause to question the expertise of those two particular individuals. The distribution among the stakeholder groups is fairly even. The owner and user groups are especially well educated, an indication that those groups are more sophisticated in the project deliver than most owners and users.

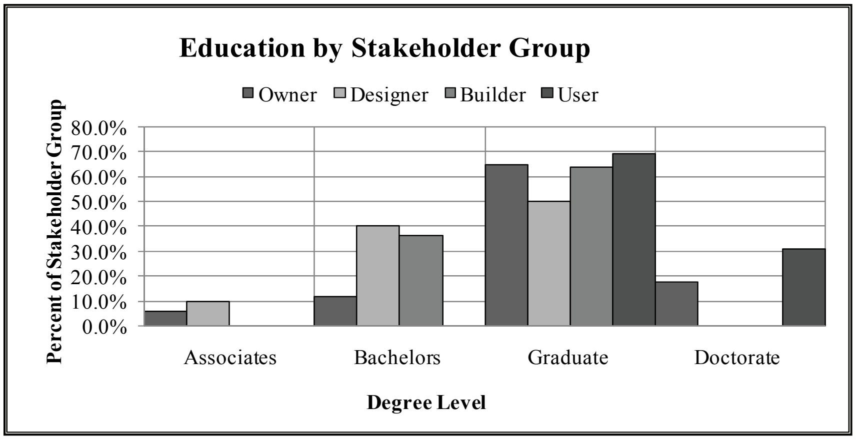


Figure 7.4. Education by stakeholder group

Round 1 - Question 4: Experience

How many years experience do you have in your area of expertise? (Select only one): Less than 10 years; 10-15 years; 15-20 years; 20-25 years; 25-30 years; 30-35 years; More than 35 years.

Years Experience	Stakeholder Groups									
	Owner		Designer		Builder		User		All	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
< 10	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
10 - 15	1	5.9%	1	10.0%	0	0.0%	1	7.7%	3	5.9%
15 - 20	4	23.5%	1	10.0%	0	0.0%	0	0.0%	5	9.8%
20 - 25	1	5.9%	1	10.0%	1	9.1%	4	30.8%	7	13.7%
25 - 30	6	35.3%	2	20.0%	5	45.5%	2	15.4%	15	29.4%
30 - 35	3	17.6%	2	20.0%	3	27.3%	5	38.5%	13	25.5%
> 35	2	11.8%	3	30.0%	2	18.2%	1	7.7%	8	15.7%
Totals	17	100.0%	10	100.0%	11	100.0%	13	100.0%	51	100.0%

Table 7.4. Participant experience frequency table

The experience level of the panel experts is highly outstanding across the board. Over 70% of the survey respondents have over 25 years of professional experience. Minimally the participant panel represents more than 1,290 years of combined professional experience! The median range of experience for the panel is between 25 and 30 years, with an average of approximately 27 years.

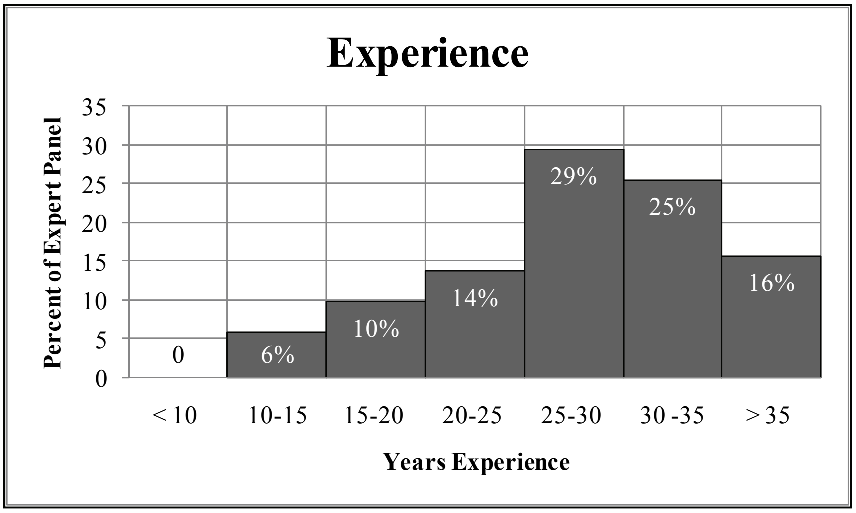


Figure 7.5. Experience histogram (overall panel of experts)

The experience screening criteria this survey was less than 10 years. Any respondent with less than 10 years of experience regardless of education and/or professional certification would have been excluded from the response set. All respondents, as expected exceeded the screening criteria. The distribution of experience among the stakeholder groups gives no reason to question the collective experience of any group.

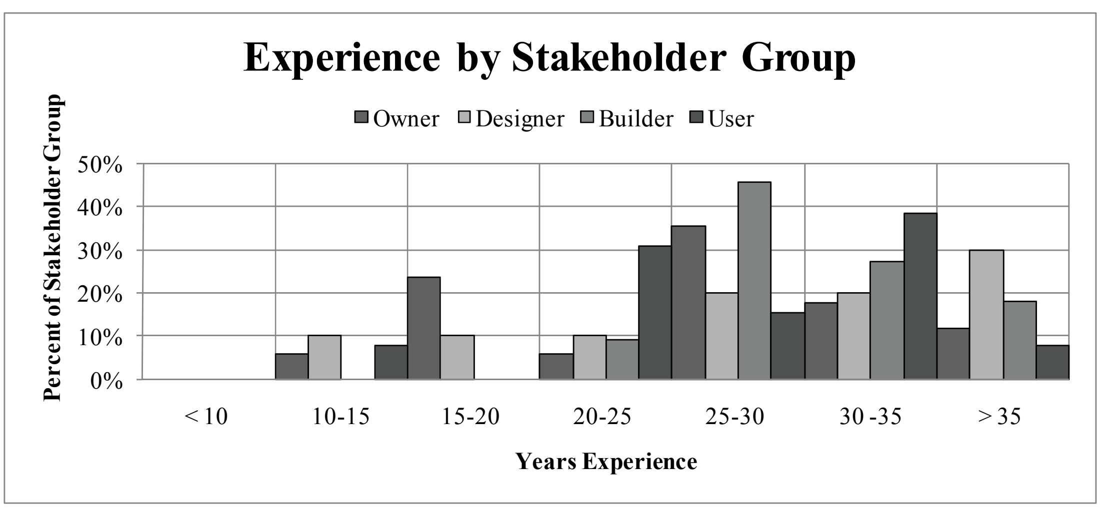


Figure 7.6. Participant experience by stakeholder group

7.4. Selection of Important Critical Success Factors

The survey participants were asked in sequence the following set of questions twice: (1) from the stakeholder's "self-interest", and (2) from the "project-interest" perspective. The questions are broken down into four categories: Design, Construction, Process, and Impact as discussed in detail earlier. For brevity questions will only be listed once below, followed by data and analysis of the data set. Special instructions were provided in the survey to prompt the participants to focus their responses accordingly for each of the "self-interest" and "project-interest" sections.

Round 1 - Question 5:

Which of the following Design Category factors do you believe are the most important for project value-creation? (Select exactly 5): Design innovation and creativity; Achieve World-Class"; Aesthetics; Constructability; Community impact and acceptance; Clear and realistic objectives; Owner's vision; Utility and functionality; Sustainability; Evidence Based Design; Other Design Factor (description required if selected).

Round 1 - Question 6:

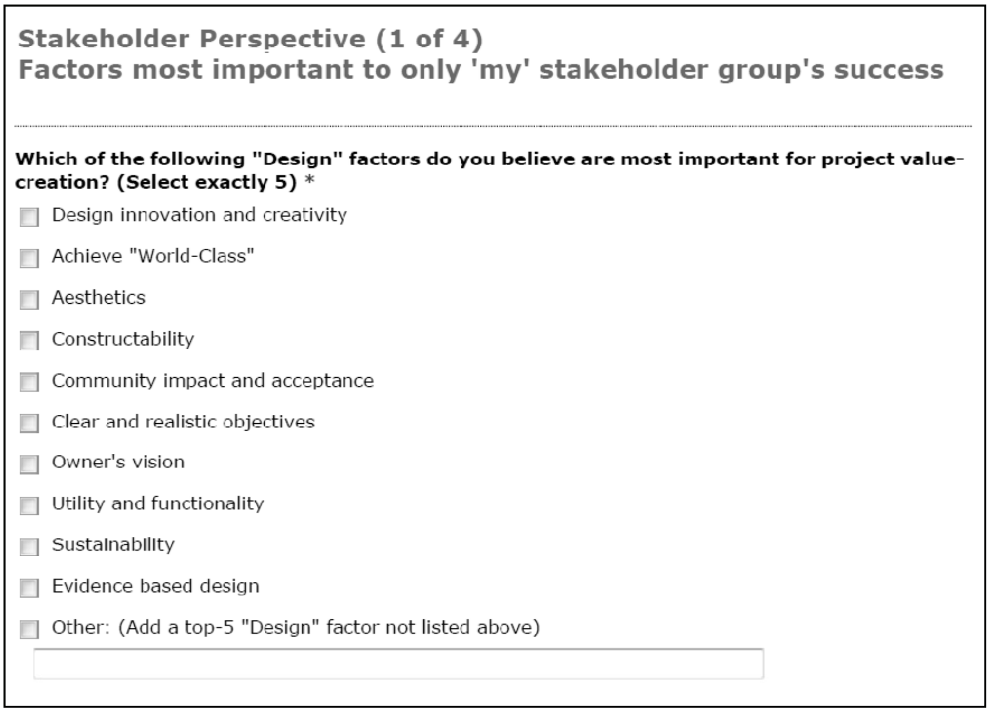
Which of the following Construction Category factors do you believe are most important for project value-creation? (Select exactly 5): Change-order management; Responsive administration and decision support; Design accuracy; Cost performance; Innovative construction means and methods; Productivity; Time performance; Safety; Constructability of Design; Quality; Other (description required if selected).

Round 1 - Question 7:

Which of the following Process Category factors do you believe are most important for project value-creation? (Select exactly 5): Competency / capability of project delivery team; Trust and respect; Dispute avoidance and resolution; Effective communication; Owner/User participation; Project Planning; Alignment of project objectives; Top management commitment; Risk identification and equitable allocation; Other (description required if selected).

Round 1 - Question 8:

Which of the following Impact Category factors do you believe are most important for project value creation? (Select exactly 5): Job satisfaction; Profit and financial objectives; Avoid contractual penalties; Contract incentives/rewards; Long-term building success / Lifecycle value of facility; Long-term business relationships; Professional reputation or image; Profession/Industry recognition or awards; Litigation avoidance; Owner/User satisfaction; Other (description required if selected).


Stakeholder Perspective (1 of 4)
Factors most important to only 'my' stakeholder group's success

Which of the following "Design" factors do you believe are most important for project value-creation? (Select exactly 5) *

- [ ] Design innovation and creativity
- [ ] Achieve "World-Class"
- [ ] Aesthetics
- [ ] Constructability
- [ ] Community impact and acceptance
- [ ] Clear and realistic objectives
- [ ] Owner's vision
- [ ] Utility and functionality
- [ ] Sustainability
- [ ] Evidence based design
- [ ] Other: (Add a top-5 "Design" factor not listed above)

Figure 7.7. Round 1 example question from web-survey

The responses to these questions are contained in frequency tables in the following sections. The data and analysis will be presented in the following order: (1) Overall data summary, (2) Design category, (3) Construction category, (4) Process category, (5) Impact category, and (6) a summary of the top 25% critical success factors selected for inclusion in the round 2 survey.

7.5. Overall: Data & Analysis

SELF-INTEREST																	
Cat.	Critical Success Factor	Frequency					Rank					Rank Fractional					
		O	D	B	U	ALL	O	D	B	U	ALL	O	D	B	U	ALL
Design	Utility and functionality	17	8	10	12	47	1.0	2.0	1.0	1.0	1.0	1.00	0.90	1.00	1.00	1.00
	Owner's vision	10	7	9	6	32	4.0	3.0	2.5	6.5	2.0	0.70	0.80	0.85	0.45	0.90
	Clear and realistic objectives	12	4	8	7	31	2.5	7.0	4.0	4.5	3.0	0.85	0.40	0.70	0.65	0.80
	Sustainability	12	6	4	7	29	2.5	4.5	6.0	4.5	4.0	0.85	0.65	0.50	0.65	0.70
	Evidence based design	8	5	2	11	26	5.5	6.0	9.0	2.0	5.0	0.55	0.50	0.20	0.90	0.60
	Constructability	8	6	9	1	24	5.5	4.5	2.5	10.0	6.0	0.55	0.65	0.85	0.10	0.50
	Design innovation and creativity	4	9	5	3	21	8.5	1.0	5.0	9.0	7.0	0.25	1.00	0.60	0.20	0.40
	Achieve World Class	7	1	3	4	15	7.0	10.0	7.5	8.0	8.0	0.40	0.10	0.35	0.30	0.30
	Aesthetics	4	2	0	8	14	8.5	8.5	10.0	3.0	9.0	0.25	0.25	0.10	0.80	0.20
	Community impact and acceptance	1	2	3	6	12	10.0	8.5	7.5	6.5	10.0	0.10	0.25	0.35	0.45	0.10
Construction	Quality	15	8	7	12	42	1.0	1.5	2.5	1.0	1.0	1.00	0.95	0.85	1.00	1.00
	Responsive Admin. & Decision Support	10	8	6	10	34	4.5	1.5	4.5	2.0	2.0	0.65	0.95	0.65	0.90	0.90
	Time Performance	13	7	3	9	32	2.0	4.0	9.5	3.0	3.0	0.90	0.70	0.15	0.80	0.80
	Cost Performance	12	4	7	8	31	3.0	7.0	2.5	4.0	4.0	0.80	0.40	0.85	0.70	0.70
	Constructability of Design	10	7	9	3	29	4.5	4.0	1.0	9.5	5.0	0.65	0.70	1.00	0.15	0.60
	Change-Order Management	7	7	4	6	24	6.0	4.0	7.5	5.0	6.0	0.50	0.70	0.35	0.60	0.50
	Design Accuracy	6	5	6	5	22	7.0	6.0	4.5	6.5	7.0	0.40	0.50	0.65	0.45	0.40
	Productivity	3	3	4	3	13	9.5	8.0	7.5	9.5	8.5	0.15	0.30	0.35	0.15	0.25
	Safety	3	0	5	5	13	9.5	10.0	6.0	6.5	8.5	0.15	0.10	0.50	0.45	0.25
	Innovative Constr. Means & Methods	4	1	3	4	12	8.0	9.0	9.5	8.0	10.0	0.30	0.20	0.15	0.30	0.10
Process	Collaboration of Project Team	13	8	8	12	41	2.5	1.5	2.5	1.5	1.5	0.85	0.95	0.85	0.95	0.95
	Effective Communication	15	8	6	12	41	1.0	1.5	5.0	1.5	1.5	1.00	0.95	0.60	0.95	0.95
	Competency & Capability of Team	13	6	9	6	34	2.5	4.0	1.0	6.0	3.0	0.85	0.70	1.00	0.50	0.80
	Trust & Respect	9	3	8	8	28	4.0	8.5	2.5	3.5	4.0	0.70	0.25	0.85	0.75	0.70
	Alignment of Project Objectives	8	5	7	5	25	5.0	5.0	4.0	7.0	5.0	0.60	0.60	0.70	0.40	0.60
	Owner / User Participation	5	7	4	8	24	8.0	3.0	7.5	3.5	6.0	0.30	0.80	0.35	0.75	0.50
	Project Planning	5	4	4	7	20	8.0	6.5	7.5	5.0	7.0	0.30	0.45	0.35	0.60	0.40
	Top Management Commitment	5	3	4	4	16	8.0	8.5	7.5	8.0	8.0	0.30	0.25	0.35	0.30	0.30
	Risk I.D. & Equitable Allocation	6	4	4	1	15	6.0	6.5	7.5	10.0	9.0	0.50	0.45	0.35	0.10	0.20
	Dispute Avoidance & Resolution	4	2	1	2	9	10.0	10.0	10.0	9.0	10.0	0.10	0.10	0.10	0.20	0.10
Impact	Owner / User satisfaction	16	10	10	12	48	1.5	1.5	1.0	1.5	1.0	0.95	0.95	1.00	0.95	1.00
	Long-term Success / Lifecycle Value	16	6	7	12	41	1.5	4.5	4.0	1.5	2.0	0.95	0.65	0.70	0.95	0.90
	Professional Reputation & Image	5	8	8	9	30	7.0	3.0	3.0	3.0	3.0	0.40	0.80	0.80	0.80	0.80
	Long-term Business Relationships	7	10	9	3	29	6.0	1.5	2.0	8.5	4.0	0.50	0.95	0.90	0.25	0.70
	Profit & Financial Objectives	11	6	5	3	25	3.0	4.5	6.0	8.5	5.0	0.80	0.65	0.50	0.25	0.60
	Litigation Avoidance	8	3	6	4	21	5.0	7.0	5.0	6.0	6.0	0.60	0.40	0.60	0.50	0.50
	Contract Incentives & Rewards	9	1	4	2	16	4.0	9.0	7.0	10.0	7.0	0.70	0.20	0.40	0.10	0.40
	Job Satisfaction	3	4	2	6	15	9.0	6.0	9.0	4.0	8.0	0.20	0.50	0.20	0.70	0.30
	Avoid Contractual Penalties	3	0	3	4	10	9.0	10.0	8.0	6.0	9.5	0.20	0.10	0.30	0.50	0.15
	Prof./Industry Recognition & Awards	3	2	1	4	10	9.0	8.0	10.0	6.0	9.5	0.20	0.30	0.10	0.50	0.15
Stakeholder Groups Types: O = Owner; D = Designer; B = Builder; U = User; ALL																	

Table 7.5. Round 1 -- Overall -- Self-Interest: Frequency and rank table

PROJECT-INTEREST																
Cat.	Critical Success Factor	Frequency					Rank					Rank Fractional				
		O	D	B	U	ALL	O	D	B	U	ALL	O	D	B	U	ALL
Design	Utility and functionality	11	9	8	7	35	2.5	1.0	3.0	3.5	1.0	0.85	1.00	0.80	0.75	1.00
	Owner's vision	9	8	9	4	30	4.0	2.0	1.5	8.5	4.0	0.70	0.90	0.95	0.25	0.70
	Clear and realistic objectives	11	6	6	10	33	2.5	3.5	4.0	1.0	2.5	0.85	0.75	0.70	1.00	0.85
	Sustainability	13	6	9	5	33	1.0	3.5	1.5	6.5	2.5	1.00	0.75	0.95	0.45	0.85
	Evidence based design	5	4	4	6	19	9.5	6.5	7.5	5.0	8.0	0.15	0.45	0.35	0.60	0.30
	Constructability	6	3	4	9	22	8.0	8.5	7.5	2.0	6.0	0.30	0.25	0.35	0.90	0.50
	Design innovation and creativity	8	5	4	7	24	5.5	5.0	7.5	3.5	5.0	0.55	0.60	0.35	0.75	0.60
	Achieve World Class	5	3	5	4	17	9.5	8.5	5.0	8.5	9.0	0.15	0.25	0.60	0.25	0.20
	Aesthetics	7	1	2	3	13	7.0	10.0	10.0	10.0	10.0	0.40	0.10	0.10	0.10	0.10
	Community impact and acceptance	8	4	4	5	21	5.5	6.5	7.5	6.5	7.0	0.55	0.45	0.35	0.45	0.40
Construction	Quality	15	9	9	7	40	1.0	1.0	1.0	4.0	1.0	1.00	1.00	1.00	0.70	1.00
	Responsive Admin. & Decision Support	11	7	6	7	31	2.5	4.0	5.5	4.0	3.5	0.85	0.70	0.55	0.70	0.75
	Time Performance	8	8	8	7	31	5.5	2.5	3.0	4.0	3.5	0.55	0.85	0.80	0.70	0.75
	Cost Performance	11	8	8	7	34	2.5	2.5	3.0	4.0	2.0	0.85	0.85	0.80	0.70	0.90
	Constructability of Design	10	5	8	7	30	4.0	5.0	3.0	4.0	5.0	0.70	0.60	0.80	0.70	0.60
	Change-Order Management	5	4	5	9	23	8.0	6.0	7.0	1.0	6.0	0.30	0.50	0.40	1.00	0.50
	Design Accuracy	6	3	4	4	17	7.0	7.5	8.0	9.0	8.0	0.40	0.35	0.30	0.20	0.30
	Productivity	4	2	1	2	9	9.5	9.0	9.0	10.0	10.0	0.15	0.20	0.20	0.10	0.10
	Safety	8	3	6	5	22	5.5	7.5	5.5	7.5	7.0	0.55	0.35	0.55	0.35	0.40
	Innovative Constr. Means & Methods	4	1	0	5	10	9.5	10.0	10.0	7.5	9.0	0.15	0.10	0.10	0.35	0.20
Process	Collaboration of Project Team	12	7	7	7	33	2.0	1.5	4.5	4.0	3.0	0.90	0.95	0.65	0.70	0.80
	Effective Communication	4	6	3	3	16	9.5	3.5	8.5	9.0	10.0	0.15	0.75	0.25	0.20	0.10
	Competency & Capability of Team	13	7	8	10	38	1.0	1.5	2.5	1.5	1.0	1.00	0.95	0.85	0.95	1.00
	Trust & Respect	4	4	3	6	17	9.5	7.5	8.5	5.5	9.0	0.15	0.35	0.25	0.55	0.20
	Alignment of Project Objectives	11	6	9	10	36	3.0	3.5	1.0	1.5	2.0	0.80	0.75	1.00	0.95	0.90
	Owner / User Participation	5	5	8	6	24	8.0	5.5	2.5	5.5	5.0	0.30	0.55	0.85	0.55	0.60
	Project Planning	6	3	5	4	18	7.0	9.5	6.0	7.0	7.5	0.40	0.15	0.50	0.40	0.35
	Top Management Commitment	10	5	7	8	30	4.5	5.5	4.5	3.0	4.0	0.65	0.55	0.65	0.80	0.70
	Risk I.D. & Equitable Allocation	10	4	1	3	18	4.5	7.5	10.0	9.0	7.5	0.65	0.35	0.10	0.20	0.35
	Dispute Avoidance & Resolution	9	3	4	3	19	6.0	9.5	7.0	9.0	6.0	0.50	0.15	0.40	0.20	0.50
Impact	Owner / User satisfaction	15	8	10	9	42	1.0	1.5	1.0	1.5	1.0	1.00	0.95	1.00	0.95	1.00
	Long-term Success / Lifecycle Value	12	7	9	9	37	3.0	3.5	2.0	1.5	2.0	0.80	0.75	0.90	0.95	0.90
	Professional Reputation & Image	8	7	8	8	31	4.0	3.5	3.0	3.0	3.0	0.70	0.75	0.80	0.80	0.80
	Long-term Business Relationships	7	8	6	5	26	6.0	1.5	4.0	7.0	4.0	0.50	0.95	0.70	0.40	0.70
	Profit & Financial Objectives	13	4	3	5	25	2.0	6.5	8.5	7.0	5.0	0.90	0.45	0.25	0.40	0.60
	Litigation Avoidance	7	4	5	3	19	6.0	6.5	5.5	10.0	6.0	0.50	0.45	0.55	0.10	0.50
	Contract Incentives & Rewards	7	0	3	6	16	6.0	10.0	8.5	4.5	9.5	0.50	0.10	0.25	0.65	0.15
	Job Satisfaction	4	4	4	6	18	9.5	6.5	7.0	4.5	7.0	0.15	0.45	0.40	0.65	0.40
	Avoid Contractual Penalties	6	3	2	5	16	8.0	9.0	10.0	7.0	9.5	0.30	0.20	0.10	0.40	0.15
	Prof./Industry Recognition & Awards	4	4	5	4	17	9.5	6.5	5.5	9.0	8.0	0.15	0.45	0.55	0.20	0.30
Stakeholder Groups Types: O = Owner; D = Designer; B = Builder; U = User; ALL																

Table 7.6. Round 1 -- Overall -- Project-Interest: Frequency and rank table

The tables 7.5. and 7.6. present the overall frequency data, and rank-orders based on the round 1 response set. The data is presented up front to support the validation and reliability testing which follows. Please note that the data and analysis section will first look at the overall results of the survey to validate the overall panel of experts, and then will be followed by sections for individual data and analysis of each of the round 1 critical success factor categories. Since the questions were assessed as a set by the survey participants, it is important to validate how the panel of experts performed both overall and by the set, or category.

7.5.1. Overall (All Categories): Inter-rater Agreement

An important measure of the success of the Delphi method is demonstrating a consensus among the panel of experts, or in this case the panels of experts. The data collected in round 1 is dichotomous based on respondent selection of critical success factors from lists of options. The data resulting data collected is yes or no for selection. The relative importance of the critical success factors must be based on frequency counts and resulting rank-ordering. Rank-order analysis is also beneficial due to normalization of data between each of the stakeholder groups. The validation question asks how well the respondents agree with each other as a whole group, and as individual stakeholders. A good measure of inter-rater agreement for this study is Kendall's coefficient of concordance, or Kendall's W. Kendall's W is based on the mean ranking of cases within a response set, perfect for this application. Kendall's W is a coefficient ranging between zero and one, where zero equals no agreement at all between raters, and one equals complete agreement between raters.

Inter-rater agreement is calculated in SPSS Statistics 18 using non-parametric analysis of the overall response set frequencies. The table below shows that there is agreement between all

Round #1 Inter-rater Agreement: Overall (all categories)											
Cat.	Critical Success Factors	Self-Interest					Project-Interest				
		Mean Rank					Mean Rank				
		O	D	B	U	All	O	D	B	U	All
Design	Aesthetics	15.50	14.50	10.64	23.04	20.10	18.97	12.60	14.14	15.88	19.81
	Community impact and acceptance	11.97	14.50	16.09	19.96	22.06	20.15	18.60	17.77	18.96	22.56
	Constructability	20.21	22.50	27.00	12.27	22.84	17.79	16.60	17.77	25.12	24.13
	Design innovation and creativity	15.50	28.50	19.73	15.35	24.02	20.15	20.60	17.77	22.04	22.95
	Evidence based design	20.21	20.50	14.27	27.65	19.31	16.62	18.60	17.77	20.50	17.46
	Clear and realistic objectives	24.91	18.50	25.18	21.50	15.39	23.68	22.60	21.41	26.65	14.72
	Owner's vision	22.56	24.50	27.00	19.96	15.78	21.32	26.60	26.86	17.42	14.32
	Sustainability	24.91	22.50	17.91	21.50	27.16	26.03	22.60	26.86	18.96	26.48
	Utility and functionality	30.79	26.50	28.82	29.19	15.78	23.68	28.60	25.05	22.04	19.42
	Achieve World Class	19.03	12.50	16.09	16.88	23.24	16.62	16.60	19.59	17.42	22.95
Construction	Change-Order Management	19.03	24.50	17.91	19.96	16.18	16.62	18.60	19.59	25.12	15.89
	Constructability of Design	22.56	24.50	27.00	15.35	15.39	22.50	20.60	25.05	22.04	19.03
	Cost Performance	24.91	18.50	23.36	23.04	20.10	23.68	26.60	25.05	22.04	19.42
	Responsive Admin. & Decision Support	22.56	26.50	21.55	26.12	18.92	23.68	24.60	21.41	22.04	20.21
	Design Accuracy	17.85	20.50	21.55	18.42	20.88	17.79	16.60	17.77	17.42	18.25
	Innovative Constr. Means & Methods	15.50	12.50	16.09	16.88	22.84	15.44	12.60	10.50	18.96	23.74
	Productivity	14.32	16.50	17.91	15.35	23.24	15.44	14.60	12.32	14.35	22.56
	Quality	28.44	26.50	23.36	29.19	22.06	28.38	28.60	26.86	22.04	23.74
	Safety	14.32	10.50	19.73	18.42	29.12	20.15	16.60	21.41	18.96	24.52
	Time Performance	26.09	24.50	16.09	24.58	16.57	20.15	26.60	25.05	22.04	17.46
Process	Alignment of Project Objectives	20.21	20.50	23.36	18.42	18.92	23.68	22.60	26.86	26.65	18.25
	Collaboration of Project Team	26.09	26.50	25.18	29.19	14.61	24.85	24.60	23.23	22.04	17.07
	Competency & Capability of Team	26.09	22.50	27.00	19.96	22.06	26.03	24.60	25.05	26.65	20.99
	Effective Communication	28.44	26.50	21.55	29.19	16.96	15.44	22.60	15.95	15.88	17.07
	Dispute Avoidance & Resolution	15.50	14.50	12.45	13.81	16.57	21.32	16.60	17.77	15.88	17.85
	Top Management Commitment	16.68	16.50	17.91	16.88	26.76	22.50	20.60	23.23	23.58	25.30
	Owner / User Participation	16.68	24.50	17.91	23.04	29.51	16.62	20.60	25.05	20.50	27.26
	Project Planning	16.68	18.50	17.91	21.50	20.49	17.79	16.60	19.59	17.42	20.60
	Risk I.D. & Equitable Allocation	17.85	18.50	17.91	12.27	14.61	22.50	18.60	12.32	15.88	17.46
	Trust & Respect	21.38	16.50	25.18	23.04	22.45	15.44	18.60	15.95	20.50	22.95
Impact	Litigation Avoidance	20.21	16.50	21.55	16.88	20.49	18.97	18.60	19.59	15.88	24.91
	Avoid Contractual Penalties	14.32	10.50	16.09	16.88	26.76	17.79	16.60	14.14	18.96	23.74
	Long-term Business Relationships	19.03	30.50	27.00	15.35	24.02	18.97	26.60	21.41	18.96	25.70
	Contract Incentives & Rewards	21.38	12.50	17.91	13.81	26.76	18.97	10.60	15.95	20.50	17.07
	Job Satisfaction	14.32	18.50	14.27	19.96	14.22	15.44	18.60	17.77	20.50	18.25
	Long-term Success / Lifecycle Value	29.62	22.50	23.36	29.19	16.96	24.85	24.60	26.86	25.12	22.56
	Owner / User satisfaction	29.62	30.50	28.82	29.19	20.10	28.38	26.60	28.68	25.12	20.21
	Profit & Financial Objectives	23.74	22.50	19.73	15.35	18.53	26.03	18.60	15.95	18.96	17.85
	Prof./Industry Recognition & Awards	14.32	14.50	12.45	16.88	16.57	15.44	18.60	19.59	17.42	17.85
	Professional Reputation & Image	16.68	26.50	25.18	24.58	21.67	20.15	24.60	25.05	23.58	17.46

Statistic	Self-Interest					Project-Interest				
	O	D	B	U	All	O	D	B	U	All
N	17	10	11	13	51	17	10	11	13	51
Kendall's W[a]	.256	.300	.233	.264	.172	.143	.204	.221	.121	.115
Chi-square	169.43	117.00	100.02	133.60	342.74	94.92	79.56	95.02	61.10	228.15
df	39	39	39	39	39	39	39	39	39	39
Asymp. Sig.	.000	.000	.000	.000	.000	.000	.000	.000	.013	.000

a. Kendall's Coefficient of Concordance

Table 7.7. Round 1 -- Overall: Inter-rater agreement

stakeholders groups and overall ranging from 0.115 to 0.300. Overall the test was significant at the 0.001 level for both self-interest and project interest. Significance levels of each of the individual stakeholder groups may also be found in Table 7.7.

Overall the results indicate that there is more agreement in the "Self-Interest" category than in the "Project-Interest" category. It is reasonable that there is a more significant level of agreement within the internal familiarity of each stakeholder group, while having a lesser amount of agreement when taking considerations outside the stakeholder group. The Designers stakeholder group had the highest level of overall agreement in the self-interest category, and the Builders stakeholder group the highest agreement in the project-centered category. Inter-rater agreement will be discussed along with each category in detail as each factor is covered later in the report.

Testing for inter-rater agreement in this survey sets a baseline for comparison with later rounds in determining if an increase in consensus is achieved. A second overall inter-rater agreement calculation will be shown at the end of this section including only the most important critical success factors selected for further analysis in round 2.

7.5.2. Overall: Reliability Testing

Reliability is a scale measure of internal consistency or agreement of values within cases, and is based on the proportion of the variation in the responses to the survey resulting from the different respondents. The answers to a reliable survey should vary because of the different respondents have different opinions, not because of random chance or confusing questions.. As discussed in the survey methodology section, intra-class correlation was calculated in SPSS to determine Cronbach's Alpha as a measure of reliability. Cronbach's alpha provides an estimated reliability approximating the following scale: zero equals no reliability; less than 0.6 equals not reliable; 0.6 is the minimum level for a reliable scale; 0.7 is reasonably reliable; 0.8 is strongly reliable; 0.9 is very reliable; and levels approaching 1.0 (> 0.98) are potentially over reliable.

Round#1 Overall (all categories) Reliability Statistics: Intra-class Correlation									
Perspective	Stakeholder Group	N	Cronbach's Alpha	95% Confidence Interval		F Test True Value 0			
				Lower Bound	Upper Bound	Value	df1	df2	Sig
Self-Interest	All	50	0.901	0.852	0.940	10.128	39	1,911	0.000
	Owner	17	0.818	0.724	0.891	5.492	39	624	0.000
	Designer	10	0.741	0.602	0.846	3.857	39	351	0.000
	Builder	11	0.671	0.497	0.804	3.040	39	390	0.000
	User	12	0.742	0.606	0.846	3.874	39	429	0.000
Project-Interest	All	50	**0.846**	**0.769**	**0.907**	**6.493**	**39**	**1,911**	**0.000**
	Owner	17	0.626	0.433	0.775	2.673	39	624	0.000
	Designer	10	0.566	0.335	0.742	2.307	39	351	0.000
	Builder	11	0.649	0.462	0.790	2.845	39	390	0.000
	User	12	0.395	0.076	0.638	1.652	39	429	0.010

Table 7.8. Round 1 - Overall: reliability testing

A reliability test was conducted use Cronbach's alpha as the test statistic. survey round 1 proves reliable at a 0.001 significance level when considering the full panel of all 50 experts. (Note: Of the 51 samples collected, there was one incomplete response set, for purposes of consistency only the 50 complete response sets were included in validation testing) The survey questions and responses were correlated overall, and by individual stakeholder groups for consistency resulting in a Cronbach's alpha score of 0.901 and 0.846 respectively for Self-Interest and Project-Interest. Overall round 1 survey is strongly to very reliable. The individual reliability scores for the stakeholder groups in general range from reliable to strongly reliable. The two exceptions are the Designer and User groups with score 0.556 and 0.395 respectively in the "Project-Interest" category. The Designer score is only marginally unreliable, but the User score is significantly less than reliable. Overall reliability scores were higher for Self-Interest than for Project-Interest. A reasonable assumption for the lower scores may be a contrast in understanding of the project delivery process inside and outside each participant's own stakeholder group. The overall assessment of reliability is that the round 1 survey is sufficiently reliable.

7.6. Design Category: Data & Analysis

Survey Round #1: Relative Importance by Frequencies (n)										
Design Category CSFs	Self-Interest Frequency					Project-Interest Frequency				
	O N=17 (2)	D N=10 (3)	B N=11 (4)	U N=13 (5)	ALL N=51 (6)	O N=17 (7)	D N=10 (8)	B N=11 (9)	U N=12 (10)	ALL N=50 (11)
(1)										
Utility and functionality	17	8	10	12	47	11	9	8	7	35
Owner's vision	10	7	9	6	32	9	8	9	4	30
Clear and realistic objectives	12	4	8	7	31	11	6	6	10	33
Sustainability	12	6	4	7	29	13	6	9	5	33
Evidence based design	8	5	2	11	26	5	4	4	6	19
Constructability	8	6	9	1	24	6	3	4	9	22
Design innovation and creativity	4	9	5	3	21	8	5	4	7	24
Achieve World Class	7	1	3	4	15	5	3	5	4	17
Aesthetics	4	2	0	8	14	7	1	2	3	13
Community impact and acceptance	1	2	3	6	12	8	4	4	5	21
Other	3 [a]	0	2 [b]	0	5	2 [c]	1 [d]	0	0	3
Total (n) =	85	50	55	65	255	85	50	55	60	250

Stakeholder Groups Types: O = Owner; D = Designer; B = Builder; U = User; ALL = O+D+B+U

Notes:
a. Return on Investment; Budget Control; Cost & Schedule
b. Safety; Completeness of Design Documents
c. Flexibility; Maintainability
d. Design Quality (minimize errors & omissions)

Table 7.9. Round 1 -- Design: Frequency table

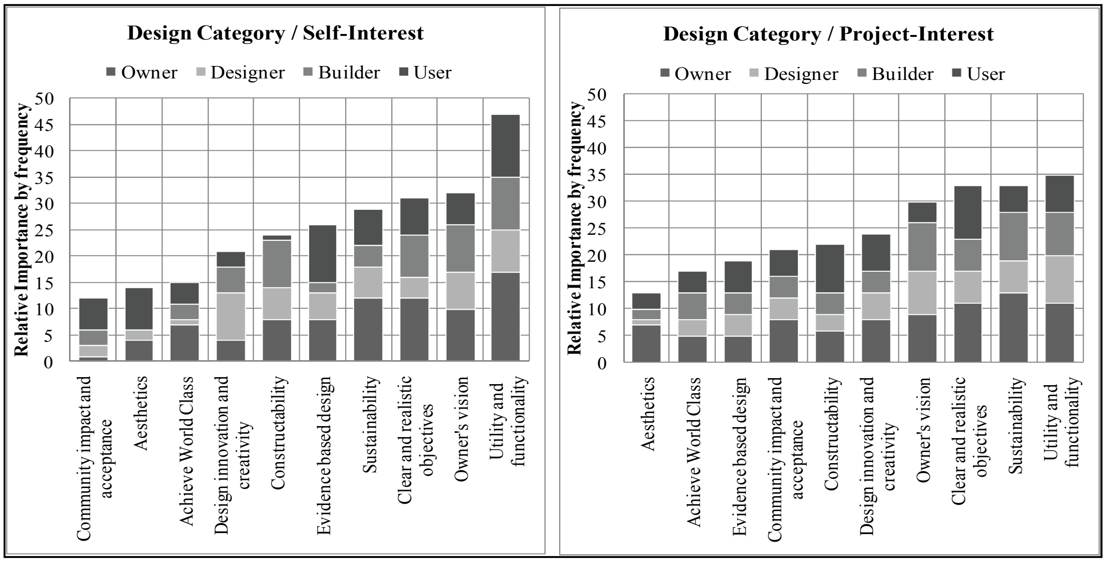


Figure 7.8. Round 1 -- Design: Relative importance by frequency

7.6.1. Inter-Rater Agreement Testing

Inter-rate agreement in the design category indicates significant difference in degree of agreement between the self-interest and project-interest categories for all stakeholder groups. Stakeholders continue to demonstrate a higher degree of inter-rater agreement in the self-interest perspective than in the project-interest perspective. In the self-interest category the Builders stakeholder group demonstrated the highest degree of agreement, and the Designers demonstrated the highest degree of agreement in the project-interest category.

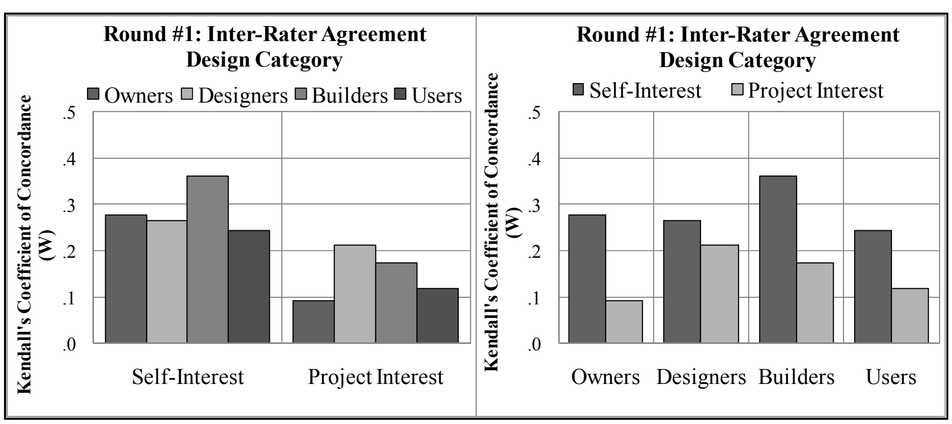


Figure 7.9. Round 1 -- Design: Inter-rater agreement by stakeholder groups

Round #1 Inter-rater Agreement: Design Category										
Critical Success Factors	Self-Interest					Project-Interest				
	Mean Rank					Mean Rank				
	O	D	B	U	All	O	D	B	U	All
Aesthetics	4.24	4.00	3.09	6.08	4.41	5.12	3.55	3.91	4.35	4.35
Community impact and acceptance	3.35	4.00	4.45	5.31	4.22	5.41	5.05	4.82	5.12	5.14
Constructability	5.41	6.00	7.18	3.38	5.39	4.82	4.55	4.82	6.65	5.24
Design innovation and creativity	4.24	7.50	5.36	4.15	5.10	5.41	5.55	4.82	5.88	5.43
Evidence based design	5.41	5.50	4.00	7.23	5.59	4.53	5.05	4.82	5.50	4.94
Clear and realistic objectives	6.59	5.00	6.73	5.69	6.08	6.29	6.05	5.73	7.04	6.31
Owner's vision	6.00	6.50	7.18	5.31	6.18	5.71	7.05	7.09	4.73	6.02
Sustainability	6.59	6.00	4.91	5.69	5.88	6.88	6.05	7.09	5.12	6.31
Utility and functionality	8.06	7.00	7.64	7.62	7.65	6.29	7.55	6.64	5.88	6.51
Achieve World Class	5.12	3.50	4.45	4.54	4.51	4.53	4.55	5.27	4.73	4.75
Statistic	Self-Interest					Project-Interest				
	O	D	B	U	All	O	D	B	U	All
N	17	10	11	13	51	17	10	11	13	51
Kendall's W[a]	.277	.264	.360	.243	.153	.092	.212	.174	.118	.082
Chi-square	42.35	23.76	35.64	28.38	70.42	14.06	19.12	17.18	13.80	37.68
df	9	9	9	9	9	9	9	9	9	9
Asymp. Sig.	.000	.005	.000	.001	.000	.120	.024	.046	.130	.000
a. Kendall's Coefficient of Concordance										

Table 7.10. Round 1 -- Design: Inter-rater agreement

7.6.2. Reliability Testing

Design Category Reliability Statistics: Intra-class Correlation									
Perspective	Stakeholder Group	N	Cronbach's Alpha	95% Confidence Interval		F Test True Value 0			
				Lower Bound	Upper Bound	Value	df1	df2	Sig
Self-Interest	All	50	0.886	0.756	0.966	8.794	9	441	0.000
	Owner	17	0.837	0.640	0.952	6.124	9	144	0.000
	Designer	10	0.690	0.295	0.909	3.228	9	81	0.002
	Builder	11	0.822	0.598	0.948	5.624	9	90	0.000
	User	12	0.692	0.308	0.909	3.245	9	99	0.002
Project-Interest	All	50	0.777	0.522	0.933	4.478	9	441	0.000
	Owner	17	0.383	-0.360	0.817	1.620	9	144	0.115
	Designer	10	0.588	0.063	0.880	2.428	9	81	0.017
	Builder	11	0.524	-0.076	0.860	2.100	9	90	0.037
	User	12	0.379	-0.393	0.818	1.611	9	99	0.122

Table 7.11. Round 1 -- Design: Reliability testing

The design category overall scored between reasonably reliable and strongly reliable. Within all stakeholder groups, there is again a difference between the reliability of the self-interest and project-interest questions. Overall the reliability of the design category is acceptable.

7.6.3. Correlation

Correlation Matrix among Design Category Stakeholder Groups (for Round #1)								
Correlation Matrix *	Self-Interest				Project-Interest			
	Owner	Designer	Builder	User	Owner	Designer	Builder	User
Owner	1.000	0.368	0.442	0.424	1.000	0.627 [a]	0.532 [a]	0.193
Designer	--	1.000	0.506 [a]	0.023	--	1.000	0.651 [a]	0.262
Builder	--	--	1.000	-0.094	--	--	1.000	0.025
User	--	--	--	1.000	--	--	--	1.000

Notes:
[a] Correlation is significant at the 0.05 level (2-tailed).
* Correlation Coefficient based on rank ordering within CSF category, and calculated in SPSS using Kendall's tau_b. (N = 10 CSFs)

Table 7.12. Round 1 -- Design: Stakeholder correlation

In the design category the only significance correlation among stakeholders in the self-interest category is between the Designer, and the Builder groups. At only 0.506 it is not reasonable to infer there is strong agreement between the designers and builder. It would be unexpected that there would be strong correlation between the self-interests of the stakeholder groups. In project-interest there is a slight, but more significant correlation amongst the owners, designers, and builders.

The critical success factor correlation matrix for self-interest demonstrates some significant negative correlations between CSFs. There are perfect negative correlations between

Owner's Vision and Evidence Based Design, and between Constructability and Aesthetics. The former is puzzling, while the latter is not unexpected. It is understandable that aesthetics and constructability could be at odd with each other. Often such examples are among the hard decisions a project team must make in weighing artistic vision against limited resources. More direct study, outside the scope of this research, might be necessary to infer cause and effect for the perfect negative correlation between Owner's Vision and Evidence Based Design. One possible inference may be a strong assumption among the other project stakeholders that the evidence based design movement is at odds with the owner's vision, or the overarching goals of the evidence based design movement are not embraced by all stakeholder groups.

Correlation Matrix among Design Category Critical Success Factors (for Round #1)										
	Self-Interest									
Correlation Matrix *	Utility & function-ality	Owner's vision	Clear & realistic objectives	Sustain-ability	Evidence based design	Construct-ability	Design innovation & creativity	Achieve World Class	Aesthetics	Community impact & acceptance
Utility & functionality	1.000	-0.236	0.775	0.000	0.236	0.000	-0.707	0.775	0.000	0.236
Owner's vision	--	1.000	-0.183	-0.548	-1.000 [a]	0.913	0.667	0.183	-0.913	0.000
Clear & realistic objectives	--	--	1.000	0.400	0.183	0.000	-0.548	0.800	0.000	-0.183
Sustainability	--	--	--	1.000	0.548	-0.400	-0.183	0.000	0.400	-0.548
Evidence based design	--	--	--	--	1.000	-0.913	-0.667	-0.183	0.913	0.000
Constructability	--	--	--	--	--	1.000	0.548	0.400	-1.000 [a]	-0.183
Design innovation & creativity	--	--	--	--	--	--	1.000	-0.183	-0.548	-0.333
Achieve World Class	--	--	--	--	--	--	--	1.000	-0.400	-0.183
Aesthetics	--	--	--	--	--	--	--	--	1.000	0.183
Community impact & acceptance	--	--	--	--	--	--	--	--	--	1.000

Notes:

[a] Correlation is significant at the 0.01 level (2-tailed).

* Correlation Coefficient based on rank ordering within CSF category, and calculated in SPSS using Kendall's tau_b. (N = 4 Stakeholder Groups: Owner; Designer; Builder; User)

Table 7.13. Round 1 -- Design: CSF correlation matrix

No matter what the inference may be for the examples above, a significant issue raised is that factors of significant importance to one or more of the stakeholder groups self-interest which there is diametrically opposed by another stakeholder group. Or stated more simply, there is a significant disagreement in terms of relative importance. Imagine what formal, or informal (unspoken), issues such diametrically opposed viewpoints may cause to the efficiency of collaboration. Each party fights for the interests most important to itself. This very issue is central to the overall thesis of this dissertation. What process may be able to best resolve such conflicts in a way that enhances collaboration and maximizes value-creation? And, do the stakeholders agree on what process is most effective? These are questions to be addressed in the subsequent survey rounds.

Correlation Matrix among Design Category Critical Success Factors (for Round #1)										
Correlation Matrix *	Project-Interest									
	Utility & function-ality	Owner's vision	Clear & realistic objectives	Sustain-ability	Evidence based design	Construct-ability	Design innovation & creativity	Achieve World Class	Aesthetics	Community impact & acceptance
Utility & functionality	1.000	0.183	-0.183	0.000	0.000	-0.913	-0.400	-0.400	0.258	0.258
Owner's vision	--	1.000	-1.000 [a]	0.548	-0.913	-0.333	-0.183	0.548	-0.236	-0.236
Clear & realistic objectives	--	--	1.000	-0.548	0.913	0.333	0.183	-0.548	0.236	0.236
Sustainability	--	--	--	1.000	-0.800	-0.183	-0.800	0.000	0.516	0.516
Evidence based design	--	--	--	--	1.000	0.183	0.400	-0.400	0.000	0.000
Constructability	--	--	--	--	--	1.000	0.548	0.183	-0.236	-0.236
Design innovation & creativity	--	--	--	--	--	--	1.000	0.400	-0.775	-0.775
Achieve World Class	--	--	--	--	--	--	--	1.000	-0.775	-0.775
Aesthetics	--	--	--	--	--	--	--	--	1.000	1.000 [a]
Community impact & acceptance	--	--	--	--	--	--	--	--	--	1.000

Notes:

[a] Correlation is significant at the 0.01 level (2-tailed).

* Correlation Coefficient based on rank ordering within CSF category, and calculated in SPSS using Kendall's tau_b. (N = 4 Stakeholder Groups: Owner; Designer; Builder; User)

Table 7.14. Round 1 -- Design -- Project-Interest: CSF correlation matrix

Comparing the self-interest and project-interest CSF correlation matrices it is obvious that there is a difference between the two perspectives. The most significant correlation in project-interest exists between Owner's Vision and Clear & Realistic Expectation, and Aesthetics and Community Impact & Acceptance. The negative correlation between expectations and owner's vision may indicate belief that the owner's vision contains objectives which are not realistic to the other project stakeholders.

7.6.4. Relative Importance by Rank-Orders

Based on frequency selection critical success factors are ranked on a scale of 1 to 10 where 1 is the highest rank. Ties are reflected by the difference between the higher and lower rank-order of adjacent CSF. For the purposes of future data comparisons, the rank orders are

Design Category CSFs	Self-Interest % Rank [a, b]					Project-Interest % Rank [a, b]				
	O N=17	D N=10	B N=11	U N=13	ALL N=51	O N=17	D N=10	B N=11	U N=12	ALL N=50
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Utility and functionality	**1.00**	**0.90**	**1.00**	**1.00**	**1.0**	**0.85**	**1.00**	**0.80**	**0.75**	**1.00**
Owner's vision	0.70	**0.80**	**0.85**	0.45	**0.9**	0.70	**0.90**	**0.95**	0.25	0.70
Clear and realistic objectives	**0.85**	0.40	0.70	0.65	**0.8**	**0.85**	**0.75**	0.70	**1.00**	**0.85**
Sustainability	**0.85**	0.65	0.50	0.65	0.7	**1.00**	**0.75**	**0.95**	0.45	**0.85**
Evidence based design	0.55	0.50	0.20	**0.90**	0.6	0.15	0.45	0.35	0.60	0.30
Constructability	0.55	0.65	**0.85**	0.10	0.5	0.30	0.25	0.35	**0.90**	0.50
Design innovation and creativity	0.25	**1.00**	0.60	0.20	0.4	0.55	0.60	0.35	**0.75**	0.60
Achieve World Class	0.40	0.10	0.35	0.30	0.3	0.15	0.25	0.60	0.25	0.20
Aesthetics	0.25	0.25	0.10	**0.80**	0.2	0.40	0.10	0.10	0.10	0.10
Community impact and acceptance	0.10	0.25	0.35	0.45	0.1	0.55	0.45	0.35	0.45	0.40
Other [c]	X	X	X	X	X	X	X	X	X	X

Stakeholder Groups Types: O = Owner; D = Designer; B = Builder; U = User

Notes:
a. %Rank: normalized rank order where 1.00 = highest ranked.
b. Selection criteria for highlighted cells (Green/Bold): greater than or equal to 0.75
c. "Other" not included in rank-order series

Table 7.15. Round 1-- Design: Relative importance %Rank

converted to a fractional ranking (%Rank) below where the rank-order scale is between 0 and 1 where 0 equals not ranked, and 1 equals the highest rank. The selection criteria for this round and round 2 is a %Rank score of 0.75 or higher in any category.

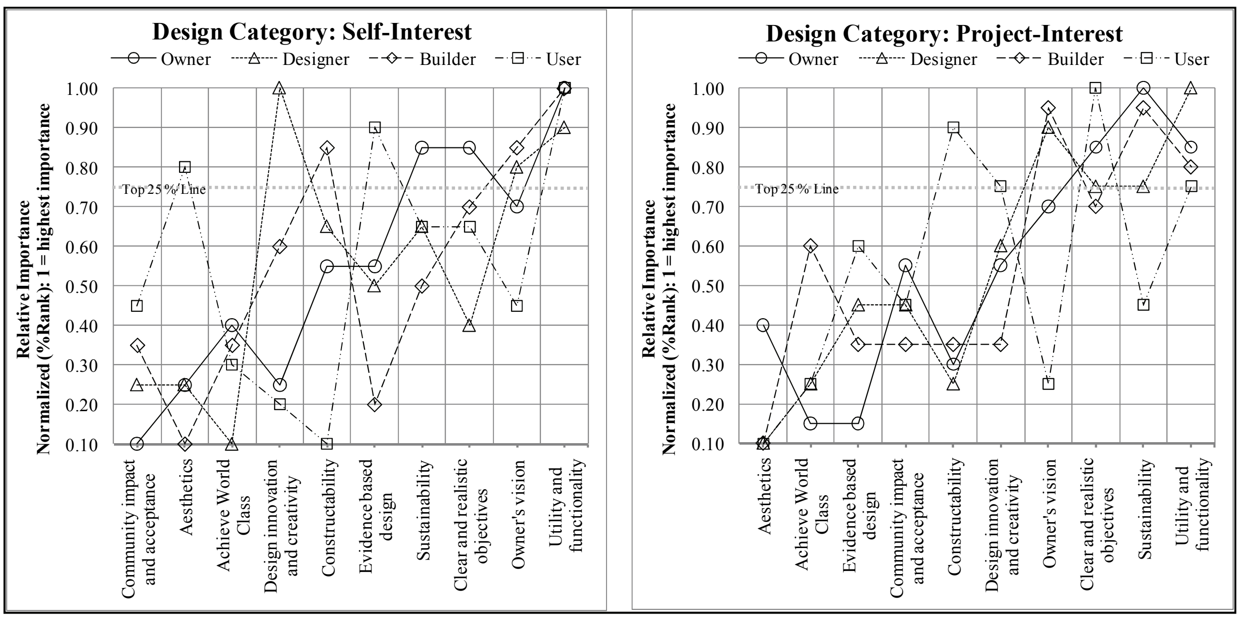


Figure 7.10. Round 1 -- Design: Relative importance by stakeholders

7.7. Construction Category: Data & Analysis

Survey Round #1: Relative Importance by Frequencies (n)										
Construction Category CSFs	Self-Interest Frequency					Project-Interest Frequency				
	O	D	B	U	ALL	O	D	B	U	ALL
	N=17	N=10	N=11	N=13	N=51	N=17	N=10	N=11	N=12	N=50
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Quality	15	8	7	12	42	15	9	9	7	40
Responsive Admin. & Decision Support	10	8	6	10	34	11	7	6	7	31
Time Performance	13	7	3	9	32	8	8	8	7	31
Cost Performance	12	4	7	8	31	11	8	8	7	34
Constructability of Design	10	7	9	3	29	10	5	8	7	30
Change-Order Management	7	7	4	6	24	5	4	5	9	23
Design Accuracy	6	5	6	5	22	6	3	4	4	17
Productivity	3	3	4	3	13	4	2	1	2	9
Safety	3	0	5	5	13	8	3	6	5	22
Innovative Constr. Means & Methods	4	1	3	4	12	4	1	0	5	10
Other	0	0	1 [b]	0	3	2 [c]	0	0	0	2
Total (n) =	85	50	55	65	255	85	50	55	60	250

Stakeholder Groups Types: O = Owner; D = Designer; B = Builder; U = User; ALL = O+D+B+U

Notes:
a. Integrated schedule; Transition to operations
b. Collaboration
c. Communication; Equipment planning

Table 7.16. Round 1 -- Construction: Frequency table

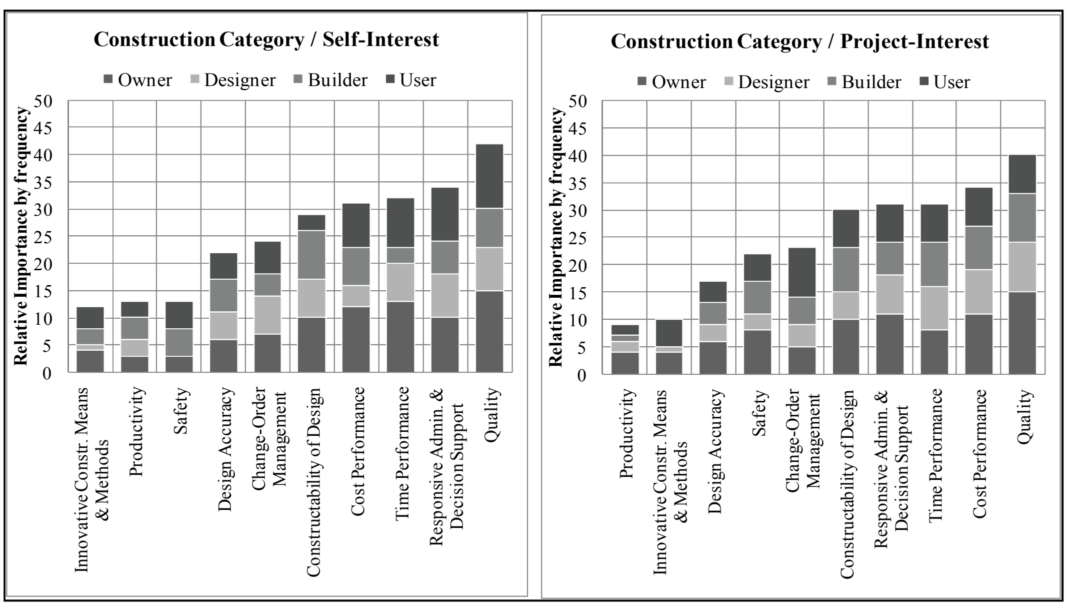


Figure 7.11. Round 1 -- Construction: CSF relative importance by frequency

7.7.1. Inter-Rater Agreement Testing

Round #1 Inter-rater Agreement: Construction Category										
Critical Success Factors	Self-Interest Mean Rank					Project-Interest Mean Rank				
	O	D	B	U	All	O	D	B	U	All
Change-Order Management	5.12	6.50	4.86	5.31	5.38	4.56	5.00	5.27	6.65	5.33
Constructability of Design	6.00	6.50	7.14	4.15	5.87	6.03	5.50	6.64	5.88	6.02
Cost Performance	6.59	5.00	6.23	6.08	6.07	6.32	7.00	6.64	5.88	6.41
Responsive Admin. & Decision Support	6.00	7.00	5.77	6.85	6.36	6.32	6.50	5.73	5.88	6.12
Design Accuracy	4.82	5.50	5.77	4.92	5.19	4.85	4.50	4.82	4.73	4.75
Innovative Constr. Means & Methods	4.24	3.50	4.41	4.54	4.21	4.26	3.50	3.00	5.12	4.06
Productivity	3.94	4.50	4.86	4.15	4.30	4.26	4.00	3.45	3.96	3.96
Quality	7.47	7.00	6.23	7.62	7.15	7.50	7.50	7.09	5.88	7.00
Safety	3.94	3.00	5.32	4.92	4.30	5.44	4.50	5.73	5.12	5.24
Time Performance	6.88	6.50	4.41	6.46	6.17	5.44	7.00	6.64	5.88	6.12
Statistic	Self-Interest					Project-Interest				
	O	D	B	U	All	O	D	B	U	All
N	17	10	11	13	51	17	10	11	13	51
Kendall's W[a]	.234	.304	.114	.205	.145	.161	.288	.279	.092	.151
Chi-square	35.77	27.36	11.30	23.95	66.34	24.65	25.92	27.65	10.80	69.29
df	9	9	9	9	9	9	9	9	9	9
Asymp. Sig.	.000	.001	.256	.004	.000	.003	.002	.001	.290	.000
a. Kendall's Coefficient of Concordance										

Table 7.17. Round 1 -- Construction: inter-rater agreement

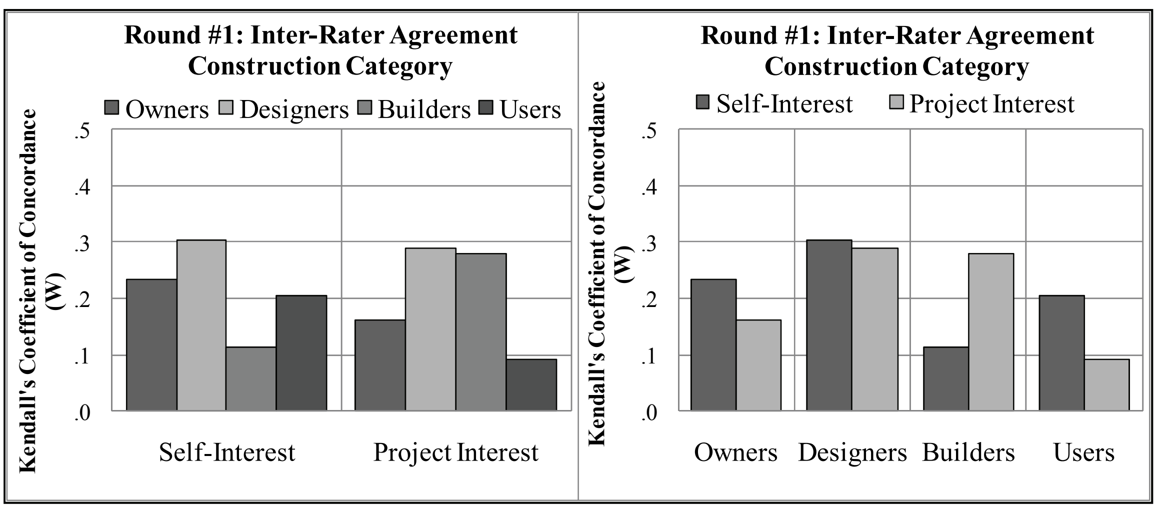


Figure 7.12. Round 1 -- Construction: Inter-rater agreement by stakeholder group

Inter-rater agreement in the construction category departs slightly from the overall trend in agreement levels between self and project interests. The overall agreement in the construction self-interest category is slightly less than in the project-interest category. The self-interest agreement remains somewhat constant while the project-interest agreement improved by 0.07 over the level in the design category. The designers demonstrated similar levels of agreement between self and project interest, while the builders demonstrated the largest difference in agreement between the self and project perspectives. The difference among builders may be inferred as recognizing differing internal goals among the construction entities represented in the builders stakeholder group (different construction companies), but a more universal agreement of what's important to making a project successful.

7.7.2. Reliability Testing

Construction Category Reliability Statistics: Intra-class Correlation									
Perspective	Stakeholder Group	N	Cronbach's Alpha	95% Confidence Interval		F Test True Value 0			
				Lower Bound	Upper Bound	Value	df1	df2	Sig
Self-Interest	All	50	0.873	0.729	0.962	7.905	9	441	0.000
	Owner	17	0.873	0.729	0.962	7.905	9	441	0.000
	Designer	10	0.746	0.421	0.926	3.931	9	81	0.000
	Builder	11	0.224	-0.753	0.772	1.288	9	90	0.254
	User	12	0.580	0.056	0.876	2.378	9	99	0.018
Project-Interest	All	50	0.888	0.760	0.967	8.919	9	441	0.000
	Owner	17	0.675	0.283	0.904	3.073	9	144	0.002
	Designer	10	0.725	0.375	0.920	3.640	9	81	0.001
	Builder	11	0.742	0.417	0.924	3.876	9	90	0.000
	User	12	0.182	-0.837	0.760	1.222	9	99	0.290

Table 7.18. Round 1 -- Construction: Reliability testing

Overall the data in the construction category is strongly reliable for both self and project perspectives. Builder reliability in self-interest, and user reliability is project interest prove unreliable, likely caused by the very low inter-rater agreement as displayed in the section above.

7.7.3. Correlations

In self-interest the only significant correlations are between owners and designer, and the owners and users. In the project interest there is significantly more correlation between stakeholder groups, again emphasizing the significant differences perspective makes when evaluating what is important to the stakeholder groups in regards to the project delivery process.

Correlation Matrix among Construction Category Stakeholder Groups (for Round #1)								
Correlation Matrix *	Self-Interest				Project-Interest			
	Owner	Designer	Builder	User	Owner	Designer	Builder	User
Owner	1.000	0.579 [a]	0.329	0.595 [a]	1.000	0.699 [b]	0.732 [b]	0.391
Designer	--	1.000	0.171	0.519	--	1.000	0.840 [b]	0.581 [a]
Builder	--	--	1.000	0.048	--	--	1.000	0.508
User	--	--	--	1.000	--	--	--	1.000

Notes:

[a] Correlation is significant at the 0.05 level (2-tailed).

[b] Correlation is significant at the 0.01 level (2-tailed).

* Correlation Coefficient based on rank ordering within CSF category, and calculated in SPSS using Kendall's tau_b. (N = 10 CSFs)

Table 7.19 Round 1-- Construction -- Stakeholder correlation matrix

For self-interest critical success factors in the construction category there are two significant completely negative correlations: Time Performance and Design Accuracy; and Cost Performance and Change-Order Management. Logically each of these pairs is directly linked together. Design problems directly cause construction delays, and change-orders drive up cost.

Correlation Matrix among Construction Category Critical Success Factors (for Round #1)										
	Self-Interest									
Correlation Matrix *	Quality	Responsive Admin. & Decision Support	Time Perform-ance	Cost Perform-ance	Construct-ability of Design	Change-Order Manage-ment	Design Accuracy	Product-ivity	Safety	Innovative Construct-ion Means & Methods
Quality	1.000	0.516	0.775	-0.707	-0.707	0.707	-0.775	-0.775	-0.516	-0.577
Responsive Admin. & Decision Support	--	1.000	0.000	-0.913	-0.183	0.913	0.000	0.000	-0.400	-0.894
Time Performance	--	--	1.000	-0.183	-0.548	0.183	-1.000 [a]	-0.800	-0.400	0.000
Cost Performance	--	--	--	1.000	0.333	-1.000 [a]	0.183	0.183	0.548	0.816
Constructability of Design	--	--	--	--	1.000	-0.333	0.548	0.913	-0.183	0.408
Change-Order Management	--	--	--	--	--	1.000	-0.183	-0.183	-0.548	-0.816
Design Accuracy	--	--	--	--	--	--	1.000	0.800	0.400	0.000
Productivity	--	--	--	--	--	--	--	1.000	0.000	0.224
Safety	--	--	--	--	--	--	--	--	1.000	0.224
Innovative Constr. Means & Methods	--	--	--	--	--	--	--	--	--	1.000

Notes:

[a] Correlation is significant at the 0.01 level (2-tailed).

* Correlation Coefficient based on rank ordering within CSF category, and calculated in SPSS using Kendall's tau_b. (N = 4 Stakeholder Groups: Owner; Designer; Builder; User)

Table 7.20. Round 1 -- Construction: Self-Interest: CSF correlation

Correlation Matrix among Construction Category Critical Success Factors (for Round #1)										
	Project-Interest									
Correlation Matrix *	Quality	Responsive Admin. & Decision Support	Time Perform-ance	Cost Perform-ance	Construct-ability of Design	Change-Order Manage-ment	Design Accuracy	Product-ivity	Safety	Innovative Construct-ion Means & Methods
Quality	1.000	-0.516	-0.333	b	-0.516	-0.707	0.775	1.000 [a]	0.577	-0.775
Responsive Admin. & Decision Support	--	1.000	-0.516	b	0.000	0.183	0.000	-0.516	-0.224	0.800
Time Performance	--	--	1.000	b	0.258	0.707	-0.516	-0.333	-0.577	0.000
Cost Performance	--	--	--	1.000	b	b	b	b	b	b
Constructability of Design	--	--	--	--	1.000	0.183	-0.800	-0.516	0.224	0.000
Change-Order Management	--	--	--	--	--	1.000	-0.548	-0.707	-0.816	0.548
Design Accuracy	--	--	--	--	--	--	1.000	0.775	0.224	-0.200
Productivity	--	--	--	--	--	--	--	1.000	0.577	-0.775
Safety	--	--	--	--	--	--	--	--	1.000	-0.671
Innovative Constr. Means & Methods	--	--	--	--	--	--	--	--	--	1.000

Notes:

[a] Correlation is significant at the 0.01 level (2-tailed).

[b] Cost is unanimously ranked at #2.

* Correlation Coefficient based on rank ordering within CSF category, and calculated in SPSS using Kendall's tau_b. (N = 4 Stakeholder Groups: Owner; Designer; Builder; User).

Table 7.21. Round 1 -- Construction -- Project-Interest: CSF correlation matrix

7.7.4. Relative Importance by Rank-Orders

Construction Category CSFs	Self-Interest % Rank [a, b]					Project-Interest % Rank [a, b]				
	O	D	B	U	ALL	O	D	B	U	ALL
	N=17	N=10	N=11	N=13	N=51	N=17	N=10	N=11	N=12	N=50
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Quality	**1.00**	**0.95**	**0.85**	**1.00**	**1.0**	**1.00**	**1.00**	**1.00**	0.70	**1.00**
Responsive Admin. & Decision Support	0.65	**0.95**	0.65	**0.90**	**0.9**	**0.85**	0.70	0.55	0.70	**0.75**
Time Performance	**0.90**	0.70	0.15	**0.80**	**0.8**	0.55	**0.85**	**0.80**	0.70	**0.75**
Cost Performance	**0.80**	0.40	**0.85**	0.70	0.7	**0.85**	**0.85**	**0.80**	0.70	**0.90**
Constructability of Design	0.65	0.70	**1.00**	0.15	0.6	0.70	0.60	**0.80**	0.70	0.60
Change-Order Management	0.50	0.70	0.35	0.60	0.5	0.30	0.50	0.40	**1.00**	0.50
Design Accuracy	0.40	0.50	0.65	0.45	0.4	0.40	0.35	0.30	0.20	0.30
Productivity	0.15	0.30	0.35	0.15	0.3	0.15	0.20	0.20	0.10	0.10
Safety	0.15	0.10	0.50	0.45	0.3	0.55	0.35	0.55	0.35	0.40
Innovative Construction Means & Methods	0.30	0.20	0.15	0.30	0.1	0.15	0.10	0.10	0.35	0.20
Other [c]	X	X	X	X	X	X	X	X	X	X

Stakeholder Groups Types: O = Owner; D = Designer; B = Builder; U = User

Notes:
a. %Rank: normalized rank order where 1.00 = highest ranked.
b. Selection criteria for highlighted cells (Green/Bold): greater than or equal to 0.75
c. "Other" not included in rank-order series

Table 7.22. Round 1 -- Construction: relative importance by %Rank

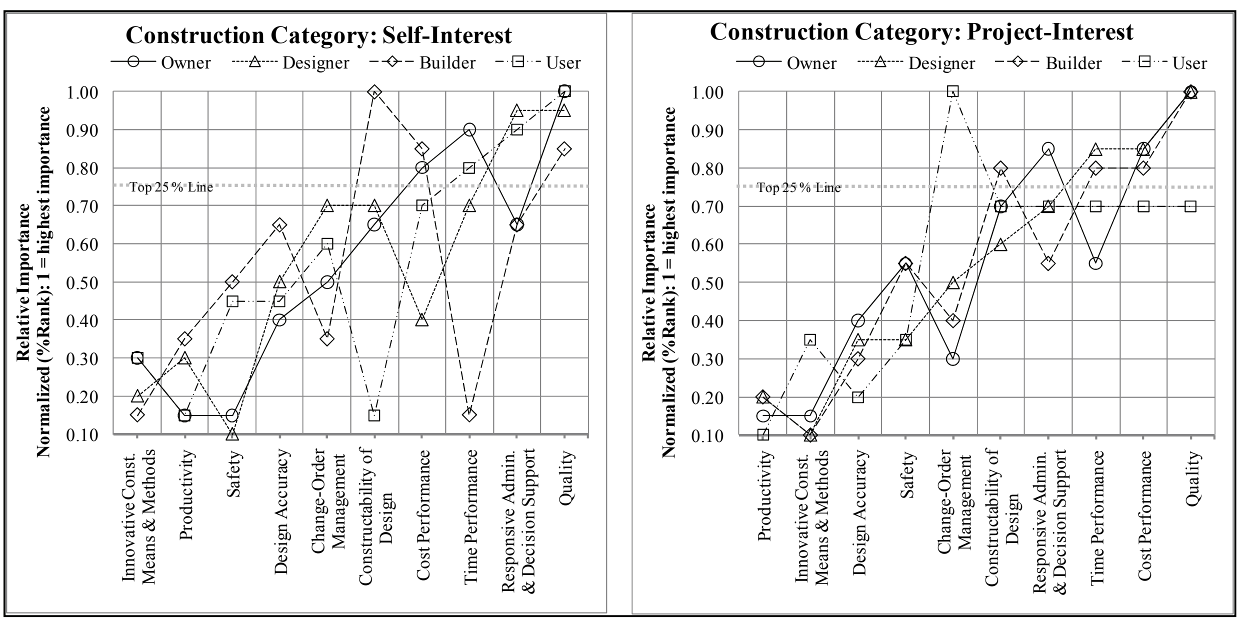


Figure 7.13. Round 1 -- Construction: Relative importance by stakeholder

7.8. Process Category: Data & Analysis

Survey Round #1: Relative Importance by Frequencies (n)										
Process Category CSFs	Self-Interest Frequency					Project-Interest Frequency				
	O	D	B	U	ALL	O	D	B	U	ALL
	N=17	N=10	N=11	N=13	N=51	N=17	N=10	N=11	N=12	N=50
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Collaboration of Project Team	13	8	8	12	41	12	7	7	7	33
Effective Communication	15	8	6	12	41	4	6	3	3	16
Competency & Capability of Team	13	6	9	6	34	13	7	8	10	38
Trust & Respect	9	3	8	8	28	4	4	3	6	17
Alignment of Project Objectives	8	5	7	5	25	11	6	9	10	36
Owner / User Participation	5	7	4	8	24	5	5	8	6	24
Project Planning	5	4	4	7	20	6	3	5	4	18
Top Management Commitment	5	3	4	4	16	10	5	7	8	30
Risk I.D. & Equitable Allocation	6	4	4	1	15	10	4	1	3	18
Dispute Avoidance & Resolution	4	2	1	2	9	9	3	4	3	19
Other	3 [a]	0	0	0	3	1 [b]	0	0	0	1
Total (n) =	85	50	55	65	255	85	50	55	60	250

Stakeholder Groups Types: O = Owner; D = Designer; B = Builder; U = User; ALL = O+D+B+U

Notes:

a. Strong contractual cost controls; coherent organized information transfer; change avoidance

b. Transition management

Table 7.23. Round 1 -- Process: Frequency table

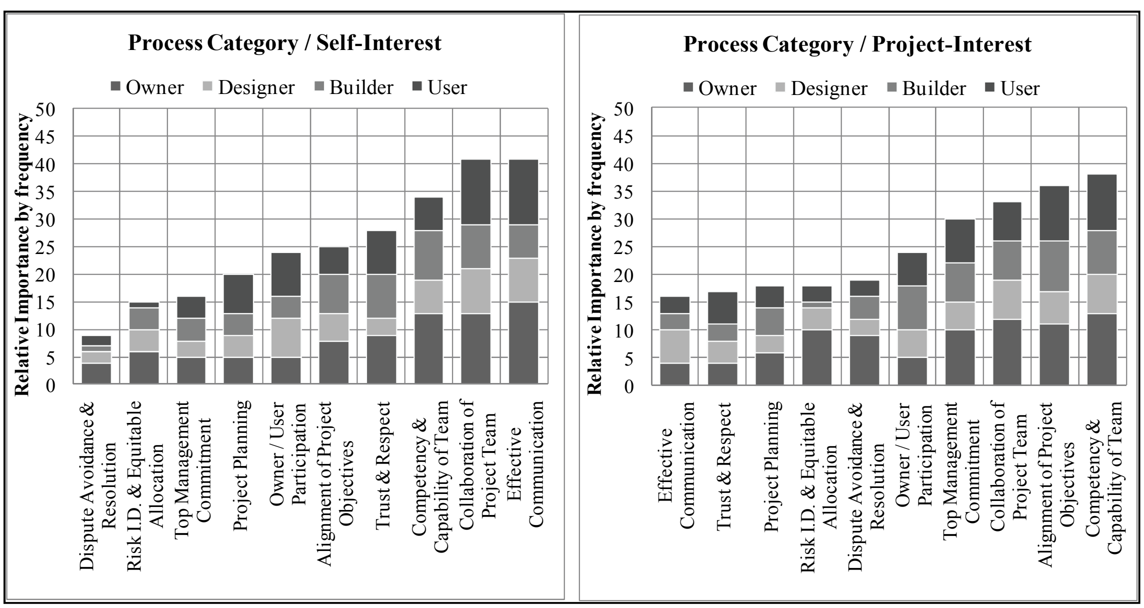


Figure 7.14. Round 1 -- Process: Relative importance by frequency

7.8.1. Inter-Rater Agreement Testing

Round #1 Inter-rater Agreement: Process Category										
Critical Success Factors	Self-Interest					Project-Interest				
	Mean Rank					Mean Rank				
	O	D	B	U	All	O	D	B	U	All
Alignment of Project Objectives	5.41	5.50	6.18	4.92	5.47	6.26	6.00	7.09	7.04	6.59
Collaboration of Project Team	6.88	7.00	6.64	7.62	7.04	6.56	6.50	6.18	5.88	6.29
Competency & Capability of Team	6.88	6.00	7.09	5.31	6.35	6.85	6.50	6.64	7.04	6.78
Effective Communication	7.47	7.00	5.73	7.62	7.04	4.21	6.00	4.36	4.35	4.63
Dispute Avoidance & Resolution	4.24	4.00	3.45	3.77	3.90	5.68	4.50	4.82	4.35	4.92
Top Management Commitment	4.53	4.50	4.82	4.54	4.59	5.97	5.50	6.18	6.27	6.00
Owner / User Participation	4.53	6.50	4.82	6.08	5.37	4.50	5.50	6.64	5.50	5.41
Project Planning	4.53	5.00	4.82	5.69	4.98	4.79	4.50	5.27	4.73	4.82
Risk I.D. & Equitable Allocation	4.82	5.00	4.82	3.38	4.49	5.97	5.00	3.45	4.35	4.82
Trust & Respect	5.71	4.50	6.64	6.08	5.76	4.21	5.00	4.36	5.50	4.73
Statistic	Self-Interest					Project-Interest				
	O	D	B	U	All	O	D	B	U	All
N	17	10	11	13	51	17	10	11	13	51
Kendall's W[a]	.203	.168	.187	.295	.164	.142	.080	.213	.174	.103
Chi-square	31.09	15.12	18.49	34.48	75.23	21.74	7.20	21.11	20.40	47.48
df	9	9	9	9	9	9	9	9	9	9
Asymp. Sig.	.000	.088	.030	.000	.000	.010	.616	.012	.016	.000
a. Kendall's Coefficient of Concordance										

Table 7.24. Round 1-- Process: Inter-rater agreement

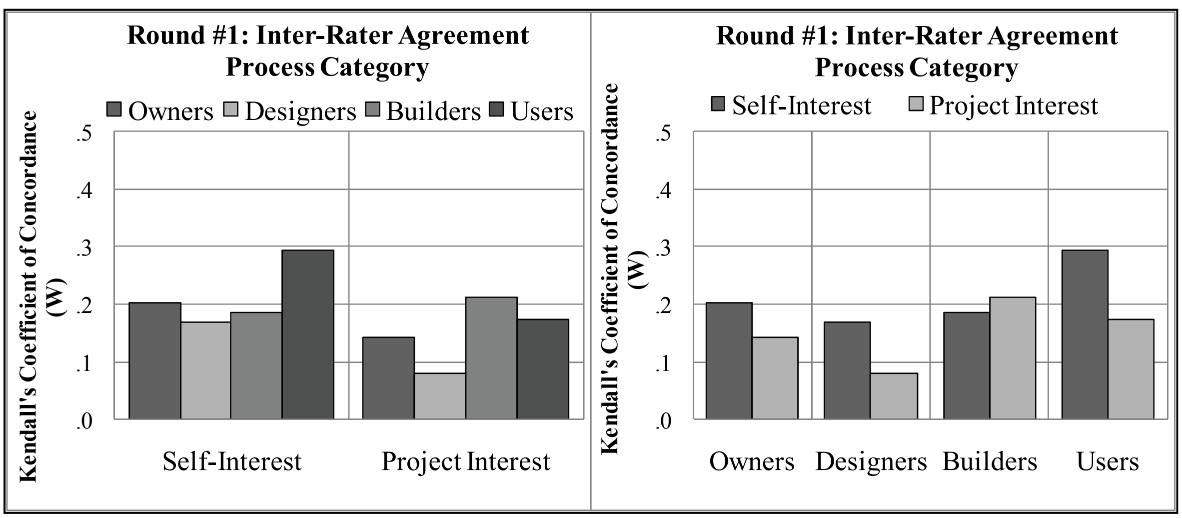


Figure 7.15. Round 1 -- Process: Inter-rater agreement by stakeholder

In general the trend of more agreement in the self-interest category continues, except for the builders which had a slightly higher level of agreement in the project-interest category.

7.8.2. Reliability Testing

Process Category Reliability Statistics: Intra-class Correlation									
Perspective	Stakeholder Group	N	Cronbach's Alpha	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound	F Test True Value 0 Value	df1	df2	Sig
Self-Interest	All	50	0.892	0.769	0.968	9.258	9	441	0.000
	Owner	17	0.755	0.460	0.928	4.080	9	144	0.000
	Designer	10	0.450	-0.252	0.839	1.817	9	81	0.077
	Builder	11	0.565	0.017	0.872	2.297	9	90	0.023
	User	12	0.770	0.484	0.932	4.349	9	99	0.000
Project-Interest	All	50	0.827	0.629	0.948	5.780	9	441	0.000
	Owner	17	0.623	0.168	0.888	2.649	9	144	0.007
	Designer	10	-0.278	-1.907	0.626	0.783	9	81	0.633
	Builder	11	0.631	0.167	0.892	2.710	9	90	0.008
	User	12	0.610	0.124	0.885	2.562	9	99	0.011

Table 7.25. Round 1-- Process: Reliability testing

Overall the reliability for the process category critical success factors is between reliable and strongly reliable. In general the stakeholder groups individually remain reliable with the exception of the designer stakeholder group.

7.8.3. Correlations

Correlation Matrix among Process Category Stakeholder Groups (for Round #1)								
Correlation Matrix *	Self-Interest Owner	Self-Interest Designer	Self-Interest Builder	Self-Interest User	Project-Interest Owner	Project-Interest Designer	Project-Interest Builder	Project-Interest User
Owner	1.000	0.578 [a]	0.859 [b]	0.500	1.000	0.434	0.447	0.434
Designer	--	1.000	0.489	0.588 [a]	--	1.000	0.415	0.525
Builder	--	--	1.000	0.483	--	--	1.000	0.732 [b]
User	--	--	--	1.000	--	--	--	1.000

Notes:

[a] Correlation is significant at the 0.05 level (2-tailed).

[b] Correlation is significant at the 0.01 level (2-tailed).

* Correlation Coefficient based on rank ordering within CSF category, and calculated in SPSS using Kendall's tau_b. (N = 10 CSFs)

Table 7.26. Round 1 -- Process: Stakeholder correlation matrix

The highest level of process category correlation between stakeholders is between the owners and builders for self-interest, and builders and users for project interest. There is significant but lesser correlation between the owners / designers, and designers / users.

Correlation Matrix among Process Category Critical Success Factors (for Round #1)										
Correlation Matrix *	Self-Interest									
	Collab- oration of Project Team	Effective Commun- ication	Comp- etency & Capability of Team	Trust & Respect	Alignment of Project Objectives	Owner / User Particip- ation	Project Planning	Top Manage- ment Commit- ment	Risk I.D. & Equitable Allocation	Dispute Avoidance & Resolution
Collaboration of Project Team	1.000	0.577	-0.816	-0.408	-0.671	0.894	0.671	-0.894	-0.577	0.577
Effective Communication	--	1.000	-0.707	-0.707	-0.775	0.258	0.000	-0.775	-0.333	0.333
Competency & Capability of Team	--	--	1.000	0.333	0.913	-0.548	-0.548	0.913	0.707	-0.707
Trust & Respect	--	--	--	1.000	0.183	-0.183	0.183	0.548	-0.236	0.236
Alignment of Project Objectives	--	--	--	--	1.000	-0.400	-0.400	0.800	0.775	-0.775
Owner / User Participation	--	--	--	--	--	1.000	0.800	-0.600	-0.516	0.516
Project Planning	--	--	--	--	--	--	1.000	-0.400	-0.775	0.775
Top Management Commitment	--	--	--	--	--	--	--	1.000	0.516	-0.516
Risk I.D. & Equitable Allocation	--	--	--	--	--	--	--	--	1.000	-1.000 [a]
Dispute Avoidance & Resolution	--	--	--	--	--	--	--	--	--	1.000

Notes:

[a] Correlation is significant at the 0.01 level (2-tailed).

* Correlation Coefficient based on rank ordering within CSF category, and calculated in SPSS using Kendall's tau_b. (N = 4 Stakeholder Groups: Owner; Designer; Builder; User).

Table 7.27 Round 1-- Process -- Self-Interest: CSF correlation matrix

Correlation Matrix among Process Category Critical Success Factors (for Round #1)										
Correlation Matrix *	Project-Interest									
	Collab- oration of Project Team	Effective Commun- ication	Comp- etency & Capability of Team	Trust & Respect	Alignment of Project Objectives	Owner / User Particip- ation	Project Planning	Top Manage- ment Commit-	Risk I.D. & Equitable Allocation	Dispute Avoidance & Resolution
Collaboration of Project Team	1.000	a	-0.894	0.408	0.671	0.671	0.671	0.000	-0.816	0.000
Effective Communication	--	1.000	a	a	a	a	a	a	a	a
Competency & Capability of Team	--	--	1.000	-0.183	-0.800	-0.400	-0.800	-0.183	0.548	0.200
Trust & Respect	--	--	--	1.000	0.183	0.183	-0.183	-0.667	-0.333	0.548
Alignment of Project Objectives	--	--	--	--	1.000	0.000	0.400	0.183	-0.183	-0.400
Owner / User Participation	--	--	--	--	--	1.000	0.400	-0.183	-0.913	0.400
Project Planning	--	--	--	--	--	--	1.000	0.548	-0.548	-0.400
Top Management Commitment	--	--	--	--	--	--	--	1.000	0.000	-0.913
Risk I.D. & Equitable Allocation	--	--	--	--	--	--	--	--	1.000	-0.183
Dispute Avoidance & Resolution	--	--	--	--	--	--	--	--	--	1.000

Notes:

[a] Effective Communication is unanimously ranked at #1.

[b] No correlation for this matrix is significant at the 0.05 level (2-tailed).

* Correlation Coefficient based on rank ordering within CSF category, and calculated in SPSS using Kendall's tau_b. (N = 4 Stakeholder Groups: Owner; Designer; Builder; User)

Table 7.28. . Round 1--Process--Project-Interest: CSF correlation matrix

7.8.4. Relative Importance by Rank-Orders

Process Category CSFs	Self-Interest % Rank [a, b]					Project-Interest % Rank [a, b]				
	O	D	B	U	ALL	O	D	B	U	ALL
	N=17	N=10	N=11	N=13	N=51	N=17	N=10	N=11	N=12	N=50
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Collaboration of Project Team	**0.85**	**0.95**	**0.85**	**0.95**	**1.0**	**0.90**	**0.95**	0.65	0.70	**0.80**
Effective Communication	**1.00**	**0.95**	0.60	**0.95**	**1.0**	0.15	**0.75**	0.25	0.20	0.10
Competency & Capability of Team	**0.85**	0.70	**1.00**	0.50	**0.8**	**1.00**	**0.95**	**0.85**	**0.95**	**1.00**
Trust & Respect	0.70	0.25	**0.85**	**0.75**	0.7	0.15	0.35	0.25	0.55	0.20
Alignment of Project Objectives	0.60	0.60	0.70	0.40	0.6	**0.80**	**0.75**	**1.00**	**0.95**	**0.90**
Owner / User Participation	0.30	**0.80**	0.35	**0.75**	0.5	0.30	0.55	**0.85**	0.55	0.60
Project Planning	0.30	0.45	0.35	0.60	0.4	0.40	0.15	0.50	0.40	0.35
Top Management Commitment	0.30	0.25	0.35	0.30	0.3	0.65	0.55	0.65	**0.80**	0.70
Risk I.D. & Equitable Allocation	0.50	0.45	0.35	0.10	0.2	0.65	0.35	0.10	0.20	0.35
Dispute Avoidance & Resolution	0.10	0.10	0.10	0.20	0.1	0.50	0.15	0.40	0.20	0.50
Other [c]	X	X	X	X	X	X	X	X	X	X
Stakeholder Groups Types: O = Owner; D = Designer; B = Builder; U = User										

Notes:
a. %Rank: normalized rank order where 1.00 = highest ranked.
b. Selection criteria for highlighted cells (Green/Bold): greater than or equal to 0.75
c. "Other" not included in rank-order series

Table 7.29. Round 1 - Process: Relative importance by %Rank

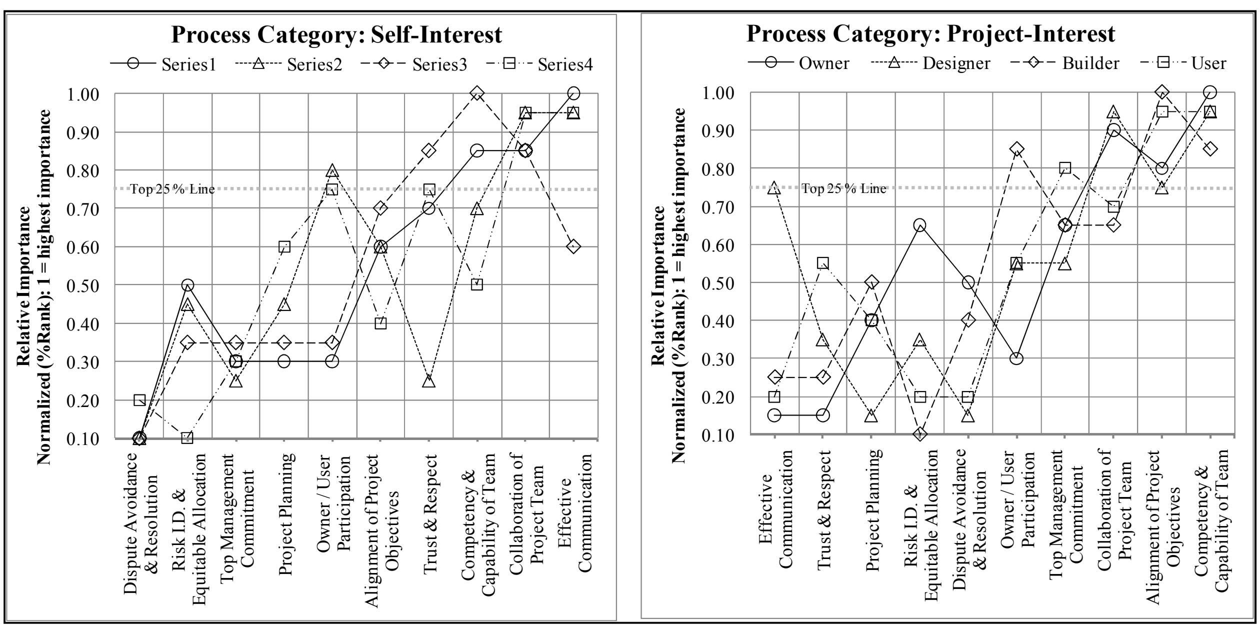


Figure 7.16. Round 1 - Process: %Rank by stakeholder

7.9. Impact Category: Data & Analysis

Survey Round #1: Relative Importance by Frequencies (n)										
Impact Category CSFs	Self-Interest Frequency					Project-Interest Frequency				
	O N=17 (2)	D N=10 (3)	B N=11 (4)	U N=13 (5)	ALL N=51 (6)	O N=17 (7)	D N=10 (8)	B N=11 (9)	U N=12 (10)	ALL N=50 (11)
(1)										
Owner / User satisfaction	16	10	10	12	48	15	8	10	9	42
Long-term Success / Lifecycle Value	16	6	7	12	41	12	7	9	9	37
Professional Reputation & Image	5	8	8	9	30	8	7	8	8	31
Long-term Business Relationships	7	10	9	3	29	7	8	6	5	26
Profit & Financial Objectives	11	6	5	3	25	13	4	3	5	25
Litigation Avoidance	8	3	6	4	21	7	4	5	3	19
Contract Incentives & Rewards	9	1	4	2	16	7	0	3	6	16
Job Satisfaction	3	4	2	6	15	4	4	4	6	18
Avoid Contractual Penalties	3	0	3	4	10	6	3	2	5	16
Prof./Industry Recognition & Awards	3	2	1	4	10	4	4	5	4	17
Other	4 [a]	0	0	1 [b]	5	2 [c]	1 [d]	0	0	3
Total (n) =	85	50	55	60	250	85	50	55	60	250

Stakeholder Groups Types: O = Owner; D = Designer; B = Builder; U = User; ALL = O+D+B+U

Notes:

a. Change avoidance, commissioning; achieve goals & objectives; swift project delivery

b. User functionality & satisfaction

c. Smooth project team hand-off to operations; swift transition to equipping, outfitting & transition

d. Public/taxpayer acceptance & satisfaction

Table 7.30. Round 1- Impact: Frequency table

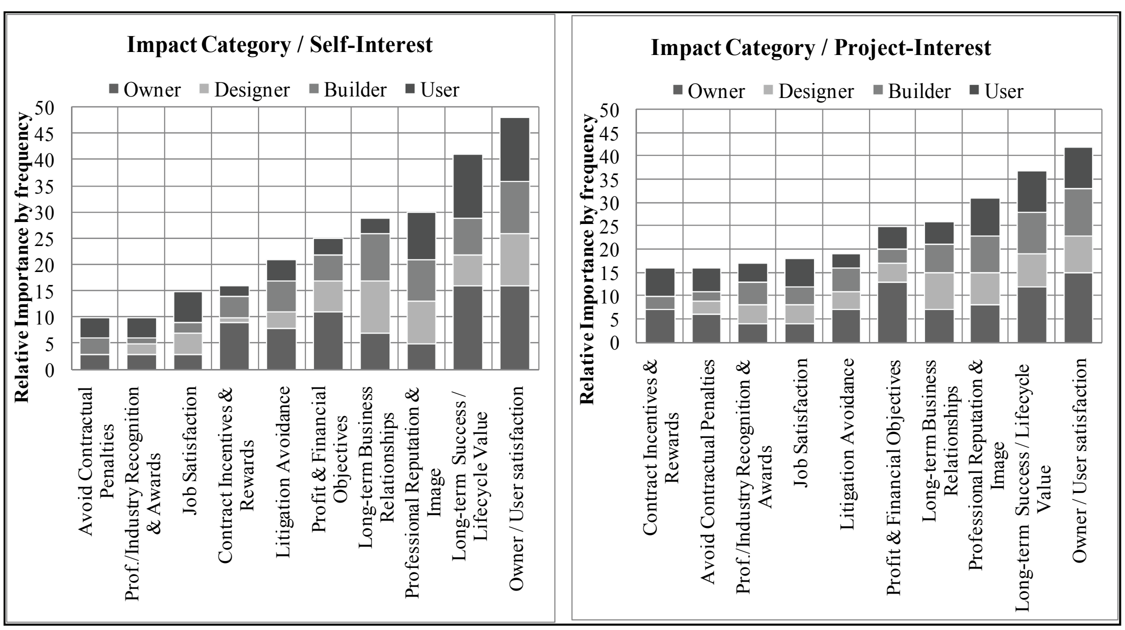


Figure 7.17. Round 1 - Impact: Relative importance by frequency

7.9.1. Inter-Rater Agreement Testing

Round #1 Inter-rater Agreement: Impact Category										
Critical Success Factors	Self-Interest Mean Rank					Project-Interest Mean Rank				
	O	D	B	U	All	O	D	B	U	All
Litigation Avoidance	5.47	4.50	5.73	4.77	5.16	5.12	5.05	5.27	4.35	4.94
Avoid Contractual Penalties	4.00	3.00	4.36	4.77	4.08	4.82	4.55	3.91	5.12	4.65
Long-term Business Relationships	5.18	8.00	7.09	4.38	5.94	5.12	7.05	5.73	5.12	5.63
Contract Incentives & Rewards	5.76	3.50	4.82	4.00	4.67	5.12	3.05	4.36	5.50	4.65
Job Satisfaction	4.00	5.00	3.91	5.54	4.57	4.24	5.05	4.82	5.50	4.84
Long-term Success / Lifecycle Value	7.82	6.00	6.18	7.85	7.12	6.59	6.55	7.09	6.65	6.71
Owner / User satisfaction	7.82	8.00	7.55	7.85	7.80	7.47	7.05	7.55	6.65	7.20
Profit & Financial Objectives	6.35	6.00	5.27	4.38	5.55	6.88	5.05	4.36	5.12	5.53
Prof./Industry Recognition & Awards	4.00	4.00	3.45	4.77	4.08	4.24	5.05	5.27	4.73	4.75
Professional Reputation & Image	4.59	7.00	6.64	6.69	6.04	5.41	6.55	6.64	6.27	6.12
Statistic	Self-Interest					Project-Interest				
	O	D	B	U	All	O	D	B	U	All
N	17	10	11	13	51	17	10	11	13	51
Kendall's W[a]	.311	.464	.273	.326	.232	.178	.237	.220	.097	.123
Chi-square	47.65	41.76	27.00	38.20	106.30	27.26	21.29	21.76	11.40	56.30
df	9	9	9	9	9	9	9	9	9	9
Asymp. Sig.	.000	.000	.001	.000	.000	.001	.011	.010	.249	.000
a. Kendall's Coefficient of Concordance										

Table 7.31. Round 1 - Impact: Inter-rater agreement

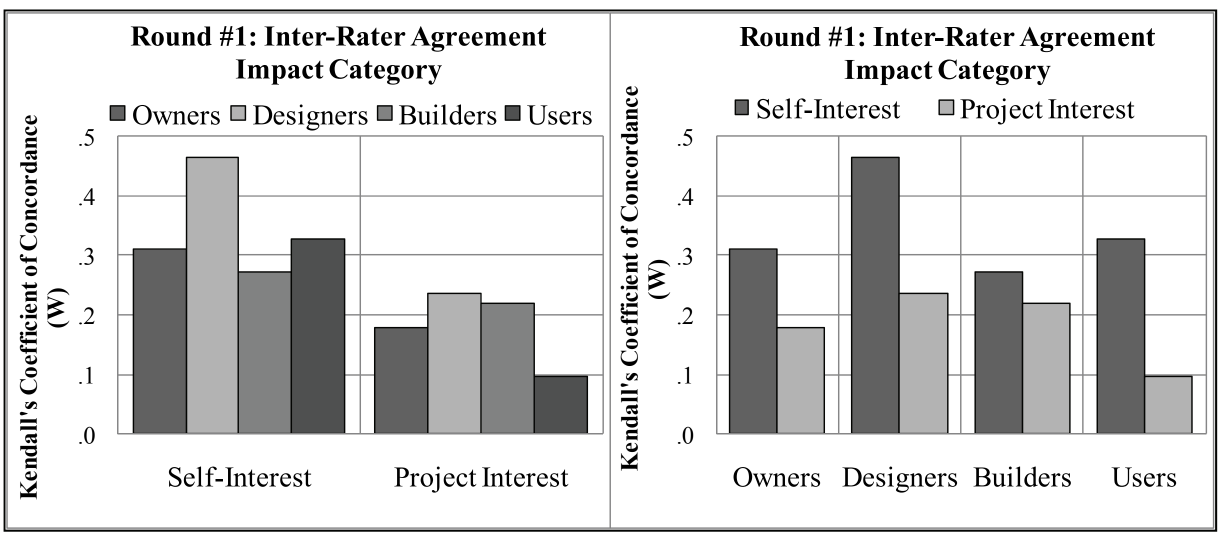


Figure 7.18. Round 1 - Impact: Inter-rater agreement by stakeholder

7.9.2. Reliability Test

Impact Category Reliability Statistics: Intra-class Correlation									
Perspective	Stakeholder Group	N	Cronbach's Alpha	95% Confidence Interval		F Test True Value 0			
				Lower Bound	Upper Bound	Value	df1	df2	Sig
Self-Interest	All	50	0.934	0.859	0.980	15.155	9	441	0.000
	Owner	17	0.862	0.696	0.959	7.237	9	144	0.000
	Designer	10	0.872	0.708	0.962	7.791	9	81	0.000
	Builder	11	0.733	0.398	0.922	3.750	9	90	0.000
	User	12	0.834	0.627	0.951	6.019	9	99	0.000
Project-Interest	All	50	0.857	0.694	0.957	7.007	9	441	0.000
	Owner	17	0.712	0.365	0.915	3.468	9	144	0.001
	Designer	10	0.641	0.184	0.895	2.789	9	81	0.007
	Builder	11	0.645	0.198	0.896	2.818	9	90	0.006
	User	12	0.230	-0.730	0.774	1.298	9	99	0.248

Table 7.32. Round 1 -- Impact: Reliability testing table

Overall the survey question tested for high reliability at a 0.001 significance level. Among the stakeholder groups there was also mostly strong reliability at a 0.001 significance level for self-interest and 0.05 level for project interest. The single exception is for the users' stakeholder group in the project-interest category which failed to achieve a 0.01 significance level.

7.9.3. Correlations

Correlation Matrix among Impact Category Stakeholder Groups (for Round #1)								
Correlation Matrix *	Self-Interest				Project-Interest			
	Owner	Designer	Builder	User	Owner	Designer	Builder	User
Owner	1.000	0.357	0.489	0.099	1.000	0.359	0.453	0.444
Designer	--	1.000	0.705 [a]	0.338	--	1.000	.0752 [a]	0.312
Builder	--	--	1.000	0.236	--	--	1.000	0.434
User	--	--	--	1.000	--	--	--	1.000

Notes:
[a] Correlation is significant at the 0.01 level (2-tailed).
* Correlation Coefficient based on rank ordering within CSF category, and calculated in SPSS using Kendall's tau_b. (N = 10 CSFs)

Table 7.33. Round 1 -- Impact: Stakeholder correlation matrix

Correlation Matrix among <u>Impact Category</u> Critical Success Factors (for Round #1)										
	Self-Interest									
Correlation Matrix *	Owner / User satisfaction	Long-term Success / Lifecycle Value	Professional Reputation & Image	Long-term Business Relation-ships	Profit & Financial Objectives	Litigation Avoid-ance	Contract Incentives & Rewards	Job Satisfact-ion	Avoid Contract-ual Penalties	Profession-al Industry Recognition & Awards
Owner / User satisfaction	1.000	a	a	a	a	a	a	a	a	a
Long-term Success / Lifecycle Value	--	1.000	-0.577	-0.816	0	0.577	0.000	0.408	0.671	0.671
Professional Reputation & Image	--	--	1.000	0.236	-0.707	-0.333	-0.707	0.236	0.000	0.000
Long-term Business Relationships	--	--	--	1.000	0.333	-0.707	0.000	-0.333	-0.913	-0.548
Profit & Financial Objectives	--	--	--	--	1.000	-0.236	0.667	-0.333	-0.548	-0.183
Litigation Avoidance	--	--	--	--	--	1.000	0.236	-0.236	0.775	0.000
Contract Incentives & Rewards	--	--	--	--	--	--	1.000	-0.667	-0.183	-0.548
Job Satisfaction	--	--	--	--	--	--	--	1.000	0.183	0.913
Avoid Contractual Penalties	--	--	--	--	--	--	--	--	1.000	0.400
Prof./Industry Recognition & Awards	--	--	--	--	--	--	--	--	--	1.000

Notes:

[a] Owner/User Satisfaction is unanimously ranked at #1.

[b] No correlation for this matrix is significant at the 0.05 level (2-tailed).

* Correlation Coefficient based on rank ordering within CSF category, and calculated in SPSS using Kendall's tau_b. (N = 4 Stakeholder Groups: Owner; Designer; Builder; User)

Table 7.34. Round 1 -- Impact -- Self-Interest: CSF correlation matrix

Correlation Matrix among <u>Impact Category</u> Critical Success Factors (for Round #1)										
	Project-Interest									
Correlation Matrix *	Owner / User satisfaction	Long-term Success / Lifecycle Value	Professional Reputation & Image	Long-term Business Relation-ships	Profit & Financial Objectives	Litigation Avoid-ance	Contract Incentives & Rewards	Job Satisfact-ion	Avoid Contract-ual Penalties	Profession-al Industry Recognition &
Owner / User satisfaction	1.000	a	a	a	a	a	a	a	a	a
Long-term Success / Lifecycle Value	--	1.000	0.516	-0.548	-0.548	-0.775	0.548	0.548	0.183	-0.224
Professional Reputation & Image	--	--	1.000	0.236	-0.707	-0.333	-0.236	0.707	-0.236	0.577
Long-term Business Relationships	--	--	--	1.000	0.000	0.707	-1.000 [b]	0.000	-0.667	0.816
Profit & Financial Objectives	--	--	--	--	1.000	0.236	0.000	-0.333	0.333	-0.408
Litigation Avoidance	--	--	--	--	--	1.000	-0.707	-0.707	-0.707	0.577
Contract Incentives & Rewards	--	--	--	--	--	--	1.000	0.000	0.667	-0.816
Job Satisfaction	--	--	--	--	--	--	--	1.000	0.333	0.000
Avoid Contractual Penalties	--	--	--	--	--	--	--	--	1.000	-0.816
Prof./Industry Recognition & Awards	--	--	--	--	--	--	--	--	--	1.000

Notes:

[a] Owner/User Satisfaction is unanimously ranked at #1.

[b] Correlation is significant at the 0.01 level (2-tailed).

* Correlation Coefficient based on rank ordering within CSF category, and calculated in SPSS using Kendall's tau_b. (N = 4 Stakeholder Groups: Owner; Designer; Builder; User)

Table 7.35. Round 1 -- Impact -- Project-Interest: CSF correlation matrix

7.9.4. Relative Importance by Rank-Orders

Impact Category CSFs	Self-Interest % Rank [a, b]					Project-Interest % Rank [a, b]				
	O N=17	D N=10	B N=11	U N=13	ALL N=51	O N=17	D N=10	B N=11	U N=12	ALL N=50
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Owner / User satisfaction	**0.95**	**0.95**	**1.00**	**0.95**	**1.0**	**1.00**	**0.95**	**1.00**	**0.95**	**1.00**
Long-term Success / Lifecycle Value	**0.95**	0.65	0.70	**0.95**	**0.9**	**0.80**	**0.75**	**0.90**	**0.95**	**0.90**
Professional Reputation & Image	0.40	**0.80**	**0.80**	**0.80**	**0.8**	0.70	**0.75**	**0.80**	**0.80**	**0.80**
Long-term Business Relationships	0.50	**0.95**	**0.90**	0.25	0.7	0.50	**0.95**	0.70	0.40	0.70
Profit & Financial Objectives	**0.80**	0.65	0.50	0.25	0.6	**0.90**	0.45	0.25	0.40	0.60
Litigation Avoidance	0.60	0.40	0.60	0.50	0.5	0.50	0.45	0.55	0.10	0.50
Contract Incentives & Rewards	0.70	0.20	0.40	0.10	0.4	0.50	0.10	0.25	0.65	0.15
Job Satisfaction	0.20	0.50	0.20	0.70	0.3	0.15	0.45	0.40	0.65	0.40
Avoid Contractual Penalties	0.20	0.10	0.30	0.50	0.2	0.30	0.20	0.10	0.40	0.15
Prof./Industry Recognition & Awards	0.20	0.30	0.10	0.50	0.2	0.15	0.45	0.55	0.20	0.30
Other [c]	X	X	X	X	X	X	X	X	X	X

Stakeholder Groups Types: O = Owner; D = Designer; B = Builder; U = User; ALL

Notes:
a. %Rank: normalized rank order where 1.00 = highest ranked.
b. Selection criteria for highlighted cells (Green/Bold): greater than or equal to 0.75
c. "Other" not included in rank-order series

Table 7.36. Round 1 -- Impact: relative importance by %Rank

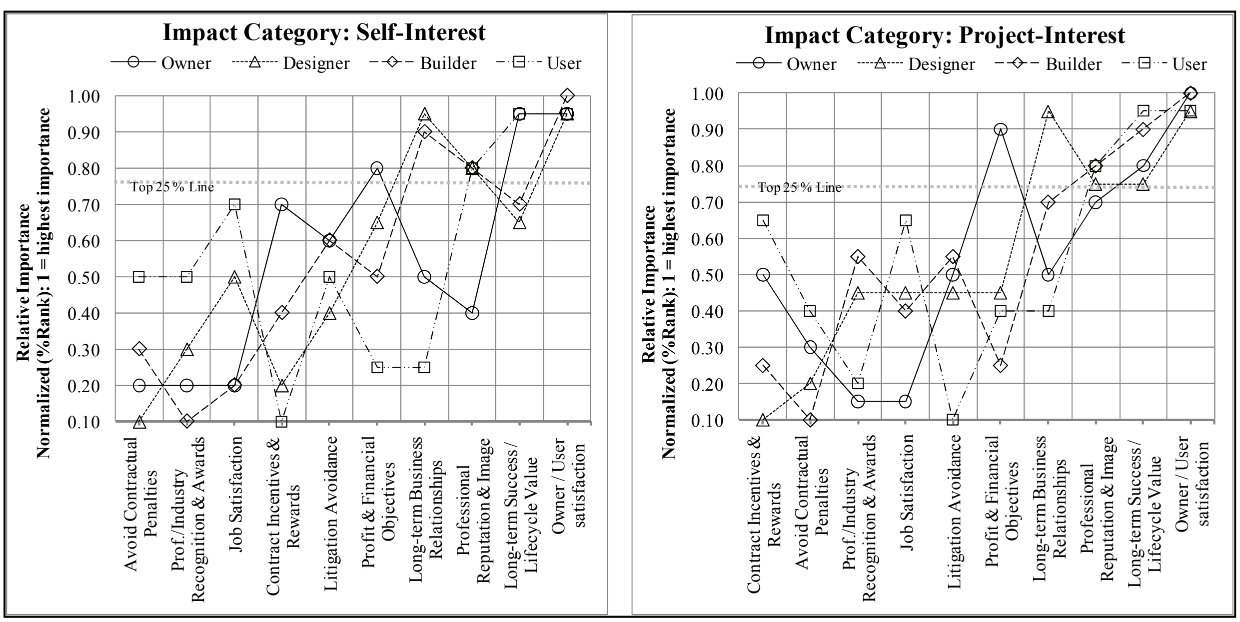


Figure 7.19. Round 1 -- Impact: relative importance by %Rank by stakeholder

7.10. Top 25% Summary

Round 1 Consolidated List of Top-25 Relative Important in All Categories

Critical Success Factors	Self-Interest % Rank [a, b]					Project-Interest % Rank [a, b]				
	O	D	B	U	ALL	O	D	B	U	ALL
	N=17	N=10	N=11	N=13	N=51	N=17	N=10	N=11	N=12	N=50
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Owner / User satisfaction	**0.95**	**0.95**	**1.00**	**0.95**	**1.0**	**1.00**	**0.95**	**1.00**	**0.95**	**1.00**
Utility and functionality	**1.00**	**0.90**	**1.00**	**1.00**	**1.0**	**0.85**	**1.00**	**0.80**	**0.75**	**1.00**
Quality	**1.00**	**0.95**	**0.85**	**1.00**	**1.0**	**1.00**	**1.00**	**1.00**	0.70	**1.00**
Long-term Success / Lifecycle Value	**0.95**	0.65	0.70	**0.95**	**0.9**	**0.80**	**0.75**	**0.90**	**0.95**	**0.90**
Competency & Capability of Team	**0.85**	0.70	**1.00**	0.50	**0.8**	**1.00**	**0.95**	**0.85**	**0.95**	**1.00**
Collaboration of Project Team	**0.85**	**0.95**	**0.85**	**0.95**	**1.0**	**0.90**	**0.95**	0.65	0.70	**0.80**
Responsive Admin. & Decision Support	0.65	**0.95**	0.65	**0.90**	**0.9**	**0.85**	0.70	0.55	0.70	**0.75**
Clear and realistic objectives	**0.85**	0.40	0.70	0.65	**0.8**	**0.85**	**0.75**	0.70	**1.00**	**0.85**
Owner's vision	0.70	**0.80**	**0.85**	0.45	**0.9**	0.70	**0.90**	**0.95**	0.25	0.70
Professional Reputation & Image	0.40	**0.80**	**0.80**	**0.80**	**0.8**	0.70	**0.75**	**0.80**	**0.80**	**0.80**
Cost Performance	**0.80**	0.40	**0.85**	0.70	0.7	**0.85**	**0.85**	**0.80**	0.70	**0.90**
Time Performance	**0.90**	0.70	0.15	**0.80**	**0.8**	0.55	**0.85**	**0.80**	0.70	**0.75**
Sustainability	**0.85**	0.65	0.50	0.65	0.7	**1.00**	**0.75**	**0.95**	0.45	**0.85**
Alignment of Project Objectives	0.60	0.60	0.70	0.40	0.6	**0.80**	**0.75**	**1.00**	**0.95**	**0.90**
~~**Long-term Business Relationships**~~ [c]	~~0.50~~	~~0.95~~	~~0.90~~	~~0.25~~	~~0.7~~	~~0.50~~	~~0.95~~	~~0.70~~	~~0.40~~	~~0.70~~
Constructability of Design [d]	0.65	0.70	**1.00**	0.15	0.6	0.70	0.60	**0.80**	0.70	0.60
Profit & Financial Objectives	**0.80**	0.65	0.50	0.25	0.6	**0.90**	0.45	0.25	0.40	0.60
Owner / User Participation	0.30	**0.80**	0.35	**0.75**	0.5	0.30	0.55	**0.85**	0.55	0.60
Effective Communication	**1.00**	**0.95**	0.60	**0.95**	**1.0**	0.15	**0.75**	0.25	0.20	0.10
Change-Order Management	0.50	0.70	0.35	0.60	0.5	0.30	0.50	0.40	**1.00**	0.50
~~**Constructability**~~ [e]	~~0.55~~	~~0.65~~	~~0.85~~	~~0.10~~	~~0.5~~	~~0.30~~	~~0.25~~	~~0.35~~	~~0.90~~	~~0.50~~
Design innovation and creativity	0.25	**1.00**	0.60	0.20	0.4	0.55	0.60	0.35	**0.75**	0.60
Trust & Respect	0.70	0.25	**0.85**	**0.75**	0.7	0.15	0.35	0.25	0.55	0.20
Evidence based design [f]	0.55	0.50	0.20	**0.90**	0.6	0.15	0.45	0.35	0.60	0.30
Dispute Avoidance & Resolution [g]	0.10	0.10	0.10	0.20	0.1	0.50	0.15	0.40	0.20	0.50
Aesthetics	0.25	0.25	0.10	**0.80**	0.2	0.40	0.10	0.10	0.10	0.10

Stakeholder Groups Types: O = Owner; D = Designer; B = Builder; U = User; ALL

Notes:

a. %Rank: normalized rank order where 1.00 = highest ranked

b. Selection criteria for highlighted areas: Top 25%: Greater than or equal to 0.75 (Shaded & Bold highlight)

c. "Long-term Business Relationships" will not be submitted for further analysis in future survey rounds because it has little direct bearing on project delivery process under the acquisition rules and regulations for public projects (the focus of this research study). In fact, control measures are in place which purposely limit or forbid relationship based procurement to protect the public's interests.

d. Constructability was evaluated in two different categories: "Design" and "Construction". This CSF was evaluated in the "Construction" category as it relates to implementability of designs and designers intent in the field. Going forward in Survey Round #2 the two "constructabilities" will be consolidated using the Construction category values.

e. See note (c) above. This "Design" category CSF (constructability) was intended to assess considerations critical to design decisions, and will be consolidated into a single CSF using the "Construction" category values in subsequent survey rounds.

f. Evidence based design was originally ommitted from the Round #2 survey do to an error. EBD was submitted for evaluation during the Round #3 survey and the results were later amended to the Round 2 survey data set. This explaination provides background for note (g) below.

g. "Dispute Avoidance & Resolution" was erroneously submitted in place of "Evidence Based Design". for assessment in the Round # 2 survey. See note (f) above for background.

Table 7.37. Round 1 top-25% highest relative importance by %Rank

7.10.1. Inter-Rater Agreement Testing of Top-25%

Round #1 Inter-Rater Agreement: Top 25%										
Critical Success Factors	Self-Interest Mean Rank					Project-Interest Mean Rank				
	O	D	B	U	All	O	D	B	U	All
Owner / User Satisfaction	16.47	16.95	16.73	16.23	16.56	16.29	14.80	16.09	14.38	15.47
Clear & Realistic Objectives	13.65	9.75	14.55	11.62	12.56	13.47	12.40	11.73	15.31	13.35
Effective Communication	15.76	14.55	12.36	16.23	14.91	14.88	13.60	13.91	15.31	14.53
Competency & Capability of Project Team	14.35	12.15	15.64	10.69	13.26	14.18	13.60	12.82	12.54	13.35
Utility & Functionality	17.18	14.55	16.73	16.23	16.32	13.47	16.00	13.91	12.54	13.82
Collaboration of Project Delivery Team	14.35	14.55	14.55	16.23	14.91	13.47	12.40	15.00	15.31	14.06
Trust & Respect	11.53	8.55	14.55	12.54	11.85	8.53	10.00	8.45	11.62	9.59
Alignment of Project Objectives	10.82	10.95	13.45	9.77	11.15	12.76	11.20	12.82	13.46	12.65
Owner / User Participation	8.71	13.35	10.18	12.54	10.91	9.24	11.20	13.91	11.62	11.24
Production of Specified Quality	15.76	14.55	13.45	16.23	15.15	16.29	16.00	15.00	12.54	15.00
Long-term Bldg. Success & Lifecycle Value	16.47	12.15	13.45	16.23	14.91	14.18	13.60	15.00	14.38	14.29
Owner's vision	12.24	13.35	15.64	10.69	12.79	12.06	14.80	15.00	9.77	12.65
Project Time Performance	14.35	13.35	9.09	13.46	12.79	11.35	14.80	13.91	12.54	12.88
Constructability	12.24	13.35	15.64	7.92	12.09	12.76	11.20	13.91	12.54	12.65
Project Cost Performance	13.65	9.75	13.45	12.54	12.56	13.47	14.80	13.91	12.54	13.59
Responsive Admin. & Decision Support	12.24	14.55	12.36	14.38	13.26	13.47	13.60	11.73	12.54	12.88
Sustainability	13.65	12.15	10.18	11.62	12.09	14.88	12.40	15.00	10.69	13.35
Evidence Based Design	10.82	10.95	8.00	15.31	11.38	11.35	11.20	9.55	12.54	11.24
Dispute Avoidance & Resolution	8.00	7.35	6.91	7.00	7.38	8.53	12.40	8.45	8.85	9.35
Profit & Financial Objectives	12.94	12.15	11.27	7.92	11.15	14.88	10.00	8.45	10.69	11.47
Professional Reputation & Image	8.71	14.55	14.55	13.46	12.32	11.35	13.60	13.91	13.46	12.88
Aesthetics	8.00	7.35	5.82	12.54	8.56	10.65	6.40	7.36	8.85	8.65
Design Innovation & Creativity	8.00	15.75	11.27	7.92	10.21	9.24	10.00	9.55	11.62	10.06
Change Order Reduction	10.12	13.35	10.18	10.69	10.91	9.24	10.00	10.64	14.38	11.00
Statistic	Self-Interest					Project-Interest				
	O	D	B	U	All	O	D	B	U	All
N	17	10	11	13	51	17	10	11	13	51
Kendall's W[a]	.236	.186	.251	.257	.141	.154	.149	.193	.104	.095
Chi-square	92.35	42.83	63.57	76.70	164.83	60.22	34.38	48.81	31.23	111.46
df	23	23	23	23	23	23	23	23	23	23
Asymp. Sig.	.000	.007	.000	.000	.000	.000	.060	.001	.117	.000

a. Kendall's Coefficient of Concordance

Table 7.38. Round 1 Top-25% inter-rater agreement

Inter-rater agreement was calculated independently for the 24 critical success factors selected for the round 2 survey to provide a baseline for comparing overall inter-rater agreement between the survey rounds. For the Delphi method to be successful it must be demonstrated that there is an increase in consensus among the members of the panel of experts.

7.11. Round 1 Findings

1. The round 1 Delphi survey is a success based on the high participation level of invited respondents, and the outstanding qualifications of the panel(s) of experts assembled.

2. The expertise of the panel of experts as a whole, and for each stakeholder group, is strongly validated in terms of education, experience, and professional certifications. The participants' population is extremely qualified for this study.

3. The results of the round 1 survey have successfully provided proof of concept that differences exist between each project stakeholder group's (Owner, Designer, Builder, and User) opinion of what are the most important factors for project success, and that relative importance depends on considerations of self-interest or project-interest. Survey round 2 will further investigate the various differences between interpretations of relative importance.

4. Twenty-four critical success factors were successfully selected for relative importance for further analysis in the round 2 survey.

5. Inter-rater agreement was validated for all categories of the round 1 survey using Kendall's coefficient of concordance as a test statistic at an overall 0.001 level of significance.

6. Reliability of the survey was validated at a 0.001 significance level utilizing intra-class correlation of the critical success factors to determine Cronbach's alpha as a test statistic.

CHAPTER 8.

ROUND 2 SURVEY REPORT

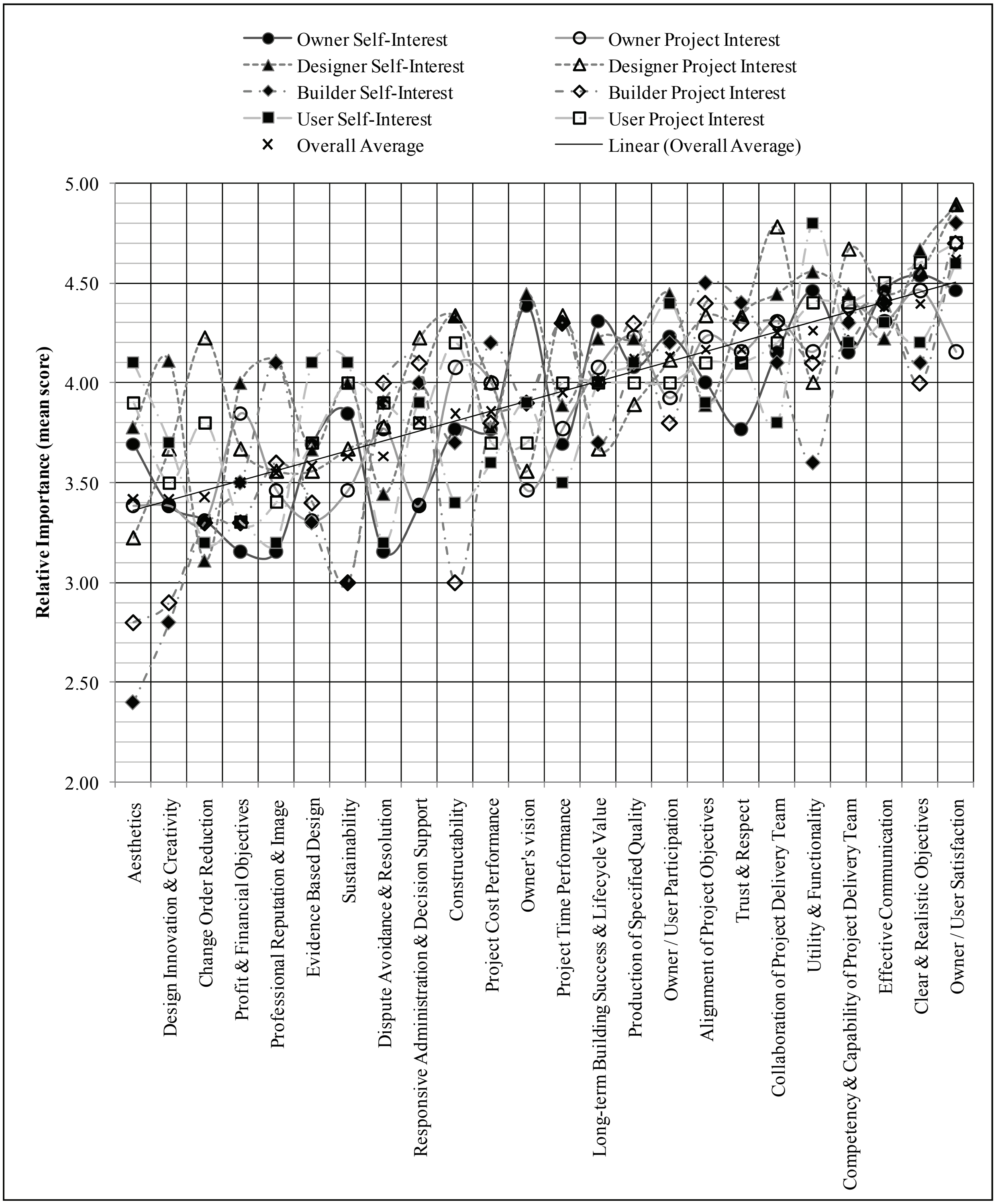


Figure 8.1. Round 2: Overall data results

8.1. Introduction

The round 2 survey report is organized in the following order: Purpose, Administrative Information, Questions Asked, Data Collected, Analysis, Findings, Summary and Conclusion. The format of the round 2 report differs from the round 1 report because the critical success factors categories have been consolidated into one comprehensive list. Now the data will be divided into categories based on stakeholder groups (All Groups, Owners, Designers, Builders, & Users) for the remainder of Delphi study. The breakdown between self-interest and project-interest remains. Table 8.1. above gives a visual pre-view of the data to be discussed below. Note the increased linearity of the response set compared to the corresponding figure at the start of the round 1 report. The increased linearity visually indicates an increase in inter-rater agreement, which will be statistically substantiated later in this report.

8.1.1. Outline of the Report

Descriptive statistic and related analysis charts and tables will be presented and will reflect choices by the overall panel of experts, and then by each individual stakeholder group. Once again the survey is tested for inter-rater agreement among participants, and for reliability. Relative importance is evaluated by rank-order, and the top-25% factors are selected to be included in the round 3 survey. Additional analysis in the round 2 report includes investigation of the differences between the relative importance from the self-interest and project-interest perspectives to include significance testing. Finally the results of rounds 1 and 2 are compared to test for validation of the Delphi process.

8.1.2. Purpose

The round 2 survey served three purposes:

1. To further evaluate the 24 most important critical success factors selected in round 1. The goal is to further refine the list of most important critical success factors by relative importance for the third and final survey round.

2. To compare inter-rater agreement statistics between round 1 and round 2 to determine if the panel of experts have achieved an increase in consensus between rounds.

3. To used the refined data set to identify and measure differences in relative importance between the self-interest and project-interest for each of the stakeholder groups.

8.1.3. Administrative

The round 2 survey was published to the participants on 15 March 2011. Weekly email reminders were automatically sent to remaining participants until the survey was closed 20 days later at 11:59 pm on 04 April 2011. The survey invitations were sent via email to a total of 51 participants. The round 2 survey invitation list was limited to the respondents who participated in the round 1 survey. All participants were provided with the result of the round 1 survey for their consideration prior to starting the round 2 survey.

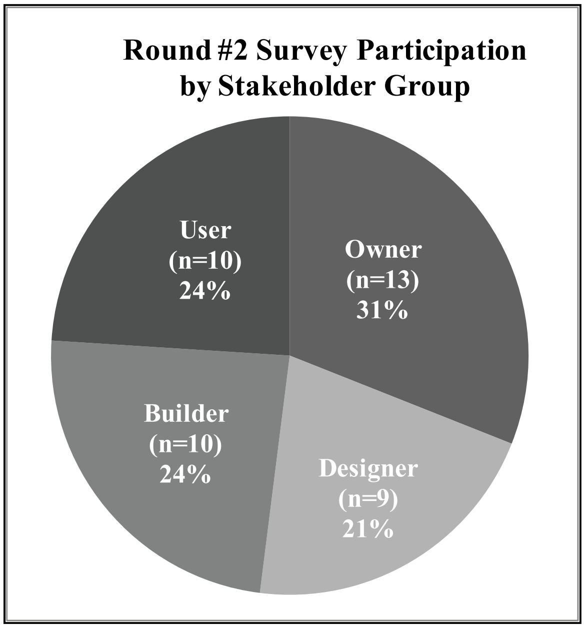
Participation Statistics:

- Invited: 51
- Started: 44
- Completed: 42
- Participation Rate: 82.3%
- Completion Rate: 95.5%
- Drop outs (after starting): 2
- Average Time to Complete Survey: 9 minutes

8.2. Round 2 Sample

<u>Round 2 - Question 1: Stakeholder Group Identification</u>

Which of the following categories do you best identify with? (Select only one): Design Team; Facility User or User's Representative; Construction Team; Owner or Owner's Representative.



Stakeholder Group (1)	Frequency (2)	Percent (3)
Owner / Owner's Representative	13	31%
Design Team	9	21%
Construction Team	10	24%
Facility User / User's Representative	10	24%
Total	42	100%

Figure 8.2. Round 2 stakeholder group participation

There was an attrition of 9 participants from rounds 1 to 2. The owners, designers, and users stakeholder groups lost 4, 1, and 3 participants respectively. Given the busy schedules and responsibilities of the sample population such attrition was planned for, and the total numbers for each stakeholder group remains within the normal range for a Delphi survey. The stakeholder distribution and overall number of participants remains appropriate for the purposes of this research project.

8.3. Evaluation of Critical Success Factors

The primary purpose of the round 3 survey to further evaluate the twenty-four critical success factors selected in round 1 for relative importance on a five-point Likert-scale: from least important to most important. The survey participants were asked the following question twice. Once each for from the self-interest and project-interest perspectives. For brevity the question will only be listed once, but the data set will be divided by self and project interests.

<u>Round 2 - Question 2: Evaluation of Critical Success Factors</u>

In light of the factors listed below, how would you rate the importance of each factor in general from your (a) Stakeholder Perspective (Self-Interest) / (b) Project Perspective (Project-Interest)?

The following 24 factors were then rated on a one to five scale (1 = least important, and 5 = most important):

1. Aesthetics
2. Alignment of Project Objectives
3. Effective Communication
4. Profit and Financial Objectives
5. Owner / User Participation
6. Competency & Capability of Project Delivery Team
7. Trust & Respect
8. Change-Order Reduction
9. Project Time Performance
10. Dispute Avoidance & Resolution
11. Utility & Functionality
12. Owner's Vision
13. Owner / User Satisfaction
14. Sustainability
15. Long-term Building Success / Lifecycle Value

16. Professional Reputation & Image
17. Clear & Realistic Objectives
18. Production of Specified Quality
19. Responsive Administration & Decision Support
20. Collaboration of Project Delivery Team
21. Design Innovation & Creativity
22. Constructability
23. Project Cost Performance
24. Evidence Based Design*

* Evidence Base Design was erroneously omitted from the round 2 survey. The factor was included as a separate question on the round 3 survey, and the results have been amended to this round 2 report. All data in this report include the mean score as rated by the panel of experts.)

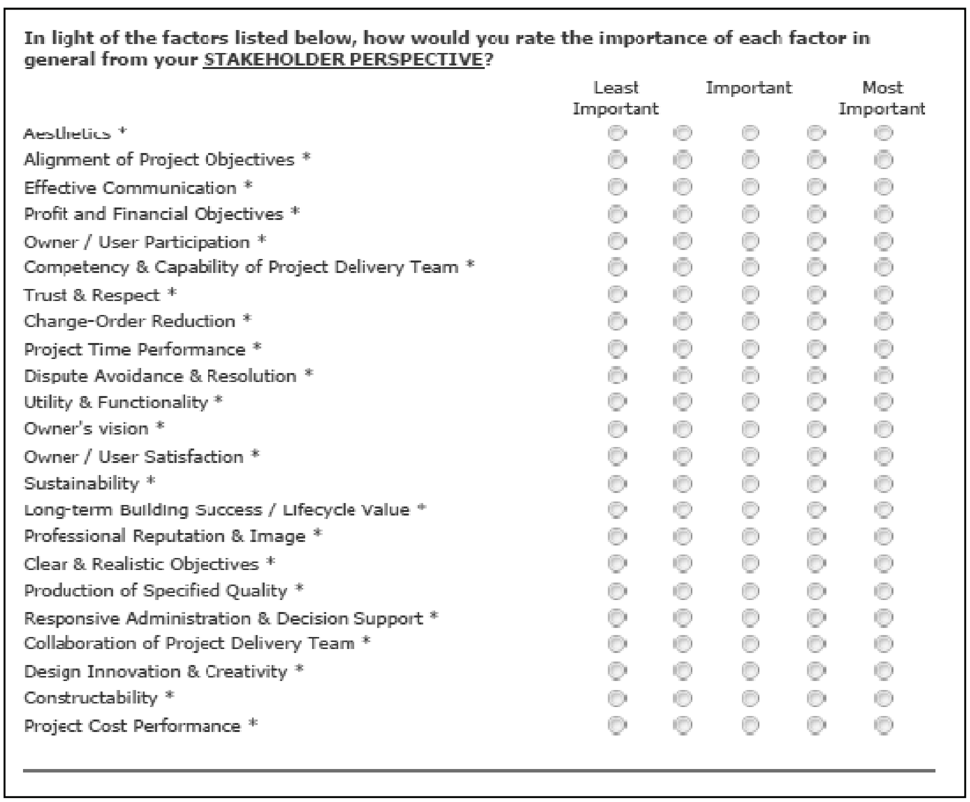


Figure 8.3 Round 2 example question from web-survey

Data & Analysis

8.3.1. Overall

Round #2 Descriptive Statistics: Overall (Owner, Designer, Builder, & User)		Self-Interest								Project-Interest							
Critical Success Factor	N	Range	Min	Max	Sum	Mean	Std. Error	Std. Dev.	Var.	Range	Min	Max	Sum	Mean	Std. Error	Std. Dev.	Var.
Aesthetics	42	4	1	5	147	3.500	0.142	0.917	0.841	4	1	5	140	3.333	0.143	0.928	0.862
Alignment of Project Objectives	42	3	2	5	171	4.071	0.125	0.808	0.653	2	3	5	179	4.262	0.113	0.734	0.539
Change Order Reduction	42	4	1	5	136	3.238	0.140	0.906	0.820	3	2	5	152	3.619	0.148	0.962	0.925
Collaboration of Project Delivery Team	42	2	3	5	173	4.119	0.124	0.803	0.644	3	2	5	184	4.381	0.123	0.795	0.632
Effective Communication	42	2	3	5	183	4.357	0.112	0.727	0.528	3	2	5	185	4.405	0.118	0.767	0.588
Competency & Capability of Project Team	42	3	2	5	179	4.262	0.118	0.767	0.588	2	3	5	185	4.405	0.103	0.665	0.442
Constructability	42	4	1	5	159	3.786	0.139	0.898	0.807	4	1	5	164	3.905	0.163	1.055	1.113
Project Cost Performance	42	4	1	5	161	3.833	0.132	0.853	0.728	3	2	5	163	3.881	0.141	0.916	0.839
Dispute Avoidance & Resolution	42	3	2	5	143	3.405	0.137	0.885	0.783	3	2	5	162	3.857	0.139	0.899	0.808
Design Innovation & Creativity	42	3	2	5	146	3.476	0.133	0.862	0.743	4	1	5	141	3.357	0.122	0.791	0.625
Evidence Based Design	42	4	1	5	155	3.690	0.147	0.950	0.902	4	1	5	146	3.476	0.141	0.917	0.841
Long-term Bldg. Success & Lifecycle Value	42	2	3	5	171	4.071	0.125	0.808	0.653	3	2	5	166	3.952	0.136	0.882	0.778
Owner / User Participation	42	2	3	5	181	4.310	0.120	0.780	0.609	3	2	5	166	3.952	0.140	0.909	0.827
Owner / User Satisfaction	42	2	3	5	196	4.667	0.081	0.526	0.276	2	3	5	192	4.571	0.097	0.630	0.397
Profit & Financial Objectives	42	4	1	5	145	3.452	0.164	1.064	1.132	4	1	5	149	3.548	0.171	1.109	1.229
Production of Specified Quality	42	2	3	5	173	4.119	0.109	0.705	0.498	3	2	5	173	4.119	0.124	0.803	0.644
Clear & Realistic Objectives	42	2	3	5	184	4.381	0.108	0.697	0.485	3	2	5	185	4.405	0.113	0.734	0.539
Professional Reputation & Image	42	3	2	5	151	3.595	0.160	1.037	1.076	4	1	5	147	3.500	0.157	1.018	1.037
Responsive Admin. & Decision Support	42	2	3	5	159	3.786	0.111	0.717	0.514	3	2	5	161	3.833	0.140	0.908	0.825
Sustainability	42	3	2	5	157	3.738	0.141	0.912	0.832	3	2	5	148	3.524	0.137	0.890	0.792
Project Time Performance	42	3	2	5	161	3.833	0.118	0.762	0.581	3	2	5	171	4.071	0.129	0.838	0.702
Trust & Respect	42	2	3	5	173	4.119	0.114	0.739	0.546	3	2	5	177	4.214	0.125	0.813	0.660
Utility & Functionality	42	3	2	5	183	4.357	0.131	0.850	0.723	4	1	5	175	4.167	0.132	0.853	0.728
Owner's vision	42	2	3	5	175	4.167	0.122	0.794	0.630	4	1	5	153	3.643	0.163	1.055	1.113

Table 8.1. Round 2 - Overall: descriptive statistics

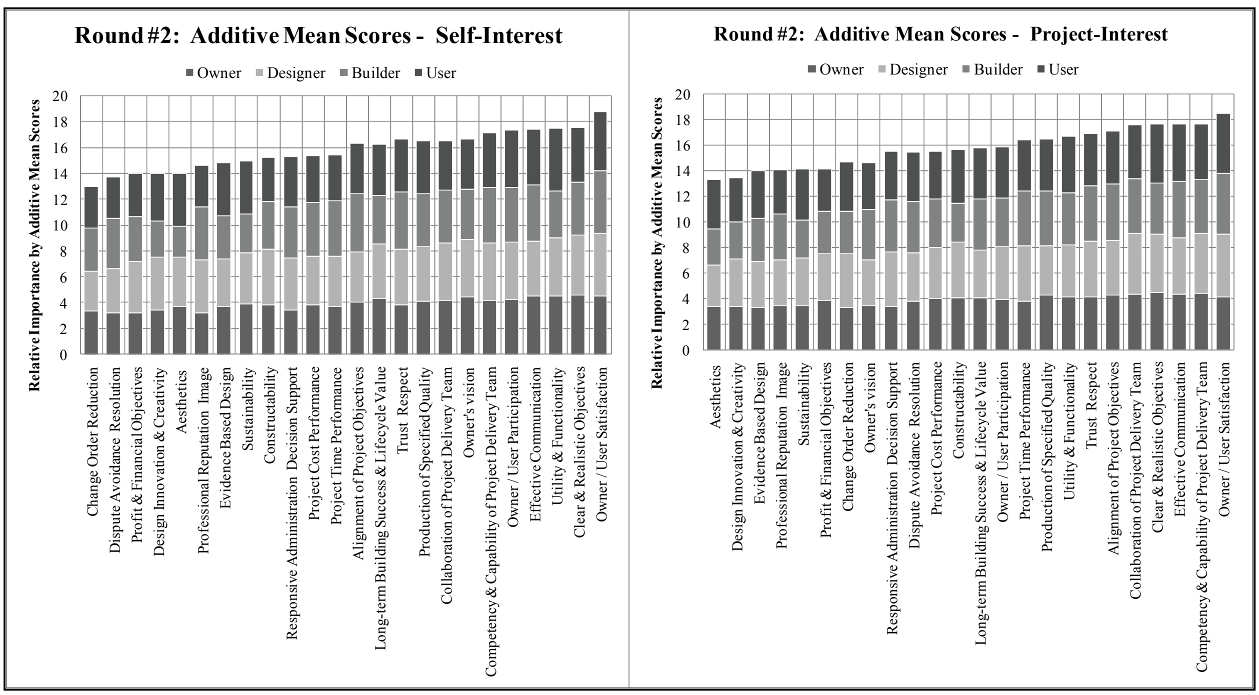


Figure 8.4. Round 2 -- Overall: relative importance by additive mean scores

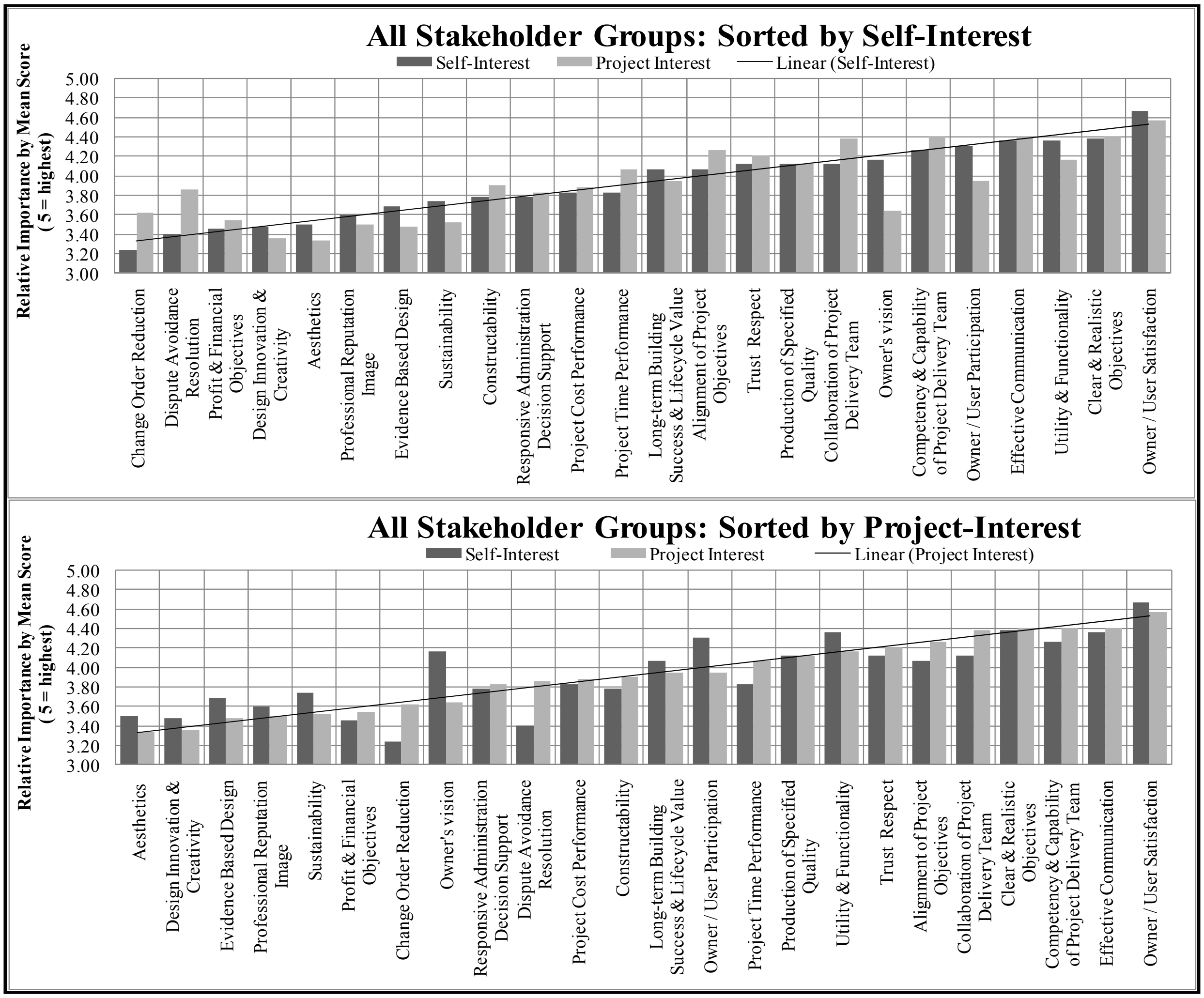


Figure 8.5. Round 2 - Overall: relative importance by average mean score

8.3.2. Owners

Round #2 Descriptive Statistics: Owners																	
		Self-Interest								Project-Interest							
Critical Success Factor	N	Range	Min	Max	Sum	Mean	Std. Error	Std. Dev.	Var.	Range	Min	Max	Sum	Mean	Std. Error	Std. Dev.	Var.
Aesthetics	13	2	3	5	48	3.692	0.175	0.630	0.397	3	2	5	44	3.385	0.241	0.870	0.756
Alignment of Project Objectives	13	2	3	5	52	4.000	0.226	0.816	0.667	2	3	5	55	4.231	0.201	0.725	0.526
Change Order Reduction	13	3	2	5	43	3.308	0.263	0.947	0.897	3	2	5	43	3.308	0.286	1.032	1.064
Collaboration of Project Delivery Team	13	2	3	5	54	4.154	0.222	0.801	0.641	2	3	5	56	4.308	0.208	0.751	0.564
Effective Communication	13	2	3	5	58	4.462	0.215	0.776	0.603	3	2	5	56	4.308	0.263	0.947	0.897
Competency & Capability of Project Team	13	3	2	5	54	4.154	0.249	0.899	0.808	2	3	5	57	4.385	0.213	0.768	0.590
Constructability	13	3	2	5	49	3.769	0.257	0.927	0.859	3	2	5	53	4.077	0.265	0.954	0.910
Project Cost Performance	13	4	1	5	49	3.769	0.303	1.092	1.192	3	2	5	52	4.000	0.277	1.000	1.000
Dispute Avoidance & Resolution	13	3	2	5	41	3.154	0.249	0.899	0.808	3	2	5	49	3.769	0.343	1.235	1.526
Design Innovation & Creativity	13	3	2	5	44	3.385	0.266	0.961	0.923	3	2	5	44	3.385	0.213	0.768	0.590
Evidence Based Design	13	4	1	5	48	3.692	0.286	1.032	1.064	4	1	5	43	3.308	0.308	1.109	1.231
Long-term Bldg. Success & Lifecycle Value	13	2	3	5	56	4.308	0.208	0.751	0.564	3	2	5	53	4.077	0.265	0.954	0.910
Owner / User Participation	13	2	3	5	55	4.231	0.231	0.832	0.692	3	2	5	51	3.923	0.265	0.954	0.910
Owner / User Satisfaction	13	2	3	5	58	4.462	0.183	0.660	0.436	2	3	5	54	4.154	0.222	0.801	0.641
Profit & Financial Objectives	13	4	1	5	41	3.154	0.296	1.068	1.141	2	3	5	50	3.846	0.249	0.899	0.808
Production of Specified Quality	13	2	3	5	53	4.077	0.239	0.862	0.744	2	3	5	55	4.231	0.201	0.725	0.526
Clear & Realistic Objectives	13	2	3	5	59	4.538	0.183	0.660	0.436	3	2	5	58	4.462	0.243	0.877	0.769
Professional Reputation & Image	13	3	2	5	41	3.154	0.249	0.899	0.808	3	2	5	45	3.462	0.291	1.050	1.103
Responsive Admin. & Decision Support	13	1	3	4	44	3.385	0.140	0.506	0.256	3	2	5	44	3.385	0.266	0.961	0.923
Sustainability	13	3	2	5	50	3.846	0.274	0.987	0.974	3	2	5	45	3.462	0.268	0.967	0.936
Project Time Performance	13	2	3	5	48	3.692	0.208	0.751	0.564	3	2	5	49	3.769	0.257	0.927	0.859
Trust & Respect	13	2	3	5	49	3.769	0.201	0.725	0.526	3	2	5	54	4.154	0.296	1.068	1.141
Utility & Functionality	13	1	4	5	58	4.462	0.144	0.519	0.269	3	2	5	54	4.154	0.249	0.899	0.808
Owner's vision	13	2	3	5	57	4.385	0.213	0.768	0.590	4	1	5	45	3.462	0.402	1.450	2.103

Table 8.2. Round 2 -- Owners: descriptive statistics

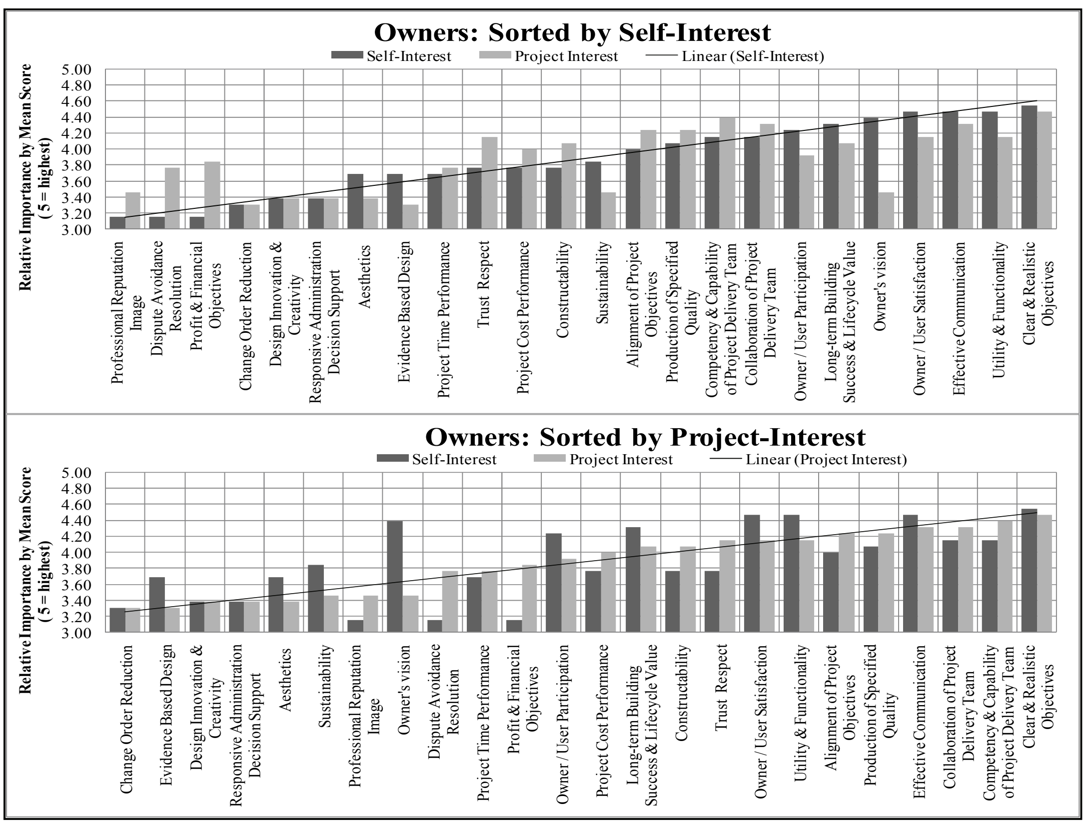


Figure 8.6. Round 2 -- Owners: relative importance by mean score

8.3.3. Designers

Round #2 Descriptive Statistics: Designers																	
		Self-Interest								Project-Interest							
Critical Success Factor	N	Range	Min	Max	Sum	Mean	Std. Error	Std. Dev.	Var.	Range	Min	Max	Sum	Mean	Std. Error	Std. Dev.	Var.
Aesthetics	9	1	3	4	34	3.778	0.147	0.441	0.194	3	1	4	29	3.222	0.324	0.972	0.944
Alignment of Project Objectives	9	2	3	5	35	3.889	0.261	0.782	0.611	2	3	5	39	4.333	0.236	0.707	0.500
Change Order Reduction	9	3	1	4	28	3.111	0.309	0.928	0.861	2	3	5	38	4.222	0.222	0.667	0.444
Collaboration of Project Delivery Team	9	2	3	5	40	4.444	0.294	0.882	0.778	1	4	5	43	4.778	0.147	0.441	0.194
Effective Communication	9	2	3	5	38	4.222	0.278	0.833	0.694	2	3	5	40	4.444	0.242	0.726	0.528
Competency & Capability of Project Team	9	2	3	5	40	4.444	0.242	0.726	0.528	1	4	5	42	4.667	0.167	0.500	0.250
Constructability	9	1	4	5	39	4.333	0.167	0.500	0.250	2	3	5	39	4.333	0.236	0.707	0.500
Project Cost Performance	9	1	3	4	34	3.778	0.147	0.441	0.194	2	3	5	36	4.000	0.236	0.707	0.500
Dispute Avoidance & Resolution	9	1	3	4	31	3.444	0.176	0.527	0.278	2	3	5	34	3.778	0.222	0.667	0.444
Design Innovation & Creativity	9	2	3	5	37	4.111	0.200	0.601	0.361	3	1	4	33	3.667	0.333	1.000	1.000
Evidence Based Design	9	3	2	5	33	3.667	0.289	0.866	0.750	3	2	5	32	3.556	0.294	0.882	0.778
Long-term Bldg. Success & Lifecycle Value	9	2	3	5	38	4.222	0.278	0.833	0.694	3	2	5	33	3.667	0.333	1.000	1.000
Owner / User Participation	9	2	3	5	40	4.444	0.242	0.726	0.528	3	2	5	37	4.111	0.309	0.928	0.861
Owner / User Satisfaction	9	1	4	5	44	4.889	0.111	0.333	0.111	1	4	5	44	4.889	0.111	0.333	0.111
Profit & Financial Objectives	9	2	3	5	36	4.000	0.236	0.707	0.500	2	3	5	33	3.667	0.289	0.866	0.750
Production of Specified Quality	9	2	3	5	38	4.222	0.278	0.833	0.694	3	2	5	35	3.889	0.389	1.167	1.361
Clear & Realistic Objectives	9	1	4	5	42	4.667	0.167	0.500	0.250	1	4	5	41	4.556	0.176	0.527	0.278
Professional Reputation & Image	9	2	3	5	37	4.111	0.309	0.928	0.861	3	2	5	32	3.556	0.338	1.014	1.028
Responsive Admin. & Decision Support	9	2	3	5	36	4.000	0.236	0.707	0.500	2	3	5	38	4.222	0.278	0.833	0.694
Sustainability	9	2	3	5	36	4.000	0.167	0.500	0.250	3	2	5	33	3.667	0.289	0.866	0.750
Project Time Performance	9	3	2	5	35	3.889	0.261	0.782	0.611	1	4	5	39	4.333	0.167	0.500	0.250
Trust & Respect	9	2	3	5	39	4.333	0.236	0.707	0.500	2	3	5	39	4.333	0.236	0.707	0.500
Utility & Functionality	9	2	3	5	41	4.556	0.242	0.726	0.528	4	1	5	36	4.000	0.441	1.323	1.750
Owner's vision	9	2	3	5	40	4.444	0.242	0.726	0.528	3	1	4	32	3.556	0.338	1.014	1.028

Table 8.3. Round 2 -- Designers: Descriptive statistics

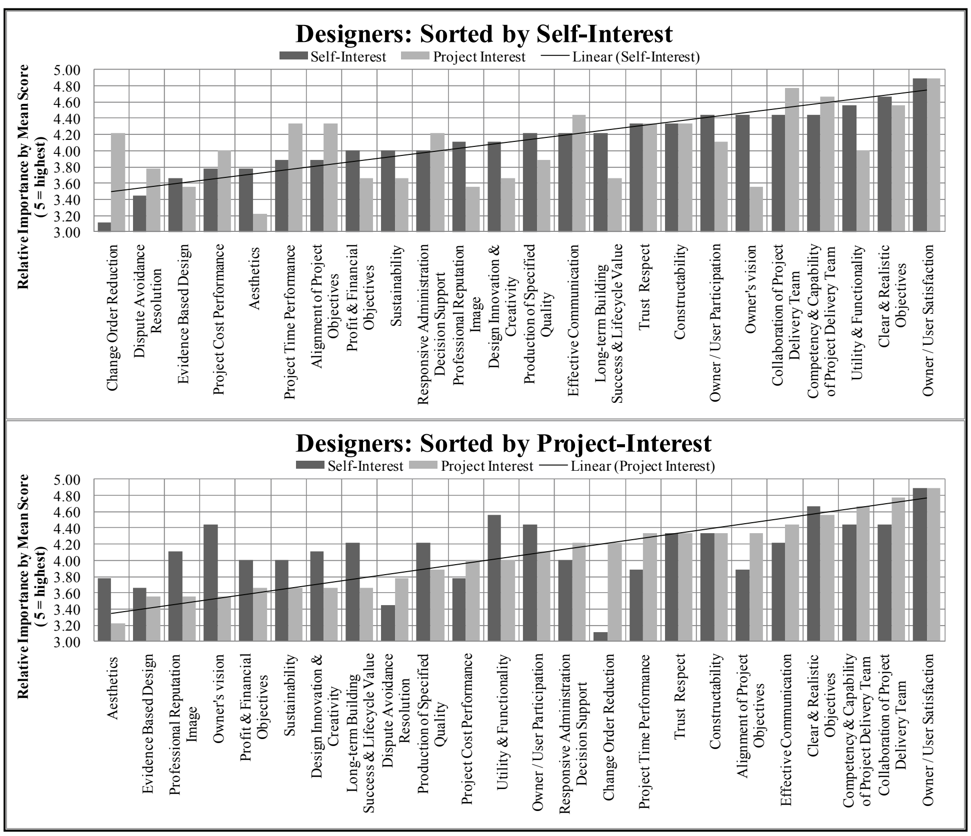


Figure 8.7. Round 2 -- Designers: relative importance by mean score

8.3.4. Builders

Critical Success Factor	N	Self-Interest								Project-Interest							
		Range	Min	Max	Sum	Mean	Std. Error	Std. Dev.	Var.	Range	Min	Max	Sum	Mean	Std. Error	Std. Dev.	Var.
Aesthetics	10	3	1	4	24	2.400	0.267	0.843	0.711	3	1	4	28	2.800	0.327	1.033	1.067
Alignment of Project Objectives	10	1	4	5	45	4.500	0.167	0.527	0.278	2	3	5	44	4.400	0.267	0.843	0.711
Change Order Reduction	10	3	2	5	33	3.300	0.260	0.823	0.678	3	2	5	33	3.300	0.260	0.823	0.678
Collaboration of Project Delivery Team	10	2	3	5	41	4.100	0.180	0.568	0.322	2	3	5	43	4.300	0.300	0.949	0.900
Effective Communication	10	1	4	5	44	4.400	0.163	0.516	0.267	2	3	5	44	4.400	0.221	0.699	0.489
Competency & Capability of Project Team	10	2	3	5	43	4.300	0.213	0.675	0.456	2	3	5	42	4.200	0.249	0.789	0.622
Constructability	10	2	3	5	37	3.700	0.260	0.823	0.678	4	1	5	30	3.000	0.422	1.333	1.778
Project Cost Performance	10	2	3	5	42	4.200	0.200	0.632	0.400	3	2	5	38	3.800	0.327	1.033	1.067
Dispute Avoidance & Resolution	10	3	2	5	39	3.900	0.314	0.994	0.989	2	3	5	40	4.000	0.258	0.816	0.667
Design Innovation & Creativity	10	2	2	4	28	2.800	0.200	0.632	0.400	2	2	4	29	2.900	0.233	0.738	0.544
Evidence Based Design	10	3	2	5	33	3.300	0.335	1.059	1.122	3	2	5	34	3.400	0.340	1.075	1.156
Long-term Bldg. Success & Lifecycle Value	10	2	3	5	37	3.700	0.260	0.823	0.678	2	3	5	40	4.000	0.258	0.816	0.667
Owner / User Participation	10	2	3	5	42	4.200	0.291	0.919	0.844	3	2	5	38	3.800	0.327	1.033	1.067
Owner / User Satisfaction	10	1	4	5	48	4.800	0.133	0.422	0.178	1	4	5	47	4.700	0.153	0.483	0.233
Profit & Financial Objectives	10	4	1	5	35	3.500	0.373	1.179	1.389	4	1	5	33	3.300	0.396	1.252	1.567
Production of Specified Quality	10	2	3	5	41	4.100	0.180	0.568	0.322	1	4	5	43	4.300	0.153	0.483	0.233
Clear & Realistic Objectives	10	2	3	5	41	4.100	0.233	0.738	0.544	2	3	5	40	4.000	0.258	0.816	0.667
Professional Reputation & Image	10	3	2	5	41	4.100	0.348	1.101	1.211	3	2	5	36	3.600	0.306	0.966	0.933
Responsive Admin. & Decision Support	10	2	3	5	40	4.000	0.258	0.816	0.667	2	3	5	41	4.100	0.277	0.876	0.767
Sustainability	10	3	2	5	30	3.000	0.333	1.054	1.111	2	2	4	30	3.000	0.258	0.816	0.667
Project Time Performance	10	2	3	5	43	4.300	0.213	0.675	0.456	2	3	5	43	4.300	0.213	0.675	0.456
Trust & Respect	10	2	3	5	44	4.400	0.221	0.699	0.489	1	4	5	43	4.300	0.153	0.483	0.233
Utility & Functionality	10	3	2	5	36	3.600	0.371	1.174	1.378	2	3	5	41	4.100	0.180	0.568	0.322
Owner's vision	10	2	3	5	39	3.900	0.277	0.876	0.767	3	2	5	39	3.900	0.277	0.876	0.767

Table 8.4. Round 2 -- Builders: descriptive statistics

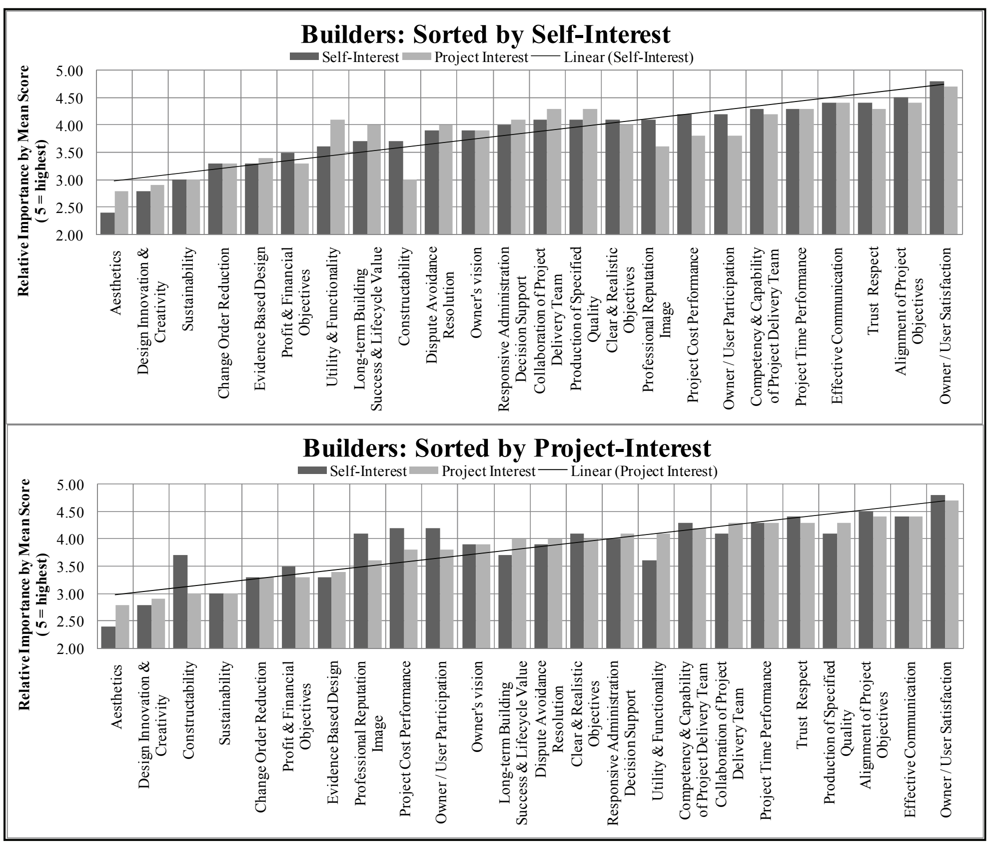


Figure 8.8. Round 2 -- Builders: Relative importance by mean score

8.3.5. Users

Round #2 Descriptive Statistics: Users																	
Critical Success Factor	N	Self-Interest								Project-Interest							
		Range	Min	Max	Sum	Mean	Std. Error	Std. Dev.	Var.	Range	Min	Max	Sum	Mean	Std. Error	Std. Dev.	Var.
Aesthetics	10	2	3	5	41	4.100	0.233	0.738	0.544	2	3	5	39	3.900	0.180	0.568	0.322
Alignment of Project Objectives	10	3	2	5	39	3.900	0.314	0.994	0.989	2	3	5	41	4.100	0.233	0.738	0.544
Change Order Reduction	10	4	1	5	32	3.200	0.327	1.033	1.067	3	2	5	38	3.800	0.327	1.033	1.067
Collaboration of Project Delivery Team	10	2	3	5	38	3.800	0.291	0.919	0.844	3	2	5	42	4.200	0.291	0.919	0.844
Effective Communication	10	2	3	5	43	4.300	0.260	0.823	0.678	2	3	5	45	4.500	0.224	0.707	0.500
Competency & Capability of Project Team	10	2	3	5	42	4.200	0.249	0.789	0.622	1	4	5	44	4.400	0.163	0.516	0.267
Constructability	10	4	1	5	34	3.400	0.340	1.075	1.156	2	3	5	42	4.200	0.200	0.632	0.400
Project Cost Performance	10	3	2	5	36	3.600	0.306	0.966	0.933	3	2	5	37	3.700	0.300	0.949	0.900
Dispute Avoidance & Resolution	10	3	2	5	32	3.200	0.291	0.919	0.844	2	3	5	39	3.900	0.233	0.738	0.544
Design Innovation & Creativity	10	2	3	5	37	3.700	0.213	0.675	0.456	1	3	4	35	3.500	0.167	0.527	0.278
Evidence Based Design	10	2	3	5	41	4.100	0.233	0.738	0.544	1	3	4	37	3.700	0.153	0.483	0.233
Long-term Bldg. Success & Lifecycle Value	10	2	3	5	40	4.000	0.258	0.816	0.667	2	3	5	40	4.000	0.258	0.816	0.667
Owner / User Participation	10	2	3	5	44	4.400	0.221	0.699	0.489	3	2	5	40	4.000	0.258	0.816	0.667
Owner / User Satisfaction	10	1	4	5	46	4.600	0.163	0.516	0.267	1	4	5	47	4.700	0.153	0.483	0.233
Profit & Financial Objectives	10	4	1	5	33	3.300	0.367	1.160	1.344	4	1	5	33	3.300	0.448	1.418	2.011
Production of Specified Quality	10	2	3	5	41	4.100	0.180	0.568	0.322	3	2	5	40	4.000	0.258	0.816	0.667
Clear & Realistic Objectives	10	2	3	5	42	4.200	0.249	0.789	0.622	1	4	5	46	4.600	0.163	0.516	0.267
Professional Reputation & Image	10	2	2	4	32	3.200	0.291	0.919	0.844	4	1	5	34	3.400	0.371	1.174	1.378
Responsive Admin. & Decision Support	10	2	3	5	39	3.900	0.233	0.738	0.544	3	2	5	38	3.800	0.249	0.789	0.622
Sustainability	10	2	3	5	41	4.100	0.180	0.568	0.322	2	3	5	40	4.000	0.211	0.667	0.444
Project Time Performance	10	2	2	4	35	3.500	0.224	0.707	0.500	3	2	5	40	4.000	0.333	1.054	1.111
Trust & Respect	10	2	3	5	41	4.100	0.233	0.738	0.544	2	3	5	41	4.100	0.277	0.876	0.767
Utility & Functionality	10	1	4	5	48	4.800	0.133	0.422	0.178	1	4	5	44	4.400	0.163	0.516	0.267
Owner's vision	10	2	3	5	39	3.900	0.233	0.738	0.544	2	3	5	37	3.700	0.213	0.675	0.456

Table 8.5. Round 2 -- Users: Descriptive statistics

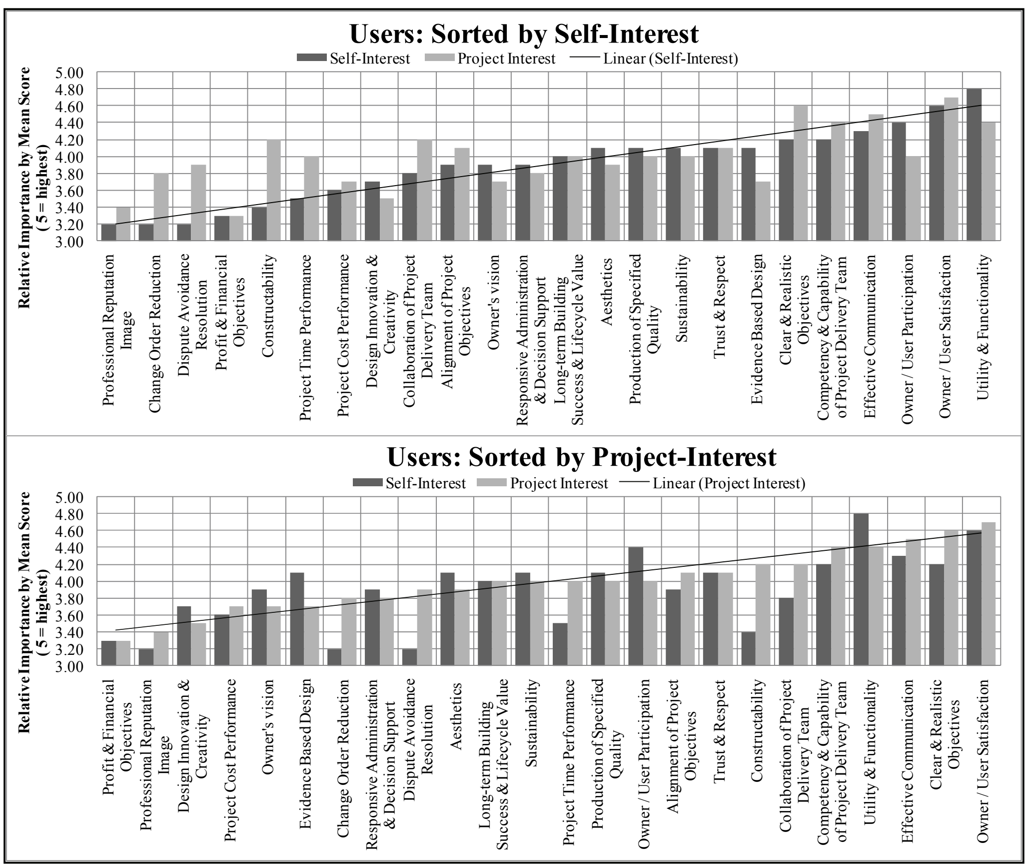


Figure 8.9. Round 2 -- Users: relative importance by mean score

8.4. Round 2 -- Inter-Rater Agreement

Round #2 Inter-Rater Agreement										
Critical Success Factors	Self-Interest					Project-Interest				
	Mean Rank					Mean Rank				
	O	D	B	U	All	O	D	B	U	All
Owner / User Satisfaction	17.08	19.33	19.60	17.95	18.37	14.73	19.28	18.35	18.75	17.52
Clear & Realistic Objectives	17.38	17.00	14.10	14.50	15.83	16.92	16.67	13.80	17.75	16.32
Effective Communication	16.92	13.50	16.70	15.30	15.75	16.38	15.56	16.55	16.35	16.24
Competency & Capability of Project Team	15.23	15.61	15.80	15.45	15.50	16.46	17.39	15.45	16.30	16.38
Utility & Functionality	17.38	16.06	10.40	19.50	15.94	14.65	13.22	14.70	16.00	14.68
Collaboration of Project Delivery Team	14.81	15.44	14.20	11.80	14.08	16.15	18.00	15.95	14.95	16.21
Trust & Respect	11.46	14.50	16.35	14.05	13.89	14.96	14.83	15.80	13.65	14.82
Alignment of Project Objectives	13.23	10.50	17.40	13.30	13.65	14.92	14.00	16.95	12.95	14.74
Owner / User Participation	14.50	15.33	14.90	16.55	15.26	12.58	13.56	12.05	12.60	12.67
Production of Specified Quality	14.08	13.22	14.50	13.95	13.96	14.96	11.94	15.35	12.50	13.82
Long-term Bldg. Success & Lifecycle Value	15.50	13.22	10.30	13.80	13.37	14.08	9.39	13.15	12.30	12.43
Owner's vision	16.81	15.44	12.30	12.35	14.38	11.04	9.00	13.15	8.80	10.57
Project Time Performance	10.35	10.50	15.60	8.50	11.19	11.00	14.44	15.95	13.15	13.43
Constructability	11.23	13.50	11.05	10.00	11.38	13.81	15.11	6.75	14.45	12.56
Project Cost Performance	12.15	9.06	15.05	9.95	11.65	13.00	11.17	12.00	9.80	11.61
Responsive Admin. & Decision Support	8.77	11.33	13.55	11.65	11.14	8.58	13.39	14.50	10.90	11.57
Sustainability	12.46	11.06	6.30	13.95	11.05	9.12	9.33	6.35	12.45	9.30
Evidence Based Design	12.00	8.72	8.25	13.85	10.85	9.04	7.94	9.40	9.45	8.99
Dispute Avoidance & Resolution	7.12	6.61	12.90	6.70	8.29	11.42	8.72	13.75	11.20	11.35
Profit & Financial Objectives	7.69	11.72	10.65	8.70	9.50	11.81	9.83	9.00	8.00	9.81
Professional Reputation & Image	6.73	12.28	14.45	7.70	9.99	9.00	8.72	11.05	8.35	9.27
Aesthetics	10.73	9.06	3.05	13.45	9.19	8.96	6.00	6.20	11.20	8.20
Design Innovation & Creativity	8.58	12.00	4.60	9.70	8.63	9.19	9.67	5.70	7.40	8.04
Change Order Reduction	7.81	5.00	8.00	7.35	7.14	7.23	12.83	8.10	10.75	9.48

Statistic	Self-Interest					Project-Interest				
	O	D	B	U	All	O	D	B	U	All
N	13	9	10	10	42	13	9	10	10	42
Kendall's W[a]	.300	.277	.410	.290	.207	.218	.297	.350	.252	.208
Chi-square	89.72	57.39	94.38	66.77	199.95	65.31	61.39	80.48	57.98	201.17
df	23	23	23	23	23	23	23	23	23	23
Asymp. Sig.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

a. Kendall's Coefficient of Concordance

Table 8.6. Round 2 inter-rater agreement table

A 0.001 significance level is achieve both overall and by all stakeholder groups individually in both the self-interest, and project-interest categories. Overall the round 2 survey demonstrates measures of inter-rater agreement overall and for every stakeholder group. Overall self-interest and project-interest scores for Kendall's coefficient of concordance are highly consistent at 0.207 and 0.208 respectively. Builders indicate the greatest level of agreement within both self and project perspectives. Inter-rater agreement is validated for the round 2 survey.

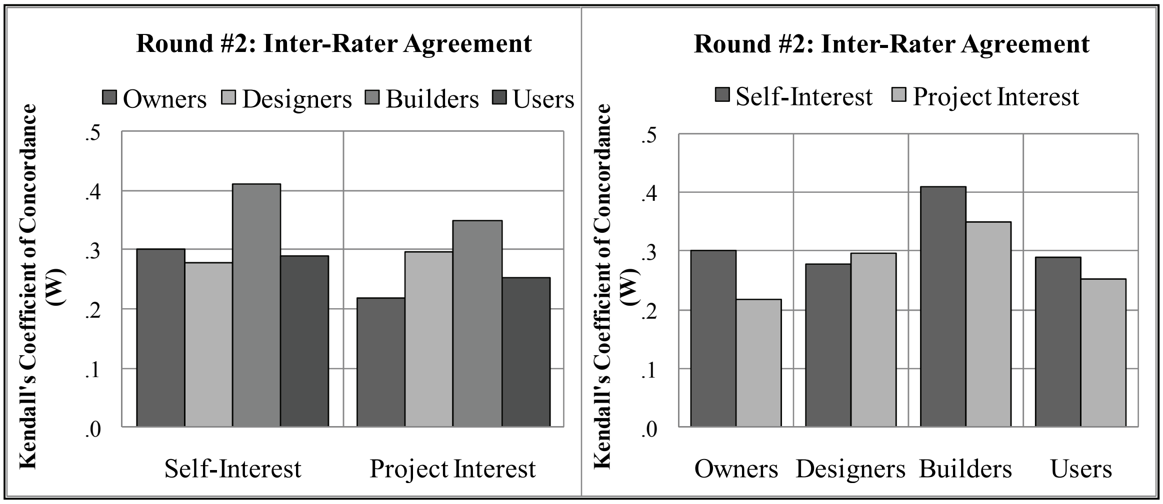


Figure 8.10. Round 2 inter-rate agreement by stakeholder group

Later on in the round 2 report the inter-rater agreement will be compared overall, and by each stakeholder group to the results from round 1 to determine if an increase in consensus has been successfully achieved by the panel(s) of experts.

8.5. Reliability Test

Round #2: Intraclass Correlation									
Perspective	Stakeholder Group	Reliability Statistics							
		N	Cronbach's Alpha	95% Confidence Interval		F Test True Value 0			
				Lower Bound	Upper Bound	Value	df1	df2	Sig
Overall Average	All	42	0.918	0.881	0.948	12.168	48	1968	0.000
	Owner	13	0.857	0.790	0.909	6.983	48	576	0.000
	Designer	9	0.776	0.668	0.859	4.466	48	384	0.000
	Builder	10	0.820	0.734	0.886	5.548	48	432	0.000
	User	10	0.667	0.508	0.790	2.999	48	432	0.000
Self-Interest	All	42	0.900	0.833	0.949	10.011	23	943	0.000
	Owner	13	0.786	0.634	0.893	4.669	23	276	0.000
	Designer	9	0.671	0.430	0.837	3.041	23	184	0.000
	Builder	10	0.837	0.719	0.919	6.141	23	207	0.000
	User	10	0.720	0.517	0.861	3.572	23	207	0.000
Project-Interest	All	42	0.895	0.824	0.947	9.498	23	943	0.000
	Owner	13	0.648	0.399	0.824	2.839	23	276	0.000
	Designer	9	0.665	0.419	0.834	2.981	23	184	0.000
	Builder	10	0.798	0.651	0.899	4.939	23	207	0.000
	User	10	0.616	0.337	0.809	2.602	23	207	0.000

Table 8.7. Round 2 Reliability test

Round #2 Intraclass Correlation Summary				
CSF Category	Stakeholder Group	N	Cronbach's Alpha	
			Self-Interest	Project-Interest
ALL	**All**	**42**	**0.900**	**0.895**
	Owner	13	0.786	0.648
	Designer	9	0.671	0.665
	Builder	10	0.837	0.798
	User	10	0.720	0.616

Table 8.8. Round 2 Reliability summary by stakeholder

The round 2 survey tests as very reliable at a 0.001 significance level. Each stakeholder group scored as reliable with a range from minimally reliable to strong reliability for the designer and builder stakeholder groups respectively. Based on the Cronbach's alpha scores the round 2 survey is validated for reliability.

8.6. Round 2 Correlations

Round #2: Correlation among Stakeholder Groups								
Correlation Matrix *	Self-Interest				Project-Interest			
	Owner	Designer	Builder	User	Owner	Designer	Builder	User
Owner	1.000	0.722 [b]	0.386	0.798 [b]	1.000	0.679 [b]	0.649 [b]	0.716 [b]
Designer	--	1.000	0.431 [a]	0.642 [b]	--	1.000	0.648 [b]	0.730 [b]
Builder	--	--	1.000	0.168	--	--	1.000	0.599 [b]
User	--	--	--	1.000	--	--	--	1.000

Notes:
[a] Correlation is significant at the 0.05 level (2-tailed).
[b] Correlation is significant at the 0.01 level (2-tailed).
* Correlation Coefficient based on mean scores, and calculated in SPSS using Pearsons Correlation. (N = 24 CSFs)

Table 8.9. Round 2 Stakeholder correlation matrix

A significant degree of correlation is indicated between the owners, designer, and users in the self-interest category. In the project-interest category there is consistent correlation among all stakeholders.

Correlation Matrix among Critical Success Factors (for Round #2)

Correlation Matrix *	Self-Interest																							
	Aesthetics	Alignment of Project Objectives	Change Order Reduction	Collaboration of Project Delivery Team	Effective Communication	Competency & Capability of Project Delivery Team	Constructability	Project Cost Performance	Dispute Avoidance & Resolution	Design Innovation & Creativity	Evidence Based Design	Long-term Build. Success / Lifecycle Value	Owner / User Participa-tion	Owner / User Satisfaction	Profit and Financial Objectives	Production of Specified Quality	Clear & Realistic Objectives	Profess-ional Reputation & Image	Responsive Administration & Decision Support	Sustainability	Project Time Performance	Trust & Respect	Utility & Functionality	Owners vision
Aesthetics	1.000	-0.982	-0.536	-0.127	-0.421	-0.174	0.015	-0.993 [b]	-0.916	0.835	0.911	0.741	0.728	-0.373	-0.056	0.212	0.511	-0.606	-0.274	0.995 [b]	-0.941	-0.512	0.999 [b]	0.376
Alignment of Project Objectives	--	1.000	0.627	-0.061	0.496	0.023	-0.203	0.953 [a]	0.871	-0.910	-0.824	-0.810	-0.772	0.254	-0.098	-0.368	-0.651	0.477	0.241	-0.995 [b]	0.865	0.447	-0.979 [a]	-0.520
Change Order Reduction	--	--	1.000	-0.375	0.979 [a]	-0.714	-0.556	0.471	0.167	-0.883	-0.403	-0.295	-0.955 [a]	-0.583	-0.783	-0.885	-0.473	-0.331	-0.555	-0.599	0.252	-0.411	-0.558	-0.316
Collaboration of Project Delivery Team	--	--	--	1.000	-0.278	0.722	0.979 [a]	0.241	0.219	0.326	-0.505	0.399	0.133	0.548	0.733	0.746	0.755	0.633	0.065	-0.035	0.412	0.256	-0.142	0.795
Effective Communication	--	--	--	--	1.000	-0.742	-0.462	0.369	0.025	-0.780	-0.359	-0.096	-0.928	-0.668	-0.793	-0.847	-0.291	-0.408	-0.705	-0.479	0.157	-0.554	-0.450	-0.131
Competency & Capability of Project	--	--	--	--	--	1.000	0.797	0.264	0.499	0.392	-0.349	-0.090	0.478	0.956 [a]	0.993 [b]	0.918	0.330	0.889	0.730	-0.085	0.487	0.800	-0.157	0.279
Constructability	--	--	--	--	--	--	1.000	0.102	0.147	0.492	-0.356	0.434	0.331	0.610	0.824	0.861	0.789	0.629	0.169	0.110	0.303	0.308	0.005	0.790
Project Cost Performance	--	--	--	--	--	--	--	1.000	0.927	-0.775	-0.949	-0.684	-0.688	0.439	0.149	-0.113	-0.415	0.674	0.288	-0.977 [a]	0.971 [a]	0.542	-0.994 [b]	-0.280
Dispute Avoidance & Resolution	--	--	--	--	--	--	--	--	1.000	-0.590	-0.827	-0.802	-0.393	0.695	0.390	0.115	-0.474	0.832	0.626	-0.889	0.957 [a]	0.813	-0.901	-0.400
Design Innovation & Creativity	--	--	--	--	--	--	--	--	--	1.000	0.632	0.683	0.924	0.170	0.499	0.714	0.707	-0.072	0.107	0.883	-0.601	-0.063	0.841	0.560
Evidence Based Design	--	--	--	--	--	--	--	--	--	--	1.000	0.423	0.655	-0.440	-0.253	-0.038	0.111	-0.701	-0.141	0.875	-0.952 [a]	-0.437	0.922	-0.037
Long-term Build. Success / Lifecycle Value	--	--	--	--	--	--	--	--	--	--	--	1.000	0.358	-0.378	0.014	0.277	0.896	-0.426	-0.623	0.767	-0.626	-0.662	0.714	0.868
Owner / User Participation	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.347	0.565	0.713	0.405	0.052	0.430	0.767	-0.509	0.213	0.750	0.227
Owner / User Satisfaction	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.919	0.774	0.042	0.949	0.866	-0.298	0.630	0.940	-0.349	0.001
Profit and Financial Objectives	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.959 [b]	0.414	0.828	0.690	0.035	0.383	0.738	-0.040	0.349
Production of Specified Quality	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.612	0.641	0.533	0.303	0.129	0.535	0.224	0.523
Clear & Realistic Objectives	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.019	-0.344	0.576	-0.277	-0.301	0.488	0.982 [a]
Professional Reputation & Image	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.726	-0.532	0.830	0.891	-0.591	0.039
Responsive Administration & Decision	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	-0.237	0.428	0.951 [a]	-0.235	-0.433
Sustainability	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	-0.903	-0.463	0.994 [b]	0.440
Project Time Performance	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.679	-0.938	-0.165
Trust & Respect	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	-0.480	-0.339
Utility & Functionality	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.347
Owners vision	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000

Notes:

[a] Correlation is significant at the 0.05 level (2-tailed).

[b] Correlation is significant at the 0.01 level (2-tailed).

* Correlation Coefficient based on mean score by stakeholder groups, and calculated in SPSS using Pearsons Correlation. (N = 4 Stakeholder Groups: Owner; Designer; Builder; User)

Table 8.10. Round 2 -- Self-Interest: CSF Correlation matrix

Correlation Matrix among Critical Success Factors (for Round #2)

Correlation Matrix *	Project-Interest																								
	Aesthetics	Alignment of Project Objectives	Change Order Reduction	Collaboration of Project Delivery Team	Effective Communication	Competency & Capability o Project Delivery Team	Constructability	Project Cost Performance	Dispute Avoidance & Resolution	Design Innovation & Creativity	Evidence Based Design	Long-term Build. Success / Lifecycle Value	Owner / User Participa-tion	Owner / User Satisfaction	Profit and Financial Objectives	Production of Specified Quality	Clear & Realistic Objectives	Profess-ional Reputation & Image	Responsive Administration & Decision Support	Sustainability	Project Time Performance	Trust & Respect	Utility & Functionality	Owners vision
Aesthetics	1.000	-0.982	0.318	-0.303	0.444	0.286	0.732	-0.330	-0.316	0.644	0.640	0.157	0.499	-0.115	-0.023	-0.508	0.826	-0.950	-0.440	0.928	-0.565	-0.825	0.800	-0.398
Alignment of Project Objectives	--	1.000	-0.134	0.466	-0.345	-0.116	-0.626	0.384	0.241	-0.509	-0.533	-0.340	-0.334	0.253	0.045	0.337	-0.729	0.988 [a]	0.564	-0.840	0.674	0.916	-0.868	0.353
Change Order Reduction	--	--	1.000	0.733	0.644	0.897	0.673	0.145	-0.402	0.803	0.717	-0.884	0.930	0.704	0.047	-0.978 [a]	0.657	-0.019	0.554	0.648	0.450	0.272	-0.137	-0.265
Collaboration of Project Delivery Team	--	--	--	1.000	0.055	0.824	0.373	0.674	-0.521	0.520	0.073	-0.938	0.673	0.485	0.435	-0.610	0.257	0.511	0.576	0.057	0.565	0.733	-0.768	-0.350
Effective Communication	--	--	--	--	1.000	0.258	0.211	-0.662	0.336	0.310	0.965 [a]	-0.396	0.439	0.806	-0.701	-0.660	0.314	-0.194	0.568	0.587	0.455	-0.048	0.451	0.400
Competency & Capability of Project	--	--	--	--	--	1.000	0.824	0.530	-0.756	0.912	0.402	-0.826	0.966 [a]	0.360	0.483	-0.891	0.758	-0.061	0.267	0.596	0.186	0.231	-0.315	-0.638
Constructability	--	--	--	--	--	--	1.000	0.332	-0.825	0.980 [a]	0.448	-0.380	0.891	-0.028	0.507	-0.787	0.987 [a]	-0.606	-0.242	0.868	-0.350	-0.357	0.178	-0.810
Project Cost Performance	--	--	--	--	--	--	--	1.000	-0.790	0.345	-0.563	-0.381	0.319	-0.313	0.927	-0.087	0.181	0.304	-0.134	-0.179	-0.084	0.396	-0.767	-0.728
Dispute Avoidance & Resolution	--	--	--	--	--	--	--	--	1.000	-0.790	0.113	0.332	-0.682	0.337	-0.903	0.462	-0.733	0.292	0.371	-0.440	0.406	0.106	0.267	0.982 [a]
Design Innovation & Creativity	--	--	--	--	--	--	--	--	--	1.000	0.519	-0.554	0.964 [a]	0.154	0.452	-0.884	0.959 [a]	-0.466	-0.046	0.847	-0.157	-0.188	0.067	-0.739
Evidence Based Design	--	--	--	--	--	--	--	--	--	--	1.000	-0.390	0.598	0.684	-0.528	-0.774	0.547	-0.394	0.398	0.778	0.265	-0.208	0.526	0.160
Long-term Build. Success / Lifecycle Value	--	--	--	--	--	--	--	--	--	--	--	1.000	-0.746	-0.740	-0.137	0.770	-0.309	-0.435	-0.750	-0.223	-0.704	-0.683	0.566	0.151
Owner / User Participation	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.396	0.331	-0.963 [a]	0.864	-0.261	0.222	0.776	0.112	0.039	-0.066	-0.586
Owner / User Satisfaction	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	-0.566	-0.595	-0.003	0.402	0.942	0.164	0.884	0.552	-0.147	0.488
Profit and Financial Objectives	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	-0.068	0.383	-0.058	-0.467	0.032	-0.439	0.024	-0.476	-0.903
Production of Specified Quality	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	-0.790	0.229	-0.390	-0.793	-0.269	-0.065	-0.038	0.355
Clear & Realistic Objectives	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	-0.698	-0.256	0.934	-0.377	-0.458	0.324	-0.733
Professional Reputation & Image	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.686	-0.773	0.782	0.954 [a]	-0.841	0.422
Responsive Administration & Decision	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	-0.152	0.989 [a]	0.790	-0.428	0.539
Sustainability	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	-0.293	-0.557	0.575	-0.452
Project Time Performance	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.854	-0.512	0.572
Trust & Respect	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	-0.881	0.271
Utility & Functionality	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.136
Owners vision	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000

Notes:

[a] Correlation is significant at the 0.05 level (2-tailed).

* Correlation Coefficient based on mean score by stakeholder groups, and calculated in SPSS using Pearsons Correlation. (N = 4 Stakeholder Groups: Owner; Designer; Builder; User)

Table 8.11. Round 2 -- Project-Interest: CSF Correlation matrix

8.7. Relative Importance by Rank-Orders

SELF-INTEREST															
Critical Success Factor	Mean					Rank					% Rank				
	O	D	B	U	ALL	O	D	B	U	ALL	O	D	B	U	ALL
Aesthetics	3.692	3.778	2.400	4.100	3.500	17.0	20.5	24.0	9.0	20.0	0.333	0.188	0.042	0.667	0.208
Alignment of Project Objectives	4.000	3.889	4.500	3.900	4.071	11.0	18.5	2.0	14.0	11.5	0.583	0.271	0.958	0.458	0.563
Change Order Reduction	3.308	3.111	3.300	3.200	3.238	21.0	24.0	20.5	23.0	24.0	0.167	0.042	0.188	0.083	0.042
Collaboration of Project Delivery Team	4.154	4.444	4.100	3.800	4.119	8.5	5.5	10.5	16.0	9.0	0.688	0.813	0.604	0.375	0.667
Effective Communication	4.462	4.222	4.400	4.300	4.357	3.0	11.0	3.5	4.0	3.5	0.917	0.583	0.896	0.875	0.896
Competency & Capability of Project Team	4.154	4.444	4.300	4.200	4.262	8.5	5.5	5.5	5.5	6.0	0.688	0.813	0.813	0.813	0.792
Constructability	3.769	4.333	3.700	3.400	3.786	14.0	8.5	16.5	20.0	15.5	0.458	0.688	0.354	0.208	0.396
Project Cost Performance	3.769	3.778	4.200	3.600	3.833	14.0	20.5	7.5	18.0	13.5	0.458	0.188	0.729	0.292	0.479
Dispute Avoidance & Resolution	3.154	3.444	3.900	3.200	3.405	23.0	23.0	14.5	23.0	23.0	0.083	0.083	0.438	0.083	0.083
Design Innovation & Creativity	3.385	4.111	2.800	3.700	3.476	19.5	13.5	23.0	17.0	21.0	0.229	0.479	0.083	0.333	0.167
Evidence Based Design	3.692	3.667	3.300	4.100	3.690	17.0	22.0	20.5	9.0	18.0	0.333	0.125	0.188	0.667	0.292
Long-term Bldg. Success & Lifecycle Valu	4.308	4.222	3.700	4.000	4.071	6.0	11.0	16.5	12.0	11.5	0.792	0.583	0.354	0.542	0.563
Owner / User Participation	4.231	4.444	4.200	4.400	4.310	7.0	5.5	7.5	3.0	5.0	0.750	0.813	0.729	0.917	0.833
Owner / User Satisfaction	4.462	4.889	4.800	4.600	4.667	3.0	1.0	1.0	2.0	1.0	0.917	1.000	1.000	0.958	1.000
Profit & Financial Objectives	3.154	4.000	3.500	3.300	3.452	23.0	16.0	19.0	21.0	22.0	0.083	0.375	0.250	0.167	0.125
Production of Specified Quality	4.077	4.222	4.100	4.100	4.119	10.0	11.0	10.5	9.0	9.0	0.625	0.583	0.604	0.667	0.667
Clear & Realistic Objectives	4.538	4.667	4.100	4.200	4.381	1.0	2.0	10.5	5.5	2.0	1.000	0.958	0.604	0.813	0.958
Professional Reputation & Image	3.154	4.111	4.100	3.200	3.595	23.0	13.5	10.5	23.0	19.0	0.083	0.479	0.604	0.083	0.250
Responsive Admin. & Decision Support	3.385	4.000	4.000	3.900	3.786	19.5	16.0	13.0	14.0	15.5	0.229	0.375	0.500	0.458	0.396
Sustainability	3.846	4.000	3.000	4.100	3.738	12.0	16.0	22.0	9.0	17.0	0.542	0.375	0.125	0.667	0.333
Project Time Performance	3.692	3.889	4.300	3.500	3.833	17.0	18.5	5.5	19.0	13.5	0.333	0.271	0.813	0.250	0.479
Trust & Respect	3.769	4.333	4.400	4.100	4.119	14.0	8.5	3.5	9.0	9.0	0.458	0.688	0.896	0.667	0.667
Utility & Functionality	4.462	4.556	3.600	4.800	4.357	3.0	3.0	18.0	1.0	3.5	0.917	0.917	0.292	1.000	0.896
Owner's vision	4.385	4.444	3.900	3.900	4.167	5.0	5.5	14.5	14.0	7.0	0.833	0.813	0.438	0.458	0.750
Stakeholder Groups Types: O = Owner; D = Designer; B = Builder; U = User; ALL															

PROJECT-INTEREST															
Critical Success Factor	Mean					Rank					% Rank				
	O	D	B	U	ALL	O	D	B	U	ALL	O	D	B	U	ALL
Aesthetics	3.385	3.222	2.800	3.900	3.333	21.0	24.0	24.0	15.5	24.0	0.167	0.042	0.042	0.396	0.042
Alignment of Project Objectives	4.231	4.333	4.400	4.100	4.262	5.5	7.5	2.5	8.5	6.0	0.813	0.729	0.938	0.688	0.792
Change Order Reduction	3.308	4.222	3.300	3.800	3.619	23.5	10.5	19.5	17.5	18.0	0.063	0.604	0.229	0.313	0.292
Collaboration of Project Delivery Team	4.308	4.778	4.300	4.200	4.381	3.5	2.0	5.5	6.5	5.0	0.896	0.958	0.813	0.771	0.833
Effective Communication	4.308	4.444	4.400	4.500	4.405	3.5	5.0	2.5	3.0	3.0	0.896	0.833	0.938	0.917	0.917
Competency & Capability of Project Team	4.385	4.667	4.200	4.400	4.405	2.0	3.0	8.0	4.5	3.0	0.958	0.917	0.708	0.854	0.917
Constructability	4.077	4.333	3.000	4.200	3.905	10.5	7.5	21.5	6.5	13.0	0.604	0.729	0.146	0.771	0.500
Project Cost Performance	4.000	4.000	3.800	3.700	3.881	12.0	13.5	15.5	20.0	14.0	0.542	0.479	0.396	0.208	0.458
Dispute Avoidance & Resolution	3.769	3.778	4.000	3.900	3.857	15.5	16.0	12.0	15.5	15.0	0.396	0.375	0.542	0.396	0.417
Design Innovation & Creativity	3.385	3.667	2.900	3.500	3.357	21.0	18.5	23.0	22.0	23.0	0.167	0.271	0.083	0.125	0.083
Evidence Based Design	3.308	3.556	3.400	3.700	3.476	23.5	22.0	18.0	20.0	22.0	0.063	0.125	0.292	0.208	0.125
Long-term Bldg. Success & Lifecycle Valu	4.077	3.667	4.000	4.000	3.952	10.5	18.5	12.0	12.0	11.5	0.604	0.271	0.542	0.542	0.563
Owner / User Participation	3.923	4.111	3.800	4.000	3.952	13.0	12.0	15.5	12.0	11.5	0.500	0.542	0.396	0.542	0.563
Owner / User Satisfaction	4.154	4.889	4.700	4.700	4.571	8.0	1.0	1.0	1.0	1.0	0.708	1.000	1.000	1.000	1.000
Profit & Financial Objectives	3.846	3.667	3.300	3.300	3.548	14.0	18.5	19.5	24.0	19.0	0.458	0.271	0.229	0.042	0.250
Production of Specified Quality	4.231	3.889	4.300	4.000	4.119	5.5	15.0	5.5	12.0	9.0	0.813	0.417	0.813	0.542	0.667
Clear & Realistic Objectives	4.462	4.556	4.000	4.600	4.405	1.0	4.0	12.0	2.0	3.0	1.000	0.875	0.542	0.958	0.917
Professional Reputation & Image	3.462	3.556	3.600	3.400	3.500	18.0	22.0	17.0	23.0	21.0	0.292	0.125	0.333	0.083	0.167
Responsive Admin. & Decision Support	3.385	4.222	4.100	3.800	3.833	21.0	10.5	9.5	17.5	16.0	0.167	0.604	0.646	0.313	0.375
Sustainability	3.462	3.667	3.000	4.000	3.524	18.0	18.5	21.5	12.0	20.0	0.292	0.271	0.146	0.542	0.208
Project Time Performance	3.769	4.333	4.300	4.000	4.071	15.5	7.5	5.5	12.0	10.0	0.396	0.729	0.813	0.542	0.625
Trust & Respect	4.154	4.333	4.300	4.100	4.214	8.0	7.5	5.5	8.5	7.0	0.708	0.729	0.813	0.688	0.750
Utility & Functionality	4.154	4.000	4.100	4.400	4.167	8.0	13.5	9.5	4.5	8.0	0.708	0.479	0.646	0.854	0.708
Owner's vision	3.462	3.556	3.900	3.700	3.643	18.0	22.0	14.0	20.0	17.0	0.292	0.125	0.458	0.208	0.333
Stakeholder Groups Types: O = Owner; D = Designer; B = Builder; U = User; ALL															

Table 8.12. Round 2 rank-order tables

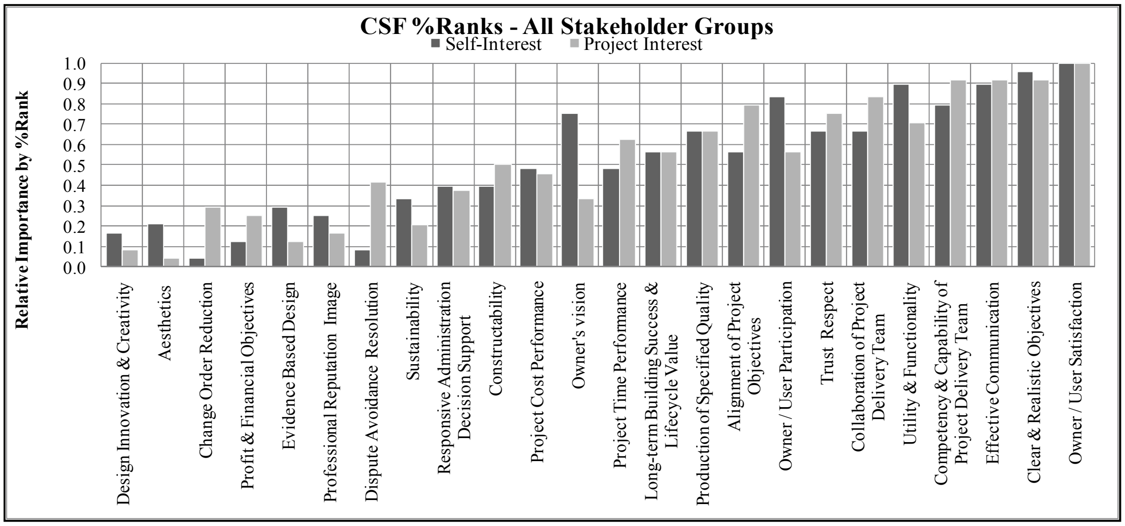


Figure 8.11. Round 2 -- Overall: relative importance by %Rank

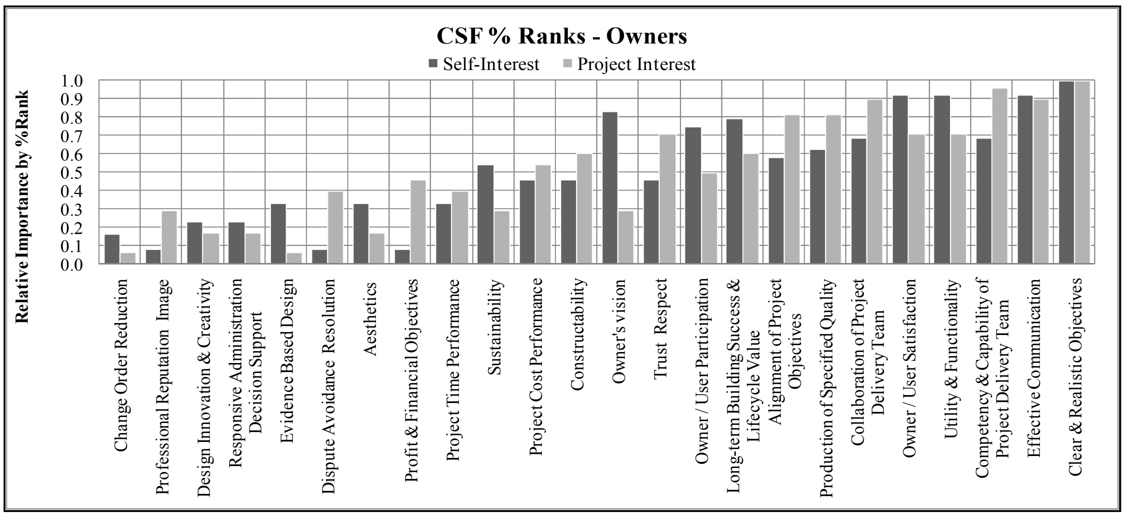


Figure 8.12. Round 2 -- Owners: relative importance by %Rank

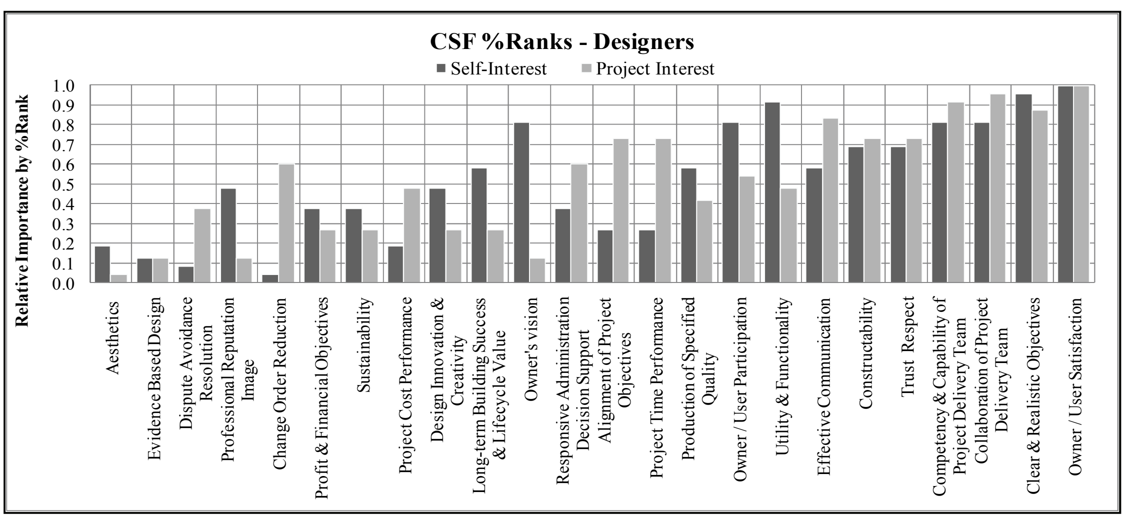


Figure 8.13. Round 2 -- Designers: relative importance by %Rank

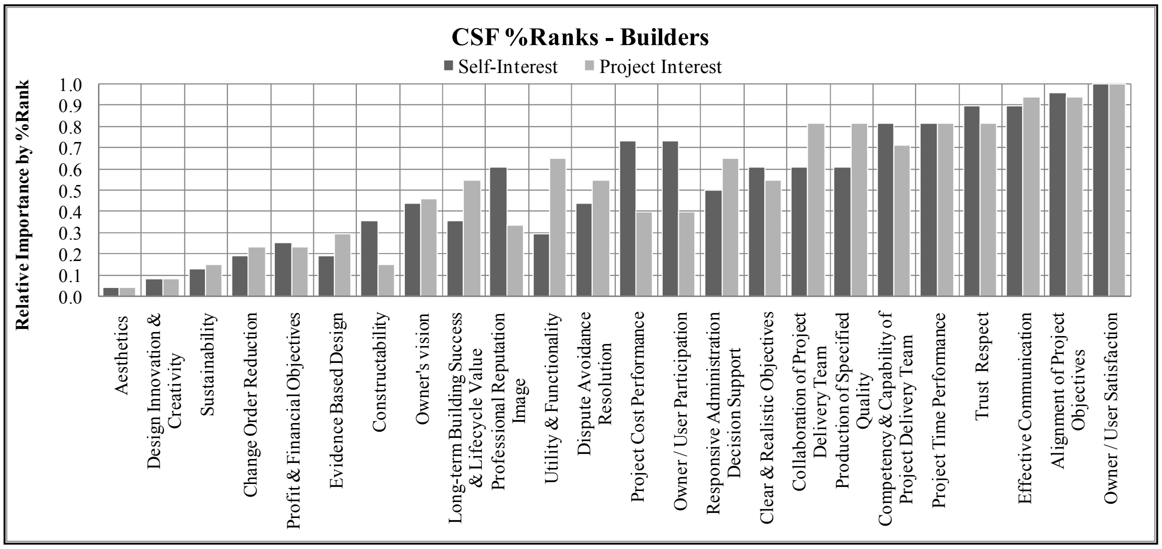


Figure 8.14. Round 2 -- Builders: relative importance by %Rank

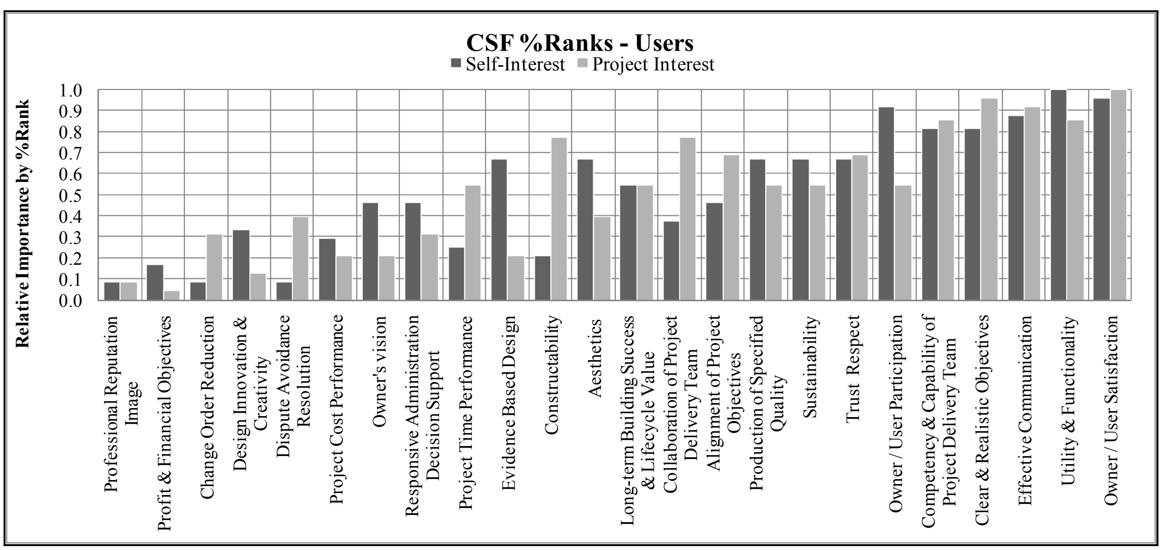


Figure 8.15. Round 2 -- Users: Relative Importance by %Rank

8.7.1. Evaluation of Rank-Orders

Critical Success Factors	Self-Interest % Rank [a, b]					Project-Interest % Rank [a, b]				
	O N=17	**D** N=10	**B** N=11	**U** N=13	**ALL** N=51	**O** N=17	**D** N=10	**B** N=11	**U** N=12	**ALL** N=50
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Owner / User Satisfaction	**0.917**	**1.000**	**1.000**	**0.958**	**1.000**	0.708	**1.000**	**1.000**	**1.000**	**1.000**
Clear & Realistic Objectives	**1.000**	**0.958**	0.604	**0.813**	**0.958**	**1.000**	**0.875**	0.542	**0.958**	**0.917**
Effective Communication	**0.917**	0.583	**0.896**	**0.875**	**0.896**	**0.896**	**0.833**	**0.938**	**0.917**	**0.917**
Competency & Capability of Project Delivery Team	0.688	**0.813**	**0.813**	**0.813**	**0.792**	**0.958**	**0.917**	0.708	**0.854**	**0.917**
Utility & Functionality	**0.917**	**0.917**	0.292	**1.000**	**0.896**	0.708	0.479	0.646	**0.854**	0.708
Collaboration of Project Delivery Team	0.688	**0.813**	0.604	0.375	0.667	**0.896**	**0.958**	**0.813**	**0.771**	**0.833**
Trust Respect	0.458	0.688	**0.896**	0.667	0.667	0.708	0.729	**0.813**	0.688	**0.750**
Owner / User Participation	**0.750**	**0.813**	0.729	**0.917**	**0.833**	0.500	0.542	0.396	0.542	0.563
Alignment of Project Objectives	0.583	0.271	**0.958**	0.458	0.563	**0.813**	0.729	**0.938**	0.688	**0.792**
Production of Specified Quality	0.625	0.583	0.604	0.667	0.667	**0.813**	0.417	**0.813**	0.542	0.667
Long-term Building Success & Lifecycle Value	**0.792**	0.583	0.354	0.542	0.563	0.604	0.271	0.542	0.542	0.563
Project Time Performance	0.333	0.271	**0.813**	0.250	0.479	0.396	0.729	**0.813**	0.542	0.625
Owner's vision	**0.833**	**0.813**	0.438	0.458	**0.750**	0.292	0.125	0.458	0.208	0.333
Project Cost Performance	0.458	0.188	0.729	0.292	0.479	0.542	0.479	0.396	0.208	0.458
Constructability	0.458	0.688	0.354	0.208	0.396	0.604	0.729	0.146	**0.771**	0.500
Responsive Administration Decision Support	0.229	0.375	0.500	0.458	0.396	0.167	0.604	0.646	0.313	0.375
Sustainability	0.542	0.375	0.125	0.667	0.333	0.292	0.271	0.146	0.542	0.208
Dispute Avoidance Resolution	0.083	0.083	0.438	0.083	0.083	0.396	0.375	0.542	0.396	0.417
Professional Reputation Image	0.083	0.479	0.604	0.083	0.250	0.292	0.125	0.333	0.083	0.167
Evidence Based Design	0.333	0.125	0.188	0.667	0.292	0.063	0.125	0.292	0.208	0.125
Profit & Financial Objectives	0.083	0.375	0.250	0.167	0.125	0.458	0.271	0.229	0.042	0.250
Change Order Reduction	0.167	0.042	0.188	0.083	0.042	0.063	0.604	0.229	0.313	0.292
Aesthetics	0.333	0.188	0.042	0.667	0.208	0.167	0.042	0.042	0.396	0.042
Design Innovation & Creativity	0.229	0.479	0.083	0.333	0.167	0.167	0.271	0.083	0.125	0.083

Stakeholder Groups Types: O = Owner; D = Designer; B = Builder; U = User; ALL

Notes:

a. %Rank: normalized rank order where 1.00 = highest ranked.

b. Selection criteria for highlighted cells (Green/Bold): greater than or equal to 0.75

Table 8.13. Round 2 evaluation of rank-ordering

Table 8.13 provides a summary of all fractional rank-order scores, and is sorted in order of overall relative importance (ALL) where 1.000 equals the highest ranking. Highlighting the top 25% (%Rank greater than or equal to 0.750) visually demonstrates variation is how each stakeholder group rated the most relatively important factors.

8.8. Top 25% Summary

	Top 25% CSFs	Self-Interest Round#2 % Rank [a, b]					Project-Interest Round#2 % Rank [a, b]				
		O	D	B	U	ALL	O	D	B	U	ALL
		N=17	N=10	N=11	N=13	N=51	N=17	N=10	N=11	N=12	N=50
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	Owner / User Satisfaction	**0.92**	**1.00**	**1.00**	**0.96**	**1.0**	0.71	**1.00**	**1.00**	**1.00**	**1.00**
2	Clear & Realistic Objectives	**1.00**	**0.96**	0.60	**0.81**	**1.0**	**1.00**	**0.88**	0.54	**0.96**	**0.92**
3	Effective Communication	**0.92**	0.58	**0.90**	**0.88**	**0.9**	**0.90**	**0.83**	**0.94**	**0.92**	**0.92**
X	~~Competency & Capability of Project Delivery Team~~	~~0.69~~	~~0.81~~	~~0.81~~	~~0.81~~	~~0.8~~	~~0.96~~	~~0.92~~	~~0.71~~	~~0.85~~	~~0.92~~
4	Utility & Functionality	**0.92**	**0.92**	0.29	**1.00**	**0.9**	0.71	0.48	0.65	**0.85**	0.71
5	Collaboration of Project Delivery Team	0.69	**0.81**	0.60	0.38	0.7	**0.90**	**0.96**	**0.81**	**0.77**	**0.83**
6	Trust Respect	0.46	0.69	**0.90**	0.67	0.7	0.71	0.73	**0.81**	0.69	**0.75**
7	Owner / User Participation	**0.75**	**0.81**	0.73	**0.92**	**0.8**	0.50	0.54	0.40	0.54	0.56
8	Alignment of Project Objectives	0.58	0.27	**0.96**	0.46	0.6	**0.81**	0.73	**0.94**	0.69	**0.79**
9	Production of Specified Quality	0.63	0.58	0.60	0.67	0.7	**0.81**	0.42	**0.81**	0.54	0.67
10	Long-term Building Success & Lifecycle Value	**0.79**	0.58	0.35	0.54	0.6	0.60	0.27	0.54	0.54	0.56
11	Project Time Performance	0.33	0.27	**0.81**	0.25	0.5	0.40	0.73	**0.81**	0.54	0.63
12	Owner's vision	**0.83**	**0.81**	0.44	0.46	**0.8**	0.29	0.13	0.46	0.21	0.33
13	Constructability	0.46	0.69	0.35	0.21	0.4	0.60	0.73	0.15	**0.77**	0.50

Stakeholder Groups Types: O = Owner; D = Designer; B = Builder; U = User; ALL

Notes:

a. %Rank: normalized rank order where 1.00 = highest ranked

b. Selection criteria for highlighted areas: Top 25%: Greater than or equal to 0.75 (Green/Bold highlight)

c. "Competency & Capability of Project Delivery Team" will not be submitted for further analysis the Round #3. Analysis of effectiveness of different project delivery methods to achieve the selected CSFs will assume competence/capability of the project delivery team.

Table 8.14. Round 2 -- Thirteen critical success factors selected for the round 3 survey

There are fourteen critical success factors which scored 0.75 or higher in at least one stakeholder group. One factor, "Competency & Capability of Project Delivery Team" is noted as significantly important ranking in as the fourth highest ranked out of the factors evaluated, but will not be selected for evaluation in the round 3 survey. The round 3 survey will evaluate different project delivery methods efficacy in attainment of factor goals. Perhaps there is not greater influence on the outcome of a project regardless of the delivery method than the quality of the individuals and leadership on the project team. Round 3 will assume an equally reasonable, competent and capable project delivery team in evaluation of the three different project delivery methods.

8.9. Difference Analysis

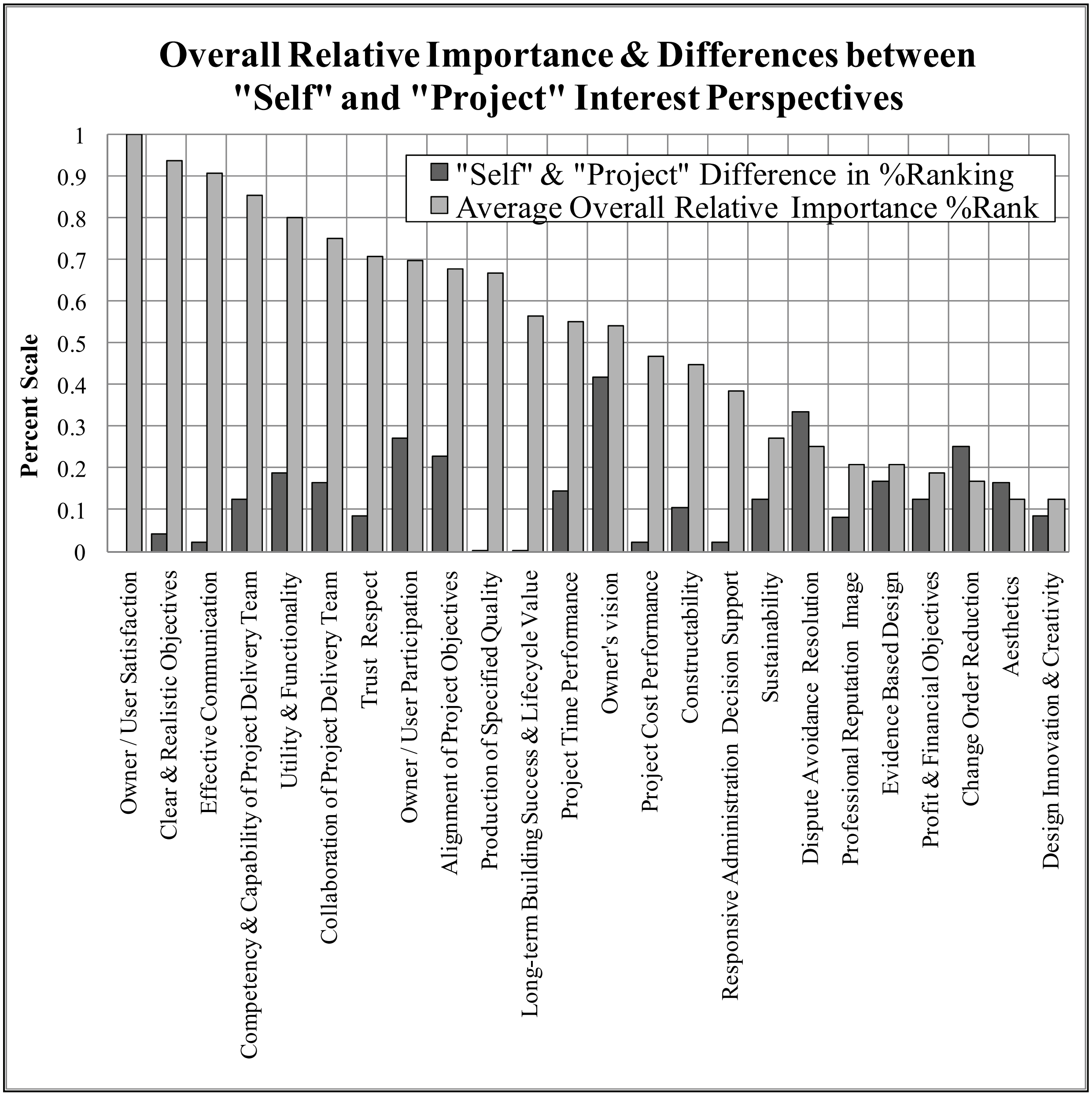


Figure 8.16. Round 2 Overall: Difference in %Ranks between Self & Project interest sorted by relative importance

Logically critical success factors with no difference in relative importance between self and project interest considerations pose less of a hindrance to stakeholder collaboration regardless of the project delivery method. Where there is a difference between self-interest and project-interest, as indicated in Figure 8.16. above, there is opportunity for additional optimization of the project delivery process and resulting value-creation. Resolving the conflict of interests, or implementing practices and procedures which mitigate the differences or make them more palatable to all stakeholder parties is sure to increase overall efficiency of the collaboration. Further study is required to prove this concept, but it is logically a sound cause and effect relationship with great potential for increased value-creation through optimization of the project delivery process.

8.9.1. Difference Analysis: Significance Test

Because the list of critical success factors in round 2 are all important, having been narrowed down by relative importance from round 1's fourty factors to the thirteen most important here in round 2, the differences between many of the mean scores is fairly slight, given that most factors recieved ratings ranging over the top three of the five-point scale. When normalized into rank-orders the differences becomes more emphasized. The emphasized difference is beneficial for highlighting differences, but more rigorous testing is required to determine the significance of these differences. A non-parametric test of related samples was conducted in SPSS Statistics 18 using the Wilcoxon Signed Rank Test for paired samples. Each factor was evaluated as a pair including the self-interest and the project-interest ratings for each critical success factor. The testing was run for the overall group rating, and each individual stakeholder's group ratings. Table 8.15 contains the resulting levels of significance for the hypothesis test run in SPSS Statistics 18. The hypothesis for the test is that there is a difference between the self and project interest ratings for each critical success factor. The null hypothesis is that no difference exists between the two ratings for the factor. Ten factors yielded significant differences in at least one stakeholder group (or overall) at a minimum 0.10 significance level.

Therefore the null hypothesis is rejected for the ten factors the 0.10 level. It is therefore concluded that a significant difference exists for ten of the critical success factors.

Significance Testing of the Difference between Self-Interest & Project-Interest					
Null Hypothesis: median of differences between Self-Interest & Project-Interest equals zero for each CSF					
	Related-Samples Wilcoxon Signed Rank Test*				
	Significance Levels				
Critical Success Factors	Owner	Designer	Builder	User	All
Owner / User Satisfaction	0.194	1.000	0.317	0.655	0.334
Production of Specified Quality	0.527	0.480	0.317	0.705	0.888
Long-term Building Success & Lifecycle Value	0.380	0.157	0.435	1.000	0.551
Responsive Administration Decision Support	1.000	0.516	0.679	0.705	0.664
Effective Communication	0.458	0.527	1.000	0.317	0.761
Project Cost Performance	0.680	0.414	0.279	0.705	0.914
Clear & Realistic Objectives	0.705	0.655	0.655	0.102	0.837
Professional Reputation Image	0.206	0.102	0.301	0.317	0.673
Trust Respect	**0.096** c	1.000	0.655	1.000	0.371
Design Innovation & Creativity	1.000	0.257	0.564	0.480	0.371
Constructability	0.257	1.000	0.168	**0.058** c	0.694
Profit & Financial Objectives	**0.070** c	**0.083** c	0.603	0.890	0.688
Sustainability	0.129	0.180	0.914	0.655	**0.095** c
Competency & Capability of Project Delivery Team	0.334	0.317	0.564	0.414	0.204
Project Time Performance	0.655	0.157	1.000	0.236	**0.079** c
Aesthetics	0.157	0.157	0.234	0.480	0.313
Collaboration of Project Delivery Team	0.720	0.257	0.480	0.206	0.108
Evidence Based Design	**0.096** c	0.705	0.705	0.194	0.115
Utility & Functionality	0.157	0.180	0.238	0.102	0.300
Alignment of Project Objectives	0.317	0.102	0.655	0.480	0.124
Change Order Reduction	1.000	**0.024** b	1.000	**0.084** c	**0.018** b
Owner / User Participation	0.102	0.480	0.102	0.157	**0.008** a
Dispute Avoidance Resolution	**0.033** b	0.257	0.783	**0.070** c	**0.008** a
Owner's vision	**0.058** c	**0.023** b	0.705	0.317	**0.007** a

Notes:
* Paired samples; Non-parametric analysis calculated in SPSS Statistics 8
a. Reject the null hypothesis, significant at the 0.01 level
b. Reject the null hypothesis, significnat at the 0.05 level
c. Reject the nul hypothesis, significant at the 0.10 level

Table 8.15. Round 2 Significance testing of difference between self and project interests

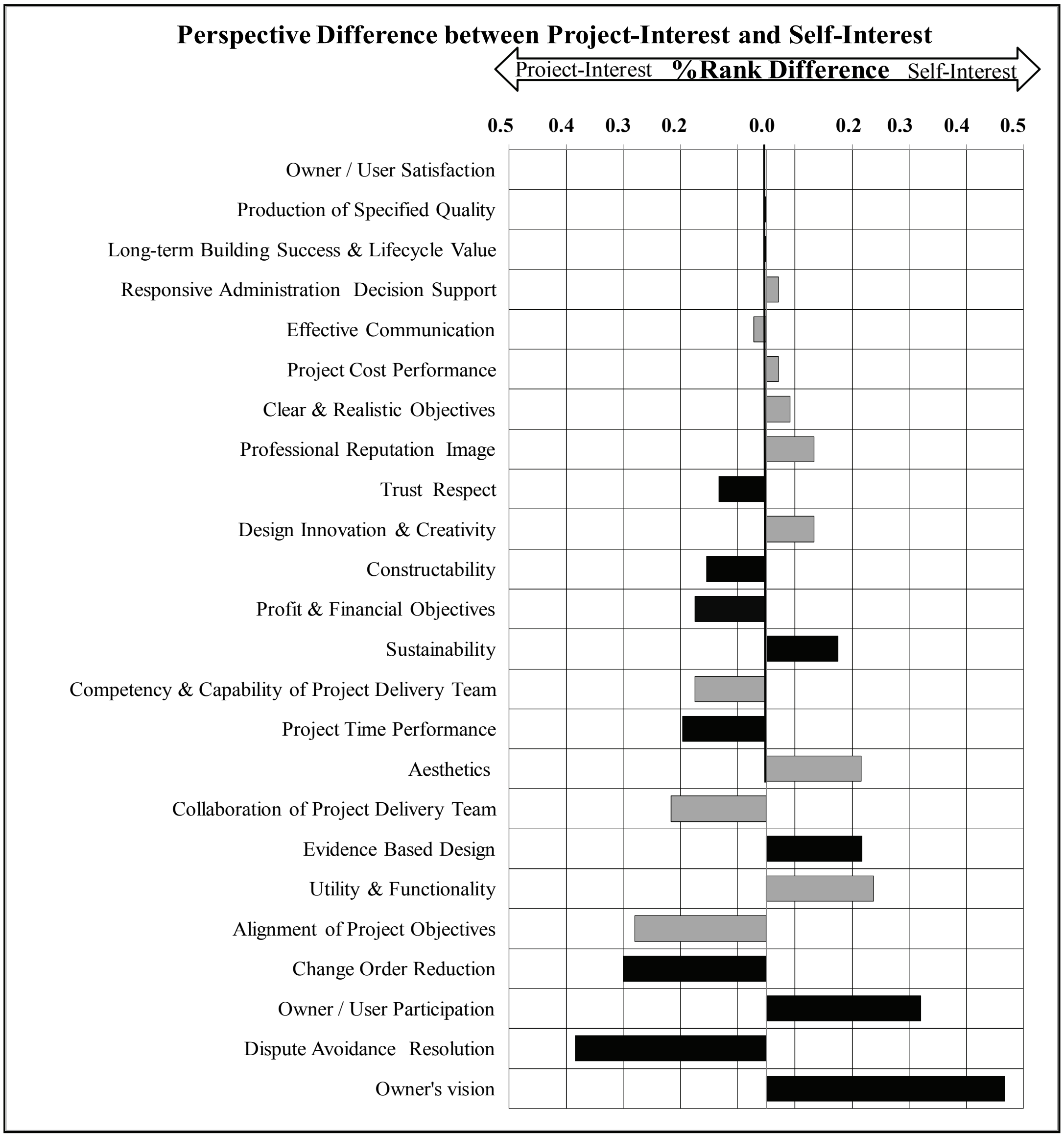


Figure 8.17 Self-Interest & Project-Interest differences. (Black bars represent statistical significance refer to Table 7.15 for level of significance)

Figure 8.17. above provides additional detail as to which "direction" the difference in relative importance moves left or right of 0.0. Here the difference is measured in difference of %Rank between the factors. The bars extending to the left indicate a greater project-interest bias to relative importance, and the bars extending to the right indicate a greater self-interest bias towards relative importance. The dark bars represent the statistical significance listed in Table 8.17.

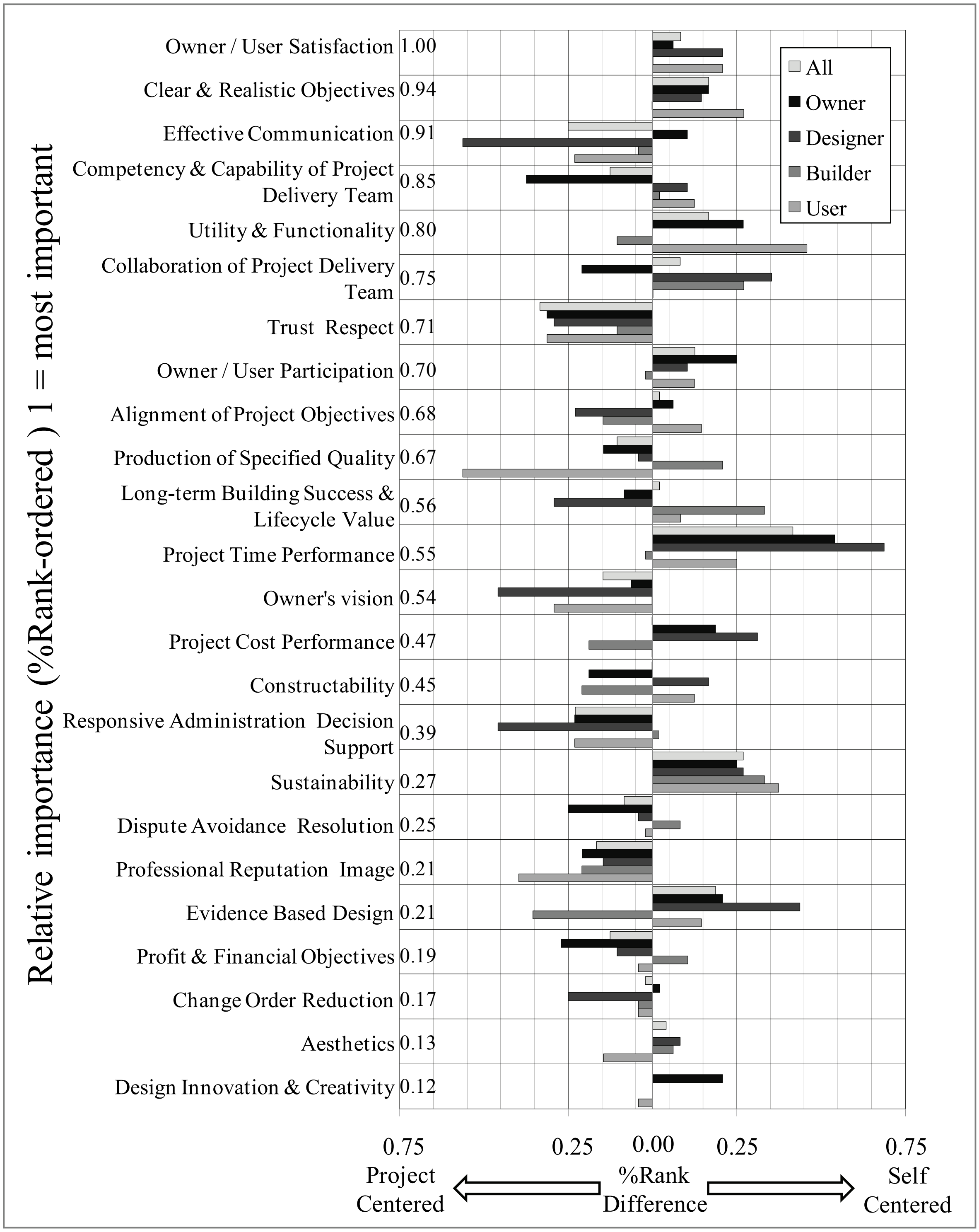


Figure 8.18. Detail of %Rank differences by stakeholder groups (and overall)

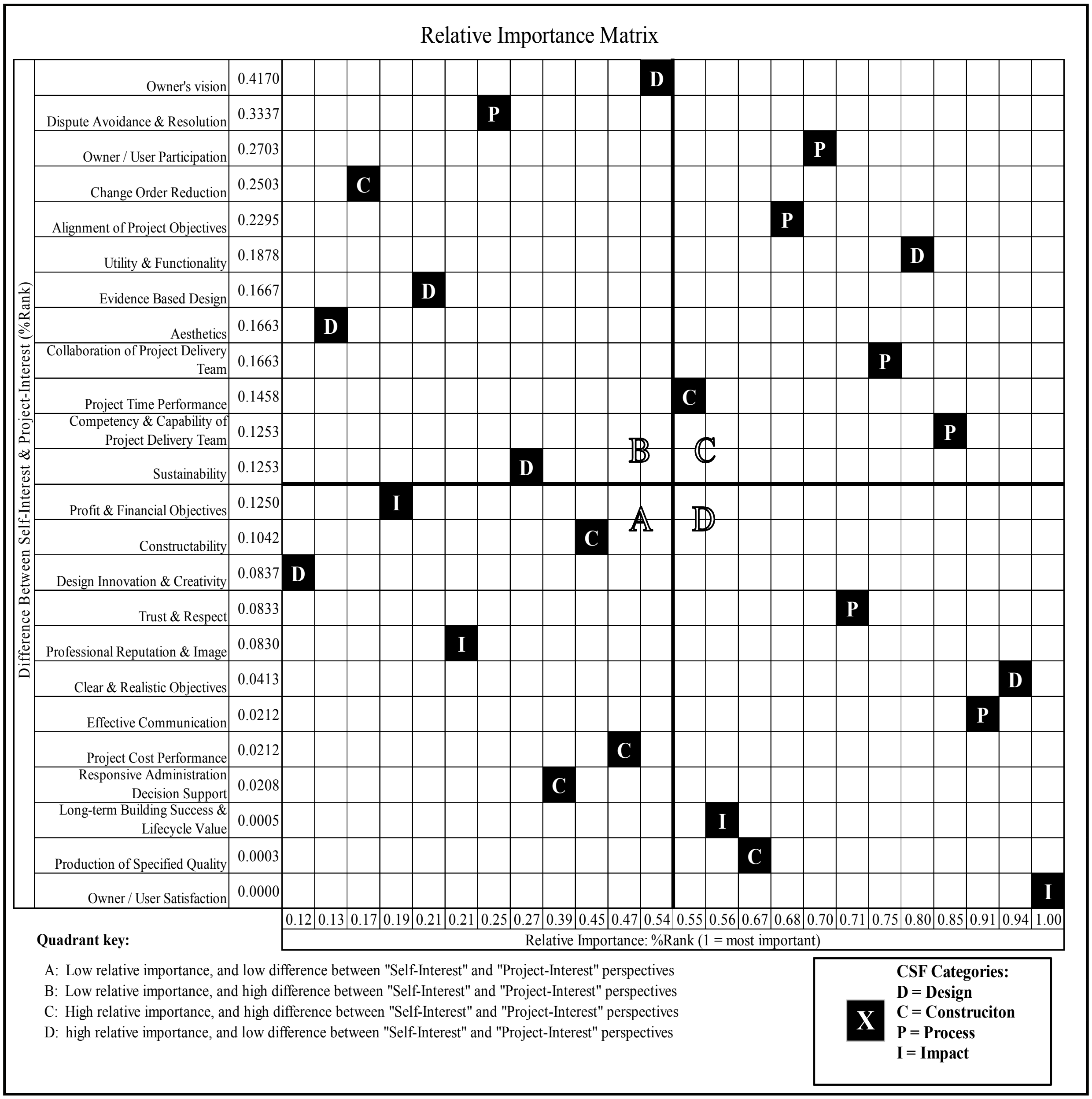


Figure 8.19. Round 2 -- Overall: difference and relative importance matrix

The matrix in Figure 8.19 plots each factor by relative importance and difference measured in fractional rank order (%Rank). Additionally each plot square is labeled for the project delivery category in which the factor was originally grouped in the round 1 survey. Quadrants C and D contain the highest relative importance, and quadrants B and C contain the greatest measured differences between self-interest and project-interest. Logically, quadrant C becomes the primary area of focus when considering factors around which additional optimization may be achieved.

The factors in quadrant C are in order of relative importance are: Competence of the Project Delivery Team, Utility & Functionality, Collaboration & Capability of the Project Team, Owner/User Participation, Alignment of Project Objectives, and Project Time Performance. Also of note is the fact that four of the six factors in quadrant C are originally from the process *category* in the round 1 survey. Additionally, 6 out of the 12 most relatively important factors are also from the process category. Factors from any of categories could potentially be influenced by use of different project delivery methods. The process category factors, as the category nomenclature implies, inextricably associated with the project delivery process. A reasonable assumption then is that the process, in this case the project delivery method, is the primary means of addressing the quadrant C factors. The hypothesis of this dissertation is that Integrated Project Delivery is the superior method of project delivery for large complex medical projects. In round 3 I will put this hypothesis to a partial test by asking the panel of experts to evaluated different project delivery methods for effectiveness related to the 13 factors selected as most important. It seems plausible that an integrated approach may benefit the factors in quadrant C (or other factors not evaluated here which meet the same criteria).

8.10. Round 2 Results Comparison of Rounds 1 & 2

When comparing the round 1 and round 2 data visually in Figure 8.20., it is plain to see that the distribution of critical success factor rankings by stakeholder group is more linear in round 2, and that angle of linearity is very nearly a perfect 45 degrees. The data is normalized as fractional rank, where 1 is the highest rank and the lowest rank approaches zero (zero = not ranked). A perfect linear rank ordered distribution would have a nearly 45 degree line from near zero on the left to 1 on the right. The linear line on the round 1 is easily seen as having a clockwise rotation to an angle closer to 30 degrees. It is obvious from the simple visual

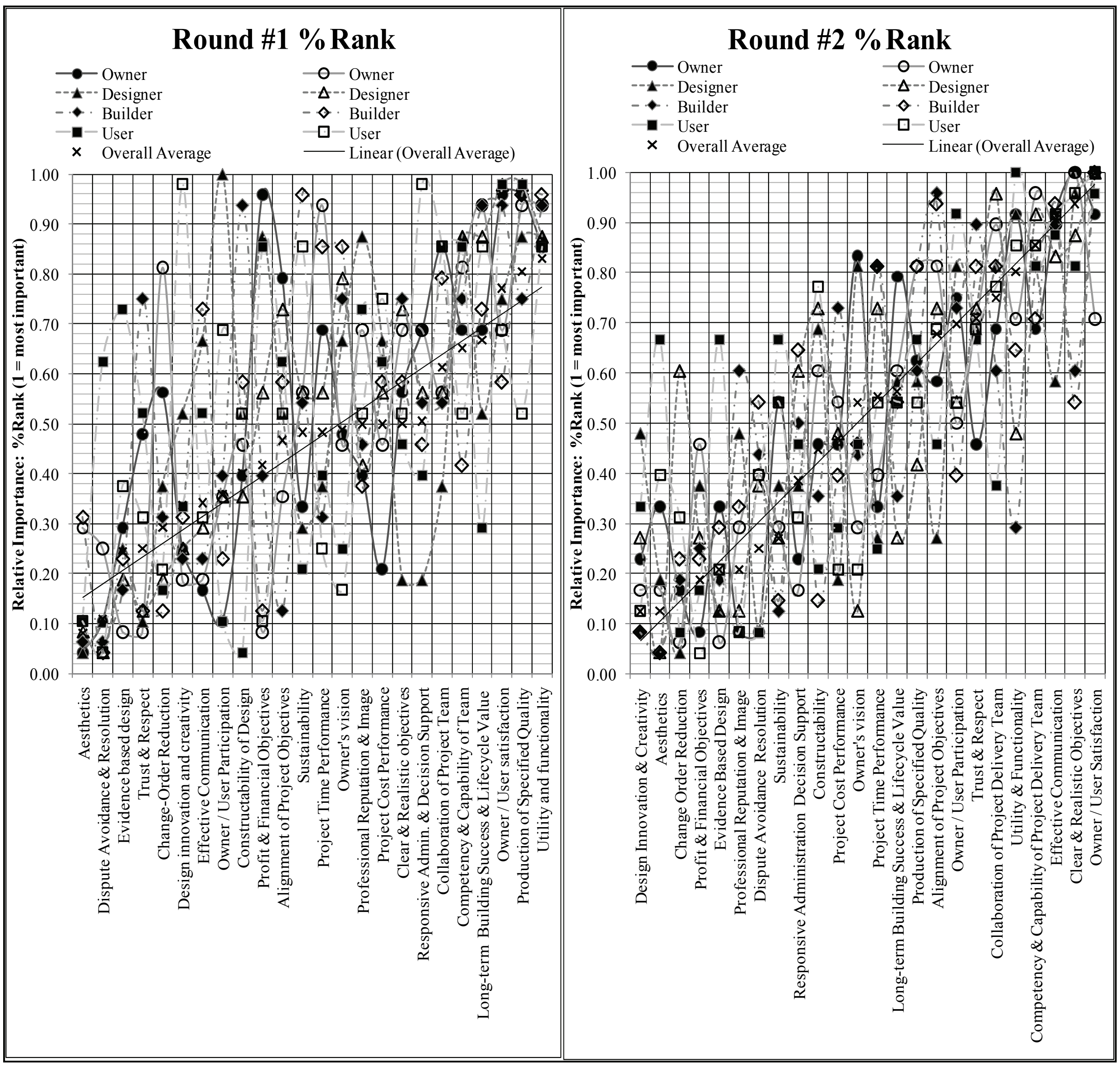


Figure 8.20. Relative importance comparison between rounds 1 & 2

inspection of the data sets that round 2 in fact achieve a higher level of inter-rater agreement and increased consensus among the overall panel of experts. The following tables and figures will directly compare the Kendall's W scores between the first two rounds of surveys to provide statistical proof to the 'thumb-nail' assessment above.

The two rounds used different measures to assess relative importance with round 1using frequency, and round 2 using a mean score based on how the panel rated each critical success factor on a five-point-scale. In both cases Kendall's coefficient of concordance is calculated based on the rank-order of the factors, and provides a consistent measure between the two rounds. Frequencies and mean scores are not readily comparable, each round was normalized by creating weighted averages by dividing each factor's score (frequency, or mean rating) by the sum of score of all factors. The weighted averages help to draw comparisons relative to the four categories in round 1 and the consolidated list in round 2.

Comparison of Rounds One and Two: Overall Self-Interest						
Critical Success Factor	Round #1			Round #2		
	Freq.	Rank	Weight Avg.	Mean	Rank	Weight Avg.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Owner / User Satisfaction	48	1	0.065	4.667	1	0.049
Clear & Realistic Objectives	31	11	0.042	4.381	2	0.046
Effective Communication	41	4	0.056	4.357	4	0.046
Utility & Functionality	47	2	0.064	4.357	4	0.046
Owner / User Participation	24	20	0.033	4.310	5	0.046
Competency & Capability of Project Team	34	7	0.046	4.262	6	0.045
Owner's vision	32	9	0.043	4.167	7	0.044
Collaboration of Project Delivery Team	41	4	0.056	4.119	9	0.044
Production of Specified Quality	42	3	0.057	4.119	9	0.044
Trust & Respect	28	16	0.038	4.119	9	0.044
Alignment of Project Objectives	25	18	0.034	4.071	12	0.043
Long-term Bldg. Success & Lifecycle Value	41	4	0.056	4.071	12	0.043
Project Cost Performance	31	11	0.042	3.833	14	0.041
Project Time Performance	32	9	0.043	3.833	14	0.041
Constructability	29	14	0.039	3.786	16	0.040
Responsive Admin. & Decision Support	34	7	0.046	3.786	16	0.040
Sustainability	29	14	0.039	3.738	17	0.040
Evidence Based Design	26	17	0.035	3.690	18	0.039
Professional Reputation & Image	30	13	0.041	3.595	19	0.038
Aesthetics	14	23	0.019	3.500	20	0.037
Design Innovation & Creativity	21	22	0.028	3.476	21	0.037
Profit & Financial Objectives	25	18	0.034	3.452	22	0.037
Dispute Avoidance & Resolution	9	24	0.012	3.405	23	0.036
Change Order Reduction	24	20	0.033	3.238	24	0.034
Number (n)	51			42		
Kendall's coefficient of concordance (W)	.141			.207		
Level of Significance	.000			.000		

Comparison of Rounds One and Two: Overall Project-Interest						
CSF	Round #1			Round #2		
	Freq.	Rank	Weight Avg.	Mean	Rank	Weight Avg.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Owner / User Satisfaction	42	1	0.061	4.571	1	0.048
Effective Communication	16	23	0.023	4.405	3	0.047
Competency & Capability of Project Team	38	3	0.055	4.405	3	0.047
Clear & Realistic Objectives	33	8	0.048	4.405	3	0.047
Collaboration of Project Delivery Team	33	8	0.048	4.381	5	0.046
Alignment of Project Objectives	36	5	0.052	4.262	6	0.045
Trust & Respect	17	22	0.024	4.214	7	0.045
Utility & Functionality	35	6	0.050	4.167	8	0.044
Production of Specified Quality	40	2	0.058	4.119	9	0.044
Project Time Performance	31	11	0.045	4.071	10	0.043
Long-term Bldg. Success & Lifecycle Value	37	4	0.053	3.952	12	0.042
Owner / User Participation	24	17	0.035	3.952	12	0.042
Constructability	30	14	0.043	3.905	13	0.041
Project Cost Performance	34	7	0.049	3.881	14	0.041
Dispute Avoidance & Resolution	19	20	0.027	3.857	15	0.041
Responsive Admin. & Decision Support	31	11	0.045	3.833	16	0.041
Owner's vision	30	14	0.043	3.643	17	0.039
Change Order Reduction	23	19	0.033	3.619	18	0.038
Profit & Financial Objectives	25	16	0.036	3.548	19	0.038
Sustainability	33	8	0.048	3.524	20	0.037
Professional Reputation & Image	31	11	0.045	3.500	21	0.037
Evidence Based Design	19	20	0.027	3.476	22	0.037
Design Innovation & Creativity	24	17	0.035	3.357	23	0.036
Aesthetics	13	24	0.019	3.333	24	0.035
Number (n)	51			42		
Kendall's coefficient of concordance (W)	.095			.208		
Level of Significance	.000			.000		

Table 8.16. Comparison of rounds 1 & 2

Comparison of Rounds One and Two: Owner Self-Interest						
	Round #1			Round #2		
CSF	Freq.	Rank	Weight Avg.	Mean	Rank	Weight Avg.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Clear & Realistic Objectives	12	9	0.048	4.538	1	0.049
Effective Communication	15	4	0.060	4.462	3	0.048
Owner / User Satisfaction	16	2	0.064	4.462	3	0.048
Utility & Functionality	17	1	0.068	4.462	3	0.048
Owner's vision	10	13	0.040	4.385	5	0.047
Long-term Bldg. Success & Lifecycle Value	16	2	0.064	4.308	6	0.046
Owner / User Participation	5	20	0.020	4.231	7	0.045
Collaboration of Project Delivery Team	13	6	0.052	4.154	9	0.045
Competency & Capability of Project Team	13	6	0.052	4.154	9	0.045
Production of Specified Quality	15	4	0.060	4.077	10	0.044
Alignment of Project Objectives	8	17	0.032	4.000	11	0.043
Sustainability	12	9	0.048	3.846	12	0.041
Constructability	10	13	0.040	3.769	14	0.041
Project Cost Performance	12	9	0.048	3.769	14	0.041
Trust & Respect	9	16	0.036	3.769	14	0.041
Aesthetics	4	22	0.016	3.692	17	0.040
Evidence Based Design	8	17	0.032	3.692	17	0.040
Project Time Performance	13	6	0.052	3.692	17	0.040
Design Innovation & Creativity	4	22	0.016	3.385	20	0.036
Responsive Admin. & Decision Support	10	13	0.040	3.385	20	0.036
Change Order Reduction	7	19	0.028	3.308	21	0.036
Dispute Avoidance & Resolution	4	22	0.016	3.154	23	0.034
Profit & Financial Objectives	11	12	0.044	3.154	23	0.034
Professional Reputation & Image	5	20	0.020	3.154	23	0.034
Number (n)	17			13		
Kendall's coefficient of concordance (W)	.236			.300		
Level of Significance	.000			.000		

Comparison of Rounds One and Two: Owner Project-Interest						
	Round #1			Round #2		
CSF	Freq.	Rank	Weight Avg.	Mean	Rank	Weight Avg.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Clear & Realistic Objectives	11	8	0.048	4.462	1	0.048
Competency & Capability of Project Team	13	3	0.057	4.385	2	0.047
Collaboration of Project Delivery Team	12	6	0.052	4.308	4	0.046
Effective Communication	4	23	0.017	4.308	4	0.046
Alignment of Project Objectives	11	8	0.048	4.231	6	0.045
Production of Specified Quality	15	1	0.065	4.231	6	0.045
Owner / User Satisfaction	15	1	0.065	4.154	8	0.045
Trust & Respect	4	23	0.017	4.154	8	0.045
Utility & Functionality	11	8	0.048	4.154	8	0.045
Constructability	10	13	0.043	4.077	11	0.044
Long-term Bldg. Success & Lifecycle Value	12	6	0.052	4.077	11	0.044
Project Cost Performance	11	8	0.048	4.000	12	0.043
Owner / User Participation	5	20	0.022	3.923	13	0.042
Profit & Financial Objectives	13	3	0.057	3.846	14	0.041
Dispute Avoidance & Resolution	9	14	0.039	3.769	16	0.041
Project Time Performance	8	16	0.035	3.769	16	0.041
Professional Reputation & Image	8	16	0.035	3.462	18	0.037
Sustainability	13	3	0.057	3.462	18	0.037
Owner's vision	9	14	0.039	3.462	18	0.037
Aesthetics	7	19	0.030	3.385	21	0.036
Design Innovation & Creativity	8	16	0.035	3.385	21	0.036
Responsive Admin. & Decision Support	11	8	0.048	3.385	21	0.036
Change Order Reduction	5	20	0.022	3.308	24	0.036
Evidence Based Design	5	20	0.022	3.308	24	0.036
Number (n)	17			13		
Kendall's coefficient of concordance (W)	.154			.218		
Level of Significance	.000			.000		

Table 8.17. Owner's comparison of rounds 1 & 2

Comparison of Rounds One and Two: Designer Self-Interest						
	Round #1			Round #2		
CSF	Freq.	Rank	Weight Avg.	Mean	Rank	Weight Avg.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Owner / User Satisfaction	10	1	0.066	4.889	1	0.049
Clear & Realistic Objectives	4	20	0.026	4.667	2	0.047
Utility & Functionality	8	3	0.053	4.556	3	0.046
Collaboration of Project Delivery Team	8	3	0.053	4.444	6	0.045
Competency & Capability of Project Team	6	14	0.040	4.444	6	0.045
Owner / User Participation	7	9	0.046	4.444	6	0.045
Owner's vision	7	9	0.046	4.444	6	0.045
Constructability	7	9	0.046	4.333	9	0.044
Trust & Respect	3	22	0.020	4.333	9	0.044
Effective Communication	8	3	0.053	4.222	11	0.043
Long-term Bldg. Success & Lifecycle Value	6	14	0.040	4.222	11	0.043
Production of Specified Quality	8	3	0.053	4.222	11	0.043
Design Innovation & Creativity	9	2	0.060	4.111	14	0.042
Professional Reputation & Image	8	3	0.053	4.111	14	0.042
Profit & Financial Objectives	6	14	0.040	4.000	16	0.040
Responsive Admin. & Decision Support	8	3	0.053	4.000	16	0.040
Sustainability	6	14	0.040	4.000	16	0.040
Alignment of Project Objectives	5	18	0.033	3.889	19	0.039
Project Time Performance	7	9	0.046	3.889	19	0.039
Aesthetics	2	23	0.013	3.778	21	0.038
Project Cost Performance	4	20	0.026	3.778	21	0.038
Evidence Based Design	5	18	0.033	3.667	22	0.037
Dispute Avoidance & Resolution	2	23	0.013	3.444	23	0.035
Change Order Reduction	7	9	0.046	3.111	24	0.031
Number (n)	10			9		
Kendall's coefficient of concordance (W)	.186			.277		
Level of Significance	.007			.000		

Comparison of Rounds One and Two: Designer Project-Interest						
	Round #1			Round #2		
CSF	Freq.	Rank	Weight Avg.	Mean	Rank	Weight Avg.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Owner / User Satisfaction	8	3	0.056	4.889	1	0.050
Collaboration of Project Delivery Team	7	7	0.049	4.778	2	0.049
Competency & Capability of Project Team	7	7	0.049	4.667	3	0.048
Clear & Realistic Objectives	6	12	0.042	4.556	4	0.047
Effective Communication	6	12	0.042	4.444	5	0.046
Alignment of Project Objectives	6	12	0.042	4.333	8	0.044
Constructability	5	16	0.035	4.333	8	0.044
Project Time Performance	8	3	0.056	4.333	8	0.044
Trust & Respect	4	19	0.028	4.333	8	0.044
Change Order Reduction	4	19	0.028	4.222	11	0.043
Responsive Admin. & Decision Support	7	7	0.049	4.222	11	0.043
Owner / User Participation	5	16	0.035	4.111	12	0.042
Project Cost Performance	8	3	0.056	4.000	14	0.041
Utility & Functionality	9	1	0.063	4.000	14	0.041
Production of Specified Quality	9	1	0.063	3.889	15	0.040
Dispute Avoidance & Resolution	3	23	0.021	3.778	16	0.039
Design Innovation & Creativity	5	16	0.035	3.667	19	0.038
Long-term Bldg. Success & Lifecycle Value	7	7	0.049	3.667	19	0.038
Profit & Financial Objectives	4	19	0.028	3.667	19	0.038
Sustainability	6	12	0.042	3.667	19	0.038
Evidence Based Design	4	19	0.028	3.556	22	0.036
Professional Reputation & Image	7	7	0.049	3.556	22	0.036
Owner's vision	8	3	0.056	3.556	22	0.036
Aesthetics	1	24	0.007	3.222	24	0.033
Number (n)	10			9		
Kendall's coefficient of concordance (W)	.149			.297		
Level of Significance	.060			.000		

Table 8.18. Designer's comparison of round 1s & 2

Comparison of Rounds One and Two: Builder Self-Interest						
	Round #1			Round #2		
CSF	Freq.	Rank	Weight Avg.	Mean	Rank	Weight Avg.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Owner / User Satisfaction	10	1	0.007	4.800	1	0.052
Alignment of Project Objectives	7	10	0.068	4.500	2	0.049
Effective Communication	6	14	0.095	4.400	4	0.048
Trust & Respect	8	6	0.041	4.400	4	0.048
Competency & Capability of Project Team	9	3	0.020	4.300	6	0.046
Project Time Performance	3	21	0.143	4.300	6	0.046
Project Cost Performance	7	10	0.068	4.200	8	0.045
Owner / User Participation	4	18	0.122	4.200	8	0.045
Collaboration of Project Delivery Team	8	6	0.041	4.100	11	0.044
Production of Specified Quality	7	10	0.068	4.100	11	0.044
Clear & Realistic Objectives	8	6	0.041	4.100	11	0.044
Professional Reputation & Image	8	6	0.041	4.100	11	0.044
Responsive Admin. & Decision Support	6	14	0.095	4.000	13	0.043
Dispute Avoidance & Resolution	1	23	0.156	3.900	15	0.042
Owner's vision	9	3	0.020	3.900	15	0.042
Constructability	9	3	0.020	3.700	17	0.040
Long-term Bldg. Success & Lifecycle Value	7	10	0.068	3.700	17	0.040
Utility & Functionality	10	1	0.007	3.600	18	0.039
Profit & Financial Objectives	5	16	0.109	3.500	19	0.038
Change Order Reduction	4	18	0.122	3.300	21	0.036
Evidence Based Design	2	22	0.150	3.300	21	0.036
Sustainability	4	18	0.122	3.000	22	0.032
Design Innovation & Creativity	5	16	0.109	2.800	23	0.030
Aesthetics	0	24	0.163	2.400	24	0.026
Number (n)	11			10		
Kendall's coefficient of concordance (W)	.251			.410		
Level of Significance	.000			.000		

Comparison of Rounds One and Two: Builder Project-Interest						
	Round #1			Round #2		
CSF	Freq.	Rank	Weight Avg.	Mean	Rank	Weight Avg.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Owner / User Satisfaction	10	1	0.063	4.700	1	0.051
Alignment of Project Objectives	9	2	0.057	4.400	3	0.048
Effective Communication	3	21	0.019	4.400	3	0.048
Collaboration of Project Delivery Team	7	14	0.044	4.300	6	0.047
Production of Specified Quality	9	2	0.057	4.300	6	0.047
Project Time Performance	8	7	0.051	4.300	6	0.047
Trust & Respect	3	21	0.019	4.300	6	0.047
Competency & Capability of Project Team	8	7	0.051	4.200	8	0.046
Responsive Admin. & Decision Support	6	15	0.038	4.100	10	0.045
Utility & Functionality	8	7	0.051	4.100	10	0.045
Dispute Avoidance & Resolution	4	18	0.025	4.000	12	0.044
Long-term Bldg. Success & Lifecycle Value	9	2	0.057	4.000	12	0.044
Clear & Realistic Objectives	6	15	0.038	4.000	12	0.044
Owner's vision	9	2	0.057	3.900	14	0.042
Project Cost Performance	8	7	0.051	3.800	16	0.041
Owner / User Participation	8	7	0.051	3.800	16	0.041
Professional Reputation & Image	8	7	0.051	3.600	17	0.039
Evidence Based Design	4	18	0.025	3.400	18	0.037
Change Order Reduction	5	17	0.032	3.300	20	0.036
Profit & Financial Objectives	3	21	0.019	3.300	20	0.036
Constructability	8	7	0.051	3.000	22	0.033
Sustainability	9	2	0.057	3.000	22	0.033
Design Innovation & Creativity	4	18	0.025	2.900	23	0.032
Aesthetics	2	24	0.013	2.800	24	0.030
Number (n)	11			10		
Kendall's coefficient of concordance (W)	.193			.350		
Level of Significance	.001			.000		

Table 8.19. Builder's comparison between rounds 1 & 2

Comparison of Rounds One and Two: User Self-Interest						
	Round #1			Round #2		
CSF	Freq.	Rank	Weight Avg.	Mean	Rank	Weight Avg.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Utility & Functionality	12	1	0.063	4.800	1	0.051
Owner / User Satisfaction	12	1	0.063	4.600	2	0.049
Owner / User Participation	8	11	0.042	4.400	3	0.047
Effective Communication	12	1	0.063	4.300	4	0.046
Competency & Capability of Project Team	6	17	0.031	4.200	6	0.045
Clear & Realistic Objectives	7	15	0.037	4.200	6	0.045
Aesthetics	8	11	0.042	4.100	9	0.044
Evidence Based Design	11	7	0.058	4.100	9	0.044
Production of Specified Quality	12	1	0.063	4.100	9	0.044
Sustainability	7	15	0.037	4.100	9	0.044
Trust & Respect	8	11	0.042	4.100	9	0.044
Long-term Bldg. Success & Lifecycle Value	12	1	0.063	4.000	12	0.043
Alignment of Project Objectives	5	20	0.026	3.900	14	0.042
Responsive Admin. & Decision Support	10	8	0.052	3.900	14	0.042
Owner's vision	6	17	0.031	3.900	14	0.042
Collaboration of Project Delivery Team	12	1	0.063	3.800	16	0.041
Design Innovation & Creativity	3	21	0.016	3.700	17	0.040
Project Cost Performance	8	11	0.042	3.600	18	0.038
Project Time Performance	9	9	0.047	3.500	19	0.037
Constructability	3	21	0.016	3.400	20	0.036
Profit & Financial Objectives	3	21	0.016	3.300	21	0.035
Change Order Reduction	6	17	0.031	3.200	23	0.034
Dispute Avoidance & Resolution	2	24	0.010	3.200	23	0.034
Professional Reputation & Image	9	9	0.047	3.200	23	0.034
Number (n)	13			10		
Kendall's coefficient of concordance (W)	.257			.290		
Level of Significance	.000			.000		

Comparison of Rounds One and Two: User Project-Interest						
	Round #1			Round #2		
CSF	Freq.	Rank	Weight Avg.	Mean	Rank	Weight Avg.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Owner / User Satisfaction	9	4	0.056	4.700	1	0.049
Clear & Realistic Objectives	10	1	0.062	4.600	2	0.048
Effective Communication	3	22	0.019	4.500	3	0.047
Competency & Capability of Project Team	10	1	0.062	4.400	5	0.046
Utility & Functionality	7	8	0.043	4.400	5	0.046
Collaboration of Project Delivery Team	7	8	0.043	4.200	7	0.044
Constructability	7	8	0.043	4.200	7	0.044
Alignment of Project Objectives	10	1	0.062	4.100	9	0.043
Trust & Respect	6	16	0.037	4.100	9	0.043
Long-term Bldg. Success & Lifecycle Value	9	4	0.056	4.000	12	0.042
Owner / User Participation	6	16	0.037	4.000	12	0.042
Production of Specified Quality	7	8	0.043	4.000	12	0.042
Sustainability	5	19	0.031	4.000	12	0.042
Project Time Performance	7	8	0.043	4.000	12	0.042
Aesthetics	3	22	0.019	3.900	16	0.041
Dispute Avoidance & Resolution	3	22	0.019	3.900	16	0.041
Change Order Reduction	9	4	0.056	3.800	18	0.040
Responsive Admin. & Decision Support	7	8	0.043	3.800	18	0.040
Project Cost Performance	7	8	0.043	3.700	20	0.039
Evidence Based Design	6	16	0.037	3.700	20	0.039
Owner's vision	4	21	0.025	3.700	20	0.039
Design Innovation & Creativity	7	8	0.043	3.500	22	0.036
Professional Reputation & Image	8	7	0.049	3.400	23	0.035
Profit & Financial Objectives	5	19	0.031	3.300	24	0.034
Number (n)	13			10		
Kendall's coefficient of concordance (W)	.104			.252		
Level of Significance	.117			.000		

Table 8.20. User's comparison between rounds 2 & 3

Comparisson Summary of Rd#1 & Rd#1 Inter-class Agreement					
Group	Test Statistics	Self-Interest		Project-Interest	
		Round #1	Round #2	Round #1	Round #2
Overall	N	51	42	51	42
	Kendall's W[a]	.141	.207	.095	.208
	Chi-square	164.828	199.951	111.455	201.173
	df	23	23	23	23
	Asymp. Sig.	.000	.000	.000	.000
Owner	N	17	13	17	13
	Kendall's W[a]	.236	.300	.154	.218
	Chi-square	92.351	89.721	60.224	65.315
	df	23	23	23	23
	Asymp. Sig.	.000	.000	.000	.000
Designer	N	10	9	10	9
	Kendall's W[a]	.186	.277	.149	.297
	Chi-square	42.828	57.388	34.380	61.389
	df	23	23	23	23
	Asymp. Sig.	.007	.000	.060	.000
Builder	N	11	10	11	10
	Kendall's W[a]	.251	.410	.193	.350
	Chi-square	63.573	94.384	48.811	80.479
	df	23	23	23	23
	Asymp. Sig.	.000	.000	.001	.000
User	N	13	10	13	10
	Kendall's W[a]	.257	.290	.104	.252
	Chi-square	76.697	66.769	31.231	57.984
	df	23	23	23	23
	Asymp. Sig.	.000	.000	.117	.000
a. Kendall's Coefficient of Concordance					

Table 8.21. Summary of rounds 1 & 2 inter-rater agreement by stakeholder group

Figure 8.21 compares the overall inter-rater agreement scores between rounds 1 and 2. Overall, Kendall's W scores increased 47% from 0.147 to 0.207 for self-interest and nearly 120% from 0.095 to 0.208 for project-interest. The null hypothesis for the validation of inter-rater agreement is that the ratings of the factors are unrelated. The computed W's for the overall panel of experts were statistically significant at greater than the 0.001 level for both self-interest and project-interest. The null hypothesis that the overall panel of expert's ratings is unrelated to each other is rejected. The conclusion is that there is a significant amount of agreement among the respondents for both self-interest and project-interest, and no further Delphi rounds are necessary to evaluate relative importance of the critical success factors.

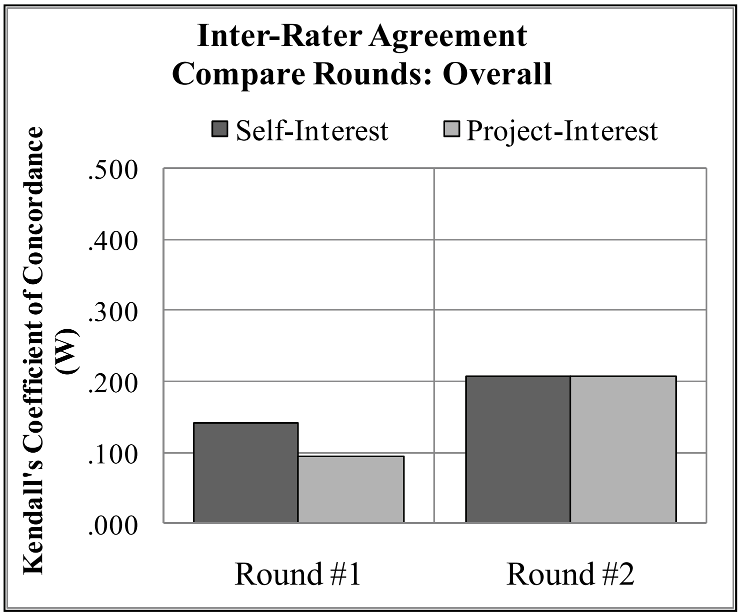


Figure 8.21. Overall comparison of rounds 1 & 2 inter-rater agreement

Figure 8.21. compares the overall inter-rater agreement scores between rounds 1 and 2. Overall, Kendall's W scores increased 47% from 0.147 to 0.207 for self-interest and nearly 120% from 0.095 to 0.208 for project-interest. The null hypothesis for the validation of inter-rater agreement is that the ratings of the factors are unrelated. The computed W's for the overall panel of experts were statistically significant greater than the 0.001 level for both self-interest and project-interest. The null hypothesis that the overall panel of expert's ratings is unrelated to each other is rejected. The conclusion is that there is a significant amount of agreement among the respondents for both self-interest and project-interest, and no further Delphi rounds are necessary to evaluate relative importance of the critical success factors.

The Kendall's W scores are also compared by individual stakeholder groups to validate each sub-panel of experts. The owners and builders stakeholder groups, also have W scores for both self-interest and project-interest which are significant at the 0.001 level. The designer group achieved a 0.10 significance level in self-interest category, and a .001 significance level in the project-interest category. Therefore the null hypothesis may also be rejected for the owner, designer, and builder stakeholder groups, and are validated for a significant amount of agreement.

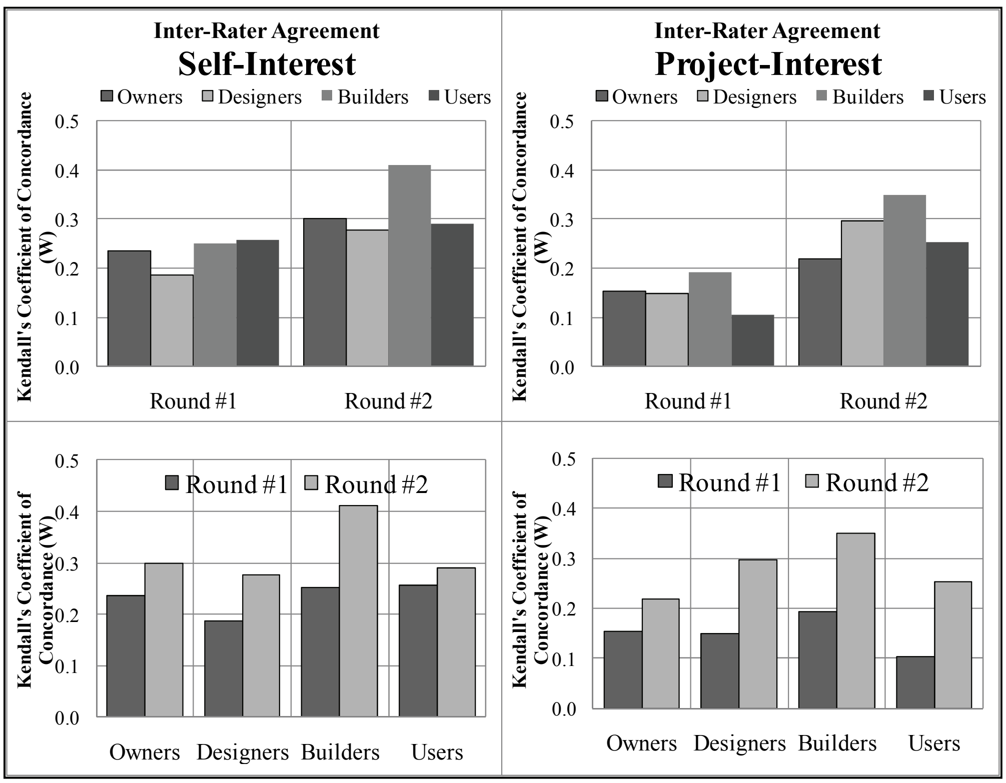


Figure 8.22. Round 1 & 2 inter-rater agreement comparison by stakeholder groups

The user stakeholder group achieved a .001 level of significance in the self-interest category in both the first and second round, and in the second round for project-interest. The user group did not achieve a 0.10 significance lever for project interest in round 1, but did achieve a 0.001 significance level in round 2 along with a 113% increase in the Kendall W score.

The null hypothesis is rejected for self-interest category, but cannot be rejected with 90% confidence for the project-interest category. With further review it is noted that the users only missed achieving a 0.10 significance in round 1 by 0.015. Taking into account (1) the significance of agreement in the self-interest category, (2) the 113% increase in inter-rater agreement score in round 2 at a 0.001 significance level, and (3) the threshold by which the user group missed achieving a 0.10 significance level for project-interest, it is reasonable to conclude the user stakeholder overall demonstrated significant inter-rater agreement.

8.11. Findings & Conclusions

The following is a summary of the findings and conclusions from the round 2 survey.

Summary of Round 2 Findings:

1. The Delphi survey process is again successful with an 83% participation rate and a 95% completion rate. The number of overall, and individual stakeholder group, participants remains adequate for implementing the Delphi method.

2. The Round 2 inter-rater agreement measured by Kendalls W indicated significant agreement overall, and within each stakeholder group at a .001 significance level.

3. The round 2 survey tested using Cronbach's alpha is reliable at the .001 significance level.

4. Thirteen critical success factors were selected, based on relative importance, to be included in the round 3 survey.

5. The relative importance of the factors was analyzed to identify the level of difference between the self-interest and project interest perspectives. Significance test determined that a significant difference between ten evaluated critical success factors exists at a 0.10 significance level.

6. Rounds 1 and 2 were inter-rater agreement tests were compared to determine if the Delphi process had resulted in an increased level of consensus amongst the panel(s) of experts. Overall, a significant increase in inter-rater agreement was measured the .001 level for both the self-interest and project interest categories.

<u>Round 2 Conclusions:</u>

It is concluded from the findings that there is significant agreement among the survey participants, and that the survey is reliable. It is concluded that significant difference do exist between self and project perspectives when rating relative importance of the critical success factors. In total the first two round of surveys support the overall dissertation by proving that there are aspects of project delivery which may be addressed in novel ways by taking into consideration differences that exist between project stakeholders within the project delivery team, and also differences within each individual stakeholder group in relation to self-interest and project-interest

The theoretical framework of this dissertation is built around value-creation and how the stakeholder groups within a project delivery team collaborate to successfully achieve goals and objectives. Thus far, the surveys have proven the existence of the significant differences based on highly qualified expert opinion and statistical testing.

The surveys have provided data to study the relative importance each stakeholder group places on many important factors for value-creation throughout the project delivery process. Understanding the relative importance provides a framework from which to find ways to optimize the delivery process to maximize the benefit to all stakeholders, and thereby maximize the value-creation.

CHAPTER 9.

ROUND 3 REPORT

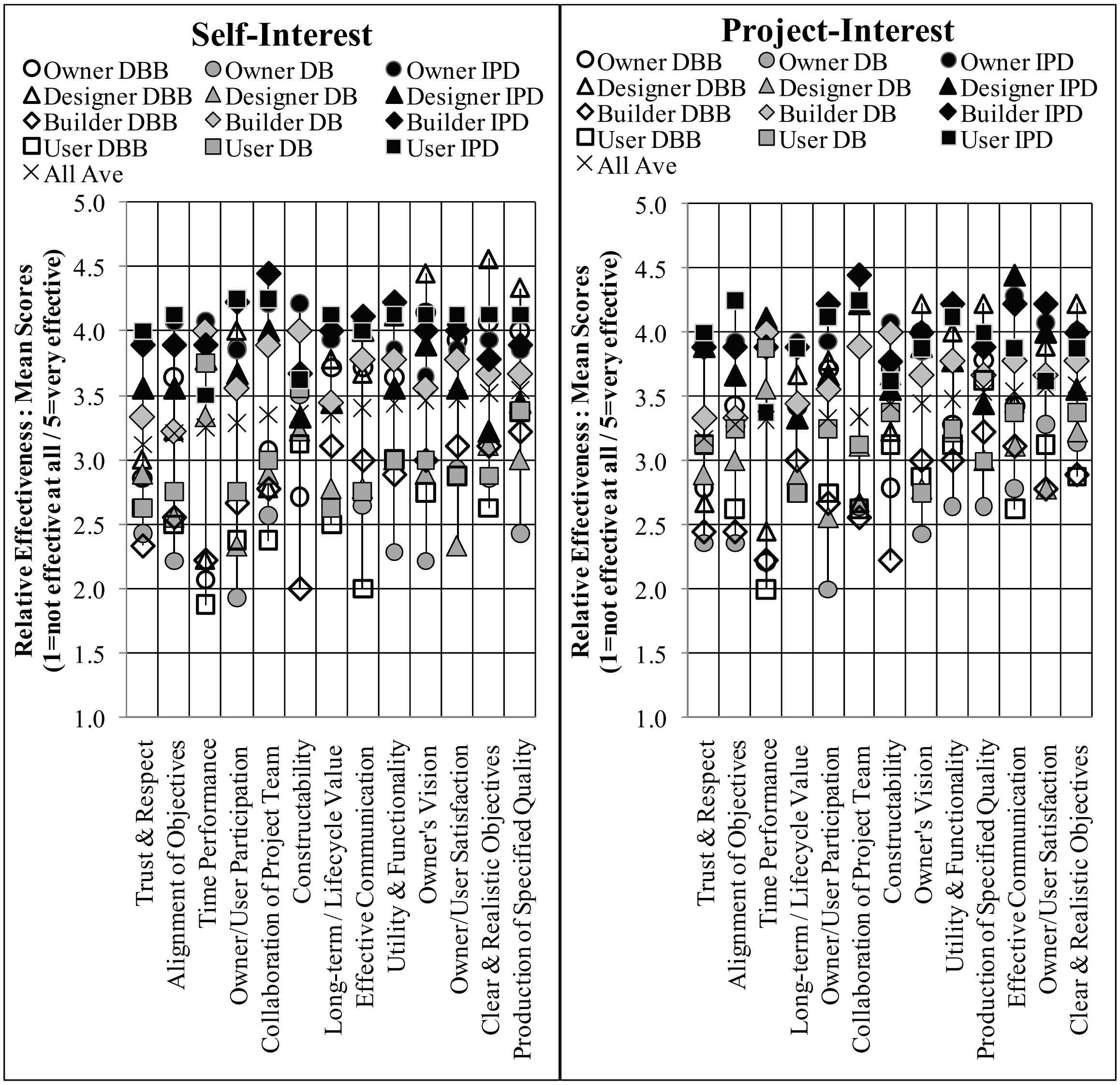


Figure 9.1. Round 3 data summary

9.1. Introduction

The round 3 departs from the goal of the first two rounds of survey. In survey rounds 1 and 2 the panel of experts selected critical success factors and assessed relative importance based each of their stakeholder group's perspectives of self-interest and project-interest. At the end of the second round the top 13 most important critical success factors have been identified. In round 3, these top 13 most important critical success factors will now be used for different purpose. The panel of experts is asked in round 3 to assess the effectiveness of three different project delivery methods: design-bid-build (DBB), design-build (DB), and Integrated Project Delivery (IPD). Figure 9.1 provides a summary of how each stakeholder group rated each project delivery method's effectiveness related to the thirteen factors. Close examination shows Integrated Project Delivery consistently rising to the top of the data distribution for relative effectiveness. This report will present the data and analysis in much greater detail below.

An important concept to consider for the round 3 survey is that evaluation is limited to the context of large, expensive, and complex projects similar to the IDBB-pilot projects the panels of experts are affiliated with. The scale of projects in scope, size, and complexity greatly influences not only relative value perception, but also realities of diminishing return on investments to enhance collaboration and/or increase project integration. Small, simple projects with modest budgets could certainly benefit from a better project delivery process, but the evaluation equation is vastly different when compared to a mega-project. By any definition three of the four IDBB pilot-projects ranging in cost between $700 million and $1.7 billion are mega-projects, and the fourth IDBB pilot-project at more than $92 million is well within the lower bound for consideration as a mega-project. [111] The panel of experts was established based on experience and participation is some of the largest and most complex projects in the military construction program.

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[111] Li Zhai, Yanfei Xin, and Chaosheng Cheng, "Understanding the Value of Project Management From a Stakeholder's Perspective: Case Study of Mega-Project Management," *Project Management Journal* 40, no. 1 (March 2009): 99-100. Defines mega-projects as "having greater complexity, more stakeholders, and more extensive influences compared with normal projects." Zhai et al cite a range of reports defining mega-projects from a range of $22 million to $500 million, with an emphasis on complexity and stakeholder challenges.

9.1.1. Organization

The round 3 survey report is organized in the following order: Purpose, Administrative Information, Questions Asked, Data & Analysis, Findings, Summary and Conclusion. The format of the round 3 report differs from the round 1 report because the critical success factors categories have been consolidated into one comprehensive list. The presentation of the data will be divided into categories based on stakeholder and the three project delivery methods being assessed. The breakdown between self-interest and project-interest remains.

9.1.2. Purpose

The purposes of the round 3 survey:

1. To validate each participant's familiarity with the three project delivery methods. Only data from participants validated for familiarity with the project delivery methods evaluated will be include.

2. To evaluate the effectiveness of three project delivery methods (DBB, DB, and IPD) to successfully achieve the most important critical success factors selected by the panel of experts.

3. To identify how each stakeholder group differs in their assessments of delivery method efficacy to infer predispositions.

4. To infer which project delivery method(s) is most effective for achieving the select important critical success factors.

5. To infer implementability of the project delivery methods based on perceptions of relative effectiveness. For a project delivery method to create real value, it must be practical in the 'real-world'. A good idea that is not implementable has no real value in practice.

6. An unrelated purpose included in the round 3 survey was evaluation of one critical success factor (Evidence Based Design) which was erroneously omitted from the list of factors to be evaluated in round 2. (The results of the evaluation of Evidence Based Design are amended to the round 2 data set, and have been included in the report and analysis for round 2)

9.1.3. Administrative

The round 3 survey was published to the participant population on 26 April 2011. Weekly email reminders were automatically sent to remaining participants until the survey was closed at 21 days later 11:59 pm on 17 May 2011. The survey invitations were sent via email to a total of 51 participants. The round 3 survey invitation list was again limited to the respondents who participated in the round 1 survey. All participants were provided with the result of the round 2 survey for their consideration prior to starting the round 3 survey.

Participation Statistics:

- Invited: 51
- Started: 44
- Completed: 42
- Participation Rate: 82.3%
- Completion Rate: 95.5%

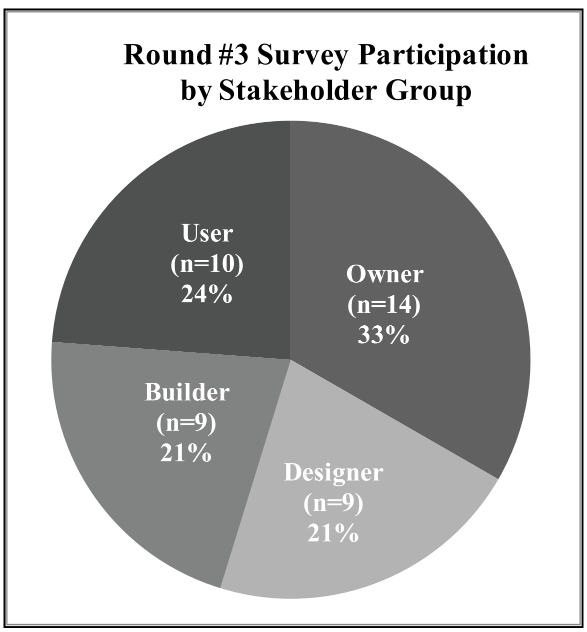
- Drop outs (after starting): 2
- Not validated for participation: 2
- Total validated participants: 40
- Average Time to Complete Survey: 16 minutes

Round 3 Questions

The following is a summary of the survey questions. A complete copy of the survey instrument is located in Appendix E.

Round 3 - Question 1: Stakeholder Group

Which of the following categories do you best identify with? (Select only one): Design Team; Facility User or User's Representative; Construction Team; Owner or Owner's Representative.



Stakeholder Group (1)	Frequency (2)	Percent (3)
Owner / Owner's Representative	14	33%
Design Team	9	21%
Construction Team	9	21%
Facility User / User's Representative	10	24%
Total	42	100%

Figure 9.2. Round 3 participation by stakeholder group

Round 3 - Question 2: Evidence Based Design

** The following question was included in the round 3 survey to correct an error of omission in the round 2 survey:*

Rate the importance of Evidence Based Design (twice: from the self-perspective and again from the project-interest perspective) on a five-point-scale, where 1 = least important, and 5 = most important?

The resulting data from this question was amended to the round 2 data and is not reported here. Please note that Evidence Based Design did not score high enough in the amended round 2 data for inclusion in the round 3 survey. Evidence Based Design was included as the last factor evaluated in the round 3 survey, in the event that amended round 2 results may have placed Evidence Based Design in the top 25%. Failing to meet the to criteria for inclusion in the round 3 survey, the data collected for Evidence Based Design in round 3 has been removed from the round 3 data set.

9.2. Familiarity with Project Delivery Methods

Round 3 - Question 3: Effectiveness of Project Delivery Methods

How familiar are you with the following project delivery methods: Design-Bid-Build (DBB), Design-Build (DB), and Integrated Project Delivery (IPD)? Rate each on the following five-point-scale: 1. Not at all familiar; 2. Slightly Familiar; 3. Somewhat familiar; 4. Moderately familiar; and 5. Very Familiar.

The original validation of survey participants in round 1 established expertise to evaluated critical success factors. The overall sample population was selected for this research project based on both expert qualification and recent and/or ongoing work associated with the military construction Integrated-Design-Bid-Build (IDBB) pilot-projects. The sample population represents the senior leadership of the largest most successful design firms and construction companies. In addition to having extensive Integrated Project Delivery experience through the IDBB pilot-projects, all the survey participants also have extensive experience with traditional design-bid-build, and design-build projects. To protect the survey participants anonymity the names of the companies are not listed in this document, but they are recognized as among the biggest and best in their respective industries.

All builder stakeholder participants are from companies that place highly on ENR's 2010 Top 400 contractors. All are within the top-25 general building contracting companies (including four in the top-ten), within the top-30 design-build contractors, and within the top-20 healthcare contractors (including 3 of the top-four). Additionally the builders represent the top-20 in construction management (CM) at risk which provides integration services to traditional project delivery methods (including 3 in the top-eleven).[112] The designers also place high on ENR's 2010 list of Top 500 design firms. The designers all come from top-25 firms including two of the top-ten healthcare designers. [113] The owners and users have been involved with many billions of dollars worth of MILCON construction using both traditional design-bid-build and design-build. The U.S. Army Corps of Engineers was one of the early adopters for design-build and has completed hundreds of DB projects.

The validation from round 1 leaves no doubt to the absolute expertise and experience of the panel members across each stakeholder group (Owner, Designer, Builder, and User). To ensure consistency in evaluating the project delivery methods in round 3, participants are asked to rate their familiarity with each method. A minimum screening criteria for individuals and groups was established at 4.00 to ensure high familiarity.

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112 ENR, "The Top 400 Contractors Sourcebook," special issue of *ENR: Engineering News-Record* 265, no. 7 (13 September 2010) (New York: The McGraw-Hill Companies), 35-36.
113 ENR, "The Top 500 Design Firms Sourcebook," special issue of *ENR: Engineering News-Record* 265, no. 1 (05 July 2010) (New York: The McGraw-Hill Companies), 25-26.

Round# 3 Descriptive Statistics: Familiarity of Project Delivery Methods											
Project Delivery Method	Familiarity Scale (1 - 5)	Owner		Designer		Builder		User		All	
		Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Design-Bid-Build (DBB)	1. Not at all	0	0%	0	0%	0	0%	0	0%	0	0%
	2. Slightly	0	0%	0	0%	0	0%	0	0%	0	0%
	3. Somewhat	0	0%	0	0%	0	0%	3	30%	3	7%
	4. Moderately	1	7%	0	0%	1	11%	1	10%	3	7%
	5. Very	13	93%	9	100%	8	89%	6	60%	36	86%
	Total	14	100%	9	100%	9	100%	10	100%	42	100%
Design-Build (DB)	1. Not at all	0	0%	0	0%	0	0%	0	0%	0	0%
	2. Slightly	0	0%	0	0%	0	0%	0	0%	0	0%
	3. Somewhat	0	0%	1	11%	1	11%	4	40%	6	14%
	4. Moderately	3	21%	2	22%	1	11%	1	10%	7	17%
	5. Very	11	79%	6	67%	7	78%	5	50%	29	69%
	Total	14	100%	9	100%	9	100%	10	100%	42	100%
Integrated Project Delivery (IPD)	1. Not at all	0	0%	0	0%	0	0%	1	10%	1	2%
	2. Slightly	0	0%	0	0%	0	0%	1	10%	1	2%
	3. Somewhat	0	0%	0	0%	0	0%	3	30%	3	7%
	4. Moderately	3	21%	1	11%	1	11%	2	20%	7	17%
	5. Very	11	79%	8	89%	8	89%	3	30%	30	71%
	Total	14	100%	9	100%	9	100%	10	100%	42	100%

Table 9.1. Round 3 familiarity frequency table

It was expected that the overwhelming majority of the participant would have a high degree of familiarity and experience with all three methods. However, it was also expected that there may be a limited number of participants who may have limited familiarity with the one or more of the delivery methods despite their involvement in the very same project delivery process, especially in the User stakeholder group. Users have a critical role in the project delivery process, but normally serve in advisory roles at best in the technical/contractual workings of the contractual relationships between other stakeholders (Owner, Design, and Builder).

Descriptive Statistics									
Stakeholder Group	Project Delivery Method	N	Range	Min.	Max.	Mean	Std. Error	Std. Deviation	Variance
Overall	Design-Bid-Build (DBB)	42	2	3	5	4.79	.087	.565	.319
	Design-Build (DB)	42	2	3	5	4.55	.114	.739	.546
	Integrated Project Delivery (IPD)	42	4	1	5	4.52	.141	.917	.841
Owners	Design-Bid-Build (DBB)	14	1	4	5	4.93	.071	.267	.071
	Design-Build (DB)	14	1	4	5	4.79	.114	.426	.181
	Integrated Project Delivery (IPD)	14	1	4	5	4.79	.114	.426	.181
Designers	Design-Bid-Build (DBB)	9	0	5	5	5.00	.000	.000	.000
	Design-Build (DB)	9	2	3	5	4.56	.242	.726	.528
	Integrated Project Delivery (IPD)	9	1	4	5	4.89	.111	.333	.111
Builders	Design-Bid-Build (DBB)	9	1	4	5	4.89	.111	.333	.111
	Design-Build (DB)	9	2	3	5	4.67	.236	.707	.500
	Integrated Project Delivery (IPD)	9	1	4	5	4.89	.111	.333	.111
Users	Design-Bid-Build (DBB)	10	2	3	5	4.30	.300	.949	.900
	Design-Build (DB)	10	2	3	5	4.10	.314	.994	.989
	Integrated Project Delivery (IPD)	10	4	1	5	3.50	.428	1.354	1.833

Table 9.2. Round 3 familiarity descriptive statistics

Descriptive Statistics (Revised)									
Stakeholder Group	Project Delivery Method	N	Range	Min.	Max.	Mean	Std. Error	Std. Deviation	Variance
Overall	***Design-Bid-Build (DBB)***	***40***	***2***	***3***	***5***	***4.83***	***.079***	***.501***	***.251***
	Design-Build (DB)	***40***	***2***	***3***	***5***	***4.63***	***.106***	***.667***	***.446***
	Integrated Project Delivery (IPD)	***40***	***2***	***3***	***5***	***4.68***	***.097***	***.616***	***.379***
Owners	Design-Bid-Build (DBB)	14	1	4	5	4.93	.071	.267	.071
	Design-Build (DB)	14	1	4	5	4.79	.114	.426	.181
	Integrated Project Delivery (IPD)	14	1	4	5	4.79	.114	.426	.181
Designers	Design-Bid-Build (DBB)	9	0	5	5	5.00	.000	.000	.000
	Design-Build (DB)	9	2	3	5	4.56	.242	.726	.528
	Integrated Project Delivery (IPD)	9	1	4	5	4.89	.111	.333	.111
Builders	Design-Bid-Build (DBB)	9	1	4	5	4.89	.111	.333	.111
	Design-Build (DB)	9	2	3	5	4.67	.236	.707	.500
	Integrated Project Delivery (IPD)	9	1	4	5	4.89	.111	.333	.111
Users	***Design-Bid-Build (DBB)***	***8***	***2***	***3***	***5***	***4.38***	***.324***	***.916***	***.839***
	Design-Build (DB)	***8***	***2***	***3***	***5***	***4.38***	***.324***	***.916***	***.839***
	Integrated Project Delivery (IPD)	***8***	***2***	***3***	***5***	***4.00***	***.327***	***.926***	***.857***

Table 9.3. Round 3 revised familiarity descriptive statistics (after screening process)

Two participants in the user stakeholder group responded with 'not familiar at all' and 'slightly familiar', causing the mean score for the user stakeholder group's familiarity of IPD to fall below 4.00 (moderately familiar). These two cases were screened out of the data set of round 3, and the descriptive statistics for the revised sample were calculated to ensure the minimum 4.0

mean score was achieved across the board. As a result of the screening process the overall panel of expert's means score increased as follows: DBB from 4.79 to 4.83, DB from 4.55 to 4.63; and IPD from 4.52 to 4.63.

Overall there was slightly more familiarity with the traditional DBB method, and equal familiarity with DB and IPD methods. The high degree of familiarity among all stakeholder groups for each of the three project delivery methods (not counting the two participants eliminated for not meeting the screening criteria) validates the appropriateness of the panel of experts to participate in round 3.

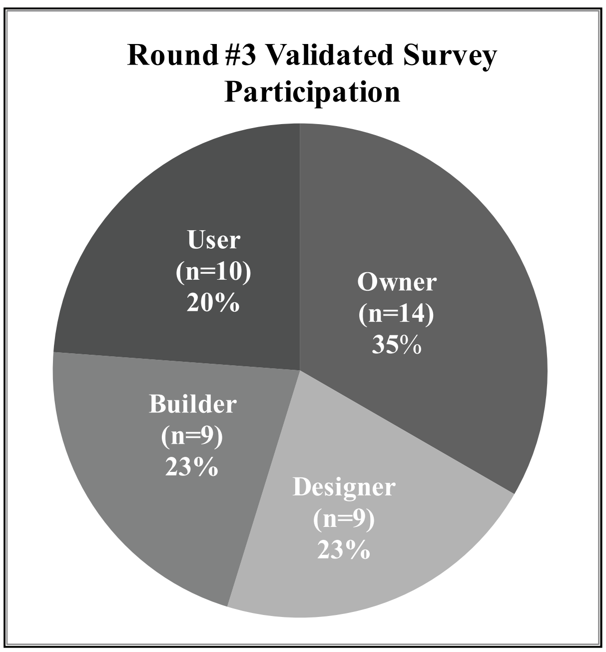


Figure 9.3. Round 3 revised participation (post-screening)

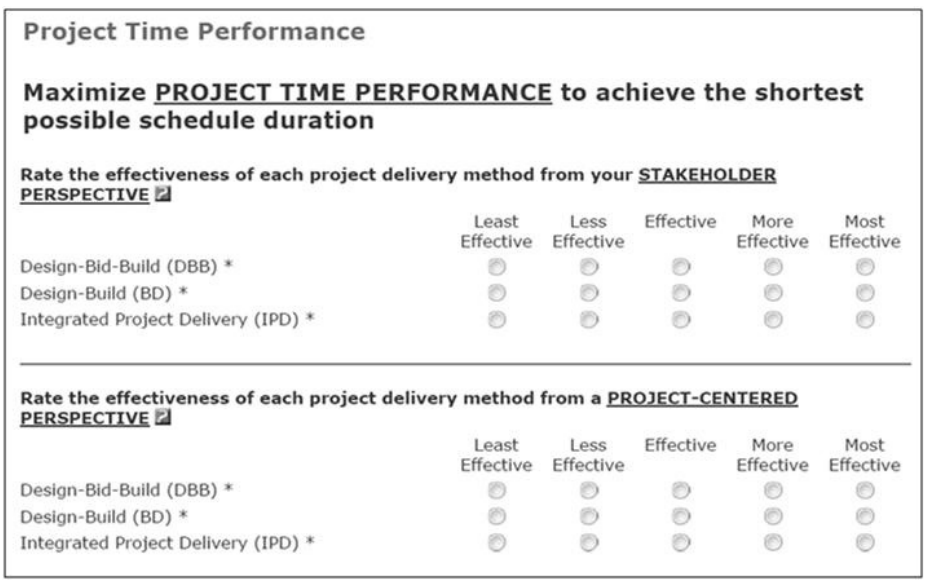
9.3. Efficacy of Project Delivery Methods

Round 3 - Question 4: Rate the Effectiveness of Project Delivery Methods

The respondents were asked the question twice (again from each the self-interest and project-interest perspectives) for each of the following critical success factors:

1. Owner & User Satisfaction
2. Clear & Realistic Objectives
3. Effective Communication
4. Collaboration of Project Delivery Team
5. Utility & Functionality
6. Trust & Respect
7. Alignment of Project Objectives
8. Owner & User Participation
9. Production of Specified Quality
10. Long-term Building Success (Lifecycle Value)
11. Project Time Performance
12. Owner's Vision
13. Constructability

Rate the effectiveness of each project delivery method to successfully achieve/enable/ensure/maintain/promote/maximize the listed critical success factors on the following one-to-five scale: 1. Least effective, 2. Less effective, 3. Effective, 4. More effective, and 5. Most effective.


Project Time Performance

Maximize PROJECT TIME PERFORMANCE to achieve the shortest possible schedule duration

Rate the effectiveness of each project delivery method from your STAKEHOLDER PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *					
Design-Build (BD) *					
Integrated Project Delivery (IPD) *					

Rate the effectiveness of each project delivery method from a PROJECT-CENTERED PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *					
Design-Build (BD) *					
Integrated Project Delivery (IPD) *					

Figure 9.4. Example of CSF question from web-survey

9.4. Design-Bid-Build: Data & Analysis

Design-Bid-Build (DBB) Relative Effectiveness																
Group	Critical Success Factor	N	Self-Centered							Project-Centered						
			Range	Min	Max	Mean	Std.Error	Std.Dev	Var.	Range	Min.	Max	Mean	Std.Error	Std.Dev	Var.
All	Owner/User Satisfaction	40	4	1	5	3.58	.182	1.152	1.328	4	1	5	3.40	.175	1.105	1.221
	Clear & Realistic Objectives	40	4	1	5	3.68	.197	1.248	1.558	4	1	5	3.58	.199	1.259	1.584
	Effective Communication	40	4	1	5	3.20	.187	1.181	1.395	4	1	5	3.20	.165	1.043	1.087
	Collaboration of Project Team	40	4	1	5	2.80	.153	.966	.933	4	1	5	2.63	.163	1.030	1.061
	Utility & Functionality	40	4	1	5	3.45	.152	.959	.921	4	1	5	3.35	.146	.921	.849
	Trust & Respect	40	4	1	5	2.73	.148	.933	.871	4	1	5	2.75	.147	.927	.859
	Alignment of Objectives	40	4	1	5	3.08	.173	1.095	1.199	4	1	5	3.03	.174	1.097	1.204
	Owner/User Participation	40	4	1	5	3.33	.177	1.118	1.251	4	1	5	3.30	.161	1.018	1.036
	Production of Specified Quality	40	3	2	5	3.78	.150	.947	.897	4	1	5	3.73	.156	.987	.974
	Long-term / Lifecycle Value	40	4	1	5	3.35	.154	.975	.951	4	1	5	3.25	.155	.981	.962
	Time Performance	40	4	1	5	2.10	.151	.955	.913	4	1	5	2.23	.150	.947	.897
	Owner's Vision	40	4	1	5	3.68	.184	1.163	1.353	4	1	5	3.60	.182	1.150	1.323
	Constructability	40	4	1	5	2.75	.163	1.032	1.064	4	1	5	2.83	.156	.984	.969
Owners	Owner/User Satisfaction	14	3	2	5	3.93	.286	1.072	1.148	4	1	5	3.64	.341	1.277	1.632
	Clear & Realistic Objectives	14	3	2	5	4.07	.267	.997	.995	4	1	5	4.00	.378	1.414	2.000
	Effective Communication	14	4	1	5	3.71	.339	1.267	1.604	4	1	5	3.43	.374	1.399	1.956
	Collaboration of Project Team	14	4	1	5	3.07	.245	.917	.841	4	1	5	2.64	.269	1.008	1.016
	Utility & Functionality	14	3	2	5	3.64	.269	1.008	1.016	4	1	5	3.29	.286	1.069	1.143
	Trust & Respect	14	4	1	5	2.86	.294	1.099	1.209	4	1	5	2.79	.281	1.051	1.104
	Alignment of Objectives	14	4	1	5	3.64	.289	1.082	1.170	4	1	5	3.43	.291	1.089	1.187
	Owner/User Participation	14	4	1	5	3.86	.294	1.099	1.209	4	1	5	3.71	.286	1.069	1.143
	Production of Specified Quality	14	3	2	5	4.00	.257	.961	.923	4	1	5	3.79	.334	1.251	1.566
	Long-term / Lifecycle Value	14	3	2	5	3.71	.266	.994	.989	4	1	5	3.43	.309	1.158	1.341
	Time Performance	14	3	1	4	2.07	.221	.829	.687	3	1	4	2.21	.239	.893	.797
	Owner's Vision	14	4	1	5	4.14	.294	1.099	1.209	4	1	5	4.00	.314	1.177	1.385
	Constructability	14	4	1	5	2.71	.244	.914	.835	4	1	5	2.79	.261	.975	.951
Designers	Owner/User Satisfaction	9	2	3	5	4.11	.309	.928	.861	2	3	5	3.89	.261	.782	.611
	Clear & Realistic Objectives	9	2	3	5	4.56	.242	.726	.528	2	3	5	4.22	.222	.667	.444
	Effective Communication	9	3	2	5	3.67	.333	1.000	1.000	3	2	5	3.44	.294	.882	.778
	Collaboration of Project Team	9	4	1	5	2.78	.434	1.302	1.694	4	1	5	2.67	.441	1.323	1.750
	Utility & Functionality	9	2	3	5	4.11	.261	.782	.611	2	3	5	4.00	.236	.707	.500
	Trust & Respect	9	2	2	4	3.00	.289	.866	.750	3	1	4	2.67	.289	.866	.750
	Alignment of Objectives	9	2	2	4	3.22	.278	.833	.694	3	2	5	3.33	.333	1.000	1.000
	Owner/User Participation	9	2	3	5	4.00	.236	.707	.500	2	3	5	3.78	.222	.667	.444
	Production of Specified Quality	9	2	3	5	4.33	.289	.866	.750	2	3	5	4.22	.278	.833	.694
	Long-term / Lifecycle Value	9	2	3	5	3.78	.278	.833	.694	2	3	5	3.67	.236	.707	.500
	Time Performance	9	4	1	5	2.22	.434	1.302	1.694	4	1	5	2.44	.377	1.130	1.278
	Owner's Vision	9	2	3	5	4.44	.242	.726	.528	2	3	5	4.22	.222	.667	.444
	Constructability	9	3	2	5	3.22	.278	.833	.694	3	2	5	3.22	.278	.833	.694
Builders	Owner/User Satisfaction	9	4	1	5	3.11	.389	1.167	1.361	3	1	4	2.78	.364	1.093	1.194
	Clear & Realistic Objectives	9	4	1	5	3.11	.389	1.167	1.361	4	1	5	2.89	.389	1.167	1.361
	Effective Communication	9	2	2	4	3.00	.167	.500	.250	1	3	4	3.11	.111	.333	.111
	Collaboration of Project Team	9	1	2	3	2.78	.147	.441	.194	2	1	3	2.56	.242	.726	.528
	Utility & Functionality	9	3	1	4	2.89	.261	.782	.611	3	1	4	3.00	.289	.866	.750
	Trust & Respect	9	2	1	3	2.33	.236	.707	.500	2	1	3	2.44	.242	.726	.528
	Alignment of Objectives	9	3	1	4	2.56	.377	1.130	1.278	3	1	4	2.44	.377	1.130	1.278
	Owner/User Participation	9	3	1	4	2.67	.289	.866	.750	3	1	4	2.67	.333	1.000	1.000
	Production of Specified Quality	9	2	2	4	3.22	.222	.667	.444	2	2	4	3.22	.222	.667	.444
	Long-term / Lifecycle Value	9	2	2	4	3.11	.261	.782	.611	3	1	4	3.00	.333	1.000	1.000
	Time Performance	9	2	1	3	2.22	.278	.833	.694	2	1	3	2.22	.278	.833	.694
	Owner's Vision	9	3	1	4	3.00	.333	1.000	1.000	3	1	4	3.00	.333	1.000	1.000
	Constructability	9	2	1	3	2.00	.289	.866	.750	2	1	3	2.22	.278	.833	.694
Users	Owner/User Satisfaction	8	4	1	5	2.88	.398	1.126	1.268	3	2	5	3.13	.295	.835	.696
	Clear & Realistic Objectives	8	4	1	5	2.63	.460	1.302	1.696	3	1	4	2.88	.350	.991	.982
	Effective Communication	8	2	1	3	2.00	.327	.926	.857	3	1	4	2.63	.324	.916	.839
	Collaboration of Project Team	8	3	1	4	2.38	.375	1.061	1.125	3	1	4	2.63	.420	1.188	1.411
	Utility & Functionality	8	2	2	4	3.00	.267	.756	.571	2	2	4	3.13	.227	.641	.411
	Trust & Respect	8	3	1	4	2.63	.324	.916	.839	3	2	5	3.13	.350	.991	.982
	Alignment of Objectives	8	3	1	4	2.50	.327	.926	.857	3	1	4	2.63	.324	.916	.839
	Owner/User Participation	8	2	1	3	2.38	.263	.744	.554	2	2	4	2.75	.250	.707	.500
	Production of Specified Quality	8	3	2	5	3.38	.324	.916	.839	2	3	5	3.63	.263	.744	.554
	Long-term / Lifecycle Value	8	2	1	3	2.50	.267	.756	.571	2	2	4	2.75	.250	.707	.500
	Time Performance	8	3	1	4	1.88	.350	.991	.982	3	1	4	2.00	.378	1.069	1.143
	Owner's Vision	8	3	1	4	2.75	.313	.886	.786	4	1	5	2.88	.398	1.126	1.268
	Constructability	8	4	1	5	3.13	.441	1.246	1.554	3	1	4	3.13	.398	1.126	1.268

Table 9.4. Round 3 -- DBB Relative effectiveness: descriptive statistics

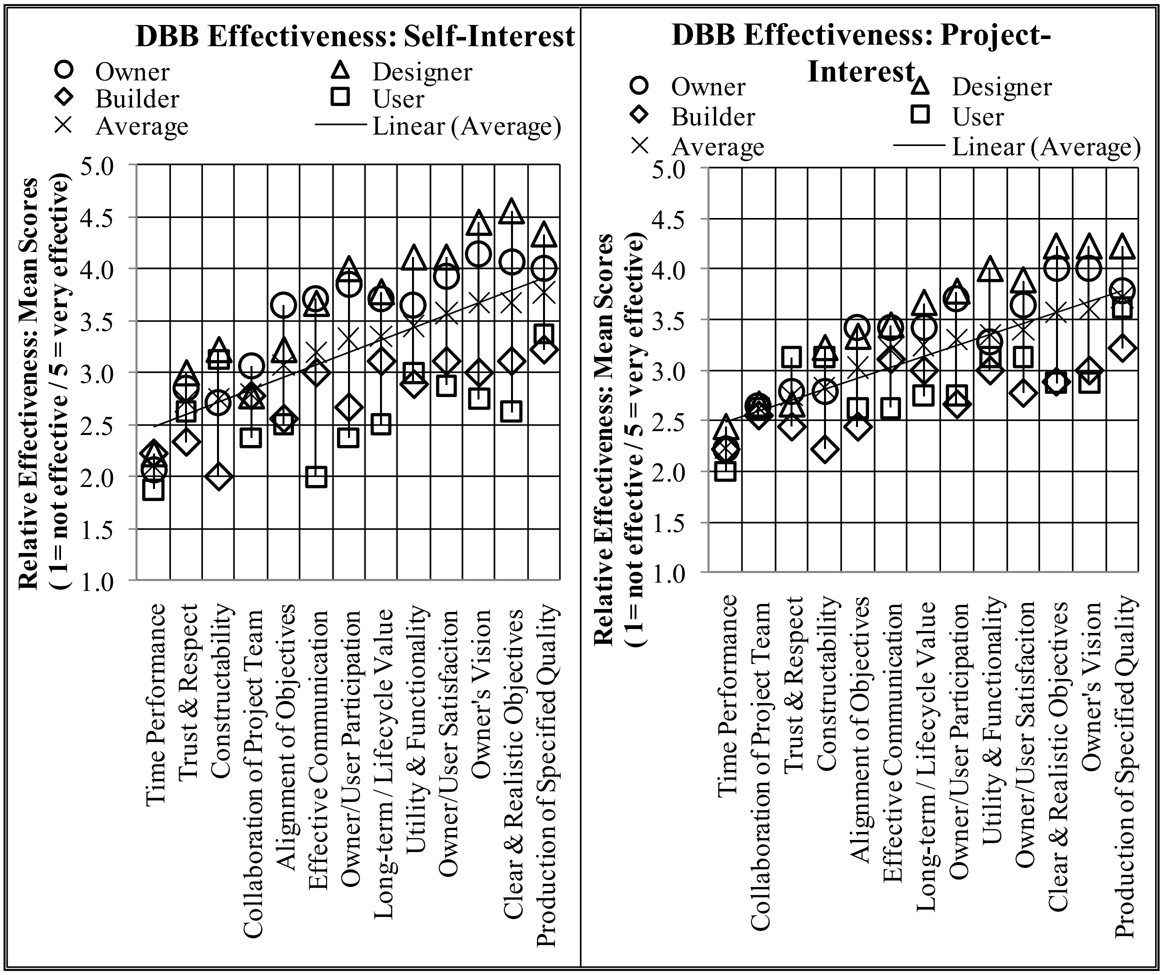


Figure 9.5. Round 3 -- DBB: relative effectiveness by average mean score

Viewing the distribution of stakeholder group mean scores in Figure 9.5 it is clear the designers rate Design-Bid-Build (DBB) highest above average among the stakeholder groups, followed by the owners in both self-interest and project interest. The builders and users display and opposing trend rating below the average in both self and project categories. The distribution is much tighter around the linear average form project-interest indicating more agreement among the stakeholders overall.

9.4.1. Inter-Rater Agreement Testing

The panel of experts demonstrated the highest levels of agreement within each stakeholder group when evaluating the Design-Bid-Build method. The owner and designer group had an exceptionally high agreement. Keep the high level of agreement in mind when reviewing the comparisons of how each group rated the methods later in this report. DBB is generally the lowest rated of the three project delivery methods.

Round #3 Inter-Rater Agreement: Design Bid Build (DBB)										
Critical Success Factors	Self-Interest Mean Rank					Project-Interest Mean Rank				
	O	D	B	U	All	O	D	B	U	All
Owner / User Satisfaction	8.75	8.67	8.11	7.81	8.40	8.68	8.17	7.50	8.00	8.16
Clear & Realistic Objectives	9.21	10.39	8.22	7.06	8.83	9.71	9.67	7.39	6.50	8.54
Effective Communication	7.21	6.94	8.22	3.88	6.71	7.18	6.33	8.61	5.94	7.06
Collaboration of Project Delivery Team	5.14	4.11	7.11	6.06	5.54	4.18	4.50	6.61	5.75	5.11
Utility & Functionality	7.43	8.44	7.72	9.19	8.08	6.82	8.61	8.33	8.63	7.93
Trust & Respect	4.64	4.17	4.83	7.69	5.19	5.04	3.56	5.17	8.38	5.40
Alignment of Project Objectives	7.64	4.83	5.94	6.88	6.48	7.64	6.33	5.61	5.94	6.55
Production of Specified Quality	8.07	8.22	6.94	5.88	7.41	7.82	8.17	6.89	6.63	7.45
Long-term Bldg. Success & Lifecycle	9.00	9.67	8.72	9.88	9.26	9.00	9.83	9.00	10.38	9.46
Project Time Performance	7.82	7.56	8.72	6.25	7.65	7.50	7.83	8.44	6.56	7.60
Owner / User Participation	2.61	3.11	4.67	4.00	3.46	3.36	3.22	4.67	3.38	3.63
Owner's vision	9.46	10.06	8.17	7.63	8.94	9.14	9.78	8.50	6.81	8.68
Constructability	4.00	4.83	3.61	8.81	5.06	4.93	5.00	4.28	8.13	5.44
Statistic	Self-Interest					Project-Interest				
	O	D	B	U	All	O	D	B	U	All
N	14	9	9	8	40	14	9	9	8	40
Kendall's W[a]	.425	.481	.309	.313	.285	.387	.463	.287	.273	.267
Chi-square	71.41	51.98	33.40	30.01	136.62	65.03	50.05	31.01	26.20	128.35
df	12	12	12	12	12	12	12	12	12	12
Asymp. Sig.	.000	.000	.001	.003	.000	.000	.000	.002	.010	.000
a. Kendall's Coefficient of Concordance										

Table 9.5. Round 3 -- DBB: inter-rater agreement testing

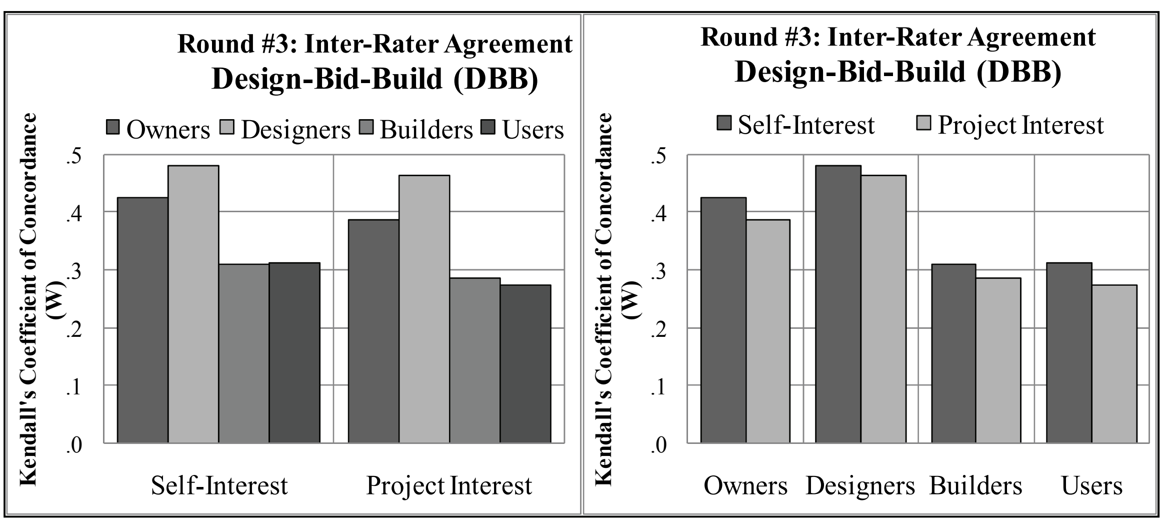


Figure 9.6. Round 3 -- DBB: Inter rate agreement comparison

9.4.2. Correlations

Round #3: Correlation among Stakeholder Groups for DBB Category								
Correlation Matrix *	Self-Interest				Project-Interest			
	Owner	Designer	Builder	User	Owner	Designer	Builder	User
Owner	1.000	0.761[b]	0.586[b]	0.149	1.000	0.800[b]	0.421[a]	0.224
Designer	--	1.000	0.575[b]	0.368	--	1.000	0.521[a]	0.395
Builder	--	--	1.000	0.209	--	--	1.000	0.258
User	--	--	--	1.000	--	--	--	1.000

Notes:

[a] Correlation is significant at the 0.05 level (2-tailed).

[b] Correlation is significant at the 0.01 level (2-tailed).

* Correlation Coefficient based on mean scores, and calculated in SPSS using Pearsons Correlation.

Table 9.6. Round 3 -- DBB: stakeholder correlation matrix

Correlations: Self-Interest Design Bid Build (DBB)

	Owner/ User Satisfac-tion	Clear & Real-istic Object-ives	Effect-ive Comm-unication	Collab-oration of Proj. Delivery Team	Utility & Functio n-ality	Trust & Respect	Align-ment of Project Objec-tives	Owner/ User Partic-ipation	Product-ion of Specif-ied Quality	Long-term Success & Life-cycle Value	Time Perform-ance	Owner's Vision	Construct-ability
Owner/User Satisfaciton	1.000	0.615**	0.516**	0.451**	0.502**	0.532**	0.473**	0.588**	0.451**	0.432**	0.063	0.621**	0.318*
Clear & Realistic Objectives	--	1.000	.584**	0.370*	0.468**	0.516**	0.656**	0.665**	0.631**	0.559**	0.243	0.667**	0.393*
Effective Communication	--	--	1.000	0.485**	0.530**	0.330*	0.543**	0.765**	0.500**	0.494**	0.073	0.664**	0.147
Collaboration of Proj. Delivery Tean	--	--	--	1.000	0.487**	0.705**	0.596**	0.536**	0.482**	0.457**	0.050	0.465**	0.283
Utility & Functionality	--	--	--	--	1.000	0.399*	0.504**	0.673**	0.679**	0.704**	0.117	0.732**	0.427**
Trust & Respect	--	--	--	--	--	1.000	0.673**	0.505**	0.479**	0.475**	0.348*	0.459**	0.593**
Alignment of Project Objectives	--	--	--	--	--	--	1.000	0.733**	0.585**	0.551**	0.287	0.664**	0.448**
Owner/User Participation	--	--	--	--	--	--	--	1.000	0.628**	0.692**	0.161	0.872**	0.361*
Production of Specified Quality	--	--	--	--	--	--	--	--	1.000	0.698**	0.139	0.700**	0.545**
Long-term Success & Lifecycle Valu	--	--	--	--	--	--	--	--	--	1.000	.347*	0.781**	0.217
Time Performance	--	--	--	--	--	--	--	--	--	--	1.000	0.238	0.182
Owner's Vision	--	--	--	--	--	--	--	--	--	--	--	1.000	0.294
Constructability	--	--	--	--	--	--	--	--	--	--	--	--	1.000

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Pearson Correlation

Correlations: Project-Interest Design Bid Build (DBB)

	Owner/ User Satisfac-tion	Clear & Real-istic Object-ives	Effect-ive Comm-unication	Collab-oration of Proj. Delivery Team	Utility & Functio n-ality	Trust & Respect	Align-ment of Project Objec-tives	Owner/ User Partic-ipation	Product-ion of Specif-ied Quality	Long-term Success & Life-cycle Value	Time Perform-ance	Owner's Vision	Construct-ability
Owner/User Satisfaciton	1.000	.734**	.574**	.315*	.640**	.451**	.689**	.506**	.621**	.521**	.353*	.613**	.585**
Clear & Realistic Objectives	--	1.000	.614**	.428**	.508**	.412**	.713**	.603**	.688**	.649**	.383*	.535**	.559**
Effective Communication	--	--	1.000	.430**	.646**	.318*	.556**	.498**	.628**	.577**	0.239	.475**	.360*
Collaboration of Proj. Delivery Tean	--	--	--	1.000	0.250	.571**	.462**	0.281	.350*	0.222	0.194	0.087	.439**
Utility & Functionality	--	--	--	--	1.000	0.195	.549**	.459**	.673**	.695**	0.172	.426**	.635**
Trust & Respect	--	--	--	--	--	1.000	.637**	.353*	.484**	.437**	.416**	.337*	.625**
Alignment of Project Objectives	--	--	--	--	--	--	1.000	.682**	.622**	.614**	.389*	.496**	.669**
Owner/User Participation	--	--	--	--	--	--	--	1.000	.493**	.565**	.354*	.806**	.489**
Production of Specified Quality	--	--	--	--	--	--	--	--	1.000	.762**	0.287	.556**	.662**
Long-term Success & Lifecycle Valu	--	--	--	--	--	--	--	--	--	1.000	.435**	.568**	.578**
Time Performance	--	--	--	--	--	--	--	--	--	--	1.000	.344*	0.291
Owner's Vision	--	--	--	--	--	--	--	--	--	--	--	1.000	.412**
Constructability	--	--	--	--	--	--	--	--	--	--	--	--	1.000

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 9.7. Round 3 -- DBB: CSF correlation matrixes

9.5. Design-Build (DB):

Design-Build (DB) Relative Effectiveness																	
Group	Critical Success Factor	N	Self-Centered							Project-Centered							
			Range	Min	Max	Mean	Std.Error	Std.Dev	Var.	Range	Min.	Max	Mean	Std.Error	Std.Dev	Var.
All	Owner/User Satisfaction	40	4	1	5	2.98	.162	1.025	1.051	4	1	5	3.33	.149	.944	.892
	Clear & Realistic Objectives	40	4	1	5	3.10	.147	.928	.862	4	1	5	3.35	.122	.770	.592
	Effective Communication	40	4	1	5	2.95	.147	.932	.869	4	1	5	3.20	.144	.911	.831
	Collaboration of Project Team	40	4	1	5	3.03	.150	.947	.897	4	1	5	3.13	.135	.853	.728
	Utility & Functionality	40	4	1	5	2.93	.145	.917	.840	4	1	5	3.15	.127	.802	.644
	Trust & Respect	40	4	1	5	2.78	.154	.974	.948	4	1	5	2.85	.146	.921	.849
	Alignment of Objectives	40	4	1	5	2.63	.132	.838	.702	4	1	5	2.90	.123	.778	.605
	Owner/User Participation	40	4	1	5	2.55	.168	1.061	1.126	4	1	5	2.73	.164	1.037	1.076
	Production of Specified Quality	40	4	1	5	3.03	.131	.832	.692	4	1	5	3.03	.131	.832	.692
	Long-term / Lifecycle Value	40	4	1	5	2.85	.137	.864	.746	3	2	5	2.95	.113	.714	.510
	Time Performance	40	3	2	5	3.80	.144	.911	.831	3	2	5	3.88	.144	.911	.830
	Owner's Vision	40	4	1	5	2.83	.156	.984	.969	4	1	5	2.85	.141	.893	.797
	Constructability	40	4	1	5	3.55	.124	.783	.613	4	1	5	3.70	.135	.853	.728
Owners	Owner/User Satisfaction	14	4	1	5	2.93	.305	1.141	1.302	4	1	5	3.29	.266	.994	.989
	Clear & Realistic Objectives	14	4	1	5	2.86	.312	1.167	1.363	4	1	5	3.14	.254	.949	.901
	Effective Communication	14	3	1	4	2.64	.269	1.008	1.016	3	1	4	2.79	.261	.975	.951
	Collaboration of Project Team	14	3	1	4	2.57	.251	.938	.879	3	1	4	2.64	.225	.842	.709
	Utility & Functionality	14	2	1	3	2.29	.194	.726	.527	3	1	4	2.64	.199	.745	.555
	Trust & Respect	14	3	1	4	2.43	.251	.938	.879	2	1	3	2.36	.225	.842	.709
	Alignment of Objectives	14	2	1	3	2.21	.187	.699	.489	2	1	3	2.36	.199	.745	.555
	Owner/User Participation	14	2	1	3	1.93	.221	.829	.687	3	1	4	2.00	.257	.961	.923
	Production of Specified Quality	14	2	1	3	2.43	.173	.646	.418	2	2	4	2.64	.169	.633	.401
	Long-term / Lifecycle Value	14	3	1	4	2.64	.225	.842	.709	2	2	4	2.79	.155	.579	.335
	Time Performance	14	2	3	5	4.00	.234	.877	.769	2	3	5	4.00	.234	.877	.769
	Owner's Vision	14	2	1	3	2.21	.214	.802	.643	2	1	3	2.43	.202	.756	.571
	Constructability	14	4	1	5	3.50	.251	.941	.885	4	1	5	3.71	.286	1.069	1.143
Designers	Owner/User Satisfaction	9	2	1	3	2.33	.236	.707	.500	2	2	4	2.78	.278	.833	.694
	Clear & Realistic Objectives	9	2	2	4	3.11	.261	.782	.611	2	2	4	3.22	.222	.667	.444
	Effective Communication	9	2	2	4	2.78	.222	.667	.444	4	1	5	3.11	.351	1.054	1.111
	Collaboration of Project Team	9	2	2	4	2.89	.261	.782	.611	2	2	4	3.11	.200	.601	.361
	Utility & Functionality	9	2	2	4	3.00	.167	.500	.250	1	3	4	3.22	.147	.441	.194
	Trust & Respect	9	2	2	4	2.89	.309	.928	.861	2	2	4	2.89	.309	.928	.861
	Alignment of Objectives	9	1	2	3	2.56	.176	.527	.278	2	2	4	3.00	.167	.500	.250
	Owner/User Participation	9	1	2	3	2.33	.167	.500	.250	2	1	3	2.56	.242	.726	.528
	Production of Specified Quality	9	2	2	4	3.00	.289	.866	.750	3	1	4	3.00	.333	1.000	1.000
	Long-term / Lifecycle Value	9	2	2	4	2.78	.222	.667	.444	2	2	4	2.89	.200	.601	.361
	Time Performance	9	3	2	5	3.33	.333	1.000	1.000	3	2	5	3.56	.377	1.130	1.278
	Owner's Vision	9	2	2	4	2.89	.261	.782	.611	1	2	3	2.78	.147	.441	.194
	Constructability	9	2	2	4	3.22	.222	.667	.444	2	3	5	3.67	.236	.707	.500
Builders	Owner/User Satisfaction	9	2	3	5	3.78	.278	.833	.694	3	2	5	3.67	.333	1.000	1.000
	Clear & Realistic Objectives	9	2	3	5	3.67	.236	.707	.500	2	3	5	3.78	.222	.667	.444
	Effective Communication	9	2	3	5	3.78	.222	.667	.444	2	3	5	3.78	.222	.667	.444
	Collaboration of Project Team	9	2	3	5	3.89	.261	.782	.611	2	3	5	3.89	.261	.782	.611
	Utility & Functionality	9	2	3	5	3.78	.222	.667	.444	2	3	5	3.78	.222	.667	.444
	Trust & Respect	9	3	2	5	3.33	.289	.866	.750	3	2	5	3.33	.289	.866	.750
	Alignment of Objectives	9	3	2	5	3.22	.278	.833	.694	2	3	5	3.33	.236	.707	.500
	Owner/User Participation	9	3	2	5	3.56	.294	.882	.778	3	2	5	3.56	.294	.882	.778
	Production of Specified Quality	9	2	3	5	3.67	.236	.707	.500	2	3	5	3.67	.236	.707	.500
	Long-term / Lifecycle Value	9	2	3	5	3.44	.242	.726	.528	2	3	5	3.44	.242	.726	.528
	Time Performance	9	2	3	5	4.00	.289	.866	.750	2	3	5	4.00	.289	.866	.750
	Owner's Vision	9	3	2	5	3.56	.294	.882	.778	3	2	5	3.67	.289	.866	.750
	Constructability	9	2	3	5	4.00	.236	.707	.500	2	3	5	4.00	.236	.707	.500
Users	Owner/User Satisfaction	8	2	2	4	2.88	.295	.835	.696	2	3	5	3.63	.263	.744	.554
	Clear & Realistic Objectives	8	2	2	4	2.88	.227	.641	.411	1	3	4	3.38	.183	.518	.268
	Effective Communication	8	2	2	4	2.75	.313	.886	.786	1	3	4	3.38	.183	.518	.268
	Collaboration of Project Team	8	2	2	4	3.00	.267	.756	.571	2	2	4	3.13	.227	.641	.411
	Utility & Functionality	8	3	1	4	3.00	.378	1.069	1.143	2	2	4	3.25	.313	.886	.786
	Trust & Respect	8	3	1	4	2.63	.375	1.061	1.125	2	2	4	3.13	.295	.835	.696
	Alignment of Objectives	8	3	1	4	2.75	.366	1.035	1.071	2	2	4	3.25	.250	.707	.500
	Owner/User Participation	8	3	1	4	2.75	.453	1.282	1.643	2	2	4	3.25	.250	.707	.500
	Production of Specified Quality	8	1	3	4	3.38	.183	.518	.268	2	2	4	3.00	.267	.756	.571
	Long-term / Lifecycle Value	8	3	1	4	2.63	.375	1.061	1.125	2	2	4	2.75	.313	.886	.786
	Time Performance	8	2	3	5	3.75	.313	.886	.786	2	3	5	3.88	.295	.835	.696
	Owner's Vision	8	3	1	4	3.00	.378	1.069	1.143	3	1	4	2.75	.366	1.035	1.071
	Constructability	40	4	1	5	3.55	.124	.783	.613	2	2	4	3.38	.263	.744	.554

Table 9.8. Round 3 -- DB Relative effectiveness: descriptive statistics

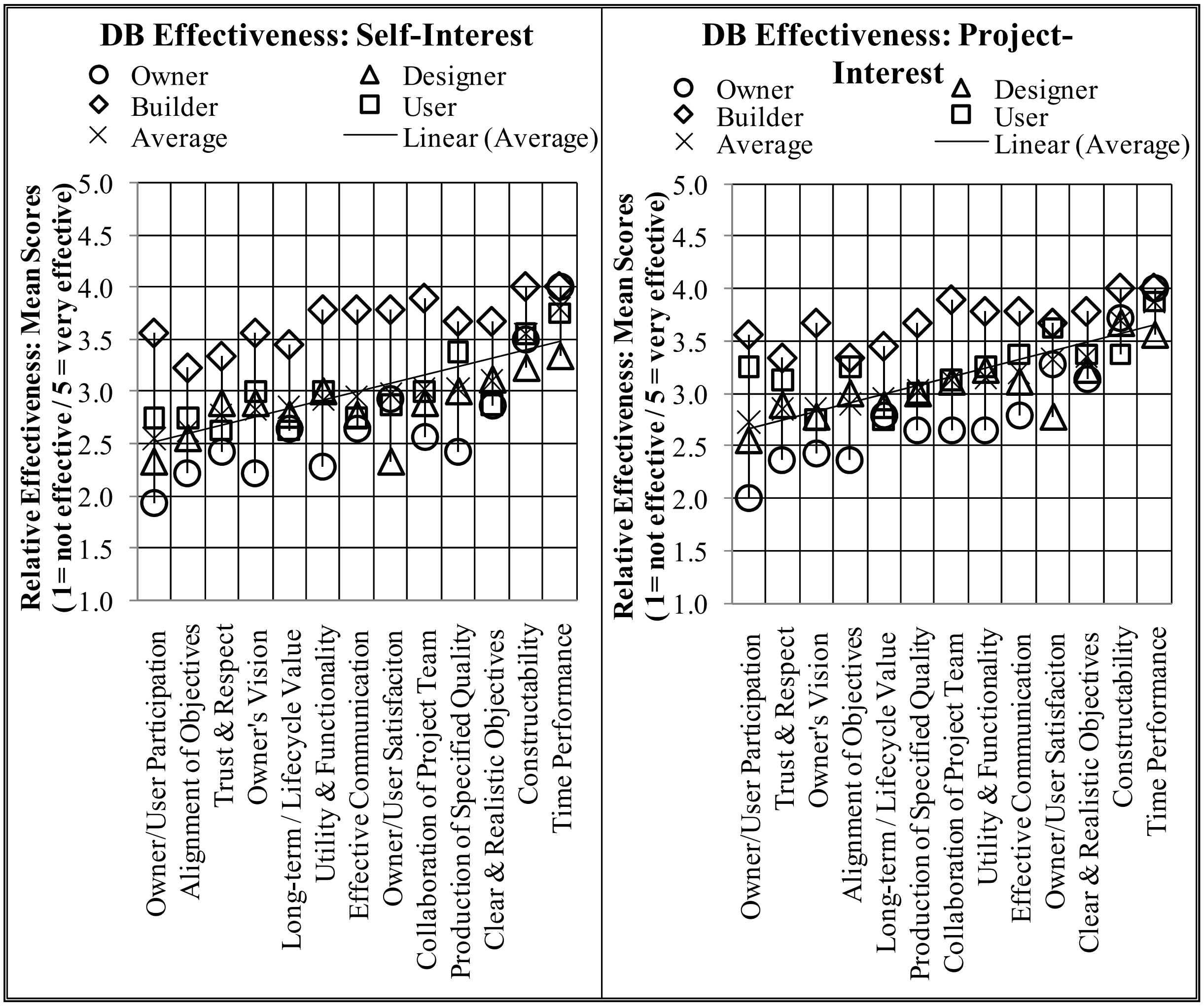


Figure 9.7. Round 3 -- DB: relative effectiveness by average mean score

In the Design-Build (DB) category, not unexpectedly, the builders rate the effectiveness significantly higher than the average of the group. The Owners overall rate effectiveness of DB the lowest among the stakeholder groups, except for "Time Performance" which they rate higher than average. Designers and Users tend to rate the effectiveness near the overall average. Designers depart from the trend for "Owner/User Satisfaction" which they rate DB significantly lower than average.

9.5.1. Inter-Rater Agreement Testing

Round #3 Inter-Rater Agreement: Design Build (DB)										
Critical Success Factors	Self-Interest					Project-Interest				
	Mean Rank					Mean Rank				
	O	D	B	U	All	O	D	B	U	All
Owner / User Satisfaction	8.36	4.67	7.56	6.50	6.98	9.04	5.67	7.00	8.81	7.78
Clear & Realistic Objectives	8.39	7.89	7.06	6.44	7.59	8.79	7.78	7.61	7.31	8.00
Effective Communication	7.18	6.78	7.50	5.63	6.85	7.14	7.17	7.39	7.94	7.36
Collaboration of Project Delivery Team	6.93	7.50	8.22	7.13	7.39	6.36	7.56	8.17	6.44	7.05
Utility & Functionality	5.54	7.83	7.67	7.38	6.90	6.36	7.56	7.61	7.38	7.11
Trust & Respect	6.14	7.44	5.06	5.00	5.96	5.07	6.56	5.00	6.56	5.69
Alignment of Project Objectives	5.21	5.56	4.89	5.69	5.31	5.14	6.67	4.94	7.25	5.86
Production of Specified Quality	4.14	4.50	6.44	6.19	5.15	3.93	4.61	6.39	6.81	5.21
Long-term Bldg. Success & Lifecycle	5.93	7.28	6.78	9.13	7.06	5.82	7.39	6.67	5.81	6.36
Project Time Performance	7.18	6.72	5.56	5.06	6.29	7.07	6.28	5.44	4.44	6.00
Owner / User Participation	10.79	9.11	8.83	10.13	9.84	10.54	8.56	8.89	9.75	9.56
Owner's vision	5.29	6.78	6.56	7.38	6.33	5.57	5.56	7.11	4.69	5.74
Constructability	9.93	8.94	8.89	9.38	9.36	10.18	9.67	8.78	7.81	9.28

Statistic	Self-Interest					Project-Interest				
	O	D	B	U	All	O	D	B	U	All
N	14	9	9	8	40	14	9	9	8	40
Kendall's W[a]	.350	.174	.202	.324	.188	.392	.160	.210	.212	.186
Chi-square	58.83	18.81	21.76	31.13	90.47	65.89	17.24	22.70	20.36	89.31
df	12	12	12	12	12	12	12	12	12	12
Asymp. Sig.	.000	.093	.040	.002	.000	.000	.141	.030	.061	.000

a. Kendall's Coefficient of Concordance

Table 9.9. Round 3 -- DB: Inter-rater agreement

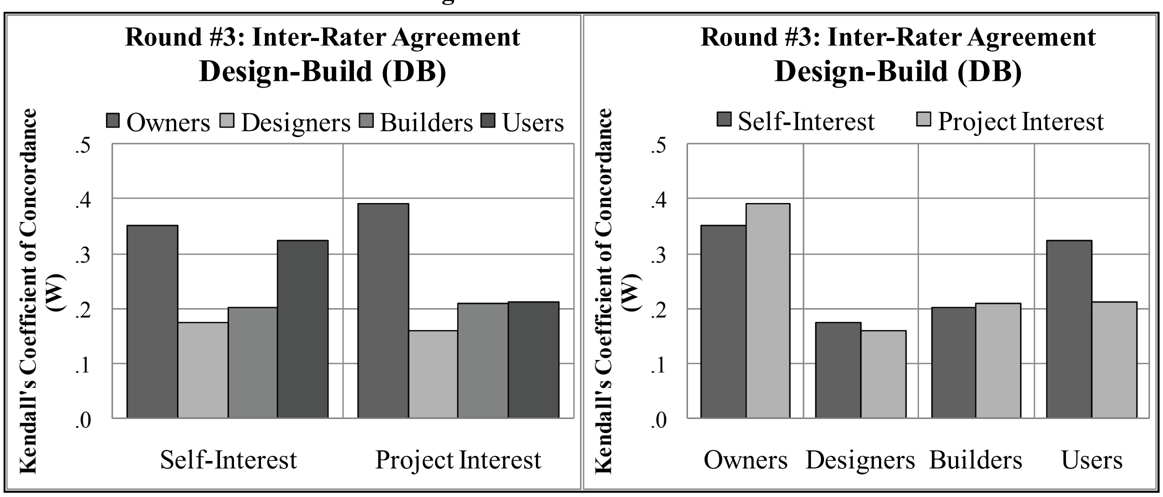


Figure 9.8. Round 3 -- BD: Inter-rater agreement comparison by stakeholder group

The Owner's group had a significantly higher level of agreement when evaluating the Design-Build method that the other stakeholders. Overall the level of agreement between self-interest and project-interest is fairly consistent, and are significant at the 0.001 level.

9.5.2. Correlations

Round #3: Correlation among Stakeholder Groups for DB Category								
Correlation Matrix *	Self-Interest				Project-Interest			
	Owner	Designer	Builder	User	Owner	Designer	Builder	User
Owner	1.000	0.339	0.512 [a]	0.260	1.000	0.547 [b]	0.548 [a]	0.464 [a]
Designer	--	1.000	0.311	0.381	--	1.000	0.470 [a]	0.441 [a]
Builder	--	--	1.000	0.606 [b]	--	--	1.000	0.346
User	--	--	--	1.000	--	--	--	1.000

Notes:

[a] Correlation is significant at the 0.05 level (2-tailed).

[b] Correlation is significant at the 0.01 level (2-tailed).

* Correlation Coefficient based on mean scores, and calculated in SPSS using Pearsons Correlation.

Table 9.10. Round 3 -- DB: stakeholder correlation matrix

Correlations: Self-Interest Design Build (DB)

	Owner/ User Satisfac- tion	Clear & Real- istic Object- ives	Effect- ive Comm- unication	Collab- oration of Proj. Delivery Team	Utility & Functio n-ality	Trust & Respect	Align- ment of Project Objec- tives	Owner/ User Partic- ipation	Product- ion of Specif- ied Quality	Long- term Success & Life- cycle Value	Time Perform- ance	Owner's Vision	Construct- ability
Owner/User Satisfaciton	1.000	0.676^{**}	0.723^{**}	0.635^{**}	0.598^{**}	0.534^{**}	0.496^{**}	0.602^{**}	0.482^{**}	0.575^{**}	0.242	0.529^{**}	0.497^{**}
Clear & Realistic Objectives	--	1.000	0.539^{**}	0.581^{**}	0.612^{**}	0.423^{**}	0.577^{**}	0.542^{**}	0.561^{**}	0.595^{**}	-0.036	0.637^{**}	0.311
Effective Communication	--	--	1.000	0.786^{**}	0.686^{**}	0.665^{**}	0.698^{**}	0.677^{**}	0.432^{**}	0.595^{**}	0.290	0.521^{**}	0.495^{**}
Collaboration of Proj. Delivery Tean	--	--	--	1.000	0.770^{**}	0.674^{**}	0.723^{**}	0.701^{**}	0.488^{**}	0.506^{**}	0.214	0.610^{**}	0.431^{**}
Utility & Functionality	--	--	--	--	1.000	0.641^{**}	0.797^{**}	0.834^{**}	0.574^{**}	0.665^{**}	0.012	0.866^{**}	0.309
Trust & Respect	--	--	--	--	--	1.000	0.617^{**}	0.694^{**}	0.355^{*}	0.477^{**}	0.237	0.600^{**}	0.335^{*}
Alignment of Project Objectives	--	--	--	--	--	--	1.000	0.786^{**}	0.529^{**}	0.664^{**}	0.168	0.727^{**}	0.362^{*}
Owner/User Participation	--	--	--	--	--	--	--	1.000	0.565^{**}	0.568^{**}	0.223	0.733^{**}	0.306
Production of Specified Quality	--	--	--	--	--	--	--	--	1.000	0.612^{**}	0.176	0.507^{**}	0.175
Long-term Success & Lifecycle Valu	--	--	--	--	--	--	--	--	--	1.000	0.221	0.572^{**}	0.353^{*}
Time Performance	--	--	--	--	--	--	--	--	--	--	1.000	0.017	0.517^{**}
Owner's Vision	--	--	--	--	--	--	--	--	--	--	--	1.000	0.261
Constructability	--	--	--	--	--	--	--	--	--	--	--	--	1.000

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Correlations: Project-Interest Design Build (DB)

	Owner/ User Satisfac- tion	Clear & Real- istic Object- ives	Effect- ive Comm- unication	Collab- oration of Proj. Delivery Team	Utility & Functio n-ality	Trust & Respect	Align- ment of Project Objec- tives	Owner/ User Partic- ipation	Product- ion of Specif- ied Quality	Long- term Success & Life- cycle Value	Time Perform- ance	Owner's Vision	Construct- ability
Owner/User Satisfaciton	1.000	0.616^{**}	0.459^{**}	0.426^{**}	0.442^{**}	0.441^{**}	0.325^{*}	0.434^{**}	0.316^{*}	0.253	0.108	0.394^{*}	0.347^{*}
Clear & Realistic Objectives	--	1.000	0.446^{**}	0.400^{*}	0.536^{**}	0.401^{*}	0.445^{**}	0.605^{**}	0.347^{*}	0.406^{**}	0.027	0.451^{**}	0.359^{*}
Effective Communication	--	--	1.000	0.693^{**}	0.624^{**}	0.586^{**}	0.644^{**}	0.439^{**}	0.331^{*}	0.291	0.216	0.321^{*}	0.343^{*}
Collaboration of Proj. Delivery Tean	--	--	--	1.000	0.684^{**}	0.742^{**}	0.715^{**}	0.561^{**}	0.429^{**}	0.389^{*}	0.186	0.598^{**}	0.299
Utility & Functionality	--	--	--	--	1.000	0.656^{**}	0.682^{**}	0.605^{**}	0.417^{**}	0.550^{**}	0.061	0.676^{**}	0.367^{*}
Trust & Respect	--	--	--	--	--	1.000	0.766^{**}	0.626^{**}	0.540^{**}	0.495^{**}	0.221	0.564^{**}	0.300
Alignment of Project Objectives	--	--	--	--	--	--	1.000	0.600^{**}	0.440^{**}	0.452^{**}	0.199	0.532^{**}	0.301
Owner/User Participation	--	--	--	--	--	--	--	1.000	0.513^{**}	0.500^{**}	0.153	0.674^{**}	0.020
Production of Specified Quality	--	--	--	--	--	--	--	--	1.000	0.606^{**}	0.173	0.489^{**}	0.228
Long-term Success & Lifecycle Valu	--	--	--	--	--	--	--	--	--	1.000	0.148	0.631^{**}	0.311
Time Performance	--	--	--	--	--	--	--	--	--	--	1.000	0.071	0.346^{*}
Owner's Vision	--	--	--	--	--	--	--	--	--	--	--	1.000	0.209
Constructability	--	--	--	--	--	--	--	--	--	--	--	--	1.000

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 9.11. Round 3 -- DB: CSF correlation matrixes

9.6. Round 3 Integrated Project Delivery (IPD)

Integrated Project Delivery (IPD) Relative Effectiveness																
Group	Critical Success Factor	N	Self-Centered							Project-Centered						
			Range	Min	Max	Mean	Std.Error	Std.Dev	Var.	Range	Min.	Max	Mean	Std.Error	Std.Dev	Var.
All	Owner/User Satisfaction	40	3	2	5	3.88	.157	.992	.984	3	2	5	4.00	.168	1.062	1.128
	Clear & Realistic Objectives	40	4	1	5	3.78	.170	1.074	1.153	4	1	5	3.85	.177	1.122	1.259
	Effective Communication	40	4	1	5	4.05	.160	1.011	1.023	4	1	5	4.23	.166	1.050	1.102
	Collaboration of Project Team	40	4	1	5	4.23	.154	.974	.948	4	1	5	4.28	.152	.960	.922
	Utility & Functionality	40	3	2	5	3.93	.149	.944	.892	4	1	5	3.95	.168	1.061	1.126
	Trust & Respect	40	4	1	5	3.85	.174	1.099	1.208	4	1	5	3.93	.177	1.118	1.251
	Alignment of Objectives	40	4	1	5	3.93	.169	1.071	1.148	4	1	5	3.93	.173	1.095	1.199
	Owner/User Participation	40	4	1	5	3.98	.181	1.143	1.307	4	1	5	3.98	.170	1.074	1.153
	Production of Specified Quality	40	4	1	5	3.83	.168	1.059	1.122	4	1	5	3.85	.158	1.001	1.003
	Long-term / Lifecycle Value	40	4	1	5	3.88	.169	1.067	1.138	4	1	5	3.78	.166	1.050	1.102
	Time Performance	40	4	1	5	3.85	.162	1.027	1.054	4	1	5	3.85	.162	1.027	1.054
	Owner's Vision	40	4	1	5	3.88	.169	1.067	1.138	4	1	5	3.90	.167	1.057	1.118
	Constructability	40	4	1	5	3.78	.166	1.050	1.102	4	1	5	3.80	.161	1.018	1.036
Owners	Owner/User Satisfaction	14	3	2	5	3.86	.312	1.167	1.363	3	2	5	4.07	.286	1.072	1.148
	Clear & Realistic Objectives	14	3	2	5	3.93	.267	.997	.995	3	2	5	3.93	.305	1.141	1.302
	Effective Communication	14	3	2	5	4.07	.267	.997	.995	2	3	5	4.29	.221	.825	.681
	Collaboration of Project Team	14	3	2	5	4.21	.261	.975	.951	3	2	5	4.21	.239	.893	.797
	Utility & Functionality	14	3	2	5	3.86	.231	.864	.747	3	2	5	3.79	.239	.893	.797
	Trust & Respect	14	3	2	5	3.93	.245	.917	.841	3	2	5	3.93	.267	.997	.995
	Alignment of Objectives	14	3	2	5	4.07	.267	.997	.995	3	2	5	3.93	.286	1.072	1.148
	Owner/User Participation	14	3	2	5	3.86	.254	.949	.901	2	3	5	3.93	.195	.730	.533
	Production of Specified Quality	14	3	2	5	3.86	.206	.770	.593	2	3	5	4.00	.148	.555	.308
	Long-term / Lifecycle Value	14	2	3	5	3.93	.221	.829	.687	2	3	5	3.93	.195	.730	.533
	Time Performance	14	2	3	5	4.07	.195	.730	.533	2	3	5	3.93	.195	.730	.533
	Owner's Vision	14	3	2	5	3.64	.248	.929	.863	3	2	5	3.86	.231	.864	.747
	Constructability	14	2	3	5	4.21	.187	.699	.489	2	3	5	4.07	.195	.730	.533
Designers	Owner/User Satisfaction	9	3	2	5	3.56	.338	1.014	1.028	3	2	5	4.00	.408	1.225	1.500
	Clear & Realistic Objectives	9	4	1	5	3.22	.465	1.394	1.944	4	1	5	3.56	.503	1.509	2.278
	Effective Communication	9	4	1	5	4.00	.408	1.225	1.500	4	1	5	4.44	.444	1.333	1.778
	Collaboration of Project Team	9	4	1	5	4.00	.408	1.225	1.500	4	1	5	4.22	.434	1.302	1.694
	Utility & Functionality	9	3	2	5	3.56	.377	1.130	1.278	4	1	5	3.78	.494	1.481	2.194
	Trust & Respect	9	4	1	5	3.56	.530	1.590	2.528	4	1	5	3.89	.564	1.691	2.861
	Alignment of Objectives	9	4	1	5	3.56	.503	1.509	2.278	4	1	5	3.67	.527	1.581	2.500
	Owner/User Participation	9	4	1	5	3.67	.553	1.658	2.750	4	1	5	3.67	.553	1.658	2.750
	Production of Specified Quality	9	4	1	5	3.44	.556	1.667	2.778	4	1	5	3.44	.503	1.509	2.278
	Long-term / Lifecycle Value	9	4	1	5	3.44	.530	1.590	2.528	4	1	5	3.33	.527	1.581	2.500
	Time Performance	9	4	1	5	3.78	.401	1.202	1.444	4	1	5	4.11	.423	1.269	1.611
	Owner's Vision	9	4	1	5	3.89	.512	1.537	2.361	4	1	5	3.89	.564	1.691	2.861
	Constructability	9	4	1	5	3.33	.408	1.225	1.500	4	1	5	3.56	.412	1.236	1.528
Builders	Owner/User Satisfaction	9	2	3	5	4.00	.289	.866	.750	2	3	5	4.22	.278	.833	.694
	Clear & Realistic Objectives	9	3	2	5	3.78	.324	.972	.944	2	3	5	4.00	.236	.707	.500
	Effective Communication	9	2	3	5	4.11	.309	.928	.861	2	3	5	4.22	.324	.972	.944
	Collaboration of Project Team	9	2	3	5	4.44	.294	.882	.778	2	3	5	4.44	.294	.882	.778
	Utility & Functionality	9	2	3	5	4.22	.278	.833	.694	2	3	5	4.22	.278	.833	.694
	Trust & Respect	9	2	3	5	3.89	.261	.782	.611	2	3	5	3.89	.261	.782	.611
	Alignment of Objectives	9	2	3	5	3.89	.261	.782	.611	2	3	5	3.89	.261	.782	.611
	Owner/User Participation	9	2	3	5	4.22	.278	.833	.694	2	3	5	4.22	.278	.833	.694
	Production of Specified Quality	9	2	3	5	3.89	.261	.782	.611	2	3	5	3.89	.261	.782	.611
	Long-term / Lifecycle Value	9	2	3	5	4.00	.289	.866	.750	2	3	5	3.89	.261	.782	.611
	Time Performance	9	2	3	5	3.89	.261	.782	.611	2	3	5	3.89	.261	.782	.611
	Owner's Vision	9	2	3	5	4.00	.289	.866	.750	2	3	5	4.00	.289	.866	.750
	Constructability	9	2	3	5	3.67	.289	.866	.750	2	3	5	3.78	.278	.833	.694
Users	Owner/User Satisfaction	8	2	3	5	4.13	.295	.835	.696	3	2	5	3.63	.420	1.188	1.411
	Clear & Realistic Objectives	8	2	3	5	4.13	.295	.835	.696	3	2	5	3.88	.398	1.126	1.268
	Effective Communication	8	2	3	5	4.00	.378	1.069	1.143	3	2	5	3.88	.441	1.246	1.554
	Collaboration of Project Team	8	2	3	5	4.25	.313	.886	.786	2	3	5	4.25	.313	.886	.786
	Utility & Functionality	8	2	3	5	4.13	.350	.991	.982	3	2	5	4.13	.398	1.126	1.268
	Trust & Respect	8	3	2	5	4.00	.423	1.195	1.429	3	2	5	4.00	.378	1.069	1.143
	Alignment of Objectives	8	2	3	5	4.13	.350	.991	.982	2	3	5	4.25	.313	.886	.786
	Owner/User Participation	8	3	2	5	4.25	.412	1.165	1.357	3	2	5	4.13	.398	1.126	1.268
	Production of Specified Quality	8	2	3	5	4.13	.350	.991	.982	3	2	5	4.00	.423	1.195	1.429
	Long-term / Lifecycle Value	8	2	3	5	4.13	.350	.991	.982	3	2	5	3.88	.398	1.126	1.268
	Time Performance	8	4	1	5	3.50	.535	1.512	2.286	4	1	5	3.38	.498	1.408	1.982
	Owner's Vision	8	2	3	5	4.13	.350	.991	.982	2	3	5	3.88	.295	.835	.696
	Constructability	8	4	1	5	3.63	.498	1.408	1.982	4	1	5	3.63	.498	1.408	1.982

Table 9.12. Round 3 -- IPD Relative effectiveness: descriptive statistics

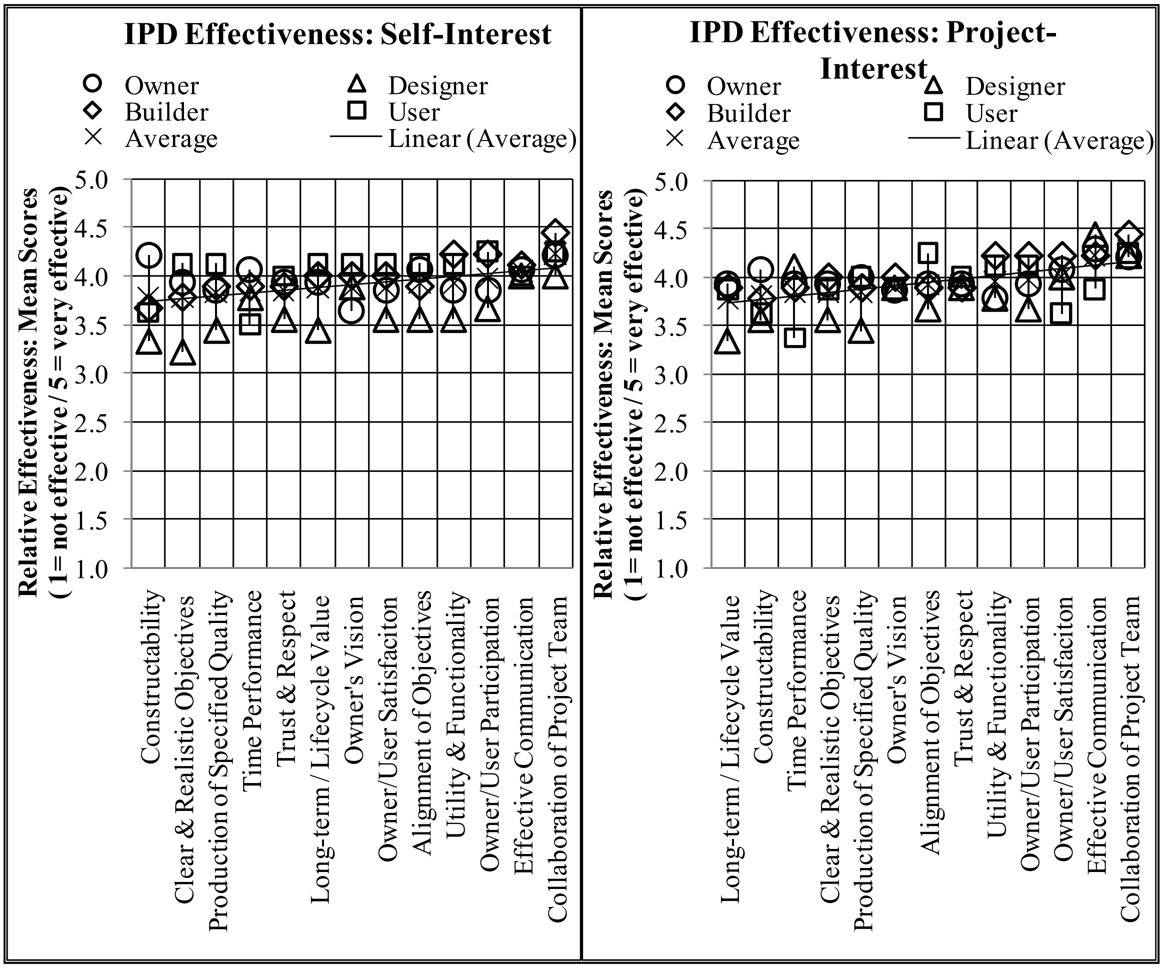


Figure 9.9. . Round 3 -- IPD: relative effectiveness by average mean score

Integrated Project Delivery scored consistently high across all thirteen critical success factors. For self-interest the Designers trended slightly below average, while the rest of the stakeholder groups clustered about the linear average. In project interest the distribution is very tight and scores on average slightly higher, with less variance, than self-interest. The average scores for both self and project interest are both the highest among the three project delivery methods, and with the least variance. The distribution suggests a high degree of agreement among all stakeholder groups.

Out of the three delivery methods the panel displayed the lowest level of agreement when assessing Integrated Project Delivery. Although the range of mean scores significantly varied, the range of mean scores is the highest ranked overall than either design-bid-build, or design-build. Additionally for the majority of the critical success factors IPD ranked highest of the three methods. The rankings will be discussed in further detail below.

9.6.1. Inter-Rater Agreement

Round #3 Inter-Rater Agreement: Integrated Project Delivery (IPD)										
Critical Success Factors	Self-Interest					Project-Interest				
	Mean Rank					Mean Rank				
	O	D	B	U	All	O	D	B	U	All
Owner / User Satisfaction	6.50	6.94	7.28	7.19	6.91	7.68	8.33	7.89	6.00	7.54
Clear & Realistic Objectives	6.64	5.78	6.28	7.19	6.48	6.61	6.61	6.56	7.50	6.78
Effective Communication	7.89	8.06	7.39	6.69	7.58	8.54	9.78	7.89	6.31	8.23
Collaboration of Project Delivery Team	8.43	7.89	9.28	8.00	8.41	8.18	8.33	9.17	8.63	8.53
Utility & Functionality	6.64	6.67	8.00	7.25	7.08	6.04	7.00	7.89	7.94	7.05
Trust & Respect	6.82	6.67	6.06	6.69	6.59	6.64	7.50	5.94	7.19	6.79
Alignment of Project Objectives	7.46	6.72	6.44	7.25	7.03	6.71	6.33	6.28	8.63	6.91
Production of Specified Quality	6.54	7.28	7.89	7.94	7.29	6.79	6.44	7.78	7.75	7.13
Long-term Bldg. Success & Lifecycle Value	6.21	6.39	6.33	7.25	6.49	6.82	5.00	6.17	7.19	6.34
Project Time Performance	7.00	6.50	6.83	7.31	6.91	6.71	5.06	6.00	6.63	6.16
Owner / User Participation	7.25	7.61	6.72	5.44	6.85	6.54	7.44	6.56	5.00	6.44
Owner's vision	5.61	8.78	6.72	7.19	6.89	6.46	7.67	6.56	6.19	6.70
Constructability	8.00	5.72	5.78	5.63	6.51	7.29	5.50	6.33	6.06	6.43
Statistic	Self-Interest					Project-Interest				
	O	D	B	U	All	O	D	B	U	All
N	14	9	9	8	40	14	9	9	8	40
Kendall's W[a]	.068	.072	.114	.088	.058	.057	.208	.123	.143	.058
Chi-square	11.34	7.81	12.34	8.47	27.82	9.50	22.50	13.27	13.73	27.82
df	12	12	12	12	12	12	12	12	12	12
Asymp. Sig.	.500	.800	.418	.748	.006	.660	.032	.350	.318	.006
a. Kendall's Coefficient of Concordance										

Table 9.13. Round 3 -- IPD: Inter-rater agreement

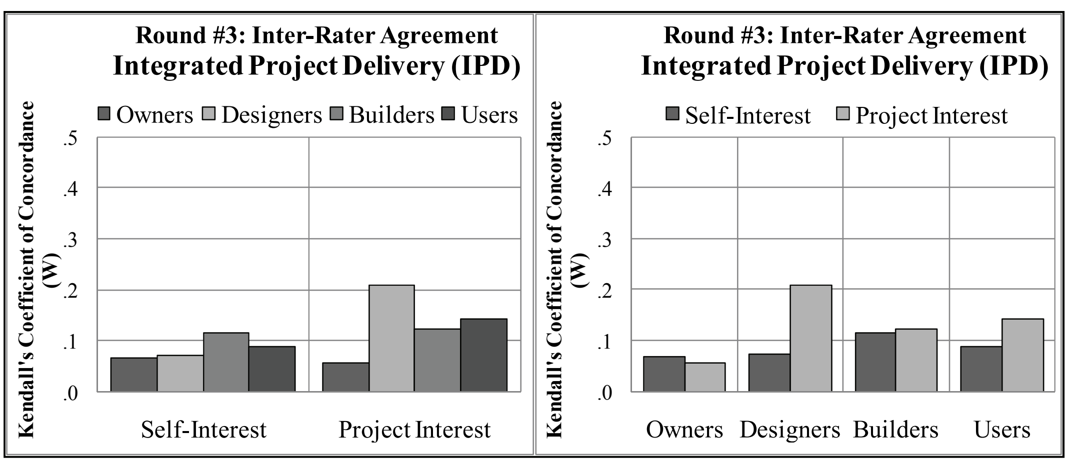


Figure 9.10. Round 3 -- IPD: Inter-rater agreement by stakeholder group

9.6.2. Correlations

Round #3: Correlation among Stakeholder Groups for IPD Category								
Correlation Matrix *	Self-Interest				Project-Interest			
	Owner	Designer	Builder	User	Owner	Designer	Builder	User
Owner	1.000	0.088	-0.215	-0.404	1.000	0.162	0.000	-0.247
Designer	--	1.000	0.484 [a]	0.027	--	1.000	0.439 [a]	-0.024
Builder	--	--	1.000	0.537 [a]	--	--	1.000	0.275
User	--	--	--	1.000	--	--	--	1.000

Notes:

[a] Correlation is significant at the 0.05 level (2-tailed).

* Correlation Coefficient based on mean scores, and calculated in SPSS using Pearsons Correlation.

Table 9.14. Round 3 -- IPD: stakeholder correlation matrix

Correlations: Self-Interest Integrated Project Delivery (IPD)

n=40	Owner/ User Satisfac-tion	Clear & Real-istic Object-ives	Effect-ive Comm-unication	Collab-oration of Proj. Delivery Team	Utility & Functio n-ality	Trust & Respect	Align-ment of Project Objec-tives	Owner/ User Partic-ipation	Product-ion of Specif-ied Quality	Long-term Success & Life-cycle Value	Time Perform-ance	Owner's Vision	Construct-ability
Owner/User Satisfaciton	1.000	0.695**	0.569**	0.720**	0.729**	0.594**	0.666**	0.630**	0.589**	0.615**	0.460**	0.639**	0.440**
Clear & Realistic Objectives	--	1.000	0.648**	0.614**	0.615**	0.579**	0.787**	0.664**	0.753**	0.646**	0.387*	0.646**	0.454**
Effective Communication	--	--	1.000	.769**	0.621**	0.607**	0.690**	0.733**	0.654**	0.553**	0.378*	0.671**	0.446**
Collaboration of Proj. Delivery Tean	--	--	--	1.000	0.716**	0.703**	0.754**	0.673**	0.611**	0.645**	0.394*	0.596**	0.477**
Utility & Functionality	--	--	--	--	1.000	0.804**	0.729**	0.687**	0.730**	0.729**	0.491**	0.729**	0.396*
Trust & Respect	--	--	--	--	--	1.000	0.839**	0.691**	0.814**	0.793**	.0525**	0.727**	0.615**
Alignment of Project Objectives	--	--	--	--	--	--	1.000	0.752**	0.824**	0.777**	0.596**	0.732**	0.577**
Owner/User Participation	--	--	--	--	--	--	--	1.000	0.822	0.670**	0.521**	0.817**	0.529**
Production of Specified Quality	--	--	--	--	--	--	--	--	1.000	0.774**	0.517**	0.820**	0.632**
Long-term Success & Lifecycle Valu	--	--	--	--	--	--	--	--	--	1.000	0.638**	0.752**	0.593**
Time Performance	--	--	--	--	--	--	--	--	--	--	1.000	0.474**	0.682**
Owner's Vision	--	--	--	--	--	--	--	--	--	--	--	1.000	0.409**
Constructability	--	--	--	--	--	--	--	--	--	--	--	--	1.000

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Correlations: Project-Interest Integrated Project Delivery (IPD)

	Owner/ User Satisfac-tion	Clear & Real-istic Object-ives	Effect-ive Comm-unication	Collab-oration of Proj. Delivery Team	Utility & Functio n-ality	Trust & Respect	Align-ment of Project Objec-tives	Owner/ User Partic-ipation	Product-ion of Specif-ied Quality	Long-term Success & Life-cycle Value	Time Perform-ance	Owner's Vision	Construct-ability
Owner/User Satisfaciton	1.000	0.775**	0.667**	0.603**	0.751**	0.626**	0.617**	0.629**	0.506**	0.575**	0.564**	0.616**	0.474**
Clear & Realistic Objectives	--	1.000	.661**	0.634**	0.618**	0.604**	0.700**	0.593**	0.550	0.667**	0.403**	0.614**	0.489**
Effective Communication	--	--	1.000	0.853**	0.747**	0.692**	0.684**	0.688**	0.667**	0.629**	0.460**	0.760**	0.547**
Collaboration of Proj. Delivery Tean	--	--	--	1.000	0.794**	0.784**	0.727**	0.653**	0.684	0.597**	0.355*	0.735**	0.451**
Utility & Functionality	--	--	--	--	1.000	0.000	0.725**	0.764**	0.717**	0.726**	0.370*	0.773**	0.489**
Trust & Respect	--	--	--	--	--	1.000	0.791**	0.682**	0.791**	0.750**	0.414**	0.796**	0.527**
Alignment of Project Objectives	--	--	--	--	--	--	1.000	0.761**	0.808**	0.743**	0.423**	0.768**	0.469**
Owner/User Participation	--	--	--	--	--	--	--	1.000	0.783**	0.677**	0.531**	0.833**	0.629**
Production of Specified Quality	--	--	--	--	--	--	--	--	1.000	0.845**	0.427**	0.785**	0.599**
Long-term Success & Lifecycle Valu	--	--	--	--	--	--	--	--	--	1.000	0.372*	0.742**	0.581**
Time Performance	--	--	--	--	--	--	--	--	--	--	1.000	0.482**	0.609**
Owner's Vision	--	--	--	--	--	--	--	--	--	--	--	1.000	0.529**
Constructability	--	--	--	--	--	--	--	--	--	--	--	--	1.000

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 9.15. Round 3 -- IPD: CSF correlation matrix

9.7. Round 3 -- Overall Data (DBB, DB, & IPD)

The trends displayed in Figure 9.15. for self and project interest categories display an overall consistently higher rating for IPD with very little variation below the overall average. DBB and DB display a large degree of variation about the overall average. DB generally rates slightly higher than DBB. DBB mostly falls below the overall average rating for effectiveness, with the exception of the Designer ratings. The data will be further analyzed later in this chapter.

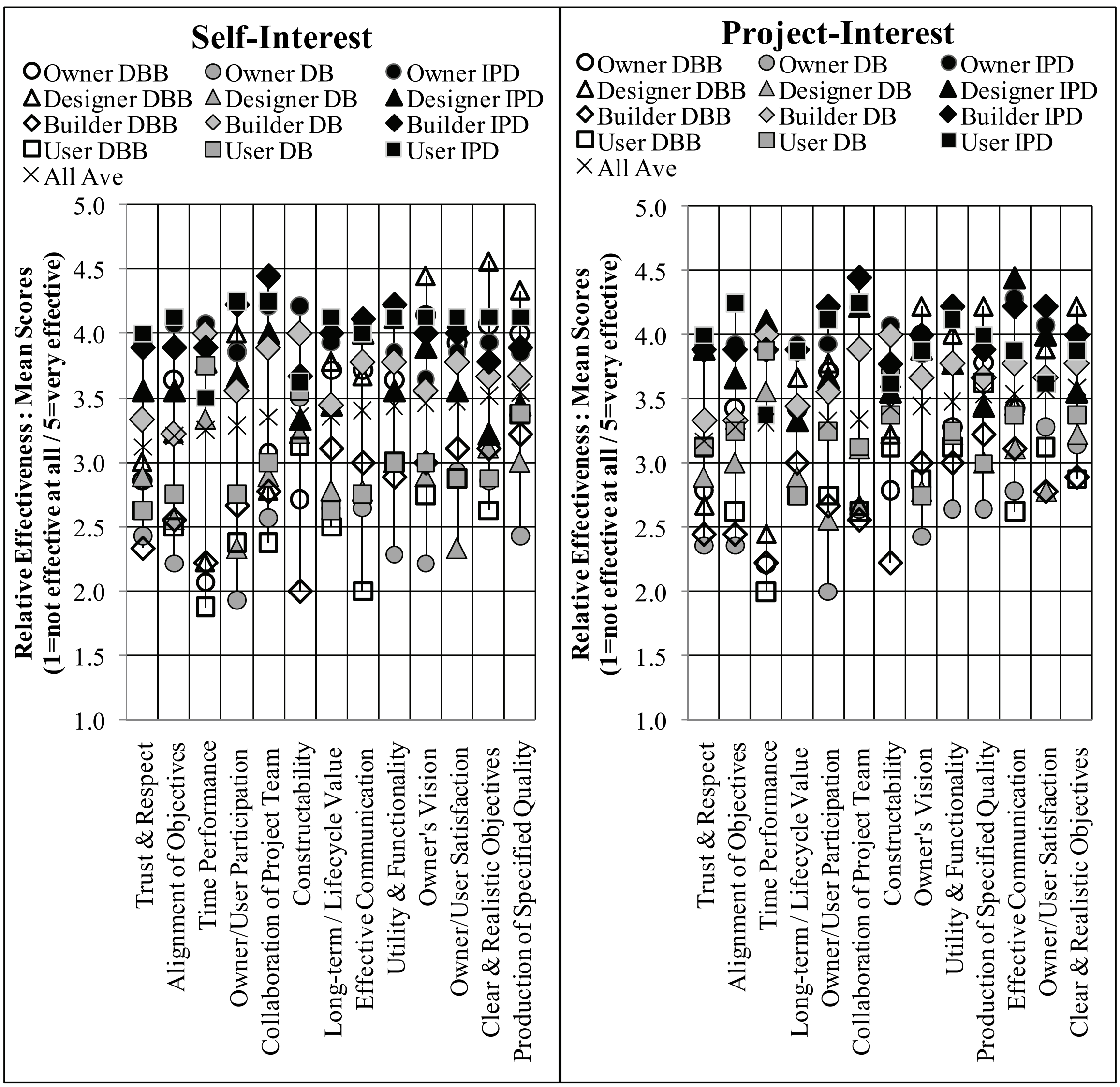


Figure 9.11. Round 3 -- Overall: relative effectiveness by average mean score

9.7.1. Round 3 Inter-Rater Agreement

Round #3 Inter-Rater Agreement: All (DBB, DB, & IPD)											
Critical Success Factors		Self-Interest					Project-Interest				
		Mean Rank					Mean Rank				
		O	D	B	U	All	O	D	B	U	All
Owner / User Satisfaction	DBB	24.96	26.72	16.83	17.06	21.95	23.07	23.06	14.22	17.75	20.01
	DB	16.64	9.67	22.17	16.38	16.26	19.75	13.06	21.06	24.19	19.43
	IPD	24.75	22.22	26.22	29.13	25.39	27.21	26.50	28.39	22.44	26.36
Clear & Realistic Objectives	DBB	26.82	31.50	16.89	14.50	23.18	26.71	26.83	14.50	16.06	21.86
	DB	16.04	16.72	21.61	16.19	17.48	18.32	16.50	22.89	20.56	19.39
	IPD	25.46	19.28	23.72	29.13	24.41	25.14	22.89	25.56	25.94	24.89
Effective Communication	DBB	22.25	22.72	14.67	7.88	17.78	20.14	18.17	15.11	13.44	17.23
	DB	13.14	14.61	22.22	14.50	15.79	13.96	16.50	22.06	21.63	17.89
	IPD	27.79	26.33	25.94	27.50	26.99	29.71	30.94	27.33	23.88	28.29
Collaboration of Project Delivery Team	DBB	15.64	13.28	11.44	11.81	13.40	11.21	11.94	10.56	12.75	11.54
	DB	12.07	16.28	23.39	17.63	16.68	12.36	16.11	23.33	17.19	16.64
	IPD	28.93	26.56	30.67	30.88	29.18	29.57	28.22	30.61	30.31	29.65
Utility & Functionality	DBB	21.75	26.94	14.22	18.44	20.56	18.11	24.78	15.50	17.88	18.98
	DB	9.25	15.61	22.28	17.50	15.26	11.96	15.67	22.22	19.00	16.51
	IPD	25.18	21.56	28.39	28.94	25.84	24.04	24.11	28.39	28.19	25.86
Trust & Respect	DBB	14.64	15.00	8.17	14.44	13.23	13.25	11.50	8.56	18.69	12.89
	DB	11.39	16.50	16.67	13.00	14.05	9.96	14.89	16.50	17.69	14.09
	IPD	25.96	22.61	24.39	26.88	25.04	25.57	25.78	24.39	26.81	25.60
Alignment of Project Objectives	DBB	22.57	17.61	12.28	13.31	17.29	19.89	18.56	11.11	13.44	16.33
	DB	8.68	11.67	16.50	14.06	12.19	9.86	14.28	17.00	19.50	14.39
	IPD	27.18	23.22	24.56	28.94	26.05	25.43	23.50	24.11	30.31	25.68
Production of Specified Quality	DBB	6.96	9.17	19.94	15.44	12.08	24.14	24.89	12.78	10.25	18.98
	DB	24.86	23.28	28.50	30.13	26.38	7.82	9.89	19.83	19.25	13.28
	IPD	22.57	23.22	12.94	16.00	19.24	26.36	23.28	28.50	27.75	26.43
Long-term Bldg. Success & Lifecycle Value	DBB	26.29	29.61	16.61	21.69	23.94	24.21	27.06	16.56	24.38	23.16
	DB	10.32	15.56	20.78	21.81	16.15	11.36	16.00	20.56	15.13	15.23
	IPD	24.39	21.39	24.61	28.94	24.68	26.54	20.44	24.33	26.19	24.60
Project Time Performance	DBB	22.93	23.28	16.61	12.19	19.44	20.04	20.83	15.94	14.00	18.09
	DB	12.79	13.72	18.00	12.81	14.18	13.79	13.33	17.89	12.75	14.40
	IPD	25.82	22.06	25.28	29.25	25.54	25.96	19.72	23.83	24.88	23.86
Owner / User Participation	DBB	7.50	9.50	8.11	6.94	7.98	8.11	9.28	8.00	6.69	8.06
	DB	25.71	20.56	24.94	26.13	24.46	25.46	20.94	25.11	27.00	24.68
	IPD	26.64	25.06	24.94	22.00	24.98	25.75	26.83	24.78	19.13	24.45
Owner's vision	DBB	28.14	30.28	16.22	16.13	23.54	25.86	26.83	16.28	15.88	21.93
	DB	8.75	14.61	20.61	17.50	14.49	10.04	11.89	21.83	13.44	13.79
	IPD	23.25	26.11	24.94	29.31	25.49	25.89	26.06	24.67	25.00	25.48
Constructability	DBB	12.54	17.22	6.67	19.56	13.68	12.86	15.78	7.39	18.44	13.40
	DB	21.32	18.61	25.11	23.00	21.90	23.29	21.56	24.94	20.31	22.68
	IPD	28.11	20.17	21.94	23.13	23.94	27.29	21.61	23.39	21.94	24.06

Statistic	Self-Interest					Project-Interest				
	O	D	B	U	All	O	D	B	U	All
N	14	9	9	8	40	14	9	9	8	40
Kendall's W[a]	.437	.293	.361	.463	.266	.418	.286	.388	.306	.260
Chi-square	232.44	100.06	123.51	140.68	404.81	222.22	97.90	132.74	93.03	395.76
df	38	38	38	38	38	38	38	38	38	38
Asymp. Sig.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

a. Kendall's Coefficient of Concordance

Table 9.16. Round 3 Inter-rater agreement

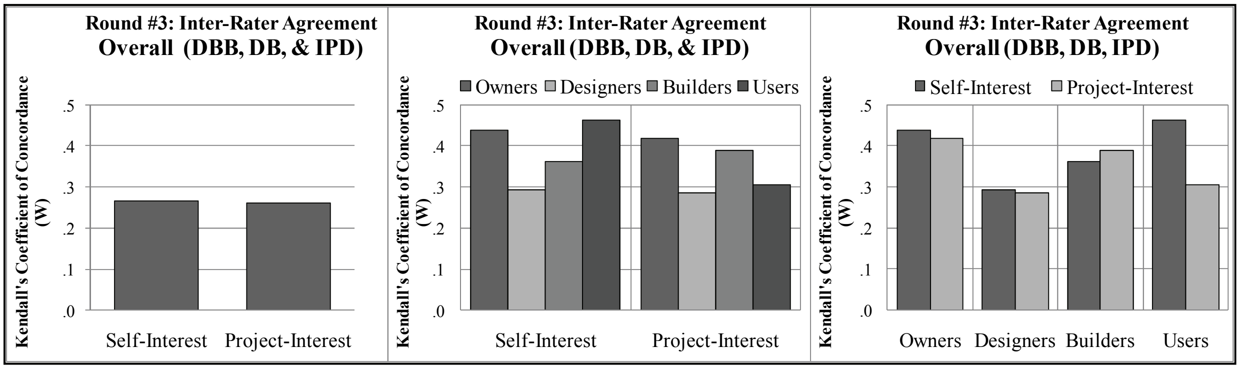


Figure 9.12. Round 3 -- Overall: Inter-rater agreement

Overall the panel of experts displayed levels of inter-rater agreement higher than that achieved in the first two rounds of surveys. For the round 3 survey, inter-rater agreement is only to note that the participants continue to demonstrate a measure of consensus. It is not appropriate to directly compare the level of agreement between rounds 1 and 2 with round 3 because the topic of the discussion has changed from relative importance of critical success factors to effectiveness of project delivery methods to achieve the CSFs. The individual stakeholder groups displayed exceptionally high degrees of inter-rater agreement with Kendall's coefficient of concordance scores ranging between 0.286 and 0.463. Inter-rater agreement specific to the panel(s) evaluation of each of the three project delivery method follows.

9.7.2. Round 3 Reliability Testing

Intraclass Correlation									
		Reliability Statistics							
Perspective	Stakeholder Group	N	Cronbach's Alpha	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound	F Test True Value 0 Value	df1	df2	Sig
Self-Interest	All	40	0.917	0.877	0.949	12.100	41	1599	0.000
	Owner	14	0.896	0.843	0.937	9.577	41	533	0.000
	Designer	9	0.710	0.557	0.825	3.447	41	328	0.000
	Builder	9	0.799	0.694	0.879	4.978	41	328	0.000
	User	8	0.837	0.750	0.902	6.136	41	287	0.000
Project-Interest	All	40	0.914	0.873	0.948	11.684	41	1599	0.000
	Owner	14	0.873	0.808	0.923	7.860	41	533	0.000
	Designer	9	0.647	0.462	0.788	2.836	41	328	0.000
	Builder	9	0.813	0.715	0.887	5.343	41	328	0.000
	User	8	0.715	0.564	0.829	3.513	41	287	0.000

Table 9.17. Round 3 Reliability testing

The results of the intraclass correlation calculation indicate a very reliable round 3 survey with Cronbach's Alpha scores of 0.917 and 0.914 respectively for the self-interest and project-interest categories. The stakeholder groups evaluated individually also returned scores ranging from 0.7109 (reasonably reliable) to 0.896 (strongly reliable). Therefore it is validated that the round 3 survey performed reliable in context of both the overall panel of experts, but also when viewed a four separate survey cohorts by stakeholder group.

For the design-bid-build category, there is a large and significant correlation between the owners and the designers, and to a somewhat lesser degree correlation between the designers and builders. Although not statistically significant, the low correlation scores between owners and users may be cause for further investigation. A logical assumption would be that the owners and designers, especially in the cases of the public projects, might have significant positive correlations in their evaluation of the project delivery methods.

Round #3: Correlation among Stakeholder Groups Overall Categories (DBB, DB, & IPD)								
Correlation Matrix *	Self-Interest				Project-Interest			
	Owner	Designer	Builder	User	Owner	Designer	Builder	User
Owner	1.000	0.603 [b]	0.208	0.250 [a]	1.000	0.628 [b]	0.340 [b]	0.401 [b]
Designer	--	1.000	0.107	0.200	--	1.000	0.258 [a]	0.280 [a]
Builder	--	--	1.000	0.695 [b]	--	--	1.000	0.660 [b]
User	--	--	--	1.000	--	--	--	1.000

Notes:

[a] Correlation is significant at the 0.05 level (2-tailed).

[b] Correlation is significant at the 0.01 level (2-tailed).

* Correlation Coefficient based on mean scores, and calculated in SPSS using Pearsons Correlation. (N =

Table 9.18. Round 3 -- Overall: stakeholder correlation matrix

9.8. Significance Testing of Relative Effectiveness

There are two means of evaluating the significance of how each project delivery method is rated for effectiveness in attaining the thirteen critical success factors selected in the round 2 survey. The first means is the direct results of the Delphi process. In the Delphi process the typical major statistics are the measures of central tendency: mean, median, and mode. In literature, median scores based on a Likert scale are favored.[114] A more rigorous statistical test is also conducted to provide a more robust argument for the superiority of Integrated Project Delivery. A Friedman test with post-hoc tests is used in this research to test for significance at the 0.05 level.

[114] Chia-Chien Hsu and Brian A. Sandford, "The Delphi Technique: Making Sense of Consensus,". *Practical Assessment, Research & Evaluation* 125, no. 10 August 2007, 09 September 2010 <http://pareonline.net/pdf/v12n10.pdf>.

9.8.1. Weighting for Relative Importance

The effectiveness ratings are weighted by the relative importance of each of the thirteen critical success factors selected during the round 2 survey. Each sample's thirteen ratings for each factor are multiplied by the weighted average relative importance listed in Table 9.19. Each stakeholder group's weighting is based on their responses as reported in the round 2 survey.

Relative Importance by Weighted Average								
CSFs	Self-Interest				Project-Interest			
	O N=17 Wt Avg	D N=10 Wt Avg	B N=11 Wt Avg	U N=13 Wt Avg	O N=17 Wt Avg	D N=10 Wt Avg	B N=11 Wt Avg	U N=12 Wt Avg
Owner / User Satisfaction	0.082	0.086	0.089	0.087	0.078	0.089	0.088	0.086
Clear & Realistic Objectives	0.084	0.083	0.076	0.079	0.084	0.082	0.075	0.084
Effective Communication	0.082	0.075	0.082	0.081	0.081	0.080	0.082	0.083
Utility & Functionality	0.082	0.081	0.067	0.091	0.078	0.072	0.077	0.081
Collaboration of Project Delivery Team	0.076	0.079	0.076	0.072	0.081	0.087	0.080	0.077
Trust Respect	0.069	0.077	0.082	0.077	0.078	0.078	0.080	0.075
Owner / User Participation	0.078	0.079	0.078	0.083	0.074	0.074	0.071	0.073
Alignment of Project Objectives	0.074	0.069	0.084	0.074	0.079	0.078	0.082	0.075
Production of Specified Quality	0.075	0.075	0.076	0.077	0.079	0.070	0.080	0.073
Long-term Building Success & Lifecycle Value	0.079	0.075	0.069	0.075	0.076	0.066	0.075	0.073
Project Time Performance	0.068	0.069	0.080	0.066	0.071	0.078	0.080	0.073
Owner's vision	0.081	0.079	0.072	0.074	0.065	0.064	0.073	0.068
Constructability	0.069	0.077	0.069	0.064	0.076	0.078	0.056	0.077

Stakeholder Groups Types: O = Owner; D = Designer; B = Builder; U = User; ALL = O+D+B+U

Table 9.19. Relative importance weighting from the round 2 survey

Table 9.20. is a summary of the resulting weighted sum aggregation of each participant's total of 78 Likert ratings completed in the round 3 survey. Appendix F contains several tables with all the raw data and weighing calculations resulting in the data in Table 9.20. The weighting of the aggregated data provides two functions. The weighting normalizes the data to ensure the evaluation of relative effectiveness is not skewed due to variation in the sample sizes between stakeholder groups. Additionally, the weighing accounts for the variation in relative importance between the thirteen critical success factors. Logically, an assessment of a project

Relative Effectiveness						
Sample	Weighted Sum Aggregated					
	Self-Interest			Project-Interest		
N=40	DBB	DB	IPD	DBB	DB	IPD
Owner01	3.589	2.678	4.251	3.554	2.681	4.241
Owner02	2.848	2.523	4.000	2.843	2.537	4.000
Owner03	3.261	3.166	2.523	3.091	3.162	2.916
Owner04	3.326	2.693	3.780	3.387	2.531	3.703
Owner05	4.728	1.501	2.654	4.717	1.518	2.687
Owner06	3.503	2.450	4.562	3.472	2.294	4.466
Owner07	4.181	2.586	4.557	3.932	2.903	4.459
Owner08	4.095	3.630	4.150	3.994	3.638	3.993
Owner09	3.476	2.411	3.055	2.768	2.840	3.377
Owner10	1.550	3.085	4.014	1.629	3.000	3.929
Owner11	3.965	2.854	4.302	3.864	2.760	4.307
Owner12	3.793	3.288	4.697	3.782	3.382	4.612
Owner13	3.059	1.414	4.527	1.577	3.006	4.417
Owner14	3.960	2.839	4.360	3.916	3.325	4.771
Designer01	3.650	2.517	4.132	3.260	2.819	4.378
Designer02	4.336	2.695	4.754	3.920	2.777	5.000
Designer03	3.857	2.711	4.297	3.596	3.085	4.618
Designer04	4.104	2.605	4.454	3.835	3.296	4.773
Designer05	4.033	2.923	3.464	4.169	3.062	4.095
Designer06	3.825	2.623	1.790	3.829	2.638	1.795
Designer07	3.472	3.303	1.381	3.396	3.294	1.324
Designer08	3.077	3.454	4.248	2.984	3.712	4.316
Designer09	2.627	2.831	3.994	2.694	2.907	4.078
Builder01	3.626	3.217	3.846	3.626	3.204	3.845
Builder02	3.000	5.000	3.000	3.000	5.000	3.056
Builder03	1.604	3.441	4.314	1.637	3.441	4.321
Builder04	2.271	4.091	4.524	1.707	4.079	4.727
Builder05	2.771	3.848	3.931	2.793	3.865	3.948
Builder06	2.818	3.775	4.236	3.234	4.009	4.475
Builder07	2.764	3.546	4.550	2.791	3.546	4.507
Builder08	3.000	3.000	3.000	3.000	3.000	3.000
Builder09	3.089	3.058	4.593	2.940	2.970	4.594
User01	2.858	3.000	2.926	2.853	3.394	3.393
User02	3.558	3.825	4.768	3.767	3.688	4.697
User03	1.843	2.358	5.000	1.670	2.783	5.000
User04	1.977	4.000	4.208	2.653	3.925	3.831
User05	2.526	3.589	4.926	2.530	3.604	4.932
User06	2.779	2.683	3.253	3.154	2.772	3.024
User07	3.609	2.577	4.598	3.688	3.339	4.040
User08	1.742	1.753	2.740	2.620	2.495	2.378

Table 9.20. Round 3 - Relative effectiveness aggregated by weighted sums

delivery method's relative effectiveness must account for the importance of the factors. With all other things being equal, a process which maximizes the most important factors is logically more effective than a process which maximizes only the least important factors. Using individual weighting factors for each stakeholder group accounts for different perceptions between stakeholder groups and provides a macro-view assessment of the project delivery methods which is representative of the entire project delivery team.

9.8.2. Friedman Test with Post-hoc Tests (Wilcoxon Signed-Rank Test)

The Friedman Test is the non-parametric alternative to the F-test used in a one-way ANOVA with repeated measures. The Friedman test indicates whether or not a significant difference between the relative effectiveness of the three project delivery methods exists, but the test does not pin-point which project delivery methods in particular differ from each other. Additional testing is required to determine if IPD is effectively superior to the other methods for attaining the selected critical success factors.

To test the individual differences (IPD-DBB, IPD-DB, & DBB-DB) a post-hoc test is run using Wilcoxon Signed-Rank Tests on the three different combinations of groups. The post-hoc tests should only be run if the Friedman Test was statistically significant.

Because making multiple comparisons increases the likelihood of making a Type I error (declaring a result significant when it is not) a Bonferroni adjustment is necessary to ensure that the overall confidence level is high. The Bonferroni adjustment uses a more stringent confidence level for each interval, and is calculated by dividing the desired significance level (0.05) by the number of tests (3 = one for each comparison).[115] For this study the Bonferroni adjusted significance level is 0.008 (one-tailed). One-tailed significance is used because I predict that the relative effectiveness of IPD is greater than the relative effectiveness of DBB or DB. The null

[115] Alan Agresti and Barbara Finlay, *Statistical Methods for the Social Sciences* (Upper Saddle River, NJ: Prentice Hall, 2009), 377.

hypothesis is no difference exists between the efficacy of IPD and DBB/DB. The alternate hypothesis is that IPD is more effective than DBB/DB.

9.8.3. Statistical Significance: Self-Interest

The Friedman Test indicates that in the Self-Interest category IPD has the highest median rank overall, as well as in each the upper and lower quartiles[116]. The Freidman test is statistically significant ($X^2(2)=30.697$, $P < 0.001$), therefore post-hoc tests may be run to determine if a significant difference exists between each pair of the project delivery methods.

The Wilcoxon Signed-Rank Test, the post-hoc test, is the nonparametric equivalent to the dependent t-test, and is used to compare two sets of scores that come from the same participants. In this case the sets of scores are paired comparisons of each of the project delivery methods evaluated by the panel of experts for efficacy in attaining the 13 critical success factors.

Significance Test -- Relative Effectiveness: Self-Interest

Project Delivery Method	Descriptive Statistics				Friedman Test	
	N	Percentiles				
		25th	50th (Median)	75th	Mean Rank	Statistics
Design-Bid-Build (DBB)	40	2.773	**3.294**	3.817	1.79	Chi-Square 30.697
Design-Build (DB)	40	2.591	**2.889**	3.451	1.53	df 2
Integrated Project Delivery (IPD)	40	3.306	**4.222**	4.544	2.69	Exact Significance .000

Table 9.21. Round 3 - Self-Interest: Friedman Test descriptive statistics, mean ranks, and test statistics

[116] Quartile is described as "percentile" in the SPSS output tables.

Wilcoxon Signed Ranks Test: Self-Interest						
Matched-Pairs	**Ranks**				**Exact Significance**	
		N	**Mean Rank**	**Sum of Ranks**	**Z**	**(1-tailed)**
IPD - DBB	Negative Ranks	6 [a]	22.00	132.00	-3.459 [j]	.000 *
	Positive Ranks	32 [b]	19.03	609.00		
	Ties	2 [c]				
	Total	40				
IPD - DB	Negative Ranks	5 [d]	18.00	90.00	-4.186 [j]	.000 *
	Positive Ranks	34 [e]	20.29	690.00		
	Ties	1 [f]				
	Total	40				
DB - DBB	Negative Ranks	24 [g]	20.00	480.00	-1.256 [k]	.107
	Positive Ranks	15 [h]	20.00	300.00		
	Ties	1 [i]				
	Total	40				

Notes:
a. IPD < DBB
b. IPD > DBB
c. IPD = DBB
d. IPD < DB
e. IPD > DB
f. IPD = DB
g. DB < DBB
h. DB > DBB
i. DB = DBB

Notes:
j. Based on negative ranks.
k. Based on positive ranks.

* Significant at a .008 level (Bonferroni adjusted from a .025 significance level (1-tailed))

Table 9.22. Round 3 -- Self-Interest: Post-Hoc Wilcoxon Signed Ranks Test

Overall Self-Interest Findings:

There was a statistically significant difference in which project delivery method was perceived most effective for achieving the 13 critical success factors, $X^2(2) = 30.679$, $P < 0.001$. Post-hoc analysis with Wilcoxon Signed-Rank Tests was conducted with a Bonferroni correction applied, resulting in a significance level set at $P < 0.008$ (1-tailed). Median perceived efficacy levels for Integrated Project Delivery (IPD), Design-Bid-Build (DBB), and Design-Build (DB) were 4.222, 3.294, and 2.889 respectively. There were significant differences between IPD and DBB (Z = - 3.459, P < 0.001), and between IPD and DB (Z = - 4.186, P < 0.001). There was not a significant difference between DBB and DB (Z= -1.256, P=0.107). The null hypothesis is rejected in the self-interest category, and it is concluded that IPD is perceived by the overall panel of experts as significantly more effective than either DBB or DB to successfully attain the 13 critical success factors.

Table 9.23. provides the Friedman Test results for each of the individual stakeholder groups in the self-interest category. In the median and upper quartiles all four stakeholder groups rated IPD with highest efficacy. In the lower quartile the Owners, Builders, and Users each rated IPD highest. In the lowest quartile the Designers rated DBB over IPD, but it must be noted that the Designer stakeholder group is the only stakeholder group which does not display statistical significance. The Owners, Builders, and Users each display statistical significance at the 0.05 level. Table 9.23. provides the results of the post-hoc tests.

Significance Test -- Relative Effectiveness: Self-Interest

Stakeholder	N	Project Delivery Method	Descriptive Statistics: Percentiles 25th	50th (Median)	75th	Friedman Test: Mean Rank	Statistics	
Owner	14	Design-Bid-Build (DBB)	3.211	**3.546**	3.998	2.14	Chi-Square	17.714
		Design-Build (DB)	2.440	**2.686**	3.105	1.14	df	2
		Integrated Project Delivery (IPD)	3.599	**4.201**	4.535	2.71	Exact Significance	.000
Designer	9	Design-Bid-Build (DBB)	3.275	**3.825**	4.069	2.11	Chi-Square	4.667
		Design-Build (DB)	2.614	**2.711**	3.113	1.44	df	2
		Integrated Project Delivery (IPD)	2.627	**4.132**	4.376	2.44	Exact Significance	.107
Builder	9	Design-Bid-Build (DBB)	2.518	**2.818**	3.045	1.39	Chi-Square	9.484
		Design-Build (DB)	3.138	**3.546**	3.970	1.89	df	2
		Integrated Project Delivery (IPD)	3.423	**4.236**	4.537	2.72	Exact Significance	.006
User	8	Design-Bid-Build (DBB)	1.877	**2.653**	3.383	1.25	Chi-Square	10.750
		Design-Build (DB)	2.413	**2.842**	3.766	1.88	df	2
		Integrated Project Delivery (IPD)	3.008	**4.403**	4.887	2.88	Exact Significance	.002

Table 9.23. Round 3 -- Self-Interest: Friedman Test descriptive statistics, mean ranks, and test statistics by stakeholder group

Wilcoxon Signed Ranks Test: Self-Interest							
Stakeholder	Matched-Pairs	Ranks				Exact Significance	
			N	Mean Rank	Sum of Ranks	Z	1-tailed
Owner	IPD - DBB	Negative Ranks	3 a	8.67	26.00	-1.664 j	.052
		Positive Ranks	11 b	7.18	79.00		
		Ties	0 c				
		Total	14				
	IPD - DB	Negative Ranks	1 d	2.00	2.00	-3.170 j	.000 *
		Positive Ranks	13 e	7.92	103.00		
		Ties	0 f				
		Total	14				
	DB - DBB	Negative Ranks	13 g	7.23	94.00	-2.605 k	.003 *
		Positive Ranks	1 h	11.00	11.00		
		Ties	0 i				
		Total	14				
Designer	IPD - DBB	Negative Ranks	3 a	7.33	22.00	-.059 j	.500
		Positive Ranks	6 b	3.83	23.00		
		Ties	0 c				
		Total	9				
	IPD - DB	Negative Ranks	2 d	5.50	11.00	-1.362 j	.102
		Positive Ranks	7 e	4.86	34.00		
		Ties	0 f				
		Total	9				
	DB - DBB	Negative Ranks	7 g	5.71	40.00	-2.073 k	.020
		Positive Ranks	2 h	2.50	5.00		
		Ties	0 i				
		Total	9				
Builder	IPD - DBB	Negative Ranks	0 a	.00	.00	-2.366 j	.008 *
		Positive Ranks	7 b	4.00	28.00		
		Ties	2 c				
		Total	9				
	IPD - DB	Negative Ranks	1 d	8.00	8.00	-1.400 j	.098
		Positive Ranks	7 e	4.00	28.00		
		Ties	1 f				
		Total	9				
	DB - DBB	Negative Ranks	2 g	1.50	3.00	-2.100 j	.020
		Positive Ranks	6 h	5.50	33.00		
		Ties	1 i				
		Total	9				
User	IPD - DBB	Negative Ranks	0 a	.00	.00	-2.521 j	.004 *
		Positive Ranks	8 b	4.50	36.00		
		Ties	0 c				
		Total	8				
	IPD - DB	Negative Ranks	1 d	1.00	1.00	-2.380 j	.008 *
		Positive Ranks	7 e	5.00	35.00		
		Ties	0 f				
		Total	8				
	DB - DBB	Negative Ranks	2 g	4.00	8.00	-1.400 j	.098
		Positive Ranks	6 h	4.67	28.00		
		Ties	0 i				
		Total	8				

Notes:
a. IPD < DBB
b. IPD > DBB
c. IPD = DBB
d. IPD < DB
e. IPD > DB
f. IPD = DB
g. DB < DBB
h. DB > DBB
i. DB = DBB

Notes:
j. Based on negative ranks.
k. Based on positive ranks.
* Significant at a .008 level (Bonferroni adjusted from a .025 significance level (1-tailed))

Table 9.24. Round 3 -- Self-Interest: Post-Hoc Wilcoxon Signed Ranks Test by stakeholder group

Stakeholder Self-Interest Findings (See tables 9.23 and 9.24)**:**

Owners: There was a statistically significant difference in which project delivery method was perceived most effective for achieving the 13 critical success factors, $X^2(2) = 17.714$, $P < 0.001$. Post-hoc analysis with Wilcoxon Signed-Rank Tests was conducted with a Bonferroni correction applied, resulting in a significance level set at $P < 0.008$ (1-tailed). Median perceived efficacy levels for Integrated Project Delivery (IPD), Design-Bid-Build (DBB), and Design-Build (DB) were 4.201, 3.546, and 2.686 respectively. There were significant differences between IPD and DBB ($Z = - 3.170$, $P < 0.001$), and between DBB and DB ($Z = - 2.605$, $P =0.003$). There was not a significant difference between IPD and DBB ($Z= - 1.664$, $P=0.052$). The null hypothesis is rejected for the comparison of IPD and DB. In the self-interest category it is concluded that IPD is perceived by the Owners as significantly more effective than DB to successfully attain the 13 critical success factors evaluated. Although the null hypothesis for IPD-DBB cannot be rejected at the 0.008 significance level, the Delphi process indicates Owner consensus, based on the median score, that IPD is perceived as more effective than DBB.

Designers: There was not a statistically significant difference in which project delivery method was perceived most effective for achieving the 13 critical success factors, $X^2(2) = 4.667$, $P =0.107$. Because statistical significance is not achieved in the Friedman Test, Post-hoc analysis with Wilcoxon Signed-Rank Tests is not relevant. Median perceived efficacy levels for Integrated Project Delivery (IPD), Design-Bid-Build (DBB), and Design-Build (DB) were 4.132, 3.825, and 2.711 respectively. Based on median scores the Delphi process indicates a consensus among the Designer's that IPD is more effective than either DBB or DB.

Builders: There was a statistically significant difference in which project delivery method was perceived most effective for achieving the 13 critical success factors, $X^2(2) = 9.484$, $P = 0.006$. Post-hoc analysis with Wilcoxon Signed-Rank Tests was conducted with a Bonferroni correction applied, resulting in a significance level set at $P < 0.008$ (1-tailed). Median perceived efficacy levels for Integrated Project Delivery (IPD), Design-Bid-Build (DBB), and Design-Build (DB) were 4.236, 3.546, and 2.818 respectively. There were significant differences between IPD and DBB ($Z = -2.366$, $P = 0.008$). There were not significant differences between IPD and DB ($Z=-1.400$, $P=0.098$) or between DBB and DB ($Z = -2.100$, $P = 0.020$). The null hypothesis is rejected for the comparison of IPD and DBB. In the self-interest category it is concluded that IPD is perceived by the Builders as significantly more effective than DBB to successfully attain the 13 critical success factors evaluated. Although the null hypothesis for IPD-DB cannot be rejected at the 0.008 significance level, the Delphi process indicates Builder consensus, based on the median score, that IPD is perceived as more effective than DB.

Users: There was a statistically significant difference in which project delivery method was perceived most effective for achieving the 13 critical success factors, $X^2(2) = 10.750$, $P = 0.002$. Post-hoc analysis with Wilcoxon Signed-Rank Tests was conducted with a Bonferroni correction applied, resulting in a significance level set at $P < 0.008$ (1-tailed). Median perceived efficacy levels for Integrated Project Delivery (IPD), Design-Bid-Build (DBB), and Design-Build (DB) were 4.403, 2.653, and 2.842 respectively. There were significant differences between IPD and DBB ($Z = -2.380$, $P = 0.004$), and between IPD and DB ($Z = -2.380$, $P = 0.008$). There was not a significant difference between DB and DBB ($Z= -1.40$, $P=0.098$). The null hypothesis is rejected for the comparison of IPD and DBB/DB. In the self-interest category it is concluded that IPD is perceived by the Users as significantly more effective than either DBB or DB to successfully attain the 13 critical success factors evaluated.

9.8.4. Statistical Significance: Project-Interest

The Friedman Test indicates that in the Project-Interest category IPD has the highest mean rank overall, as well as in each the upper and lower quartiles. The Freidman test is statistically significant ($X^2(2)=22.615$, $P < 0.001$), therefore post-hoc tests may be run to determine if a significant difference exists between each pair of the project delivery methods.

The Wilcoxon Signed-Rank Test, the post-hoc test, is the nonparametric equivalent to the dependent t-test, and is used to compare two sets of scores that come from the same participants. In this case the sets of scores are paired comparisons of each of the project delivery methods evaluated by the panel of experts for efficacy in attaining the 13 critical success factors.

Significance Test -- Relative Effectiveness: Project-Interest

Project Delivery Method	Descriptive Statistics				Friedman Test	
		Percentiles				
	N	25th	50th (Median)	75th	Mean Rank	Statistics
Design-Bid-Build (DBB)	40	2.774	**3.194**	3.778	1.78	Chi-Square 22.615
Design-Build (DB)	40	2.779	**3.074**	3.520	1.63	df 2
Integrated Project Delivery (IPD)	40	3.471	**4.168**	4.572	2.60	Exact Significance .000

Table 9.25. Round 3 - Project-Interest: Friedman Test descriptive statistics, mean ranks, and test statistics

Overall Project-Interest Findings:

There was a statistically significant difference in which project delivery method was perceived most effective for achieving the 13 critical success factors, $X^2(2) = 22.615$, $P < 0.001$.

Post-hoc analysis with Wilcoxon Signed-Rank Tests was conducted with a Bonferroni correction applied, resulting in a significance level set at $P < 0.008$ (1-tailed). Median perceived efficacy levels for Integrated Project Delivery (IPD), Design-Bid-Build (DBB), and Design-Build (DB) were 4.168, 3.194, and 3.074 respectively. There were significant differences between IPD and DBB ($Z = -3.824$, $P < 0.001$), and between IPD and DB ($Z = -4.075$, $P < 0.001$). There was not a significant difference between DBB and DB ($Z = -0.098$, $P = 0.464$). The null hypothesis is rejected in the project-interest category, and it is concluded that IPD is perceived by the overall panel of experts as significantly more effective than either DBB or DB to successfully attain the 13 critical success factors.

Wilcoxon Signed Ranks Test: <u>Project-Interest</u>						
Matched-Pairs	**Ranks**				**Exact Significance**	
		N	**Mean Rank**	**Sum of Ranks**	**Z**	**(1-tailed)**
IPD - DBB	Negative Ranks	8 a	14.50	116.00	-3.824 j	.000 *
	Positive Ranks	31 b	21.42	664.00		
	Ties	1 c				
	Total	40				
IPD - DB	Negative Ranks	7 d	14.00	98.00	-4.075 j	.000 *
	Positive Ranks	32 e	21.31	682.00		
	Ties	1 f				
	Total	40				
DB - DBB	Negative Ranks	22 g	18.05	397.00	-.098 k	.464
	Positive Ranks	17 h	22.53	383.00		
	Ties	1 i				
	Total	40				

Notes:
a. IPD < DBB
b. IPD > DBB
c. IPD = DBB
d. IPD < DB
e. IPD > DB
f. IPD = DB
g. DB < DBB
h. DB > DBB
i. DB = DBB

Notes:
j. Based on negative ranks.
k. Based on positive ranks.

* Significant at a .008 level (Bonferroni adjusted from a .025 significance level (1-tailed))

Table 9.26. Round 3 -- Project-Interest: Post-Hoc Wilcoxon Signed Ranks Test

Table 8.27. provides the Friedman Test results for each of the individual stakeholder groups in the project-interest category. IPD is rated as most effective by all the stakeholders in each quartile with the exception of the Designers where DBB is highest rated in the lower quartile. The Owners and Builders each display statistical significance at the 0.05 level. The Designers and Users failed to achieve the 0.050 significance level. Only the Owners and Builders will be taken into consideration in the post-hoc testing. Table 9.26. provides the results of the post-hoc tests.

Significance Test -- Relative Effectiveness: Project-Interest								
			Descriptive Statistics Percentiles			Friedman Test		
Stakeholder	N	Project Delivery Method	25th	**50th (Median)**	75th	Mean Rank	Statistics	
Owner	14	Design-Bid-Build (DBB)	2.824	**3.513**	3.920	1.93	Chi-Square	13.000
		Design-Build (DB)	2.536	**2.872**	3.203	1.36	df	2
		Integrated Project Delivery (IPD)	3.622	**4.121**	4.461	2.71	Exact Significance	.001
Designer	9	Design-Bid-Build (DBB)	3.122	**3.596**	3.878	2.11	Chi-Square	4.667
		Design-Build (DB)	2.798	**3.062**	3.295	1.44	df	2
		Integrated Project Delivery (IPD)	2.937	**4.316**	4.696	2.44	Exact Significance	.107
Builder	9	Design-Bid-Build (DBB)	2.249	**2.940**	3.117	1.22	Chi-Square	12.250
		Design-Build (DB)	3.102	**3.546**	4.044	2.00	df	2
		Integrated Project Delivery (IPD)	3.451	**4.321**	4.551	2.78	Exact Significance	.001
User	8	Design-Bid-Build (DBB)	2.553	**2.753**	3.555	1.75	Chi-Square	1.750
		Design-Build (DB)	2.775	**3.367**	3.667	1.88	df	2
		Integrated Project Delivery (IPD)	3.116	**3.936**	4.873	2.38	Exact Significance	.531

Table 9.27. Round 3 -- Project-Interest: Friedman Test descriptive statistics, mean ranks, and test statistics by stakeholder group

Wilcoxon Signed Ranks Test: Project-Interest							
Stakeholder	Matched-Pairs	Ranks				Exact Significance	
			N	Mean Rank	Sum of Ranks	Z	1-tailed
Owner	IPD - DBB	Negative Ranks	3 a	5.00	15.00	-2.354 j	.008 *
		Positive Ranks	11 b	8.18	90.00		
		Ties	0 c				
		Total	14				
	IPD - DB	Negative Ranks	1 d	1.00	1.00	-3.233 j	.000 *
		Positive Ranks	13 e	8.00	104.00		
		Ties	0 f				
		Total	14				
	DB - DBB	Negative Ranks	10 g	7.70	77.00	-1.538b k	.068
		Positive Ranks	4 h	7.00	28.00		
		Ties	0 i				
		Total	14				
Designer	IPD - DBB	Negative Ranks	3 a	6.00	18.00	-.533 j	.326
		Positive Ranks	6 b	4.50	27.00		
		Ties	0 c				
		Total	9				
	IPD - DB	Negative Ranks	2 d	5.00	10.00	-1.481 j	.082
		Positive Ranks	7 e	5.00	35.00		
		Ties	0 f				
		Total	9				
	DB - DBB	Negative Ranks	7 g	5.29	37.00	-1.718 k	.049
		Positive Ranks	2 h	4.00	8.00		
		Ties	0 i				
		Total	9				
Builder	IPD - DBB	Negative Ranks	0 a	.00	.00	-2.521 j	.004 *
		Positive Ranks	8 b	4.50	36.00		
		Ties	1 c				
		Total	9				
	IPD - DB	Negative Ranks	1 d	8.00	8.00	-1.400 j	.098
		Positive Ranks	7 e	4.00	28.00		
		Ties	1 f				
		Total	9				
	DB - DBB	Negative Ranks	1 g	2.00	2.00	-2.240 j	.012
		Positive Ranks	7 h	4.86	34.00		
		Ties	1 i				
		Total	9				
User	IPD - DBB	Negative Ranks	2 a	1.50	3.00	-2.100 j	.020
		Positive Ranks	6 b	5.50	33.00		
		Ties	0 c				
		Total	8				
	IPD - DB	Negative Ranks	3 d	2.00	6.00	-1.680 j	.055
		Positive Ranks	5 e	6.00	30.00		
		Ties	0 f				
		Total	8				
	DB - DBB	Negative Ranks	4 g	2.50	10.00	-1.120 j	.156
		Positive Ranks	4 h	6.50	26.00		
		Ties	0 i				
		Total	8				

Notes:
a. IPD < DBB
b. IPD > DBB
c. IPD = DBB
d. IPD < DB
e. IPD > DB
f. IPD = DB
g. DB < DBB
h. DB > DBB
i. DB = DBB

Notes:
j. Based on negative ranks.
k. Based on positive ranks.
* Significant at a .008 level (Bonferroni adjusted from a .025 significance level (1-tailed))

Table 9.28. Round 3 -- Project-Interest: Post-Hoc Wilcoxon Signed Ranks Test by stakeholder group

Stakeholder Project-Interest Findings (See tables 9.27 and 9.28)**:**

Owners: There was a statistically significant difference in which project delivery method was perceived most effective for achieving the 13 critical success factors, $X^2(2) = 13.000$, $P = 0.001$. Post-hoc analysis with Wilcoxon Signed-Rank Tests was conducted with a Bonferroni correction applied, resulting in a significance level set at $P < 0.008$ (1-tailed). Median perceived efficacy levels for Integrated Project Delivery (IPD), Design-Bid-Build (DBB), and Design-Build (DB) were 4.121, 3.513, and 2.872 respectively. There were significant differences between IPD and DBB ($Z = -2.354$, $P = 0.008$), and between IPD and DB ($Z = -3.233$, $P < 0.001$). There was not a significant difference between DB and DBB ($Z = -1.538$, $P = 0.068$). The null hypothesis is rejected for the comparison of IPD and DBB/DB. In the project-interest category it is concluded that IPD is perceived by the Owners as significantly more effective than DBB or DB to successfully attain the 13 critical success factors evaluated.

Designers: There was not a statistically significant difference in which project delivery method was perceived most effective for achieving the 13 critical success factors, $X^2(2) = 4.667$, $P = 0.107$. Because statistical significance is not achieved in the Friedman Test, Post-hoc analysis with Wilcoxon Signed-Rank Tests is not relevant. Median perceived efficacy levels for Integrated Project Delivery (IPD), Design-Bid-Build (DBB), and Design-Build (DB) were 4.316, 3.596, and 2.798 respectively. Although the null hypothesis for IPD and DBB/DB cannot be evaluated for the Designer's stakeholder group in the project-interest category, the Delphi process indicates a consensus among the Designer's that IPD is more effective than either DBB or DB based on the median quartile.

Builders: There was a statistically significant difference in which project delivery method was perceived most effective for achieving the 13 critical success factors, $X^2(2) =$

12.250, P =0.001. Post-hoc analysis with Wilcoxon Signed-Rank Tests was conducted with a Bonferroni correction applied, resulting in a significance level set at $P < 0.008$ (1-tailed). Median perceived efficacy levels for Integrated Project Delivery (IPD), Design-Bid-Build (DBB), and Design-Build (DB) were 4.321, 2.940, and 3.546 respectively. There were significant differences between IPD and DBB ($Z = -5.521$, $P = 0.004$). There were not significant differences between IPD and DB ($Z=-1.400$, $P=0.098$) or between DBB and DB ($Z = -2.240$, $P = 0.012$). The null hypothesis is rejected for the comparison of IPD and DBB. In the project-interest category it is concluded that IPD is perceived by the Builders as significantly more effective than DBB to successfully attain the 13 critical success factors evaluated. Although the null hypothesis for IPD-DB cannot be rejected at the 0.008 significance level, the Delphi process indicates Builder consensus, based on the median score, that IPD is perceived as more effective than DB.

Users: There was not a statistically significant difference in which project delivery method was perceived most effective for achieving the 13 critical success factors, $X^2(2) = 1.750$, $P = 0.531$. Because statistical significance is not achieved in the Friedman Test, Post-hoc analysis with Wilcoxon Signed-Rank Tests is not relevant. Median perceived efficacy levels for Integrated Project Delivery (IPD), Design-Bid-Build (DBB), and Design-Build (DB) were 3.936, 2.753, and 3.367 respectively. Although the null hypothesis for IPD and DBB/DB cannot be evaluated for the User's stakeholder group in the project-interest category, the Delphi process indicates a consensus among the User's that IPD is more effective than either DBB or DB based on the median quartile.

9.8.5. Comparison of Mean Effectiveness Distributions

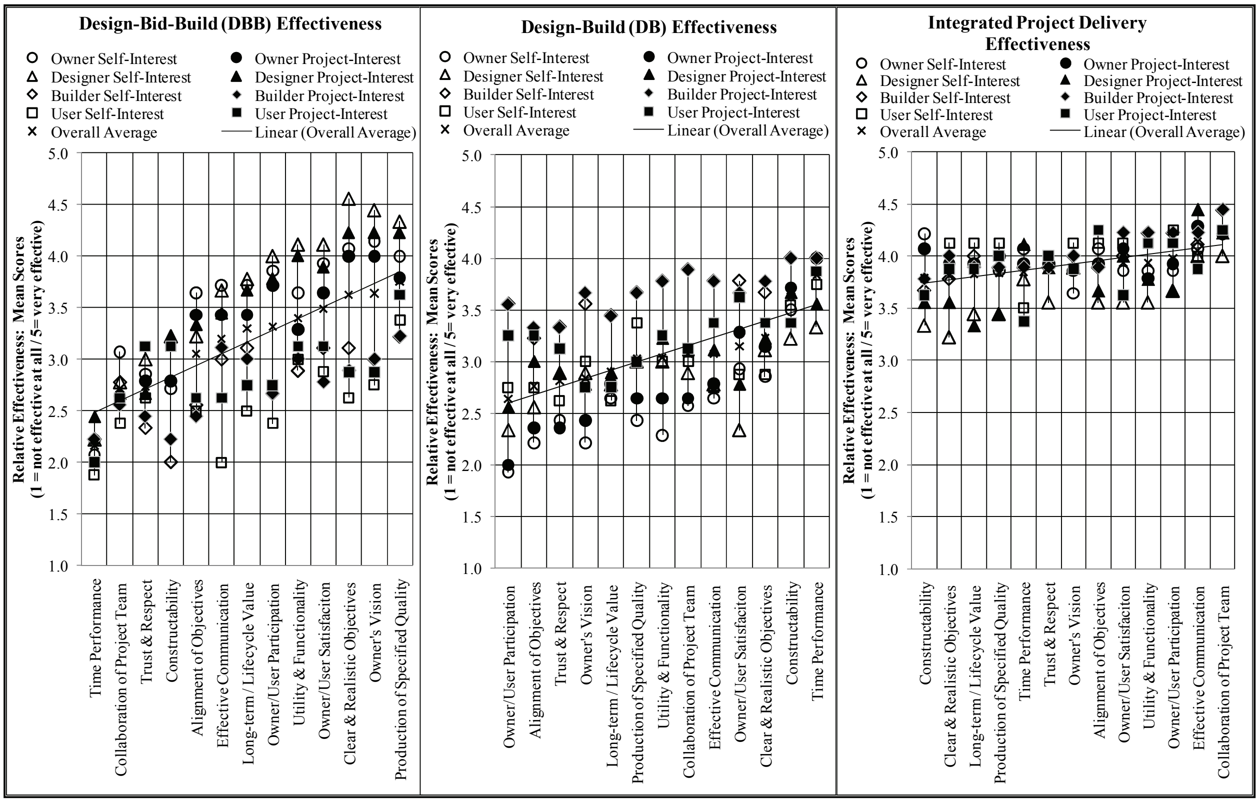


Figure 9.13. Round 3 comparison of project delivery methods' average mean score distributions

Figure 9.14 compares the distribution of mean scores for relative effectiveness for each of the three delivery methods. It is clear that IPD is consistently rated the most effective overall and displays the least variance about the overall average trend line as visual proof there was significant agreement among the panel of expert.

9.8.6. Overall Comparisons of Effectiveness Ratings

Figure 9.15 the overall average mean scores and trend lines are plotted for self-interest and project interest. It is extremely clear that IPD is consistently rated more effective than DBB or DB for effectiveness in achieving the 13 CSF's.

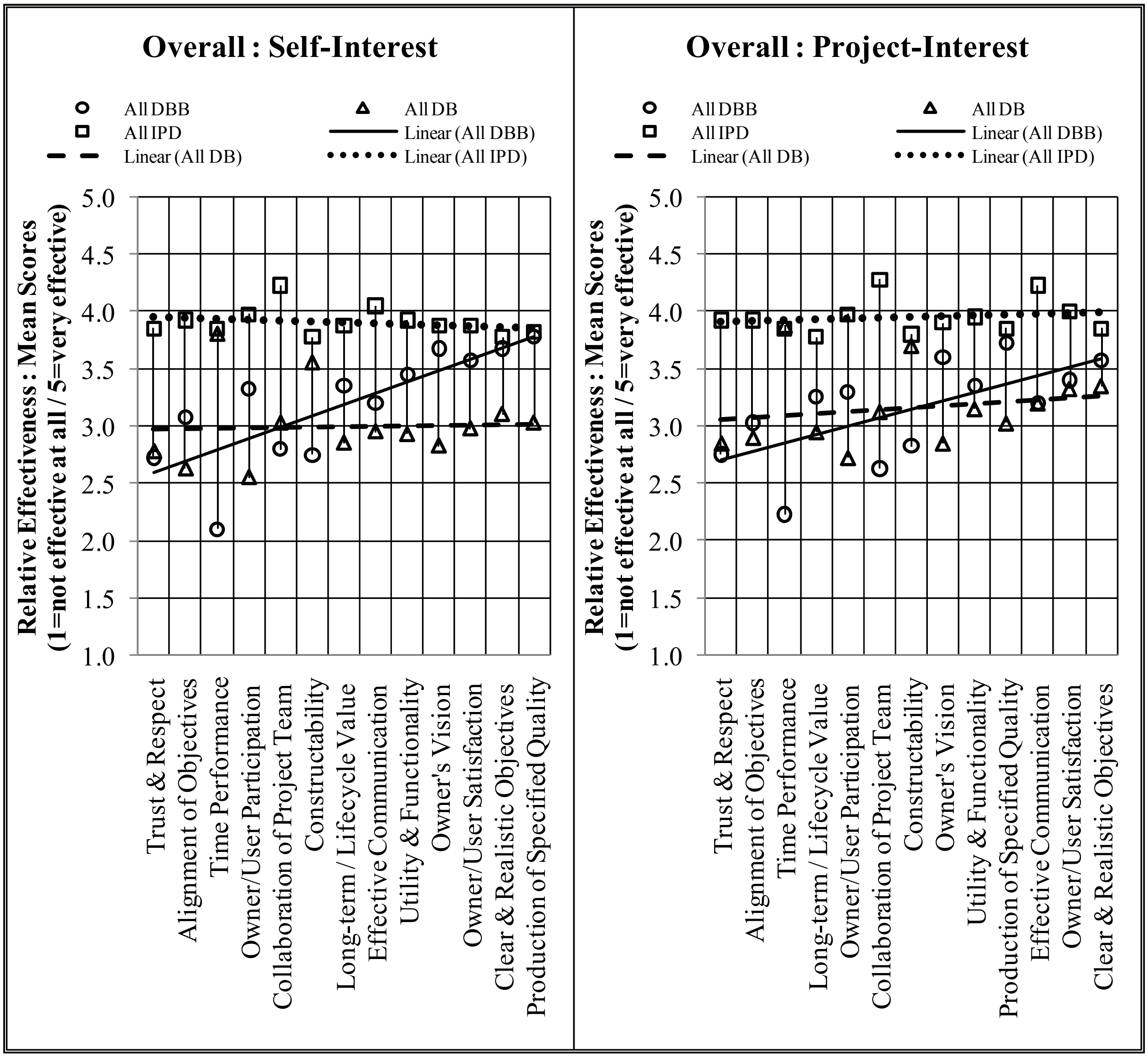


Figure 9.14. Round 3 -- Overall: Comparison of relative effectiveness by project delivery method

9.8.7. Comparison of Median Weighted Averages

Figure 9.16 plots the median weighted average for each stakeholder group by project delivery method. It is significant that the stakeholder median scores for IPD are rated highest and have the tightest distribution cluster about the overall average score. Not only does the panel of experts have the highest degree of consensus in evaluating IPD, but they also rate the perceived effectiveness of IPD higher than either DBB or DBB. The Friedman Tests discussed above indicates that the comparison of the data plotted in Figure 9.16. is highly significant (P<0.001) .

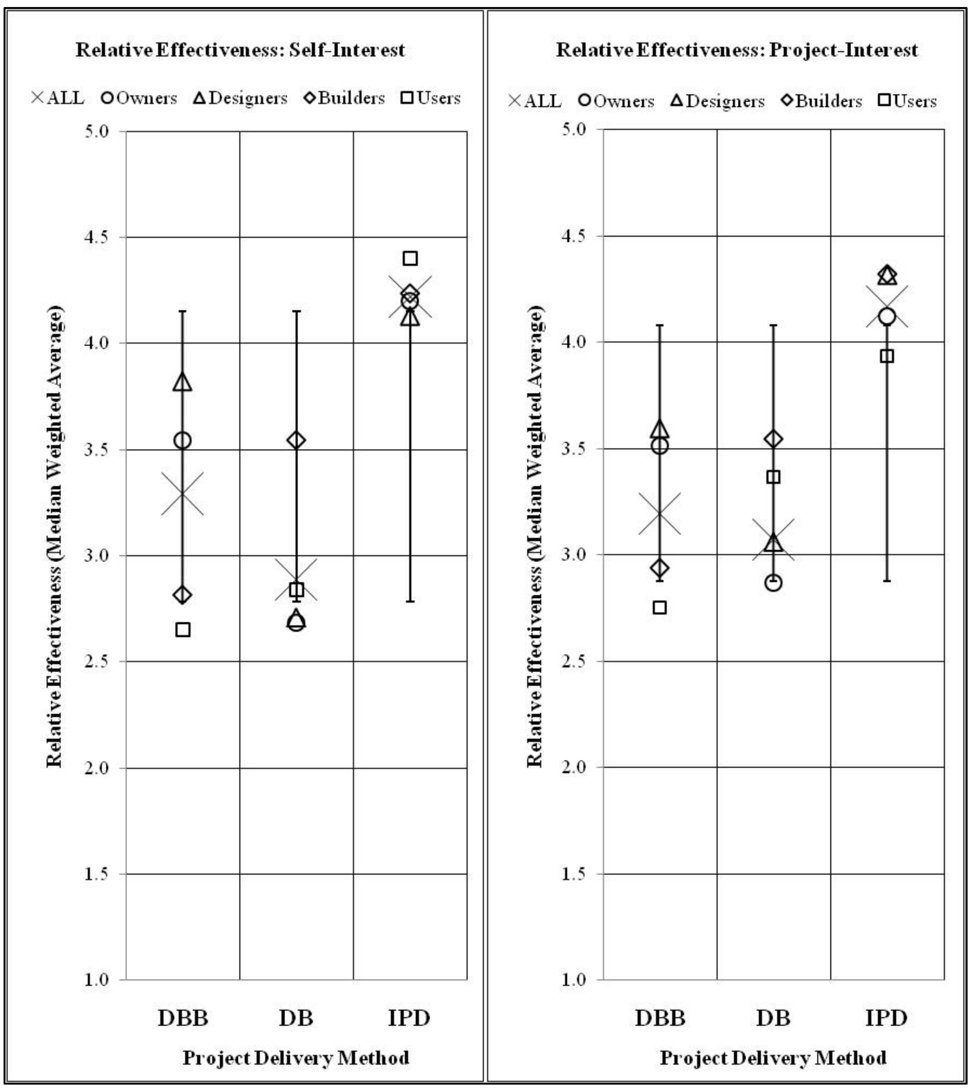


Figure 9.15. Median Weighted Averages (with standard deviation)

9.8.8. Implementability of IPD

Inferred from analysis of Figures 9.14 through 9.16., and reinforced by the significance testing, is that IPD is perceived as a superiorly effective project delivery method compared to either DBB or DB in this study. Another important inference which may be drawn from the data is a measure of implementability or executionablity of the project delivery methods. The effective implementation of the project delivery method can influence project success and further realize value-creation for the project. [117] Kim argues that "no plan, no matter how good it appears can be good unless it is implementable".[118] Assuming IPD is feasible logically, theoretically, technically, and economically there remains one measure of feasibility critical to implementability: acceptance, or buy-in, by the project stakeholders. The acceptance may be viewed as *political* feasibility.[119] For a multi-party party collaboration, such as IPD, to be politically feasible each party must perceive a benefit for themselves. If there is no self-interest benefit, there is no incentive for the individual parties to accept the strategy despite an overall benefit to project-interest. The results of this research indicate a *political* consensus among the project stakeholders that IPD is significantly more effective than the other project delivery methods, but more importantly the inter-group differences are the least. The data indicates that IPD is politically feasible among the various stakeholder groups necessary to successfully accomplish the project. In the context of large, complex projects, the research data shown in Figure 9.16. suggests IPD is more implementable for both self-interest and project-interest than DBB or DB.

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[117] Li Zhai, Yanfei Xin, and Chaosheng Cheng, "Understanding the Value of Project Management From a Stakeholder's Perspective: Case Study of Mega-Project Management," *Project Management Journal* 40, no. 1 (March 2009): 101-02.
[118] Kim, "Countermodeling as a Strategy for Decision Making: Epistemological Problems in Design", 27.
[119] Kim, 1980, 30.

While it is important that the method be implementable for project-interest, it is even more important for self-interest. As discussed earlier in the dissertation, collaborative game theory calls for a superadditive relationship where optimization of individual stakeholder utility results in higher group utility. A more collaborative project delivery method, such as IPD, provides the framework where each stakeholder may be internally motivated by what is good for them, while externally benefitting the other stakeholders. In practice all parties attempt to portray a "team first" or "project first" attitude, but business survival in the real-world requires self-interest first. To establish the best project team possible to ensure project success, the method must be perceived in self-interest as implementable. Otherwise there is little incentive for the best qualified design and construction business (and individuals) to commit to the IPD process no matter what benefits it may provide to owner and users.

9.9. Round 3 Findings

1. The panel of experts was sufficiently familiar with the three project delivery methods to assess relative effectiveness of DBB, DB, and IPD to achieve the thirteen critical success factors selected in rounds 1 and 2. Two participants from the users group were screened out due to failing to meet the high familiarity criterion for participation. Surveys 1 and 2 also revealed that out of 40 CSF's, 13 CSFs or 32.5% were determined to be most significant in importance to project success.

2. The round 3 survey tested as highly reliable with a Cronbach's Alpha scores of 0.917 for self-interest, and 0.914 for project-interest at a .001 level of significance.

3. The round 3 survey tested positive for inter-rater agreement with minimum overall Kendall's W scores of 0.260 for the overall panel of experts, 0.418 for e owners, 0.285 for designers, 0.361 for builders, and 0.306 for users all at 0.001 significance.

4. The Friedman Test indicated overall statistical significance for both the self-interest category ($X^2(2)=30.697$, $P < 0.001$) and the project-interest category ($X^2(2) = 22.615$, $P < 0.001$). Post-hoc Wilcoxon Signed Ranks Tests determined statistical significance greatly exceeding the Bonferroni adjusted 0.008 level. It is with strong significance that the superiority of IPD effectiveness over DBB and DB is perceived by the overall panel of experts.

5. Analysis of the aggregated median weighted average effectiveness scores (weighted by relative importance) indicates an overwhelming consensus that IPD is perceived more effective than either DBB or DB. IPD displayed the highest median scores in every stakeholder group for both self-interest and project interest. Additional proof of statistical significance is provided by individual stakeholder ratings of relative effectiveness as follows: Owner self-interest IPD over DB ($P<0.001$), Builder self-interest IPD over DBB

(P<0.008), User self-interest IPD over DBB/DB (P=0.004/0.008), Owner project-interest IPD over DBB/DB (P=0.008/0.000), and Builder project-interest IPD over DBB (P=0.004).

6. Based on the findings of the round 3 survey it is strongly concluded that the Delphi panel(s) perceive Integrated Project Delivery as superiorly effective in achieving the thirteen critical success factors in comparison to the design-bid-build and design-build project delivery methods.

7. IPD is logically perceived as more implementable than DBB or DB for attainment of the thirteen factors evaluated. The implementability inference is confined to the research context for large, complex project types.

CHAPTER 10.

CONCLUSIONS AND FUTURE RESEARCH

10.1. Summary of Work

This dissertation has described Integrated Project Deliver as a superior project delivery method for effective value-creation in the context of large complex military construction projects such as the IDBB pilot-projects. The relationship between project goals and value-creation was established as a basis for correlating attainment of critical success factors with evaluating the effectiveness of project delivery methods to successfully create value. A Delphi survey method was modified by expanding the panel of experts to include significant additional sub-panels representing each of the key stakeholder groups (Owner, Designer, Builder, and User) required to provide a macro-level analysis of the project delivery process rather than a micro-level analysis of any single stakeholder group. The survey successfully identified critical success factors representative of the overall project delivery process, and additionally provided an assessment of relative importance of the CSFs. The survey data identified significant differences in perceptions of relative importance between the different project stakeholder groups, and also identified significant differences internal to each stakeholder groups' perceptions of self-interest and project-interest. Taking into consideration the multiple perceptive viewpoints of all project stakeholders from a macro-viewpoint allowed an evaluation of project effectiveness not focused on any single micro-aspect of the project delivery process. The macro-viewed assessment concluded that the collected data corroborated the hypothesis that Integrated Project Delivery provides the normative model for value-creation in large, complex medical military construction projects.

10.2. Contribution to Knowledge

As a nation at war during very difficult economic times, it is critical to find ways to maximize the value of resources expended on provision of world-class healthcare for those who have already sacrificed so much. A goal of this research is to improve the way the U.S. Army approaches project execution for medical projects. This research demonstrates the importance of taking a comprehensive, macro-level viewpoint of the project delivery process, and validates a normative model for project delivery which has great potential for improving our world through enhanced value-creation. This research contributes to knowledge of project delivery in the following ways:

1. Developing a means of evaluating the project delivery process based on a macro-viewpoint taking into consideration all phases of project delivery: Conceptual, Design, Construction, and Operational.

2. Identifying and seeking to understand the differing perceptions of self-interest and project-interest each stakeholder group have is critical to developing the formal contractual basis for maximizing benefit for all stakeholders. Providing a basis for optimizing a collaborative project delivery process by accounting for differences in stakeholder perceptions.

3. Providing a knowledge base surrounding the project delivery process and significant practical contributions to the military medical construction program. This research may lead to implementation of process improvements

to the Medical MILCON program to better provide for the best environment of care possible for our wounded warriors, and their families.

4. Providing basis of broader application of IPD in general, and IDBB in particular, to other types of large scale projects beyond MILCON.

10.3. Extensions and Future Research

The experience gained in this research may be utilized in the following areas:

1. Further study of "Owner's" Stakeholder group for MILCON/public projects by breaking down the multiple parties within the MILCON "Owner's" stakeholder group by key sub-groups. Sub-groups include: Department of Defense, Department of Army, U.S. Army Corps of Engineers, U.S. Army Health Facility Planning Agency, Installation Departments of Public Works, TMA, etc. Identify which CSFs are most important, and any significant variances within the "Home team". Because of the multiple agencies and bureaucracies involved there may be significant variances which limit the optimization within the "Owner's" stakeholder group. Ideally (theoretically) all should be on the same page of music, but in practice each sub-group has different agendas and priorities similar to that between the primary stakeholder groups (Owner, Designer, Builder, & User).

2. Game Theory. Explore how an Integrated Project Delivery methodology may be advantageous to an owner for mitigating opportunistic bidding. The framework of a contract for multi-party Integrated Project Delivery in theory should virtually eliminate any beyond-contract reward based on design interpretation and/or errors if the builder is a responsible party to the design team.[120]

3. Lifecycle Analysis of IPD or IDBB Projects. Due to the currently emergent and experimental nature of IPD there is not a large body of completed comparable projects to assess. At some point in the future, post-occupancy evaluations and lifecycle assessments may be used to compare long-term results of facilities delivered with IPD and traditional methods. The data collected for critical success factor relative importance during this research may be used in the future to create a model for measuring how successful each of the IDBB pilot-projects, or other future projects performed in value-creation. Other researchers have demonstrated models for converting the relative importance data into a performance index by which to evaluate project performance. The methodology used in this research may be utilized to establish a broader range of important critical success factors to evaluate different aspect of project success.

[120] S. Ping Ho and Liang Y. Liu. "Analytical Model for Analyzing Construction Claims and Opportunistic Bidding." *Journal of Construction Engineering and Management* 130, no. 1 (1 February 2004): 94-104.

4. Development of contractual optimization models based on CSF analysis of project stakeholder groups which best address CSF variance between project stakeholder groups. A more difficult consideration is how best to compensate and incentivize the short-term project stakeholders (Designer and Builder) in light of foregoing self-interest for the benefit of the overall project. The scope of this research project is focused on demonstrating the effectiveness of the Integrated Project Delivery process to successfully attain project goals, and create value. There is much additional research which may be conducted into how best to establish a contractual framework to optimize collaborative interaction of each stakeholder. Game Theory may be used to model how best to compensate stakeholders for their collaborative contributions.

APPENDIX A: INTEGRATED DESIGN-BID-BUILD PILOT-PROJECTS

- **<u>Fort Belvoir Community Hospital, Fort Belvoir, VA</u>**

  ~$1.2 billion program, 1.3 million square feet, U.S. Army Corps of Engineers, IDBB fast-track, awarded at less than 15% design, Start 2007 - End 2011.

- **<u>San Antonio Military Medical Center - North, Fort Sam Houston, San Antonio, TX</u>**,

  ~$703 million construction program, 760,000 square foot expansion of Brook Army Medical Center, and 288,000 square foot renovation of existing medical center, U.S. Army Corps of Engineers, IDBB fast-track, Start 2007 - End 2011.

- **<u>Battlefield Health and Trauma Center, Fort Sam Houston, San Antonio, TX</u>**,

  ~$92 million program, U.S. Army Corps of Engineers, IDBB fast-track, Start 2007 - End 2011.

- **<u>National Geo-Spatial Intelligence Agency New Campus East, Fairfax County, VA</u>**,

  2.4 million square feet, $1.7 billion, U.S. Army Corps of Engineers, IDBB fast-track, awarded at 35% design, Start 2007 - End 2011.

APPENDIX B: INSTITUTIONAL REVIEW BOARD (IRB)

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

Office of the Vice Chancellor for Research
Institutional Review Board
528 East Green Street
Suite 203
Champaign, IL 61820

November 2, 2010

Michael Kim
Architecture
212 TBH
MC-621

RE: *Integrated Project Delivery: A Value-Creation Study of Integrated-Design-Bid-Build (IDBB) Military Construction (MILCON) pilot projects with emphasis on complex medical programs*
IRB Protocol Number: 11122

Dear Michael:

Thank you for submitting the completed IRB application form for your project entitled *Integrated Project Delivery: A Value-Creation Study of Integrated-Design-Bid-Build (IDBB) Military Construction (MILCON) pilot projects with emphasis on complex medical programs*. Your project was assigned Institutional Review Board (IRB) Protocol Number 11122 and reviewed. It has been determined that the research activities described in this application meet the criteria for exemption at 45CFR46.101(b). Categories 2 and 4 apply. Category 2 applies because the study uses online survey methods to assess perceptions of various experts regarding evaluation of value creation for design of health related military construction projects. No information is collected on the surveys that can lead to personal identification. Category 4 applies because retrospective analysis of construction project documentation collected from 2006 through 9/9/2010 (last day prior to submission of application for exemption) will occur. This data was originally collected for the purposes of planning and implementing military construction projects rather than research purposes.

This determination of exemption only applies to the research study as submitted. **Exempt protocols are approved for a maximum of three years.** Please note that additional modifications to your project need to be submitted to the IRB for review and exemption determination or approval before the modifications are initiated. To submit modifications to your protocol, please complete the IRB Research Amendment Form (see http://irb.illinois.edu/?q=forms-and-instructions/research-amendments.html).

We appreciate your conscientious adherence to the requirements of human subject research. If you have any questions about the IRB process, or if you need assistance at any time, please feel free to contact me or the IRB Office, or visit our website at http://www.irb.illinois.edu.

Sincerely,

Sue Keehn, Director, Institutional Review Board

c: Michael Brennan

telephone (217) 333-2670 • *fax* (217) 333-0405 • *email* IRB@illinois.edu

APPENDIX C: ROUND 1 SURVEY INSTRUMENT

Round 1 Survey

Exit Survey »

Integrated Project Delivery: Critical Success Factors for Value-Creation

Informed Consent Agreement

The purpose of this research study is to assess Integrated Project Delivery (IPD) impacts on value-creation. LTC Michael Brennan, under the direction of Dr. Michael Kim, is conducting this research as partial fulfillment of the requirements for a Ph.D. degree in Architecture at the University of Illinois Urbana-Champaign.

You are invited to participate in this research project because you have been identified as a subject matter expert in planning, design, construction, maintenance, and/or operations of one of the military construction Integrated-Design-Bid-Build pilot projects.

Your participation in this research study is voluntary. You may choose not to participate. If you decide to participate in this research survey, you may withdraw at any time. If you decide not to participate in this study or if you withdraw from participating at any time, you will not be penalized.

The procedure involves filling an online survey that will take approximately 10-15 minutes. Your responses will be confidential and we do not collect identifying information such as your name, email address or IP address. The survey questions will be about creating value through an integrated project delivery process.

We will do our best to keep your information confidential. All data is stored in a password protected electronic format. To help protect your confidentiality, the surveys will not contain information that will personally identify you. The results of this study will be used for scholarly purposes only and may be shared with University of Illinois Urbana-Champaign representatives.

If you have any questions about the research study, please contact LTC Michael Brennan, PhD Candidate, University of Illinois Urbana-Champaign at mdbrenna@illinois.edu, michael.d.brennan@us.army.mil / (703)473-3587 or Dr. Michael Kim at mkkim1@illinois.edu / (217) 244-8012. This research has been reviewed according to University of Illinois Urbana-Champaign IRB procedures for research involving human subjects.

If you have any questions about your rights as a participant in this study, please contact the University of Illinois" Institutional Review Board at 217-333-2670 (collect calls accepted if you identify yourself as a research participant) or via email at irb@illinois.edu.

Do you agree to participate in this survey?

DISAGREE: If you do not wish to participate, please decline participation by closing your browser to exit the survey.

AGREE: Check the box below to indicate you have read the above information, voluntarily agree to participate, and are at least 18 years of age.

☐ I Agree

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5%

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Round 1 Survey

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Exit Survey »

Questions marked with a * are required

Integrated Project Delivery: Critical Success Factors for Value-Creation

Professional Experience (1 of 4)

This survey is based on the Delphi Model and is dependent on the collective wisdom of a limited group of subject matter experts. The data collected from this section of the survey will be used to provide a basis to validate the collective expertise and experience of survey participants.

Which of the following categories do you best identify with? (Select only one) *

- Design Team
- Facility User or User's Representative (i.e. Healthcare Professional)
- Construction Team
- Owner or Owner's Representative

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14%

Respondent Anonymity Assurance

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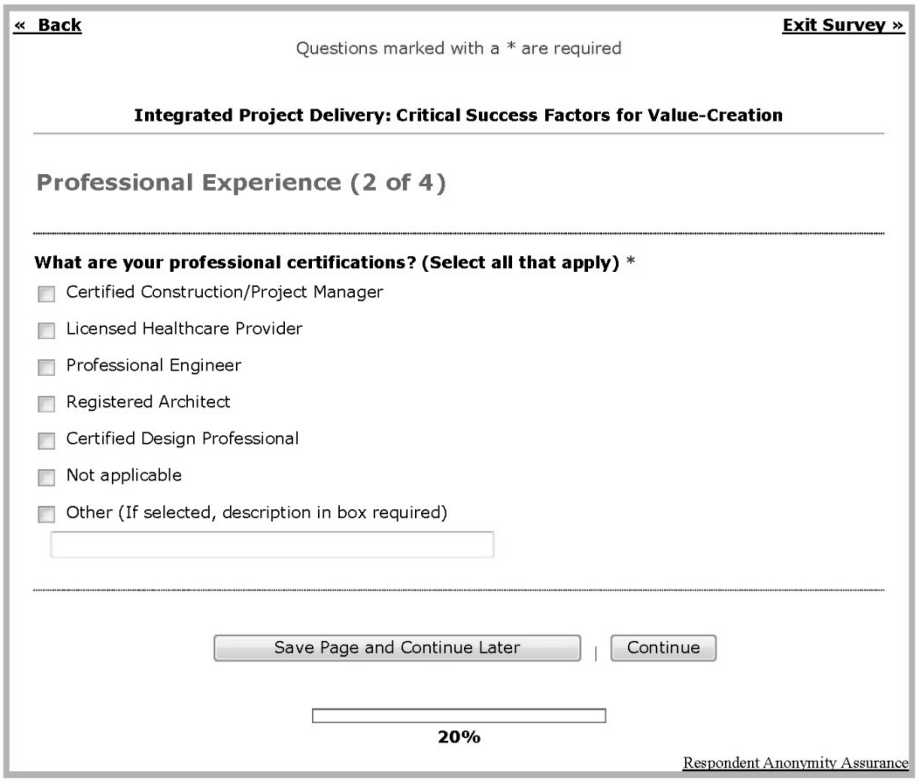
Round 1 Survey



« Back

Exit Survey »

Questions marked with a * are required

Integrated Project Delivery: Critical Success Factors for Value-Creation

Professional Experience (2 of 4)

What are your professional certifications? (Select all that apply) *

- [ ] Certified Construction/Project Manager
- [ ] Licensed Healthcare Provider
- [ ] Professional Engineer
- [ ] Registered Architect
- [ ] Certified Design Professional
- [ ] Not applicable
- [ ] Other (If selected, description in box required)

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20%

Respondent Anonymity Assurance

Page 3 of 19

Round 1 Survey

« Back **Exit Survey »**

Questions marked with a * are required

Integrated Project Delivery: Critical Success Factors for Value-Creation

Professional Experience (3 of 4)

What level of formal education (related to your area of expertise) have you completed? (Select only one) *

- ○ Associates Degree or other training leading to professional certification
- ○ Bachelors Degree
- ○ Graduate / Professional Degree
- ○ Doctorate Degree
- ○ Not applicable

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26%

Respondent Anonymity Assurance

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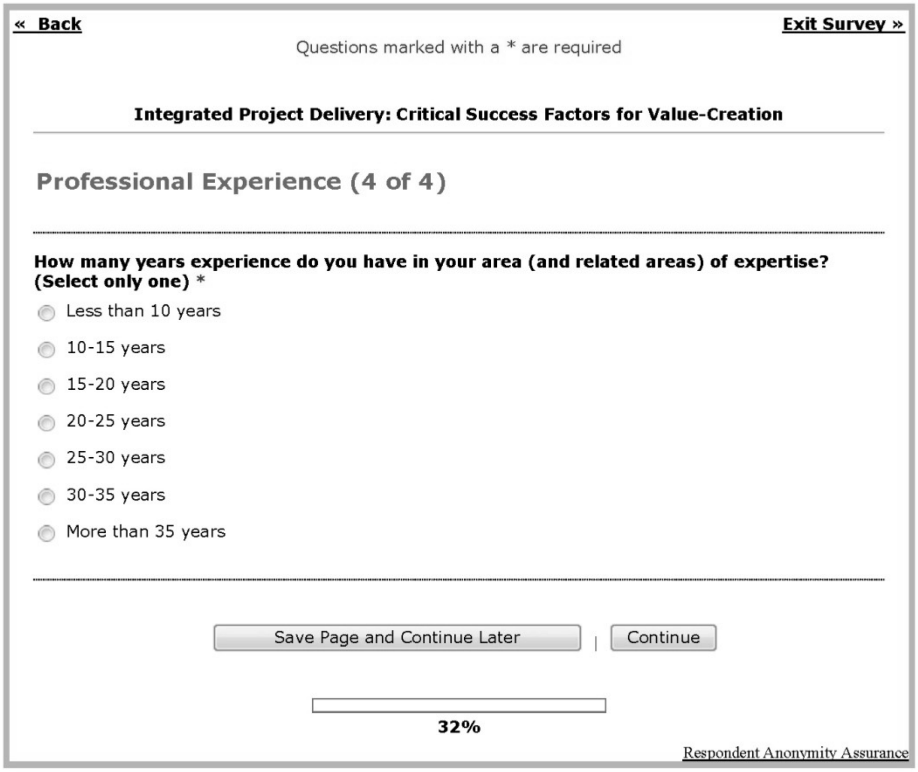
Round 1 Survey



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Exit Survey »

Questions marked with a * are required

Integrated Project Delivery: Critical Success Factors for Value-Creation

Professional Experience (4 of 4)

How many years experience do you have in your area (and related areas) of expertise? (Select only one) *

- Less than 10 years
- 10-15 years
- 15-20 years
- 20-25 years
- 25-30 years
- 30-35 years
- More than 35 years

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32%

Respondent Anonymity Assurance

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« Back — Exit Survey »

Integrated Project Delivery: Critical Success Factors for Value-Creation

Survey Overview & Instructions

This next series of questions will ask you to select the project delivery factors which you believe are most important to the project team's ability to successfully create value.

The listed factors are loosely broken down into four facets of project delivery: Design, Construciton, Process, and Impact.

In sequence you are asked to select the factors from two distinct perspectives. First from the "Stakeholder Perspective", then from the "Project Team Perspective":

(1) STAKEHOLDER PERSPECTIVE: The question to ask yourself is "What factors are most important to only 'MY' stakeholder group's success (Owner, Designer, Builder, or User)"?

(2) PROJECT TEAM PERSPECTIVE: The question to ask yourself is "What factors are most important to overall success of the project and all project stakeholders"?

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38%

Respondent Anonymity Assurance

Round 1 Survey

« Back

Exit Survey »

Integrated Project Delivery: Critical Success Factors for Value-Creation

SPECIAL INSTRUCTIONS:

Answer the next 4 questions
from the
perspective of the "Stakeholder" group you selected earlier.

Consider what is most important to the success of your stakeholder group.
(*Owner, Designer, Builder, or User*)

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41%

Respondent Anonymity Assurance

Page 7 of 19

Round 1 Survey

« Back | Exit Survey »

Questions marked with a * are required

Integrated Project Delivery: Critical Success Factors for Value-Creation

Stakeholder Perspective (1 of 4)
Factors most important to only 'my' stakeholder group's success

Which of the following "Design" factors do you believe are most important for project value-creation? (Select exactly 5) *

- [ ] Design innovation and creativity
- [ ] Achieve "World-Class"
- [ ] Aesthetics
- [ ] Constructability
- [ ] Community impact and acceptance
- [ ] Clear and realistic objectives
- [ ] Owner's vision
- [ ] Utility and functionality
- [ ] Sustainability
- [ ] Evidence based design
- [ ] Other: (Add a top-5 "Design" factor not listed above)

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47%

Respondent Anonymity Assurance

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Round 1 Survey

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Questions marked with a * are required

Integrated Project Delivery: Critical Success Factors for Value-Creation

Stakeholder Perspective (2 of 4)
Factors most important to only 'my' stakeholder group's success

Which of the following "Construction" factors do you believe are most important for project value-creation? (Select exactly 5) *

- [ ] Change-order management
- [ ] Responsive administration / decision support
- [ ] Design accuracy
- [ ] Cost Performance
- [ ] Innovative construction means and methods
- [ ] Productivity
- [ ] Time performance
- [ ] Safety
- [ ] Constructability of Design
- [ ] Quality
- [ ] Other: (Add a top-5 "Construction" factor not listed above)

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52%

Respondent Anonymity Assurance

« Back | Exit Survey »

Questions marked with a * are required

Integrated Project Delivery: Critical Success Factors for Value-Creation

Stakeholder Perspective (3 of 4)
Factors most important to only 'my' stakeholder group's success

Which of the following "Process" factors do you believe are most important for project value-creation? (Select exactly 5) *

- [ ] Competency / Capability of project delivery team
- [ ] Collaboration of Integrated Project Team
- [ ] Trust and Respect
- [ ] Dispute avoidance and resolution
- [ ] Effective communication
- [ ] Owner / User participation
- [ ] Project planning
- [ ] Alignment of project objectives
- [ ] Top management commitment
- [ ] Risk: identification and equitable allocation
- [ ] Other: (Add a top-5 "Process" factor not listed above)

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58%

Respondent Anonymity Assurance

« Back   Exit Survey »

Questions marked with a * are required

Integrated Project Delivery: Critical Success Factors for Value-Creation

Stakeholder Perspective (4 of 4)
Factors most important to only 'my' stakeholder group's success

Which of the following "Impact" factors do you believe are most important for project value-creation? (Select exactly 5) *

- ☐ Job satisfaction
- ☐ Profit and financial objectives
- ☐ Avoid contractual penalties
- ☐ Contract Incentives / Rewards
- ☐ Long-term building success /Lifecycle Value of facility
- ☐ Long-term business relationships
- ☐ Professional reputation or image
- ☐ Profession/Industry Recognition or Awards
- ☐ Litigation avoidance
- ☐ Owner/ user satisfaction
- ☐ Other: (Add a top-5 "Impact" factor not listed above)

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64%

Respondent Anonymity Assurance

« Back	Exit Survey »

Integrated Project Delivery: Critical Success Factors for Value-Creation

SPECIAL INSTRCTIONS:

Answer the next 4 questions from the "Project Team" perspective.

Consider what is in the best interest of the project, and the collective project team as a whole.

For this section, keep in mind that the building is only a means, not the end. (Kim)

Value-creation encompasses much more than the economic value of the "bricks and mortar". Successful value-creation is measured by the ability of the facility, as designed , constructed, and operated, to achieve its intended purpose and use.

When considering critical success factors (CSF) please keep in mind the big picture of how the project delivery process effects the long-term facility value across the spectrum of stakeholders of both the project delivery team (designer, builder, owner, users) and other long-term stakeholders (customers, community and environment).

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70%

Respondent Anonymity Assurance

« Back | Exit Survey »

Questions marked with a * are required

Integrated Project Delivery: Critical Success Factors for Value-Creation

Project Team Perspective (1 of 4)
Factors most important to overall success of the project for all project stakeholders

Which of the following "Design" factors do you believe are most important for project value-creation? (Select exactly 5) *

- [ ] Aesthetics
- [ ] Evidence based design
- [ ] Community impact and acceptance
- [ ] Constructability
- [ ] Design innovation and creativity
- [ ] Owner's vision
- [ ] Achieve "World-Class"
- [ ] Sustainability
- [ ] Clear and realistic objectives
- [ ] Utility and functionality
- [ ] Other: (Add a top-5 "Design" factor not listed above)

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76%

Respondent Anonymity Assurance

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Exit Survey »

Questions marked with a * are required

Integrated Project Delivery: Critical Success Factors for Value-Creation

Project Team Perspective (2 of 4)
Factors most important to overall success of the project for all project stakeholders

Which of the following "Construction" factors do you believe are most important for project value-creation? (Select exactly 5) *

- ☐ Change-order management
- ☐ Constructability of Design
- ☐ Cost Performance
- ☐ Time performance
- ☐ Design accuracy
- ☐ Productivity
- ☐ Innovative construction means and methods
- ☐ Responsive administration / decision support
- ☐ Quality
- ☐ Safety
- ☐ Other: (Add a top-5 "Construction" factor not listed above)

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82%

Respondent Anonymity Assurance

Round 1 Survey

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Exit Survey »

Questions marked with a * are required

Integrated Project Delivery: Critical Success Factors for Value-Creation

Project Team Perspective (3 of 4)
Factors most important to overall success of the project for all project stakeholders

Which of the following "Process" factors do you believe are most important for project value-creation? (Select exactly 5) *

- ☐ Effective communication
- ☐ Alignment of project objectives
- ☐ Collaboration of Integrated Project Team
- ☐ Dispute avoidance and resolution
- ☐ Risk: identification and equitable allocation
- ☐ Owner / User participation
- ☐ Project planning
- ☐ Top management commitment
- ☐ Competency / Capability of project delivery team
- ☐ Trust and Respect
- ☐ Other: (Add a top-5 "Process" factor not listed above)

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88%

Respondent Anonymity Assurance

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Round 1 Survey

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Exit Survey »

Questions marked with a * are required

Integrated Project Delivery: Critical Success Factors for Value-Creation

Project Team Perspective (4 of 4)
Factors most important to overall success of the project for all project stakeholders

Which of the following "Impact" factors do you believe are most important for project value-creation? (Select exactly 5) *

- [ ] Avoid contractual penalties
- [ ] Long-term business relationships
- [ ] Owner/ user satisfaction
- [ ] Litigation avoidance
- [ ] Long-term building success /Lifecycle Value of facility
- [ ] Contract Incentives / Rewards
- [ ] Job satisfaction
- [ ] Profession/Industry Recognition or Awards
- [ ] Professional reputation or image
- [ ] Profit and financial objectives
- [ ] Other: (Add a top-5 "Impact" factor not listed above)

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94%

Respondent Anonymity Assurance

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« Back Exit Survey »

Integrated Project Delivery: Critical Success Factors for Value-Creation

THANK YOU! Your participation is greatly appreciated.

You will be provided with the results of this survey when the Round #2 survey is published later in January.

Please click on the "Submit Survey" button below to submit your responses and close your browser.

Submit Survey

100%

Respondent Anonymity Assurance

Thank you for your participation in this pilot survey! The Round #1 survey will be launched shortly after the closure of this preliminary pilot survey.

Thank You for completing this survey

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Respondent Anonymity Assurance

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Respondent Anonymity Assurance

QuestionPro offers a unique guarantee to survey researchers to protect the privacy and confidentiality of the respondents. The Respondent Anonymity Assurance (RAA) is only applicable and valid for our "Corporate" License holders.

What is RAA?
One of the challenges researchers face is the requirement for two directly conflicting issues:-

1. The ability to track who has responded to the survey and who has not -- for sending out reminder emails, giving out prizes or compensation etc.

   AND

2. For human subjects protocols or other privacy reasons, ensuring that email identifications not be linked to the response data.

From a technical standpoint, if we need to track who has taken the survey and who has not, the survey researcher also implicitly has the ability to track the response for each individual.

To overcome this issue, the Respondent Anonymity Assurance has been introduced. QuestionPro asserts that once RAA is enabled on a survey, although computer generated identification numbers for individuals will be generated, the survey researcher will not have access to both the respondent's email address as well as the response data at the same time.

What assertions does QuestionPro make for RAA-enabled surveys?

1. Only QuestionPro personnel can enable this guarantee for any survey
2. Once the RAA is enabled for a survey, at the request of the survey researcher, it will remain perpetual and cannot be rescinded -- by the researcher or anyone else
3. The QuestionPro Survey Software will never present a respondent's email address linked to the response data in any of the analysis tools, reports and data downloads
4. In the exceptionally unlikely event that a breach occurs for any reason, technical or otherwise, QuestionPro will immediately notify the respondent as well as the survey researcher about the issue. If the respondent requests his response data to be removed from the servers as a result of the breach, QuestionPro will comply with the request even if the survey researcher does not agree. Furthermore, QuestionPro will make all reasonable efforts to make sure that such a breach does not occur again

Are there any Exceptions?

Under certain conditions, including but not limited to law enforcement requests and subpoenas, QuestionPro may have to divulge respondent data as well as email address if required to do so by law. QuestionPro is incorporated in the State of Washington, United States. QuestionPro also has offices in India.

The legal jurisdiction for any disputes arising out of this or any other agreement shall be King County, WA.

Limits of Liability

QuestionPro shall not be liable in any event for incidental or consequential damages in connection with, or arising out of, the furnishing, performance, or use of this documentation, or any software provided by QuestionPro.

QuestionPro may be held liable only in the case of willful negligence on QuestionPro's part. Furthermore, the damages are limited to actual damages and not perceived, punitive, consequential or incidental damages.

How do I know if a survey I am taking is protected by this guarantee?

For surveys that have RAA enabled, a link to the details about the guarantee will be put on the "Bottom Right" corner of the survey. This link cannot be removed or added by the survey researcher. It will be automatically added on surveys that have the anonymity guarantee enabled. Once this link is enabled it cannot be removed, changed or edited. The text for the link will be the following:-

QuestionPro: Respondent Anonymity Assurance

I am taking a survey, and it is not protected by RAA! What do I do?

Not all surveys need this level of protection. This only applies to surveys that have a computer generated respondent identification mechanism enabled. Many researchers choose not to enable this and send out a simple link to the survey *without* the identification mechanism. In such cases there is no way of identifying who has taken the survey and who has not. Please consult with the owner of the survey to see if respondent identification is enabled or not. In most cases, researchers will disclose this information at the beginning of the survey.

A questionpro.com sales agent is available to answer your questions

Furthermore, QuestionPro may not be held liable for privacy claims made by survey researchers.

APPENDIX D: ROUND 2 SURVEY INSTRUMENT

Round 2 Survey

Exit Survey »

Informed Consent Agreement

The purpose of this research study is to compare relative effectiveness of several project delivery methods for maximum value-creation. LTC Michael Brennan, under the direction of Dr. Michael Kim, is conducting this research as partial fulfillment of the requirements for a Ph.D. degree in Architecture at the University of Illinois Urbana-Champaign.

Your participation in this research study is voluntary. You may choose not to participate. If you decide to participate in this research survey, you may withdraw at any time. If you decide not to participate in this study or if you withdraw from participating at any time, you will not be penalized.

The procedure involves filling an online survey that will take approximately 10 minutes. Your responses will be confidential and we do not collect identifying information such as your name, email address or IP address. The survey questions will be about creating value through an integrated project delivery process.

We will do our best to keep your information confidential. All data is stored in a password protected electronic format. To help protect your confidentiality, the surveys will not contain information that will personally identify you. The results of this study will be used for scholarly purposes only and may be shared with University of Illinois Urbana-Champaign representatives.

If you have any questions about the research study, please contact LTC Michael Brennan, PhD Candidate, University of Illinois Urbana-Champaign at mdbrenna@illinois.edu, michael.d.brennan@us.army.mil / (703)473-3587 or Dr. Michael Kim at mkkim1@illinois.edu / (217) 244-8012. This research has been reviewed according to University of Illinois Urbana-Champaign IRB procedures for research involving human subjects.

If you have any questions about your rights as a participant in this study, please contact the University of Illinois" Institutional Review Board at 217-333-2670 (collect calls accepted if you identify yourself as a research participant) or via email at irb@illinois.edu.

Do you agree to participate in this survey?

DISAGREE: If you do not wish to participate, please decline participation by closing your browser to exit the survey.

AGREE: Check the box below to indicate you have read the Informed Consent Agreement, voluntarily agree to participate, and are at least 18 years of age.

☐ I Agree

Continue

18%

Respondent Anonymity Assurance

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Round 2 Survey

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Exit Survey »

Round #1 Survey Results

Thank you again for your participation in the Round #1 Survey!

Survey Round #1 Results may viewed at the following link:

https://netfiles.uiuc.edu/mdbrenna/www/Survey_Results/Round%20%231%20Survey%20Results.pdf

Based on frequency of selection, the Panel of Experts has narrowed the list of Critical Success Factors (CSF's) by nearly 50%. Only CSF's receiving a 60% or greater selection rate by any one of the four stakeholder groups (Owner, Designer, Builder, and User) is included in a new composite list of CSF's to be assessed in this Round #2 Survey.

Notes:
(1) The "Panel of Experts" has been strongly validated based on education, professional certifications, and/or years of experience. (See results for more information)

(2) Cross-tabulation analysis between "Stakeholder Groups" and "Frequency of CSF Selection" indicates statistical significance.

Continue

31%

Respondent Anonymity Assurance

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Round 2 Survey

« Back

Exit Survey »

Questions marked with a * are required

Stakeholder Group

Which of the following categories do you best identify with? (Select only one) *

- Design Team
- Facility User or User's Representative
- Construction Team
- Owner or Owner's Representative

Continue

43%

Respondent Anonymity Assurance

Page 3 of 10

Round 2 Survey

« Back

Exit Survey »

Round #2 Survey Overview & Instructions

You will be asked to assess the relative importance of each factor on a 5-point scale from "Least Important" to "Most Important".

As in Survey Round #1, in sequence you are asked to assess the factors from two distinct perspectives. First from the "Stakeholder Perspective", then from the "Project Centered Perspective":

(1) STAKEHOLDER PERSPECTIVE: The question to ask yourself is "How important is the factor to only 'MY' stakeholder group's success (Owner, Designer, Builder, or User)"?

(2) PROJECT-CENTERED PERSPECTIVE: The question to ask yourself is "How important is the factor to the overall success of the project and all project stakeholders"?

Continue

56%

Respondent Anonymity Assurance

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Round 2 Survey

« Back

Exit Survey »

SPECIAL INSTRUCTIONS:

Assess the following critical success factors from the perspective of the "STAKEHOLDER" group you selected earlier.

Consider how important each factor is to the success of your stakeholder group.
(*Owner, Designer, Builder, or User*)

Continue

62%

Respondent Anonymity Assurance

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Round 2 Survey

« Back Exit Survey »

Questions marked with a * are required

In light of the factors listed below, how would you rate the importance of each factor in general from your STAKEHOLDER PERSPECTIVE?

	Least Important		Important		Most Important
Aesthetics *	○	○	○	○	○
Alignment of Project Objectives *	○	○	○	○	○
Effective Communication *	○	○	○	○	○
Profit and Financial Objectives *	○	○	○	○	○
Owner / User Participation *	○	○	○	○	○
Competency & Capability of Project Delivery Team *	○	○	○	○	○
Trust & Respect *	○	○	○	○	○
Change-Order Reduction *	○	○	○	○	○
Project Time Performance *	○	○	○	○	○
Dispute Avoidance & Resolution *	○	○	○	○	○
Utility & Functionality *	○	○	○	○	○
Owner's vision *	○	○	○	○	○
Owner / User Satisfaction *	○	○	○	○	○
Sustainability *	○	○	○	○	○
Long-term Building Success / Lifecycle Value *	○	○	○	○	○
Professional Reputation & Image *	○	○	○	○	○
Clear & Realistic Objectives *	○	○	○	○	○
Production of Specified Quality *	○	○	○	○	○
Responsive Administration & Decision Support *	○	○	○	○	○
Collaboration of Project Delivery Team *	○	○	○	○	○
Design Innovation & Creativity *	○	○	○	○	○
Constructability *	○	○	○	○	○
Project Cost Performance *	○	○	○	○	○

Continue

68%

Respondent Anonymity Assurance

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« Back　　　　Exit Survey »

SPECIAL INSTRCTIONS:

Answer the following question from the "PROJECT-CENTERED" perspective.

Consider how important each factor is to the overall success of the project, and the collective success of project team as a whole.

For this section, keep in mind that the building is only a means, not the end. (Kim)

Value-creation encompasses much more than the economic value of the "bricks and mortar". Successful value-creation is measured by the ability of the facility, as designed , constructed, and operated, to achieve its intended purpose and use.

When considering critical success factors (CSF) please keep in mind the big picture of how the project delivery process effects the long-term facility value across the spectrum of stakeholders of both the project delivery team (designer, builder, owner, users) and other long-term stakeholders (customers, community and environment).

Continue

81%

Respondent Anonymity Assurance

6

Round 2 Survey

« Back Exit Survey »

Questions marked with a * are required

In light of the factors listed below, how would you rate the importance of each factor in general from a PROJECT-CENTERED PERSPECTIVE?

	Least Important		Important		Most Important
Owner's vision *	○	○	○	○	○
Alignment of Project Objectives *	○	○	○	○	○
Trust & Respect *	○	○	○	○	○
Clear & Realistic Objectives *	○	○	○	○	○
Effective Communication *	○	○	○	○	○
Owner / User Satisfaction *	○	○	○	○	○
Responsive Administration & Decision Support *	○	○	○	○	○
Dispute Avoidance & Resolution *	○	○	○	○	○
Design Innovation & Creativity *	○	○	○	○	○
Aesthetics *	○	○	○	○	○
Collaboration of Project Delivery Team *	○	○	○	○	○
Constructability *	○	○	○	○	○
Competency & Capability of Project Delivery Team *	○	○	○	○	○
Profit and Financial Objectives *	○	○	○	○	○
Utility & Functionality *	○	○	○	○	○
Professional Reputation & Image *	○	○	○	○	○
Owner / User Participation *	○	○	○	○	○
Project Cost Performance *	○	○	○	○	○
Long-term Building Success / Lifecycle Value *	○	○	○	○	○
Sustainability *	○	○	○	○	○
Project Time Performance *	○	○	○	○	○
Change-Order Reduction *	○	○	○	○	○
Production of Specified Quality *	○	○	○	○	○

Continue

87%

Respondent Anonymity Assurance

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Round 2 Survey

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Exit Survey »

THANK YOU! Your participation is greatly appreciated.

You will be provided with the results of this survey when the Round #3 (final) survey is published.

Round #3 will ask the Panel of Experts to weigh in on the effectiveness of different project delivery methods to acheive the most important critical success factors.

Please click on the "Submit Survey" button below to submit your responses and close your browser.

Submit Survey

100%

Respondent Anonymity Assurance

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Respondent Anonymity Assurance

QuestionPro offers a unique guarantee to survey researchers to protect the privacy and confidentiality of the respondents. The Respondent Anonymity Assurance (RAA) is only applicable and valid for our "Corporate" License holders.

What is RAA?
One of the challenges researchers face is the requirement for two directly conflicting issues:-

1. The ability to track who has responded to the survey and who has not -- for sending out reminder emails, giving out prizes or compensation etc.

   AND

2. For human subjects protocols or other privacy reasons, ensuring that email identifications not be linked to the response data.

From a technical standpoint, if we need to track who has taken the survey and who has not, the survey researcher also implicitly has the ability to track the response for each individual.

To overcome this issue, the Respondent Anonymity Assurance has been introduced. QuestionPro asserts that once RAA is enabled on a survey, although computer generated identification numbers for individuals will be generated, the survey researcher will not have access to both the respondent's email address as well as the response data at the same time.

What assertions does QuestionPro make for RAA-enabled surveys?

1. Only QuestionPro personnel can enable this guarantee for any survey
2. Once the RAA is enabled for a survey, at the request of the survey researcher, it will remain perpetual and cannot be rescinded -- by the researcher or anyone else
3. The QuestionPro Survey Software will never present a respondent's email address linked to the response data in any of the analysis tools, reports and data downloads
4. In the exceptionally unlikely event that a breach occurs for any reason, technical or otherwise, QuestionPro will immediately notify the respondent as well as the survey researcher about the issue. If the respondent requests his response data to be removed from the servers as a result of the breach, QuestionPro will comply with the request even if the survey researcher does not agree. Furthermore, QuestionPro will make all reasonable efforts to make sure that such a breach does not occur again

Are there any Exceptions?

Under certain conditions, including but not limited to law enforcement requests and subpoenas, QuestionPro may have to divulge respondent data as well as email address if required to do so by law. QuestionPro is incorporated in the State of Washington, United States. QuestionPro also has offices in India.

The legal jurisdiction for any disputes arising out of this or any other agreement shall be King County, WA.

Limits of Liability

QuestionPro shall not be liable in any event for incidental or consequential damages in connection with, or arising out of, the furnishing, performance, or use of this documentation, or any software provided by QuestionPro.

QuestionPro may be held liable only in the case of willful negligence on QuestionPro's part. Furthermore, the damages are limited to actual damages and not perceived, punitive, consequential or incidental damages.

How do I know if a survey I am taking is protected by this guarantee?

For surveys that have RAA enabled, a link to the details about the guarantee will be put on the "Bottom Right" corner of the survey. This link cannot be removed or added by the survey researcher. It will be automatically added on surveys that have the anonymity guarantee enabled. Once this link is enabled it cannot be removed, changed or edited. The text for the link will be the following:-

QuestionPro: Respondent Anonymity Assurance

APPENDIX E: ROUND 3 SURVEY INSTRUMENT

Round 3 Survey

Exit Survey »

Informed Consent Agreement

The purpose of this research study is to compare relative effectiveness of several project delivery methods for maximum value-creation. LTC Michael Brennan, under the direction of Dr. Michael Kim, is conducting this research as partial fulfillment of the requirements for a Ph.D. degree in Architecture at the University of Illinois Urbana-Champaign.

Your participation in this research study is voluntary. You may choose not to participate. If you decide to participate in this research survey, you may withdraw at any time. If you decide not to participate in this study or if you withdraw from participating at any time, you will not be penalized.

The procedure involves filling an online survey that will take approximately 10 minutes. Your responses will be confidential and we do not collect identifying information such as your name, email address or IP address. The survey questions will be about creating value through an integrated project delivery process.

We will do our best to keep your information confidential. All data is stored in a password protected electronic format. To help protect your confidentiality, the surveys will not contain information that will personally identify you. The results of this study will be used for scholarly purposes only and may be shared with University of Illinois Urbana-Champaign representatives.

If you have any questions about the research study, please contact LTC Michael Brennan, PhD Candidate, University of Illinois Urbana-Champaign at mdbrenna@illinois.edu, michael.d.brennan@us.army.mil / (703)473-3587 or Dr. Michael Kim at mkkim1@illinois.edu / (217) 244-8012. This research has been reviewed according to University of Illinois Urbana-Champaign IRB procedures for research involving human subjects.

If you have any questions about your rights as a participant in this study, please contact the University of Illinois" Institutional Review Board at 217-333-2670 (collect calls accepted if you identify yourself as a research participant) or via email at irb@illinois.edu.

Do you agree to participate in this survey?

DISAGREE: If you do not wish to participate, please decline participation by closing your browser to exit the survey.

AGREE: Check the box below to indicate you have read the Informed Consent Agreement, voluntarily agree to participate, and are at least 18 years of age.

☐ **I Agree**

Continue

3%

Respondent Anonymity Assurance

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« Back

Exit Survey »

Round #2 Survey Results

Thank you again for your participation on the "Panel of Experts" for this series of surveys.

Survey Round #2 Results may viewed at the following link:

*** * * Survey Round # 2 Results * * ***

Based on the results of Survey Round #2, the list of Critical Success Factors (CSF's) has been further narrowed down to those selected as most important.

The final survey in this series (Round #3) will ask you to rate the effectiveness of different project delivery methods to best achieve the selected CSF's.

Continue

6%

Respondent Anonymity Assurance

Round 3 Survey

« Back

Exit Survey »

Questions marked with a * are required

Stakeholder Group

Once again, please select the category you best identify with. (Select only one) *

- Construction Team
- Design Team
- Facility User or User's Representative
- Owner or Owner's Representative

Continue

9%

Respondent Anonymity Assurance

6

Round 3 Survey

« Back | Exit Survey »

Questions marked with a * are required

** AMENDMENT TO SURVEY ROUND #2 **

Due to an oversight, one factor which met qualifying criteria in Survey Round #1, but was accidentally omitted from Survey Round #2:

EVIDENCE BASED DESIGN (EBD)

Please assess the relative importance of "Evidence Based Design" below. (Collected responses will be amended to Survey Round #2 final results)

In light of the Round #2 factors listed at the bottom of the page:

Rate the importance of Evidence Based Design from your STAKEHOLDER GROUP'S PERSPECTIVE.

	Least Important		Important		Most Important
Evidence Based Design *	○	○	○	○	○

Rate the importance of Evidence Based Design from a PROJECT-CENTERED PERSPECTIVE.

	Least Important		Important		Most Important
Evidence Based Design *	○	○	○	○	○

Aesthetics
Alignment of Project Objectives
Change-Order Reduction
Clear & Realistic Objectives
Collaboration of Project Delivery Team
Competency & Capability of Project Delivery Team
Constructability
Project Cost Performance
Design Innovation & Creativity
Dispute Avoidance & Resolution
Effective Communication
Long-term Building Success / Lifecycle Value
Owner / User Satisfaction
Owner / User Participation
Owner's vision
Professional Reputation & Image
Profit and Financial Objectives
Production of Specified Quality
Responsive Administration & Decision Support
Sustainability
Project Time Performance
Trust & Respect
Utility & Functionality

Continue

15%

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Respondent Anonymity Assurance

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Questions marked with a * are required

Project Delivery Methods

Design-Bid-Build (DBB) , ***also known as "Traditional Method*:**

Linear process, where the owner first enters into a contract with a designer to produce a 100% design. The 100% design documents are then used by the owner to competitively bid and award a separate construction contract. Simultaneous design and construction is not possible using the DBB method.

Design-Build (DB):

A single contract for design and construction services. Typically the owner contracts with a construction contractor with in-house design, or a pre-established design partner. Note: MILCON Design-Build projects typically first require a separate design services contract for request-for-proposal (RFP) development. Typically the completion of a 35% concept design is required to competitively bid the DB contract.

Integrated Project Delivery (IPD) / Integrated Design-Bid-Build (IDBB):

IPD is a collaborative multi-party contractual relationship where the designer and builder collaborate with the owner/users throughout all phases of design and construction. IDBB is the MILCON pilot-project method to implement Integrated Project Delivery (IPD). IDBB is also referred to as Early Contractor Involvement (ECI).

How familiar are you with the following project delivery methods?

	Not At All Familiar	Slightly Familiar	Somewhat Familiar	Moderately Familiar	Very Familiar
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (DB) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Continue

22%

Respondent Anonymity Assurance

« Back Exit Survey »

Round #3 Survey Overview & Instructions

NOTE: The conceptual framework for the following questions is limited to VERY LARGE & COMPLEX PROJECTS ONLY. (scale and scope similar to the MILCON IDBB pilot-projects at Fort Belvoir, VA and Fort Sam Houston/Joint Base San Antonio, TX)

You will be asked to rate the effectiveness of different project delivery methods to successfully achieve the most important critical success factors as selected by the panel of experts in survey rounds 1 & 2.

As in the previous surveys, you are asked to assess the effectiveness of the project delivery methods from two distinct perspectives. First from the "Stakeholder Perspective", then from the "Project Centered Perspective":

(1) STAKEHOLDER PERSPECTIVE: The question to ask yourself is "How effective is the project delivery method for MY stakeholder group's interests?"

(2) PROJECT-CENTERED PERSPECTIVE: The question to ask yourself is "How effective is the project delivery method for the success of the project?

Continue

24%

Respondent Anonymity Assurance

Round 3 Survey

« Back | Exit Survey »

Questions marked with a * are required

Owner & User Satisfaction

Successfully achieve OWNER & USER SATISFACTION

Rate the effectiveness of each project delivery method from your STAKEHOLDER PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *					
Design-Build (BD) *					
Integrated Project Delivery (IPD) *					

Rate the effectiveness of each project delivery method from a PROJECT-CENTERED PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *					
Design-Build (BD) *					
Integrated Project Delivery (IPD) *					

Continue

29%

Respondent Anonymity Assurance

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« Back   Exit Survey »

Questions marked with a * are required

Clear & Realistic Project Objectives

Maintain CLEAR & REALISTIC PROJECT OBJECTIVES throughout the entire project delivery process

Rate the effectiveness of each project delivery method from your STAKEHOLDER PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *					
Design-Build (BD) *					
Integrated Project Delivery (IPD) *					

Rate the effectiveness of each project delivery method from a PROJECT-CENTERED PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *					
Design-Build (BD) *					
Integrated Project Delivery (IPD) *					

Continue

35%

Respondent Anonymity Assurance

« Back   Exit Survey »

Questions marked with a * are required

Effective Communication

Promote EFFECTIVE COMMUNICATION between all project stakeholders throughout the entire project delivery process

Rate the effectiveness of each project delivery method from your STAKEHOLDER PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (BD) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Rate the effectiveness of each project delivery method from a PROJECT-CENTERED PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (BD) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Continue

40%

Respondent Anonymity Assurance

« Back

Exit Survey »

Questions marked with a * are required

Collaboration of Project Delivery Team

Maximize COLLABORATION OF PROJECT DELIVERY TEAM

Rate the effectiveness of each project delivery method from your STAKEHOLDER PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *					
Design-Build (BD) *					
Integrated Project Delivery (IPD) *					

Rate the effectiveness of each project delivery method from a PROJECT-CENTERED PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *					
Design-Build (BD) *					
Integrated Project Delivery (IPD) *					

Continue

45%

Respondent Anonymity Assurance

Round 3 Survey

« Back Exit Survey »

Questions marked with a * are required

Utility & Functionality

Maximize the Utility & Functionality value of the facility produced

Rate the effectiveness of each project delivery method from your STAKEHOLDER PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (BD) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Rate the effectiveness of each project delivery method from a PROJECT-CENTERED PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (BD) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Continue

50%

Respondent Anonymity Assurance

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Round 3 Survey

« Back

Exit Survey »

Questions marked with a * are required

Trust & Respect

Maximize TRUST & RESPECT between all project stakeholders

Rate the effectiveness of each project delivery method from your STAKEHOLDER PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (BD) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Rate the effectiveness of each project delivery method from a PROJECT-CENTERED PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (BD) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Continue

55%

Respondent Anonymity Assurance

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« Back | Exit Survey »

Questions marked with a * are required

Alignment of Project Objectives

Maximize the ALIGNMENT OF PROJECT OBJECTIVES between all project stakeholders across the entire project delivery process

Rate the effectiveness of each project delivery method from your STAKEHOLDER PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (BD) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Rate the effectiveness of each project delivery method from a PROJECT-CENTERED PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (BD) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Continue

61%

Respondent Anonymity Assurance

« Back Exit Survey »

Questions marked with a * are required

Owner & User Participation

Enable OWNER & USER PARTICIPATION throughout the entire project delivery process

Rate the effectiveness of each project delivery method from your STAKEHOLDER PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (BD) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Rate the effectiveness of each project delivery method from a PROJECT-CENTERED PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (BD) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Continue

66%

Respondent Anonymity Assurance

Round 3 Survey

« Back

Exit Survey »

Questions marked with a * are required

Production of Specified Quality

Successfully achieve the PRODUCTION OF SPECIFIED QUALITY

Rate the effectiveness of each project delivery method from your STAKEHOLDER PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (BD) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Rate the effectiveness of each project delivery method from a PROJECT-CENTERED PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (BD) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Continue

71%

Respondent Anonymity Assurance

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Exit Survey »

Questions marked with a * are required

Long-term Building Success (Lifecycle Value)

Maximize LONG-TERM BUILDING SUCCESS (LIFECYCLE VALUE) of the facility produced

Rate the effectiveness of each project delivery method from your STAKEHOLDER PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (BD) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Rate the effectiveness of each project delivery method from a PROJECT-CENTERED PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (BD) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Continue

76%

Respondent Anonymity Assurance

Round 3 Survey

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Exit Survey »

Questions marked with a * are required

Project Time Performance

Maximize PROJECT TIME PERFORMANCE to achieve the shortest possible schedule duration

Rate the effectiveness of each project delivery method from your STAKEHOLDER PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (BD) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Rate the effectiveness of each project delivery method from a PROJECT-CENTERED PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (BD) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Continue

81%

Respondent Anonymity Assurance

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Questions marked with a * are required

Owner's Vision

Ensure the OWNER'S VISION is fully realized by the project delivery process

Rate the effectiveness of each project delivery method from your STAKEHOLDER PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *					
Design-Build (BD) *					
Integrated Project Delivery (IPD) *					

Rate the effectiveness of each project delivery method from a PROJECT-CENTERED PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *					
Design-Build (BD) *					
Integrated Project Delivery (IPD) *					

Continue

87%

Respondent Anonymity Assurance

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Questions marked with a * are required

Constructability

Maximize CONSTRUCTABILITY throughout the entire project delivery process

Rate the effectiveness of each project delivery method from your STAKEHOLDER PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *					
Design-Build (BD) *					
Integrated Project Delivery (IPD) *					

Rate the effectiveness of each project delivery method from a PROJECT-CENTERED PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *					
Design-Build (BD) *					
Integrated Project Delivery (IPD) *					

Continue

92%

Respondent Anonymity Assurance

Round 3 Survey

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Questions marked with a * are required

EVIDENCE BASED DESIGN

Maximize the implementation of EVIDENCE BASED DESIGN principles throughout the project delivery process

Rate the effectiveness of each project delivery method from your STAKEHOLDER PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (BD) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Rate the effectiveness of each project delivery method from a PROJECT-CENTERED PERSPECTIVE

	Least Effective	Less Effective	Effective	More Effective	Most Effective
Design-Bid-Build (DBB) *	○	○	○	○	○
Design-Build (BD) *	○	○	○	○	○
Integrated Project Delivery (IPD) *	○	○	○	○	○

Continue

97%

Respondent Anonymity Assurance

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Exit Survey »

Once again...THANK YOU for participating in all 3 rounds of the Delphi survey! Your assistance is greatly appreciated!

You will be provided with the final results and analysis of all three surveys within the next 60 days.

Please click on the "Submit Survey" button below to submit your responses and close your browser.

Submit Survey

100%

Respondent Anonymity Assurance

Respondent Anonymity Assurance

QuestionPro offers a unique guarantee to survey researchers to protect the privacy and confidentiality of the respondents. The Respondent Anonymity Assurance (RAA) is only applicable and valid for our "Corporate" License holders.

What is RAA?

One of the challenges researchers face is the requirement for two directly conflicting issues:-

1. The ability to track who has responded to the survey and who has not -- for sending out reminder emails, giving out prizes or compensation etc.

   AND

2. For human subjects protocols or other privacy reasons, ensuring that email identifications not be linked to the response data.

From a technical standpoint, if we need to track who has taken the survey and who has not, the survey researcher also implicitly has the ability to track the response for each individual.

To overcome this issue, the Respondent Anonymity Assurance has been introduced. QuestionPro asserts that once RAA is enabled on a survey, although computer generated identification numbers for individuals will be generated, the survey researcher will not have access to both the respondent's email address as well as the response data at the same time.

What assertions does QuestionPro make for RAA-enabled surveys?

1. Only QuestionPro personnel can enable this guarantee for any survey
2. Once the RAA is enabled for a survey, at the request of the survey researcher, it will remain perpetual and cannot be rescinded -- by the researcher or anyone else
3. The QuestionPro Survey Software will never present a respondent's email address linked to the response data in any of the analysis tools, reports and data downloads
4. In the exceptionally unlikely event that a breach occurs for any reason, technical or otherwise, QuestionPro will immediately notify the respondent as well as the survey researcher about the issue. If the respondent requests his response data to be removed from the servers as a result of the breach, QuestionPro will comply with the request even if the survey researcher does not agree. Furthermore, QuestionPro will make all reasonable efforts to make sure that such a breach does not occur again

Are there any Exceptions?

Under certain conditions, including but not limited to law enforcement requests and subpoenas, QuestionPro may have to divulge respondent data as well as email address if required to do so by law. QuestionPro is incorporated in the State of Washington, United States. QuestionPro also has offices in India.

The legal jurisdiction for any disputes arising out of this or any other agreement shall be King County, WA.

Limits of Liability

QuestionPro shall not be liable in any event for incidental or consequential damages in connection with, or arising out of, the furnishing, performance, or use of this documentation, or any software provided by QuestionPro.

QuestionPro may be held liable only in the case of willful negligence on QuestionPro's part. Furthermore, the damages are limited to actual damages and not perceived, punitive, consequential or incidental damages.

How do I know if a survey I am taking is protected by this guarantee?

For surveys that have RAA enabled, a link to the details about the guarantee will be put on the "Bottom Right" corner of the survey. This link cannot be removed or added by the survey researcher. It will be automatically added on surveys that have the anonymity guarantee enabled. Once this link is enabled it cannot be removed, changed or edited. The text for the link will be the following:-

QuestionPro: Respondent Anonymity Assurance

APPENDIX F: ROUND 3 WEIGHTED SUM CALCULATIONS

Design-Bid-Build (DBB) -- Self-Interest															
		Owner/User Satisfaction	Clear & Realistic Objectives	Effective Communication	Collaboration of Project Team	Utility & Functionality	Trust & Respect	Alignment of Objectives	Owner/User Participation	Production of Specified Quality	Long-term Lifecycle Value	Time Performance	Owner's Vision	Constructability	Weighted Sum Aggregated Relatie Effectiveness
Owner01	Raw	5	4	5	3	4	2	4	4	4	3	2	4	2	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.411	0.334	0.411	0.246	0.306	0.139	0.312	0.295	0.300	0.238	0.136	0.323	0.139	**3.589**
Owner02	Raw	3	3	2	3	3	3	3	3	3	3	3	3	2	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.246	0.251	0.164	0.246	0.229	0.208	0.234	0.221	0.225	0.238	0.204	0.242	0.139	**2.848**
Owner03	Raw	5	4	3	3	3	3	3	3	3	3	2	4	3	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.411	0.334	0.246	0.246	0.229	0.208	0.234	0.221	0.225	0.238	0.136	0.323	0.208	**3.261**
Owner04	Raw	3	5	3	2	2	3	5	4	4	3	2	4	3	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.246	0.418	0.246	0.164	0.153	0.208	0.390	0.295	0.300	0.238	0.136	0.323	0.208	**3.326**
Owner05	Raw	5	5	5	5	5	5	5	5	5	5	1	5	5	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.411	0.418	0.411	0.411	0.382	0.347	0.390	0.368	0.375	0.397	0.068	0.404	0.347	**4.728**
Owner06	Raw	5	4	4	3	4	3	4	3	4	3	2	4	2	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.411	0.334	0.329	0.246	0.306	0.208	0.312	0.221	0.300	0.238	0.136	0.323	0.139	**3.503**
Owner07	Raw	4	4	4	4	4	4	5	5	5	5	2	5	3	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.329	0.334	0.329	0.329	0.306	0.278	0.390	0.368	0.375	0.397	0.136	0.404	0.208	**4.181**
Owner08	Raw	5	5	4	3	4	4	4	4	4	4	4	5	3	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.411	0.418	0.329	0.246	0.306	0.278	0.312	0.295	0.300	0.317	0.272	0.404	0.208	**4.095**
Owner09	Raw	4	2	3	4	4	3	4	4	4	4	2	4	3	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.329	0.167	0.246	0.329	0.306	0.208	0.312	0.295	0.300	0.317	0.136	0.323	0.208	**3.476**
Owner10	Raw	2	3	1	1	2	1	1	1	2	2	1	1	2	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.164	0.251	0.082	0.082	0.153	0.069	0.078	0.074	0.150	0.159	0.068	0.081	0.139	**1.550**
Owner11	Raw	3	5	5	3	5	2	3	5	5	5	2	5	3	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.246	0.418	0.411	0.246	0.382	0.139	0.234	0.368	0.375	0.397	0.136	0.404	0.208	**3.965**
Owner12	Raw	3	5	5	3	3	3	4	4	5	4	3	4	3	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.246	0.418	0.411	0.246	0.229	0.208	0.312	0.295	0.375	0.317	0.204	0.323	0.208	**3.793**
Owner13	Raw	3	3	5	3	3	1	3	5	3	3	1	5	1	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.246	0.251	0.411	0.246	0.229	0.069	0.234	0.368	0.225	0.238	0.068	0.404	0.069	**3.059**
Owner14	Raw	5	5	3	3	5	3	3	4	5	5	2	5	3	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.411	0.418	0.246	0.246	0.382	0.208	0.234	0.295	0.375	0.397	0.136	0.404	0.208	**3.960**
Designer01	Raw	5	5	5	2	5	2	3	4	4	3	1	5	3	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.432	0.413	0.373	0.161	0.393	0.153	0.236	0.275	0.299	0.224	0.069	0.393	0.230	**3.650**
Designer02	Raw	5	5	3	5	5	4	4	4	5	5	3	5	3	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.432	0.413	0.224	0.403	0.393	0.306	0.314	0.275	0.373	0.373	0.206	0.393	0.230	**4.336**
Designer03	Raw	3	5	4	4	4	4	3	4	5	4	2	5	3	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.259	0.413	0.299	0.322	0.314	0.306	0.236	0.275	0.373	0.299	0.138	0.393	0.230	**3.857**
Designer04	Raw	5	5	5	4	4	4	4	5	5	4	1	4	3	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.432	0.413	0.373	0.322	0.314	0.306	0.314	0.344	0.373	0.299	0.069	0.314	0.230	**4.104**
Designer05	Raw	5	5	3	3	5	3	4	5	5	3	1	5	5	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.432	0.413	0.224	0.242	0.393	0.230	0.314	0.344	0.373	0.224	0.069	0.393	0.383	**4.033**
Designer06	Raw	4	4	3	1	4	3	3	4	5	5	5	5	4	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.346	0.330	0.224	0.081	0.314	0.230	0.236	0.275	0.373	0.373	0.344	0.393	0.306	**3.825**
Designer07	Raw	4	5	4	2	3	3	4	4	3	3	3	4	3	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.346	0.413	0.299	0.161	0.236	0.230	0.314	0.275	0.224	0.224	0.206	0.314	0.230	**3.472**
Designer08	Raw	3	3	4	2	4	2	2	3	4	4	2	4	3	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.259	0.248	0.299	0.161	0.314	0.153	0.157	0.206	0.299	0.299	0.138	0.314	0.230	**3.077**
Designer09	Raw	3	4	2	2	3	2	2	3	3	3	2	3	2	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.259	0.330	0.149	0.161	0.236	0.153	0.157	0.206	0.224	0.224	0.138	0.236	0.153	**2.627**

Design-Bid-Build (DBB) -- Self-Interest															
		Owner/User Satisfaction	**Clear & Realistic Objectives**	**Effective Communication**	**Collaboration of Project Team**	**Utility & Functionality**	**Trust & Respect**	**Alignment of Objectives**	**Owner/User Participation**	**Production of Specified Quality**	**Long-term Lifecycle Value**	**Time Performance**	**Owner's Vision**	**Constructability**	**Weighted Sum Aggregated Relatie Effectiveness**
Builder01	Raw	4	4	4	3	4	3	4	4	3	4	3	4	3	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.357	0.305	0.327	0.201	0.305	0.245	0.312	0.335	0.229	0.275	0.240	0.290	0.206	**3.626**
Builder02	Raw	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.268	0.229	0.245	0.201	0.229	0.245	0.234	0.251	0.229	0.206	0.240	0.217	0.206	**3.000**
Builder03	Raw	1	1	3	2	3	1	1	1	3	2	1	1	1	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.089	0.076	0.245	0.134	0.229	0.082	0.078	0.084	0.229	0.138	0.080	0.072	0.069	**1.604**
Builder04	Raw	5	3	3	3	1	3	1	2	2	2	1	2	1	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.446	0.229	0.245	0.201	0.076	0.245	0.078	0.167	0.152	0.138	0.080	0.145	0.069	**2.271**
Builder05	Raw	3	3	3	3	3	2	2	3	3	3	3	3	2	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.268	0.229	0.245	0.201	0.229	0.164	0.156	0.251	0.229	0.206	0.240	0.217	0.138	**2.771**
Builder06	Raw	2	4	2	3	3	2	4	2	4	4	2	4	1	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.178	0.305	0.164	0.201	0.229	0.164	0.312	0.167	0.305	0.275	0.160	0.290	0.069	**2.818**
Builder07	Raw	3	2	3	3	3	2	2	3	4	3	2	4	2	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.268	0.152	0.245	0.201	0.229	0.164	0.156	0.251	0.305	0.206	0.160	0.290	0.138	**2.764**
Builder08	Raw	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.268	0.229	0.245	0.201	0.229	0.245	0.234	0.251	0.229	0.206	0.240	0.217	0.206	**3.000**
Builder09	Raw	4	5	3	2	3	2	3	3	4	4	2	3	2	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.357	0.381	0.245	0.134	0.229	0.164	0.234	0.251	0.305	0.275	0.160	0.217	0.138	**3.089**
User01	Raw	3	3	3	3	3	3	3	3	3	2	2	3	3	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.260	0.238	0.243	0.272	0.215	0.232	0.249	0.221	0.232	0.151	0.132	0.221	0.192	**2.858**
User02	Raw	5	5	3	3	3	3	3	3	5	3	2	4	4	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.434	0.396	0.243	0.272	0.215	0.232	0.249	0.221	0.387	0.226	0.132	0.294	0.257	**3.558**
User03	Raw	3	1	1	1	3	1	1	2	3	3	1	3	1	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.260	0.079	0.081	0.091	0.215	0.077	0.083	0.147	0.232	0.226	0.066	0.221	0.064	**1.843**
User04	Raw	2	2	1	2	2	2	2	1	4	1	1	1	5	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.174	0.158	0.081	0.181	0.143	0.155	0.166	0.074	0.309	0.075	0.066	0.074	0.321	**1.977**
User05	Raw	3	2	2	2	3	3	2	2	3	3	2	3	3	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.260	0.158	0.162	0.181	0.215	0.232	0.166	0.147	0.232	0.226	0.132	0.221	0.192	**2.526**
User06	Raw	3	2	2	3	4	3	3	3	3	3	1	3	3	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.260	0.158	0.162	0.272	0.287	0.232	0.249	0.221	0.232	0.226	0.066	0.221	0.192	**2.779**
User07	Raw	3	4	3	4	4	4	4	3	4	3	4	3	4	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.260	0.317	0.243	0.362	0.287	0.309	0.332	0.221	0.309	0.226	0.264	0.221	0.257	**3.609**
User08	Raw	1	2	1	1	2	2	2	2	2	2	2	2	2	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.087	0.158	0.081	0.091	0.143	0.155	0.166	0.147	0.155	0.151	0.132	0.147	0.128	**1.742**

Design-Bid-Build (DBB) -- Project-Interest															
		Owner/User Satisfaction	**Clear & Realistic Objectives**	**Effective Communication**	**Collaboration of Project Team**	**Utility & Functionality**	**Trust & Respect**	**Alignment of Objectives**	**Owner/User Participation**	**Production of Specified Quality**	**Long-term Lifecycle Value**	**Time Performance**	**Owner's Vision**	**Constructability**	**Weighted Sum Aggregated Relatie Effectiveness**
Owner01	Raw	5	4	5	3	4	2	4	4	4	3	2	4	2	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.390	0.335	0.404	0.234	0.323	0.156	0.294	0.317	0.317	0.229	0.141	0.260	0.153	**3.554**
Owner02	Raw	3	3	2	3	3	3	3	3	3	3	3	3	2	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.234	0.251	0.162	0.234	0.242	0.234	0.221	0.238	0.238	0.229	0.212	0.195	0.153	**2.843**
Owner03	Raw	4	4	3	3	3	3	3	3	3	3	2	3	3	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.312	0.335	0.242	0.234	0.242	0.234	0.221	0.238	0.238	0.229	0.141	0.195	0.229	**3.091**
Owner04	Raw	4	5	3	2	2	3	5	4	4	3	2	4	3	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.312	0.418	0.242	0.156	0.162	0.234	0.368	0.317	0.317	0.229	0.141	0.260	0.229	**3.387**
Owner05	Raw	5	5	5	5	5	5	5	5	5	5	1	5	5	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.390	0.418	0.404	0.390	0.404	0.390	0.368	0.397	0.397	0.382	0.071	0.325	0.382	**4.717**
Owner06	Raw	5	5	4	3	3	3	3	3	4	3	3	4	2	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.390	0.418	0.323	0.234	0.242	0.234	0.221	0.238	0.317	0.229	0.212	0.260	0.153	**3.472**
Owner07	Raw	5	5	4	3	4	3	4	4	5	4	2	5	3	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.390	0.418	0.323	0.234	0.323	0.234	0.294	0.317	0.397	0.306	0.141	0.325	0.229	**3.932**
Owner08	Raw	5	5	4	3	4	3	4	4	4	4	4	5	3	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.390	0.418	0.323	0.234	0.323	0.234	0.294	0.317	0.317	0.306	0.283	0.325	0.229	**3.994**
Owner09	Raw	3	2	3	2	3	3	3	3	3	3	2	3	3	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.234	0.167	0.242	0.156	0.242	0.234	0.221	0.238	0.238	0.229	0.141	0.195	0.229	**2.768**
Owner10	Raw	2	2	1	1	3	1	2	1	2	2	1	1	2	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.156	0.167	0.081	0.078	0.242	0.078	0.147	0.079	0.159	0.153	0.071	0.065	0.153	**1.629**
Owner11	Raw	3	5	5	2	5	2	3	5	5	5	2	5	3	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.234	0.418	0.404	0.156	0.404	0.156	0.221	0.397	0.397	0.382	0.141	0.325	0.229	**3.864**
Owner12	Raw	3	5	5	3	3	3	4	4	5	4	3	4	3	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.234	0.418	0.404	0.234	0.242	0.234	0.294	0.317	0.397	0.306	0.212	0.260	0.229	**3.782**
Owner13	Raw	1	1	1	1	1	1	1	5	1	1	1	5	1	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.397	0.079	0.076	0.071	0.325	0.076	**1.577**
Owner14	Raw	3	5	3	3	3	4	4	4	5	5	3	5	4	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.234	0.418	0.242	0.234	0.242	0.312	0.294	0.317	0.397	0.382	0.212	0.325	0.306	**3.916**
Designer01	Raw	5	4	5	1	5	1	2	3	4	3	1	5	3	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.443	0.330	0.402	0.072	0.433	0.078	0.149	0.235	0.282	0.199	0.078	0.322	0.235	**3.260**
Designer02	Raw	4	5	4	5	4	3	4	4	4	4	3	4	3	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.354	0.412	0.322	0.362	0.346	0.235	0.298	0.314	0.282	0.266	0.235	0.258	0.235	**3.920**
Designer03	Raw	3	4	4	3	4	3	4	4	5	4	2	4	3	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.266	0.330	0.322	0.217	0.346	0.235	0.298	0.314	0.352	0.266	0.157	0.258	0.235	**3.596**
Designer04	Raw	4	4	4	4	4	4	4	4	5	4	2	4	3	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.354	0.330	0.322	0.290	0.346	0.314	0.298	0.314	0.352	0.266	0.157	0.258	0.235	**3.835**
Designer05	Raw	5	5	3	3	5	3	5	5	5	3	2	5	5	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.443	0.412	0.241	0.217	0.433	0.235	0.372	0.392	0.352	0.199	0.157	0.322	0.392	**4.169**
Designer06	Raw	4	4	3	1	4	3	3	4	5	5	5	5	4	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.354	0.330	0.241	0.072	0.346	0.235	0.223	0.314	0.352	0.332	0.392	0.322	0.314	**3.829**
Designer07	Raw	4	5	3	3	3	3	3	4	3	3	3	4	3	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.354	0.412	0.241	0.217	0.260	0.235	0.223	0.314	0.211	0.199	0.235	0.258	0.235	**3.396**
Designer08	Raw	3	3	3	2	4	2	2	3	4	4	2	4	3	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.266	0.247	0.241	0.145	0.346	0.157	0.149	0.235	0.282	0.266	0.157	0.258	0.235	**2.984**
Designer09	Raw	3	4	2	2	3	2	3	3	3	3	2	3	2	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.266	0.330	0.161	0.145	0.260	0.157	0.223	0.235	0.211	0.199	0.157	0.193	0.157	**2.694**

Design-Bid-Build (DBB) -- Project-Interest															
		Owner/User Satisfaction	Clear & Realistic Objectives	Effective Communication	Collaboration of Project Team	Utility & Functionality	Trust & Respect	Alignment of Objectives	Owner/User Participation	Production of Specified Quality	Long-term Lifecycle Value	Time Performance	Owner's Vision	Constructability	Weighted Sum Aggregated Relatie Effectiveness
Builder01	Raw	4	4	4	3	4	3	4	4	3	4	3	4	3	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.351	0.299	0.329	0.230	0.321	0.241	0.284	0.329	0.241	0.299	0.241	0.292	0.168	**3.626**
Builder02	Raw	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.264	0.224	0.247	0.230	0.241	0.241	0.213	0.247	0.241	0.224	0.241	0.219	0.168	**3.000**
Builder03	Raw	1	1	3	2	3	1	1	1	3	2	1	1	1	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.088	0.075	0.247	0.153	0.241	0.080	0.071	0.082	0.241	0.150	0.080	0.073	0.056	**1.637**
Builder04	Raw	1	2	3	3	1	3	1	1	2	1	1	2	1	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.088	0.150	0.247	0.230	0.080	0.241	0.071	0.082	0.161	0.075	0.080	0.146	0.056	**1.707**
Builder05	Raw	3	3	3	3	3	2	2	3	3	3	3	3	2	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.264	0.224	0.247	0.230	0.241	0.161	0.142	0.247	0.241	0.224	0.241	0.219	0.112	**2.793**
Builder06	Raw	4	3	3	1	4	3	4	3	4	4	2	4	3	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.351	0.224	0.247	0.077	0.321	0.241	0.284	0.247	0.321	0.299	0.161	0.292	0.168	**3.234**
Builder07	Raw	3	2	3	3	3	2	2	3	4	3	2	4	2	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.264	0.150	0.247	0.230	0.241	0.161	0.142	0.247	0.321	0.224	0.161	0.292	0.112	**2.791**
Builder08	Raw	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.264	0.224	0.247	0.230	0.241	0.241	0.213	0.247	0.241	0.224	0.241	0.219	0.168	**3.000**
Builder09	Raw	3	5	3	2	3	2	2	3	4	4	2	3	2	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.264	0.374	0.247	0.153	0.241	0.161	0.142	0.247	0.321	0.299	0.161	0.219	0.112	**2.940**
User01	Raw	3	3	3	3	3	3	3	3	3	2	2	3	3	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.259	0.253	0.248	0.242	0.231	0.226	0.220	0.226	0.220	0.147	0.147	0.204	0.231	**2.853**
User02	Raw	5	4	3	3	3	5	3	3	5	3	3	5	4	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.431	0.338	0.248	0.242	0.231	0.376	0.220	0.226	0.367	0.220	0.220	0.339	0.308	**3.767**
User03	Raw	2	1	1	1	2	2	1	2	3	2	1	3	1	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.172	0.084	0.083	0.081	0.154	0.150	0.073	0.150	0.220	0.147	0.073	0.204	0.077	**1.670**
User04	Raw	3	4	2	4	3	2	2	2	4	2	1	1	4	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.259	0.338	0.165	0.323	0.231	0.150	0.147	0.150	0.294	0.147	0.073	0.068	0.308	**2.653**
User05	Raw	3	2	2	2	3	3	2	2	3	3	2	3	3	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.259	0.169	0.165	0.161	0.231	0.226	0.147	0.150	0.220	0.220	0.147	0.204	0.231	**2.530**
User06	Raw	3	3	3	3	4	3	3	3	4	4	1	3	4	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.259	0.253	0.248	0.242	0.308	0.226	0.220	0.226	0.294	0.294	0.073	0.204	0.308	**3.154**
User07	Raw	3	3	4	4	4	4	4	4	4	3	4	3	4	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.259	0.253	0.330	0.323	0.308	0.301	0.294	0.301	0.294	0.220	0.294	0.204	0.308	**3.688**
User08	Raw	3	3	3	1	3	3	3	3	3	3	2	2	2	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.259	0.253	0.248	0.081	0.231	0.226	0.220	0.226	0.220	0.220	0.147	0.136	0.154	**2.620**

Design-Build (DB) -- Self-Interest															
		Owner/User Satisfaction	Clear & Realistic Objectives	Effective Communication	Collaboration of Project Team	Utility & Functionality	Trust & Respect	Alignment of Objectives	Owner/User Participation	Production of Specified Quality	Long-term Lifecycle Value	Time Performance	Owner's Vision	Constructability	Weighted Sum Aggregated Relatie Effectiveness
Owner01	Raw	3	3	3	3	2	1	2	1	2	3	5	2	5	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.246	0.251	0.246	0.246	0.153	0.069	0.156	0.074	0.150	0.238	0.340	0.161	0.347	**2.678**
Owner02	Raw	3	3	3	2	2	2	2	2	2	2	4	2	4	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.246	0.251	0.246	0.164	0.153	0.139	0.156	0.147	0.150	0.159	0.272	0.161	0.278	**2.523**
Owner03	Raw	4	4	3	3	3	3	3	3	3	3	3	3	3	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.329	0.334	0.246	0.246	0.229	0.208	0.234	0.221	0.225	0.238	0.204	0.242	0.208	**3.166**
Owner04	Raw	2	3	2	3	3	2	3	2	3	3	3	3	3	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.164	0.251	0.164	0.246	0.229	0.139	0.234	0.147	0.225	0.238	0.204	0.242	0.208	**2.693**
Owner05	Raw	1	1	1	1	1	1	1	1	3	2	5	1	1	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.225	0.159	0.340	0.081	0.069	**1.501**
Owner06	Raw	3	3	2	2	2	1	2	1	3	4	4	1	4	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.246	0.251	0.164	0.164	0.153	0.069	0.156	0.074	0.225	0.317	0.272	0.081	0.278	**2.450**
Owner07	Raw	2	3	2	2	2	2	2	2	2	3	5	3	4	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.164	0.251	0.164	0.164	0.153	0.139	0.156	0.147	0.150	0.238	0.340	0.242	0.278	**2.586**
Owner08	Raw	5	5	4	3	3	4	3	3	3	4	4	3	3	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.411	0.418	0.329	0.246	0.229	0.278	0.234	0.221	0.225	0.317	0.272	0.242	0.208	**3.630**
Owner09	Raw	3	1	2	2	2	3	2	2	2	2	5	2	4	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.246	0.084	0.164	0.164	0.153	0.208	0.156	0.147	0.150	0.159	0.340	0.161	0.278	**2.411**
Owner10	Raw	3	4	3	4	3	3	3	3	3	3	3	2	3	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.246	0.334	0.246	0.329	0.229	0.208	0.234	0.221	0.225	0.238	0.204	0.161	0.208	**3.085**
Owner11	Raw	4	3	3	4	3	3	2	1	2	2	3	3	4	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.329	0.251	0.246	0.329	0.229	0.208	0.156	0.074	0.150	0.159	0.204	0.242	0.278	**2.854**
Owner12	Raw	3	3	4	3	3	3	3	3	3	3	5	3	4	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.246	0.251	0.329	0.246	0.229	0.208	0.234	0.221	0.225	0.238	0.340	0.242	0.278	**3.288**
Owner13	Raw	1	1	1	1	1	3	1	1	1	1	3	1	3	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.082	0.084	0.082	0.082	0.076	0.208	0.078	0.074	0.075	0.079	0.204	0.081	0.208	**1.414**
Owner14	Raw	4	3	4	3	2	3	2	2	2	2	4	2	4	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.329	0.251	0.329	0.246	0.153	0.208	0.156	0.147	0.150	0.159	0.272	0.161	0.278	**2.839**
Designer01	Raw	1	2	3	3	3	3	3	3	2	2	3	2	3	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.086	0.165	0.224	0.242	0.236	0.230	0.236	0.206	0.149	0.149	0.206	0.157	0.230	**2.517**
Designer02	Raw	2	3	2	2	4	2	3	3	2	3	2	4	3	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.173	0.248	0.149	0.161	0.314	0.153	0.236	0.206	0.149	0.224	0.138	0.314	0.230	**2.695**
Designer03	Raw	3	4	2	2	3	2	2	2	4	3	2	4	2	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.259	0.330	0.149	0.161	0.236	0.153	0.157	0.138	0.299	0.224	0.138	0.314	0.153	**2.711**
Designer04	Raw	2	4	2	2	2	2	2	2	4	2	4	2	4	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.173	0.330	0.149	0.161	0.157	0.153	0.157	0.138	0.299	0.149	0.275	0.157	0.306	**2.605**
Designer05	Raw	2	3	3	4	3	4	2	2	3	3	3	3	3	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.173	0.248	0.224	0.322	0.236	0.306	0.157	0.138	0.224	0.224	0.206	0.236	0.230	**2.923**
Designer06	Raw	3	3	3	3	3	2	2	2	3	2	3	2	3	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.259	0.248	0.224	0.242	0.236	0.153	0.157	0.138	0.224	0.149	0.206	0.157	0.230	**2.623**
Designer07	Raw	3	3	3	3	3	4	3	2	4	4	4	3	4	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.259	0.248	0.224	0.242	0.236	0.306	0.236	0.138	0.299	0.299	0.275	0.236	0.306	**3.303**
Designer08	Raw	3	4	3	4	3	4	3	3	3	3	5	3	4	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.259	0.330	0.224	0.322	0.236	0.306	0.236	0.206	0.224	0.224	0.344	0.236	0.306	**3.454**
Designer09	Raw	2	2	4	3	3	3	3	2	2	3	4	3	3	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.173	0.165	0.299	0.242	0.236	0.230	0.236	0.138	0.149	0.224	0.275	0.236	0.230	**2.831**

Design-Build (DB) -- Self-Interest															
		Owner/User Satisfaction	Clear & Realistic Objectives	Effective Communication	Collaboration of Project Team	Utility & Functionality	Trust & Respect	Alignment of Objectives	Owner/User Participation	Production of Specified Quality	Long-term Lifecycle Value	Time Performance	Owner's Vision	Constructability	Weighted Sum Aggregated Relatie Effectiveness
Builder01	Raw	3	4	3	3	3	3	3	3	3	3	3	4	4	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.268	0.305	0.245	0.201	0.229	0.245	0.234	0.251	0.229	0.206	0.240	0.290	0.275	**3.217**
Builder02	Raw	5	5	5	5	5	5	5	5	5	5	5	5	5	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.446	0.381	0.409	0.335	0.381	0.409	0.390	0.418	0.381	0.344	0.400	0.362	0.344	**5.000**
Builder03	Raw	3	4	3	4	4	3	3	3	3	3	4	4	4	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.268	0.305	0.245	0.268	0.305	0.245	0.234	0.251	0.229	0.206	0.320	0.290	0.275	**3.441**
Builder04	Raw	5	4	4	4	4	4	3	4	4	3	5	4	5	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.446	0.305	0.327	0.268	0.305	0.327	0.234	0.335	0.305	0.206	0.400	0.290	0.344	**4.091**
Builder05	Raw	4	4	4	5	4	3	4	4	4	3	4	4	3	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.357	0.305	0.327	0.335	0.305	0.245	0.312	0.335	0.305	0.206	0.320	0.290	0.206	**3.848**
Builder06	Raw	4	3	4	4	4	4	2	4	4	4	5	3	4	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.357	0.229	0.327	0.268	0.305	0.327	0.156	0.335	0.305	0.275	0.400	0.217	0.275	**3.775**
Builder07	Raw	4	3	4	4	4	3	3	4	3	3	4	3	4	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.357	0.229	0.327	0.268	0.305	0.245	0.234	0.335	0.229	0.206	0.320	0.217	0.275	**3.546**
Builder08	Raw	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.268	0.229	0.245	0.201	0.229	0.245	0.234	0.251	0.229	0.206	0.240	0.217	0.206	**3.000**
Builder09	Raw	3	3	4	3	3	2	3	2	4	4	3	2	4	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.268	0.229	0.327	0.201	0.229	0.164	0.234	0.167	0.305	0.275	0.240	0.145	0.275	**3.058**
User01	Raw	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.260	0.238	0.243	0.272	0.215	0.232	0.249	0.221	0.232	0.226	0.198	0.221	0.192	**3.000**
User02	Raw	3	3	4	4	4	4	4	4	4	3	5	4	4	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.260	0.238	0.325	0.362	0.287	0.309	0.332	0.294	0.309	0.226	0.330	0.294	0.257	**3.825**
User03	Raw	2	3	2	2	3	2	2	1	3	2	3	3	3	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.174	0.238	0.162	0.181	0.215	0.155	0.166	0.074	0.232	0.151	0.198	0.221	0.192	**2.358**
User04	Raw	4	4	4	4	4	4	4	4	4	4	4	4	4	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.347	0.317	0.325	0.362	0.287	0.309	0.332	0.294	0.309	0.302	0.264	0.294	0.257	**4.000**
User05	Raw	4	3	3	3	4	3	3	4	4	4	4	4	4	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.347	0.238	0.243	0.272	0.287	0.232	0.249	0.294	0.309	0.302	0.264	0.294	0.257	**3.589**
User06	Raw	3	3	2	3	3	2	2	3	3	2	3	3	3	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.260	0.238	0.162	0.272	0.215	0.155	0.166	0.221	0.232	0.151	0.198	0.221	0.192	**2.683**
User07	Raw	2	2	2	3	2	2	3	2	3	2	5	2	4	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.174	0.158	0.162	0.272	0.143	0.155	0.249	0.147	0.232	0.151	0.330	0.147	0.257	**2.577**
User08	Raw	2	2	2	2	1	1	1	1	3	1	3	1	3	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.174	0.158	0.162	0.181	0.072	0.077	0.083	0.074	0.232	0.075	0.198	0.074	0.192	**1.753**

Design-Build (DB) - Project-Interest															
		Owner/User Satisfaction	Clear & Realistic Objectives	Effective Communication	Collaboration of Project Team	Utility & Functionality	Trust & Respect	Alignment of Objectives	Owner/User Participation	Production of Specified Quality	Long-term Lifecycle Value	Time Performance	Owner's Vision	Constructability	Weighted Sum Aggregated Relatie Effectiveness
Owner01	Raw	3	3	3	3	2	1	2	1	2	3	5	2	5	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.234	0.251	0.242	0.234	0.162	0.078	0.147	0.079	0.159	0.229	0.354	0.130	0.382	**2.681**
Owner02	Raw	3	3	3	2	2	2	2	2	2	2	4	2	4	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.234	0.251	0.242	0.156	0.162	0.156	0.147	0.159	0.159	0.153	0.283	0.130	0.306	**2.537**
Owner03	Raw	4	4	3	3	3	3	3	3	3	3	3	3	3	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.312	0.335	0.242	0.234	0.242	0.234	0.221	0.238	0.238	0.229	0.212	0.195	0.229	**3.162**
Owner04	Raw	2	3	2	3	3	2	2	2	2	3	3	3	3	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.156	0.251	0.162	0.234	0.242	0.156	0.147	0.159	0.159	0.229	0.212	0.195	0.229	**2.531**
Owner05	Raw	1	1	1	1	1	1	1	1	3	2	5	1	1	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.238	0.153	0.354	0.065	0.076	**1.518**
Owner06	Raw	4	3	1	1	2	1	1	1	3	3	3	3	4	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.312	0.251	0.081	0.078	0.162	0.078	0.074	0.079	0.238	0.229	0.212	0.195	0.306	**2.294**
Owner07	Raw	3	3	3	2	3	2	3	2	2	3	5	3	4	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.234	0.251	0.242	0.156	0.242	0.156	0.221	0.159	0.159	0.229	0.354	0.195	0.306	**2.903**
Owner08	Raw	5	5	4	3	4	3	2	4	3	4	4	3	3	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.390	0.418	0.323	0.234	0.323	0.234	0.147	0.317	0.238	0.306	0.283	0.195	0.229	**3.638**
Owner09	Raw	4	3	2	3	2	3	3	2	2	3	4	2	4	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.312	0.251	0.162	0.234	0.162	0.234	0.221	0.159	0.159	0.229	0.283	0.130	0.306	**2.840**
Owner10	Raw	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.234	0.251	0.242	0.234	0.242	0.234	0.221	0.238	0.238	0.229	0.212	0.195	0.229	**3.000**
Owner11	Raw	4	2	3	4	3	3	2	1	2	2	3	3	4	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.312	0.167	0.242	0.312	0.242	0.234	0.147	0.079	0.159	0.153	0.212	0.195	0.306	**2.760**
Owner12	Raw	3	4	4	3	3	3	3	3	3	3	5	3	4	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.234	0.335	0.323	0.234	0.242	0.234	0.221	0.238	0.238	0.229	0.354	0.195	0.306	**3.382**
Owner13	Raw	3	3	3	3	3	3	3	1	3	3	5	1	5	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.234	0.251	0.242	0.234	0.242	0.234	0.221	0.079	0.238	0.229	0.354	0.065	0.382	**3.006**
Owner14	Raw	4	4	4	3	3	3	3	2	4	2	4	2	5	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.312	0.335	0.323	0.234	0.242	0.234	0.221	0.159	0.317	0.153	0.283	0.130	0.382	**3.325**
Designer01	Raw	3	3	5	3	4	2	3	1	1	2	3	2	4	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.266	0.247	0.402	0.217	0.346	0.157	0.223	0.078	0.070	0.133	0.235	0.129	0.314	**2.819**
Designer02	Raw	2	4	1	2	4	2	3	3	2	3	3	3	4	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.177	0.330	0.080	0.145	0.346	0.157	0.223	0.235	0.141	0.199	0.235	0.193	0.314	**2.777**
Designer03	Raw	4	4	3	3	3	2	3	3	4	3	2	3	3	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.354	0.330	0.241	0.217	0.260	0.157	0.223	0.235	0.282	0.199	0.157	0.193	0.235	**3.085**
Designer04	Raw	2	3	3	3	3	3	3	3	4	3	5	3	5	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.177	0.247	0.241	0.217	0.260	0.235	0.223	0.235	0.282	0.199	0.392	0.193	0.392	**3.296**
Designer05	Raw	2	3	3	4	3	4	3	3	3	3	3	3	3	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.177	0.247	0.241	0.290	0.260	0.314	0.223	0.235	0.211	0.199	0.235	0.193	0.235	**3.062**
Designer06	Raw	3	3	3	3	3	2	2	2	3	2	3	2	3	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.266	0.247	0.241	0.217	0.260	0.157	0.149	0.157	0.211	0.133	0.235	0.129	0.235	**2.638**
Designer07	Raw	3	3	3	3	3	4	3	3	4	4	3	3	4	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.266	0.247	0.241	0.217	0.260	0.314	0.223	0.235	0.282	0.266	0.235	0.193	0.314	**3.294**
Designer08	Raw	4	4	4	4	3	4	4	3	3	3	5	3	4	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.354	0.330	0.322	0.290	0.260	0.314	0.298	0.235	0.211	0.199	0.392	0.193	0.314	**3.712**
Designer09	Raw	2	2	3	3	3	3	3	2	3	3	5	3	3	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.177	0.165	0.241	0.217	0.260	0.235	0.223	0.157	0.211	0.199	0.392	0.193	0.235	**2.907**

Design-Build (DB) - Project-Interest

		Owner/User Satisfaction	Clear & Realistic Objectives	Effective Communication	Collaboration of Project Team	Utility & Functionality	Trust & Respect	Alignment of Objectives	Owner/User Participation	Production of Specified Quality	Long-term Lifecycle Value	Time Performance	Owner's Vision	Constructability	Weighted Sum Aggregated Relatie Effectiveness
Builder01	Raw	3	4	3	3	3	3	3	3	3	3	3	4	4	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.264	0.299	0.247	0.230	0.241	0.241	0.213	0.247	0.241	0.224	0.241	0.292	0.224	**3.204**
Builder02	Raw	5	5	5	5	5	5	5	5	5	5	5	5	5	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.439	0.374	0.411	0.383	0.402	0.402	0.355	0.411	0.402	0.374	0.402	0.364	0.280	**5.000**
Builder03	Raw	3	4	3	4	4	3	3	3	3	3	4	4	4	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.264	0.299	0.247	0.307	0.321	0.241	0.213	0.247	0.241	0.224	0.321	0.292	0.224	**3.441**
Builder04	Raw	5	4	4	4	4	4	3	4	4	3	5	4	5	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.439	0.299	0.329	0.307	0.321	0.321	0.213	0.329	0.321	0.224	0.402	0.292	0.280	**4.079**
Builder05	Raw	4	4	4	5	4	3	4	4	4	3	4	4	3	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.351	0.299	0.329	0.383	0.321	0.241	0.284	0.329	0.321	0.224	0.321	0.292	0.168	**3.865**
Builder06	Raw	4	4	4	4	4	4	3	4	4	4	5	4	4	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.351	0.299	0.329	0.307	0.321	0.321	0.213	0.329	0.321	0.299	0.402	0.292	0.224	**4.009**
Builder07	Raw	4	3	4	4	4	3	3	4	3	3	4	3	4	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.351	0.224	0.329	0.307	0.321	0.241	0.213	0.329	0.241	0.224	0.321	0.219	0.224	**3.546**
Builder08	Raw	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.264	0.224	0.247	0.230	0.241	0.241	0.213	0.247	0.241	0.224	0.241	0.219	0.168	**3.000**
Builder09	Raw	2	3	4	3	3	2	3	2	4	4	3	2	4	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.176	0.224	0.329	0.230	0.241	0.161	0.213	0.164	0.321	0.299	0.241	0.146	0.224	**2.970**
User01	Raw	4	3	4	3	4	4	4	3	3	3	3	3	3	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.345	0.253	0.330	0.242	0.308	0.301	0.294	0.226	0.220	0.220	0.220	0.204	0.231	**3.394**
User02	Raw	3	3	4	4	4	4	4	4	3	3	5	3	4	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.259	0.253	0.330	0.323	0.308	0.301	0.294	0.301	0.220	0.220	0.367	0.204	0.308	**3.688**
User03	Raw	3	3	3	3	3	3	3	2	3	2	3	2	3	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.259	0.253	0.248	0.242	0.231	0.226	0.220	0.150	0.220	0.147	0.220	0.136	0.231	**2.783**
User04	Raw	4	4	4	4	4	4	4	3	4	4	4	4	4	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.345	0.338	0.330	0.323	0.308	0.301	0.294	0.226	0.294	0.294	0.294	0.272	0.308	**3.925**
User05	Raw	4	3	3	3	4	3	3	4	4	4	4	4	4	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.345	0.253	0.248	0.242	0.308	0.226	0.220	0.301	0.294	0.294	0.294	0.272	0.308	**3.604**
User06	Raw	3	3	3	3	2	2	3	4	2	2	4	3	2	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.259	0.253	0.248	0.242	0.154	0.150	0.220	0.301	0.147	0.147	0.294	0.204	0.154	**2.772**
User07	Raw	5	4	3	3	3	3	3	3	3	2	5	2	4	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.431	0.338	0.248	0.242	0.231	0.226	0.220	0.226	0.220	0.147	0.367	0.136	0.308	**3.339**
User08	Raw	3	4	3	2	2	2	2	3	2	2	3	1	3	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.259	0.338	0.248	0.161	0.154	0.150	0.147	0.226	0.147	0.147	0.220	0.068	0.231	**2.495**

Integrated Project Delivery (IPD) -- Self-Interest

		Owner/User Satisfaction	Clear & Realistic Objectives	Effective Communication	Collaboration of Project Team	Utility & Functionality	Trust & Respect	Alignment of Objectives	Owner/User Participation	Production of Specified Quality	Long-term Lifecycle Value	Time Performance	Owner's Vision	Constructability	Weighted Sum Aggregated Relatie Effectiveness
Owner01	Raw	5	5	5	4	4	3	5	5	4	3	4	4	4	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.411	0.418	0.411	0.329	0.306	0.208	0.390	0.368	0.300	0.238	0.272	0.323	0.278	**4.251**
Owner02	Raw	4	4	4	4	4	4	4	4	4	4	4	4	4	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.329	0.334	0.329	0.329	0.306	0.278	0.312	0.295	0.300	0.317	0.272	0.323	0.278	**4.000**
Owner03	Raw	2	2	2	3	3	3	3	2	2	3	3	2	3	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.164	0.167	0.164	0.246	0.229	0.208	0.234	0.147	0.150	0.238	0.204	0.161	0.208	**2.523**
Owner04	Raw	4	4	4	4	4	4	3	3	4	4	3	4	4	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.329	0.334	0.329	0.329	0.306	0.278	0.234	0.221	0.300	0.317	0.204	0.323	0.278	**3.780**
Owner05	Raw	2	2	3	2	2	2	2	3	3	3	4	2	5	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.164	0.167	0.246	0.164	0.153	0.139	0.156	0.221	0.225	0.238	0.272	0.161	0.347	**2.654**
Owner06	Raw	5	5	5	5	5	4	5	4	4	5	5	4	3	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.411	0.418	0.411	0.411	0.382	0.278	0.390	0.295	0.300	0.397	0.340	0.323	0.208	**4.562**
Owner07	Raw	5	4	5	5	5	4	4	5	4	5	4	5	4	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.411	0.334	0.411	0.411	0.382	0.278	0.312	0.368	0.300	0.397	0.272	0.404	0.278	**4.557**
Owner08	Raw	4	4	5	4	4	4	4	4	4	4	5	4	4	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.329	0.334	0.411	0.329	0.306	0.278	0.312	0.295	0.300	0.317	0.340	0.323	0.278	**4.150**
Owner09	Raw	2	3	3	3	3	3	3	3	3	3	4	3	4	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.164	0.251	0.246	0.246	0.229	0.208	0.234	0.221	0.225	0.238	0.272	0.242	0.278	**3.055**
Owner10	Raw	4	4	4	5	4	4	4	4	4	4	3	4	4	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.329	0.334	0.329	0.411	0.306	0.278	0.312	0.295	0.300	0.317	0.204	0.323	0.278	**4.014**
Owner11	Raw	5	4	4	5	4	5	5	4	4	3	4	4	5	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.411	0.334	0.329	0.411	0.306	0.347	0.390	0.295	0.300	0.238	0.272	0.323	0.347	**4.302**
Owner12	Raw	4	5	5	5	3	5	5	5	5	5	4	5	5	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.329	0.418	0.411	0.411	0.229	0.347	0.390	0.368	0.375	0.397	0.272	0.404	0.347	**4.697**
Owner13	Raw	5	5	3	5	5	5	5	3	5	5	5	3	5	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.411	0.418	0.246	0.411	0.382	0.347	0.390	0.221	0.375	0.397	0.340	0.242	0.347	**4.527**
Owner14	Raw	3	4	5	5	4	5	5	5	4	4	5	3	5	
	Weight	0.082	0.084	0.082	0.082	0.076	0.069	0.078	0.074	0.075	0.079	0.068	0.081	0.069	
	Weighted Score	0.246	0.334	0.411	0.411	0.306	0.347	0.390	0.368	0.300	0.317	0.340	0.242	0.347	**4.360**
Designer01	Raw	3	3	5	4	5	5	4	5	5	3	4	5	3	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.259	0.248	0.373	0.322	0.393	0.383	0.314	0.344	0.373	0.224	0.275	0.393	0.230	**4.132**
Designer02	Raw	4	5	5	4	4	5	5	5	5	5	5	5	5	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.346	0.413	0.373	0.322	0.314	0.383	0.393	0.344	0.373	0.373	0.344	0.393	0.383	**4.754**
Designer03	Raw	4	4	4	4	4	4	4	5	5	5	4	5	4	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.346	0.330	0.299	0.322	0.314	0.306	0.314	0.344	0.373	0.373	0.275	0.393	0.306	**4.297**
Designer04	Raw	4	3	4	5	5	5	5	4	4	5	5	5	4	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.346	0.248	0.299	0.403	0.393	0.383	0.393	0.275	0.299	0.373	0.344	0.393	0.306	**4.454**
Designer05	Raw	4	2	4	5	3	4	4	3	2	4	4	3	3	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.346	0.165	0.299	0.403	0.236	0.306	0.314	0.206	0.149	0.299	0.275	0.236	0.230	**3.464**
Designer06	Raw	2	2	4	4	2	1	1	1	1	1	1	1	2	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.173	0.165	0.299	0.322	0.157	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.153	**1.790**
Designer07	Raw	2	1	1	1	2	1	1	1	1	1	3	2	1	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.173	0.083	0.075	0.081	0.157	0.077	0.079	0.069	0.075	0.075	0.206	0.157	0.077	**1.381**
Designer08	Raw	5	5	4	4	4	4	4	4	4	4	4	5	4	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.432	0.413	0.299	0.322	0.314	0.306	0.314	0.275	0.299	0.299	0.275	0.393	0.306	**4.248**
Designer09	Raw	4	4	5	5	3	3	4	5	4	3	4	4	4	
	Weight	0.086	0.083	0.075	0.081	0.079	0.077	0.079	0.069	0.075	0.075	0.069	0.079	0.077	
	Weighted Score	0.346	0.330	0.373	0.403	0.236	0.230	0.314	0.344	0.299	0.224	0.275	0.314	0.306	**3.994**

Integrated Project Delivery (IPD) -- Self-Interest															
		Owner/User Satisfaction	Clear & Realistic Objectives	Effective Communication	Collaboration of Project Team	Utility & Functionality	Trust & Respect	Alignment of Objectives	Owner/User Participation	Production of Specified Quality	Long-term Lifecycle Value	Time Performance	Owner's Vision	Constructability	Weighted Sum Aggregated Relatie Effectiveness
Builder01	Raw	4	4	3	4	4	4	4	4	4	4	4	3	4	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.357	0.305	0.245	0.268	0.305	0.327	0.312	0.335	0.305	0.275	0.320	0.217	0.275	**3.846**
Builder02	Raw	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.268	0.229	0.245	0.201	0.229	0.245	0.234	0.251	0.229	0.206	0.240	0.217	0.206	**3.000**
Builder03	Raw	5	5	5	5	5	4	4	4	3	4	4	4	4	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.446	0.381	0.409	0.335	0.381	0.327	0.312	0.335	0.229	0.275	0.320	0.290	0.275	**4.314**
Builder04	Raw	3	5	5	5	5	5	5	5	5	5	3	5	3	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.268	0.381	0.409	0.335	0.381	0.409	0.390	0.418	0.381	0.344	0.240	0.362	0.206	**4.524**
Builder05	Raw	4	4	4	5	4	3	4	5	4	3	4	4	3	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.357	0.305	0.327	0.335	0.305	0.245	0.312	0.418	0.305	0.206	0.320	0.290	0.206	**3.931**
Builder06	Raw	5	2	4	5	5	5	3	5	4	4	4	4	5	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.446	0.152	0.327	0.335	0.381	0.409	0.234	0.418	0.305	0.275	0.320	0.290	0.344	**4.236**
Builder07	Raw	5	4	5	5	5	4	4	5	4	5	5	5	3	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.446	0.305	0.409	0.335	0.381	0.327	0.312	0.418	0.305	0.344	0.400	0.362	0.206	**4.550**
Builder08	Raw	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.268	0.229	0.245	0.201	0.229	0.245	0.234	0.251	0.229	0.206	0.240	0.217	0.206	**3.000**
Builder09	Raw	4	4	5	5	4	4	5	4	5	5	5	5	5	
	Weight	0.089	0.076	0.082	0.067	0.076	0.082	0.078	0.084	0.076	0.069	0.080	0.072	0.069	
	Weighted Score	0.357	0.305	0.409	0.335	0.305	0.327	0.390	0.335	0.381	0.344	0.400	0.362	0.344	**4.593**
User01	Raw	3	3	3	3	3	3	3	2	3	3	3	3	3	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.260	0.238	0.243	0.272	0.215	0.232	0.249	0.147	0.232	0.226	0.198	0.221	0.192	**2.926**
User02	Raw	4	4	5	5	5	5	5	5	5	5	4	5	5	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.347	0.317	0.406	0.453	0.358	0.387	0.415	0.368	0.387	0.377	0.264	0.368	0.321	**4.768**
User03	Raw	5	5	5	5	5	5	5	5	5	5	5	5	5	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.434	0.396	0.406	0.453	0.358	0.387	0.415	0.368	0.387	0.377	0.330	0.368	0.321	**5.000**
User04	Raw	4	4	3	4	4	4	4	5	4	5	5	5	4	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.347	0.317	0.243	0.362	0.287	0.309	0.332	0.368	0.309	0.377	0.330	0.368	0.257	**4.208**
User05	Raw	5	5	5	5	5	5	5	5	5	5	5	4	5	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.434	0.396	0.406	0.453	0.358	0.387	0.415	0.368	0.387	0.377	0.330	0.294	0.321	**4.926**
User06	Raw	4	4	3	4	3	2	3	4	3	3	3	3	3	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.347	0.317	0.243	0.362	0.215	0.155	0.249	0.294	0.232	0.226	0.198	0.221	0.192	**3.253**
User07	Raw	5	5	5	5	5	5	5	5	5	4	2	5	3	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.434	0.396	0.406	0.453	0.358	0.387	0.415	0.368	0.387	0.302	0.132	0.368	0.192	**4.598**
User08	Raw	3	3	3	3	3	3	3	3	3	3	1	3	1	
	Weight	0.087	0.079	0.081	0.091	0.072	0.077	0.083	0.074	0.077	0.075	0.066	0.074	0.064	
	Weighted Score	0.260	0.238	0.243	0.272	0.215	0.232	0.249	0.221	0.232	0.226	0.066	0.221	0.064	**2.740**

Integrated Project Delivery (IPD) -- Project-Interest															
		Owner/User Satisfaction	**Clear & Realistic Objectives**	**Effective Communication**	**Collaboration of Project Team**	**Utility & Functionality**	**Trust & Respect**	**Alignment of Objectives**	**Owner/User Participation**	**Production of Specified Quality**	**Long-term Lifecycle Value**	**Time Performance**	**Owner's Vision**	**Constructability**	**Weighted Sum Aggregated Relatie Effectiveness**
Owner01	Raw	5	5	5	4	4	3	5	5	4	3	4	4	4	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.390	0.418	0.404	0.312	0.323	0.234	0.368	0.397	0.317	0.229	0.283	0.260	0.306	**4.241**
Owner02	Raw	4	4	4	4	4	4	4	4	4	4	4	4	4	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.312	0.335	0.323	0.312	0.323	0.312	0.294	0.317	0.317	0.306	0.283	0.260	0.306	**4.000**
Owner03	Raw	2	2	3	4	3	3	3	3	3	3	3	3	3	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.156	0.167	0.242	0.312	0.242	0.234	0.221	0.238	0.238	0.229	0.212	0.195	0.229	**2.916**
Owner04	Raw	4	4	4	4	4	4	2	3	4	4	3	4	4	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.312	0.335	0.323	0.312	0.323	0.312	0.147	0.238	0.317	0.306	0.212	0.260	0.306	**3.703**
Owner05	Raw	2	2	3	2	2	2	2	3	3	3	4	2	5	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.156	0.167	0.242	0.156	0.162	0.156	0.147	0.238	0.238	0.229	0.283	0.130	0.382	**2.687**
Owner06	Raw	5	5	5	5	4	5	5	4	4	4	5	4	3	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.390	0.418	0.404	0.390	0.323	0.390	0.368	0.317	0.317	0.306	0.354	0.260	0.229	**4.466**
Owner07	Raw	5	4	5	5	5	4	4	4	4	5	4	5	4	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.390	0.335	0.404	0.390	0.404	0.312	0.294	0.317	0.317	0.382	0.283	0.325	0.306	**4.459**
Owner08	Raw	4	4	5	4	3	3	4	4	4	4	5	4	4	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.312	0.335	0.404	0.312	0.242	0.234	0.294	0.317	0.317	0.306	0.354	0.260	0.306	**3.993**
Owner09	Raw	4	2	3	3	3	3	3	4	4	4	4	3	4	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.312	0.167	0.242	0.234	0.242	0.234	0.221	0.317	0.317	0.306	0.283	0.195	0.306	**3.377**
Owner10	Raw	4	4	4	4	4	4	4	4	4	4	3	4	4	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.312	0.335	0.323	0.312	0.323	0.312	0.294	0.317	0.317	0.306	0.212	0.260	0.306	**3.929**
Owner11	Raw	5	4	4	5	4	5	5	4	4	3	4	4	5	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.390	0.335	0.323	0.390	0.323	0.390	0.368	0.317	0.317	0.229	0.283	0.260	0.382	**4.307**
Owner12	Raw	3	5	5	5	3	5	5	5	5	5	4	5	5	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.234	0.418	0.404	0.390	0.242	0.390	0.368	0.397	0.397	0.382	0.283	0.325	0.382	**4.612**
Owner13	Raw	5	5	5	5	5	5	5	3	5	5	3	3	3	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.390	0.418	0.404	0.390	0.404	0.390	0.368	0.238	0.397	0.382	0.212	0.195	0.229	**4.417**
Owner14	Raw	5	5	5	5	5	5	4	5	4	4	5	5	5	
	Weight	0.078	0.084	0.081	0.078	0.081	0.078	0.074	0.079	0.079	0.076	0.071	0.065	0.076	
	Weighted Score	0.390	0.418	0.404	0.390	0.404	0.390	0.294	0.397	0.317	0.306	0.354	0.325	0.382	**4.771**
Designer01	Raw	4	2	5	5	5	5	4	5	5	3	5	5	4	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.354	0.165	0.402	0.362	0.433	0.392	0.298	0.392	0.352	0.199	0.392	0.322	0.314	**4.378**
Designer02	Raw	5	5	5	5	5	5	5	5	5	5	5	5	5	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.443	0.412	0.402	0.362	0.433	0.392	0.372	0.392	0.352	0.332	0.392	0.322	0.392	**5.000**
Designer03	Raw	5	4	5	4	5	5	5	5	4	5	4	5	4	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.443	0.330	0.402	0.290	0.433	0.392	0.372	0.392	0.282	0.332	0.314	0.322	0.314	**4.618**
Designer04	Raw	5	5	5	5	5	5	5	5	4	5	4	5	4	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.443	0.412	0.402	0.362	0.433	0.392	0.372	0.392	0.282	0.332	0.314	0.322	0.314	**4.773**
Designer05	Raw	4	4	5	5	4	5	4	3	3	3	5	4	4	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.354	0.330	0.402	0.362	0.346	0.392	0.298	0.235	0.211	0.199	0.392	0.258	0.314	**4.095**
Designer06	Raw	2	2	4	4	2	1	1	1	1	1	1	1	2	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.177	0.165	0.322	0.290	0.173	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.157	**1.795**
Designer07	Raw	2	1	1	1	1	1	1	1	1	1	4	1	1	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.177	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.314	0.064	0.078	**1.324**
Designer08	Raw	5	5	5	4	4	4	4	4	4	4	4	5	4	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.443	0.412	0.402	0.290	0.346	0.314	0.298	0.314	0.282	0.266	0.314	0.322	0.314	**4.316**
Designer09	Raw	4	4	5	5	3	4	4	4	4	3	5	4	4	
	Weight	0.089	0.082	0.080	0.072	0.087	0.078	0.074	0.078	0.070	0.066	0.078	0.064	0.078	
	Weighted Score	0.354	0.330	0.402	0.362	0.260	0.314	0.298	0.314	0.282	0.199	0.392	0.258	0.314	**4.078**

		Owner/User Satisfaction	Clear & Realistic Objectives	Effective Communication	Collaboration of Project Team	Utility & Functionality	Trust & Respect	Alignment of Objectives	Owner/User Participation	Production of Specified Quality	Long-term Lifecycle Value	Time Performance	Owner's Vision	Constructability	Weighted Sum Aggregated Relatie Effectiveness
Integrated Project Delivery (IPD) -- Project-Interest															
Builder01	Raw	4	4	3	4	4	4	4	4	4	4	4	3	4	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.351	0.299	0.247	0.307	0.321	0.321	0.284	0.329	0.321	0.299	0.321	0.219	0.224	**3.845**
Builder02	Raw	3	3	3	3	3	3	3	3	3	3	3	3	4	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.264	0.224	0.247	0.230	0.241	0.241	0.213	0.247	0.241	0.224	0.241	0.219	0.224	**3.056**
Builder03	Raw	5	5	5	5	5	4	4	4	3	4	4	4	4	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.439	0.374	0.411	0.383	0.402	0.321	0.284	0.329	0.241	0.299	0.321	0.292	0.224	**4.321**
Builder04	Raw	5	5	5	5	5	5	5	5	5	5	3	5	3	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.439	0.374	0.411	0.383	0.402	0.402	0.355	0.411	0.402	0.374	0.241	0.364	0.168	**4.727**
Builder05	Raw	4	4	4	5	4	3	4	5	4	3	4	4	3	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.351	0.299	0.329	0.383	0.321	0.241	0.284	0.411	0.321	0.224	0.321	0.292	0.168	**3.948**
Builder06	Raw	5	4	5	5	5	5	3	5	4	4	4	4	5	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.439	0.299	0.411	0.383	0.402	0.402	0.213	0.411	0.321	0.299	0.321	0.292	0.280	**4.475**
Builder07	Raw	5	4	5	5	5	4	4	5	4	4	5	5	3	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.439	0.299	0.411	0.383	0.402	0.321	0.284	0.411	0.321	0.299	0.402	0.364	0.168	**4.507**
Builder08	Raw	3	3	3	3	3	3	3	3	3	3	3	3	3	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.264	0.224	0.247	0.230	0.241	0.241	0.213	0.247	0.241	0.224	0.241	0.219	0.168	**3.000**
Builder09	Raw	4	4	5	5	4	4	5	4	5	5	5	5	5	
	Weight	0.088	0.075	0.082	0.077	0.080	0.080	0.071	0.082	0.080	0.075	0.080	0.073	0.056	
	Weighted Score	0.351	0.299	0.411	0.383	0.321	0.321	0.355	0.329	0.402	0.374	0.402	0.364	0.280	**4.594**
User01	Raw	4	3	3	4	4	4	4	3	3	3	3	3	3	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.345	0.253	0.248	0.323	0.308	0.301	0.294	0.226	0.220	0.220	0.220	0.204	0.231	**3.393**
User02	Raw	4	5	5	5	5	4	5	5	5	5	4	4	5	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.345	0.422	0.413	0.404	0.385	0.301	0.367	0.376	0.367	0.367	0.294	0.272	0.385	**4.697**
User03	Raw	5	5	5	5	5	5	5	5	5	5	5	5	5	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.431	0.422	0.413	0.404	0.385	0.376	0.367	0.376	0.367	0.367	0.367	0.339	0.385	**5.000**
User04	Raw	3	4	3	4	4	4	4	4	4	4	4	4	4	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.259	0.338	0.248	0.323	0.308	0.301	0.294	0.301	0.294	0.294	0.294	0.272	0.308	**3.831**
User05	Raw	5	5	5	5	5	5	5	5	5	5	5	4	5	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.431	0.422	0.413	0.404	0.385	0.376	0.367	0.376	0.367	0.367	0.367	0.272	0.385	**4.932**
User06	Raw	4	4	3	3	3	2	3	4	2	2	3	3	3	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.345	0.338	0.248	0.242	0.231	0.150	0.220	0.301	0.147	0.147	0.220	0.204	0.231	**3.024**
User07	Raw	2	2	5	5	5	5	5	5	5	4	2	5	3	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.172	0.169	0.413	0.404	0.385	0.376	0.367	0.376	0.367	0.294	0.147	0.339	0.231	**4.040**
User08	Raw	2	3	2	3	2	3	3	2	3	3	1	3	1	
	Weight	0.086	0.084	0.083	0.081	0.077	0.075	0.073	0.075	0.073	0.073	0.073	0.068	0.077	
	Weighted Score	0.172	0.253	0.165	0.242	0.154	0.226	0.220	0.150	0.220	0.220	0.073	0.204	0.077	**2.378**

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Lieutenant Colonel Michael D. Brennan is an active duty Army officer. Brennan graduated from the University of Notre Dame with a Bachelor of Architecture degree and was commissioned through ROTC as a Medical Service officer in 1992. His first duty assignments were in the 3d Infantry Division serving as Medical Platoon Leader in the 1st Battalion, 15th Infantry in Schweinfurt, Germany, and as Division Medical Supply Officer and Executive Officer of Foxtrot Company, 703d Main Support Battalion in Kitzingen, Germany. In 1995 he was assigned as Architect in the Europe Region Medical Command's Health Facility Project Office in Heidelberg, Germany. In 1997 Brennan returned stateside and was reassigned to the Pentagon serving as Deputy Director, Medical Military Construction (MILCON), and later as Chief, Programs Evaluation and Analysis Branch at the U.S. Army Health Facility Planning Agency. In 1999 he deployed to Kosovo leading a team to design the hospital at Camp Bondsteel. In 2000 Brennan was reassigned overseas to Korea where he served as Commander, Charlie Company, 302d Forward Support Battalion, 2d Infantry Division at Camp Casey, and later as Chief Materiel Branch at the 121st General Hospital in Seoul.

In 2002 Brennan was selected for long-term civilian graduate studies at the University of Illinois, where in 2004 he graduated with both a Master of Architecture degree and a Master of Science degree in Civil Engineering. After completing Command and General Staff College, Lieutenant Colonel Brennan was assigned to duty at the Walter Reed Army Medical Center where as Chief of the Health Facility Project Office he oversaw completion of over $100 million of construction projects to include the Military Amputee Training Center. He oversaw the Base Realignment and Closure (BRAC) planning and programming for the $2.3 billion relocation of the Walter Reed Army Medical Center to Bethesda, Maryland and Fort Belvoir, Virginia. In

2006 Lieutenant Colonel Brennan deployed to Iraq serving as 3d MEDCOM Deputy G4, and Health Facility Planner responsible for theater-wide medical facility projects including construction of the Multi-National Forces Hospital at Al Asad. Following Iraq, he returned to the U.S. Army Health Facility Planning Agency as Program Manager for the $1.2 billion, 1.3 million square foot Fort Belvoir Community Hospital project. In 2008 he returned to the University of Illinois to start a Ph.D. program in the School of Architecture.

He is married to Lieutenant Colonel (retired) Mia Brennan, and they have four young children. Upon completion of his Ph.D. Lieutenant Colonel Brennan will continue on active-duty with the U.S. Army Health Facility Planning Agency.