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COMMODITY VS VALUE-ADDED
CONTRACTOR SERVICES

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Research Report 205-11

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COMMODITY VS VALUE-ADDED CONTRACTOR SERVICES

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A Report to
Construction Industry Institute
The University of Texas at Austin

Under the Guidance of
CII Project Team 205
Commodity vs Value-Added Contractor Services

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EXECUTIVE SUMMARY

Research Team 205 investigated the balance between value-added services of engineering and construction service contracts and those services that are undifferentiated or commodity-like. Owners and contractors are using different terminologies and definitions in such a dialogue, and as a result such dialogues often become frustrating and emotional. Because of the multiple definitions people use, miscommunication not only occurs between Owner and Contractor, but also within each of their organizations.

As a way to overcome this communication barrier and achieve an objective basis to conduct a detailed study, the Team developed a set of common definitions, and then ran a series of workshops with groups of Owners only and Contractors only. Although some criticism of the other side occurred during these workshops, it is interesting to note that comments during breaks tended to be similar to this quote from a Contractor:

“We are often our own worst enemy and force the Owners to treat us as a commodity.”

A similar quote from an Owner was:

“We do not do a good job of articulating what features and functions provide benefits and thus the bid process is both vague and ambiguous for Contractors.”

Following the workshops, the Team conducted a case study of a number of projects at one company, and then gathered and analyzed data from a large number of projects from both Owner and Contractor pairs to identify which offerings in the bid really added value and which ones did not.

First of all, the definitions as provided in Table 5.2 need to be applied and used throughout the construction industry to enable a dialogue to continue regarding critical issues and decisions regarding both procurement strategies by Owners and marketing

strategies by Contractors. The Team believes that it has shown that Contractors do have a more thorough understanding of value-added engineering practices than frequently acknowledged by Owners; however, it is imperative that much of the dialogue center on Owner net value-added so that a common language for interpreting projects can be found. The definitions for Net Value-added, Differentiation, and Commodity are key to participating in the constructive dialogue needed in the construction industry on this topic. **Net Value-added** is value in relation to its associated cost. It is the same concept as economic value-added. To continue to be economically viable, an Owner is compelled to consider both changes in benefit streams and changes in cost streams caused by a particular capital project. **Differentiation** is the dissimilarity of the features and functions of a good or service. An Owner should desire differentiation only if it is known that the differentiation may lead to higher net value-added. A **Commodity** is an undifferentiated good/service. In a global economy, an Owner must buy a truly undifferentiated Contractor good or service on the basis of price since, by definition, the benefits could not be more.

A term that brings remarkable clarity to the concepts involved in this research is differentiation. The question becomes what are differentiated goods or services and how do they add to net value-added. Many actions provide value-added; dramatically fewer provide net value-added. Owners must attain net-value-added from projects to stay in business. Contractors may provide an undifferentiated good or service at a low cost (choose a strategy to be the low-cost provider), may provide a differentiated service that provides a superior net value-added to the Owner (choose a strategy to respond to specified Owner needs in the marketplace), may provide a clearly differentiated service

that only a few Owners can afford (choose a strategy to be a market niche provider), or may provide some combination of differentiated, partially differentiated, or undifferentiated goods and services.

In summary, the Team has:

- Adapted the conceptual definitions of commodities and value-added in economic terms, in order to develop a robust definition of these terms in the capital project delivery context.
- Tested these definitions against participation in capital project delivery processes by members of the Team, to ensure that the definitions adequately capture nuances of Owner needs and Contractor market positioning. Workshops, case study, and data collection were used to triangulate the potential use of the definitions.
- Developed models based on economic theories regarding resources and transactions.
- Evaluated perceptions of differentiators used by Owners during pre-qualification and final bid processes.
- Determined that Owners and Contractors have perceptions of key differentiators that often differ dramatically.
- Determined the relation of key differentiators to net value-added for the Owner.
- Translated results into models and suggestions that can lead to a positive dialogue in the construction industry for achieving higher net value-added for Owners and recognition of value-added provided by Contractors.

The Team is proud of this industry. Both Owners and Contractors from workshops, data collection participants, and structured interviews want to see the whole

industry succeed. All parties clearly understand that this will only happen if construction services (internal or external to the Owner company) yield net value-added to the Owner. The lack of definitions and tools for communication and analysis get in the way; however, basic truths are that both Owners and Contractors want a successful project for the Owner and that everything cannot be the most important. Trade-offs must be made. If all differentiators (the Team identified 80) are considered important, then nothing is very important and contract price dominates the decision.

Key issues are:

1. Which differentiators are relatively important to project success?
2. How do Owners use these differentiators in their evaluation of Contractors for a specific project?
3. How do Contractors determine their specific competitiveness on each differentiator for a specific project?

Specific differentiators that are relatively important fall within seven categories statistically related to net value-added. The seven categories are risk management, facility operating performance, customer relations, safety, financial considerations, delivery methodology, and quality management. Categories not included at all above include Contractor financial status, project management, Contractor personnel capability, Contractor resources, and certifications and regulations. This does not mean that these are ignored. It simply means that they are treated as order qualifiers only and that acceptable levels are required to be in the pool of eligible Contractors for a specific project.

Note that the contract price was not significantly related to Owner's net value-added. In fact, if a Contractor felt the price was emphasized more, there was a decrease in

the net value-added of the project. The complete list of differentiators negatively related to net value-added during prequalification include strong design management capability and resources, Contractor history with Owner including number of prior projects, management information system, managerial experience, and compatibility of software used. Various reasons can be posited as to why these negative relationships exist; however, the application interpretation is that these should not be in the list of items emphasized and that placing great weight on any one of these items during prequalification may reduce the Owner's options for a final Contractor selection to the Owner's detriment. The list of differentiators negatively related during the final bid process includes office locations, strong design management capability and resources, compatibility of software used, parent company ownership and support and contract price. The logical explanation on the negative relationship with an emphasis on compatibility of software used is that this barrier is not a truly important one for achieving the Owner's goals and that perhaps most Contractors can work around software differences without much difficulty.

Only the positive relationships are reported in the set of differentiators to be used for evaluation and communication. There are only 16 metrics out of the original 80 suggested for inclusion in evaluating net value-added and determining differentiation. Categories and the relative weights of categories based on Team analyses of project data along with the specific differentiators to be considered within each category are:

Delivery Methodology (24%)

- Demonstrated means of integrating planning process with scheduling software
- Means of demonstrating delivery track record over recent projects

- Construction Management Systems
- Unique field delivery strategy

Safety (20%)

- Contractor commitment to zero injury goal
- Safety plan (definitive & relevant & providing assurance of accountability)
- Safety personnel experience

Quality Management (17%)

- Actual field verification procedures
- Technical & general information accuracy
- Constructability (capability, experience)

Facility Operating Performance (14%)

- Use of sustainable development tools and philosophies
- Reducing ongoing facility operating costs

Financial Considerations (12%)

- Financial penalties
- Proposed payment schedule

Risk Management (7%)

- Management of contractual risk

Customer relations (6%)

- Formal problem resolution procedure

Based on these results the Team developed a tool that can be used by industry members. The Owner identifies primary functional capabilities with importance weighting, and assesses the Contractor's capabilities to meet those capabilities vs. the

Contractor's own self-assessment. Significant gaps or differences can be used to foster in-depth analysis and communication. The tool with values for an example application is provided in Table 5.1. The tool can be used by an Owner to communicate relative importance of differentiators to potential Contractors or even to a specific alliance partner. It can also be used by an Owner to evaluate alternate Contractor options as shown in the example. The tool can be used by a Contractor to communicate value-adding services to the Owner on a specific contract bid. A Contractor may also use the tool to conduct an analysis of its competitive position in the marketplace and to identify a specific market opportunity or niche. Suggested differentiators and weights based on analysis of RT 205 Team data are provided in Appendix 2. The complete list of the 80 differentiators under the 12 categories is provided in Appendix 3.

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1 INTRODUCTION

1.1 Overview of Value-Added versus Commodity

1.1.1 Context for the Research

This project was developed through the CII research needs assessment process. Reportedly, the project developed in response to comments at several needs assessment workshops that contractor services, engineering services in particular, were becoming “commodities.” The issue, though arguably poorly defined as indicated by the quotation marks around the term “commodities,” was received very emotionally by the participants of the Board of Advisors meeting. Both contractor and owner members of CII held strong opinions about the implications and impacts of this phenomenon, which seemed to be well-recognized by the Board members even without clearly defined terms. The research team was given a video of an open session on this topic held at the meeting at which this research project was authorized, upon which these comments are based. The comments and issues of the participants at this session seemed to fall into three general categories:

- What contractor services are commodities?
- How can we tell commodity services from value-added commodities?
- Should value-added services be purchased and compensated differently?

The session included a good deal of historical context for the comments presented by the participants. Of course, individual participants had differing experiences, but an overall picture could be developed that generalizes the discussion somewhat. In the late 1990s and the early part of this new millennia, intense price competition in the global market and the demand from investors to provide higher profits drove Owners to look at all areas

of expenditure for cost savings. Engineering and construction services were not exempt from this search for savings. Increasingly in this quest for cost savings, Owners began to view engineering and construction services as a commodity. The providers of engineering and construction services (Contractors) responded by citing that their output was a value-add and not a commodity – and so an impasse ensued.

Based on the discussion, it was clear that there was widespread understanding and persistent anecdotal evidence to suggest that engineering and construction services were frequently procured by Owners as commodities. Engineering and construction services were also understood, however, to be highly complex processes with multiple interfaces that need careful and considered management. Several participants argued that these complex interfaces may be overlooked if Owners make procurement decisions that, in effect, categorize engineering and construction as commodities.

The discussions therefore made it clear that there was a lack of understanding as to the components of the capital facility delivery process that could be properly treated as a “commodity” and those components that would be better treated as “value-added.” As a result, Owners and Contractors were clearly at odds with each other over how capital facilities should be best procured. It follows logically that this difference would make it difficult for Contractors to develop strategic marketing and investment plans, and for Owners to understand how to approach the market for construction services. Contractors reported that they perceived that they were either under-valued by the Owners or not recognized or accepted as providers of value-added services by the Owners. Another way to summarize this observation is that Contractors clearly needed improved methods for differentiating and marketing their services. It was also clear that there were different

levels of understanding of the problems that might arise if Owners treated differentiated engineering and construction services as commodities. However, several representatives of both communities concluded that, as a result of failing to appropriately differentiate, Owners might not be positioning themselves to extract value-added services that have the potential to optimize the life-cycle capital, operational and maintenance costs of ownership. Both Owners and Contractors clearly needed better models for evaluating potential value-added services against increased capital investment costs. It was further clear that in the absence of such models, Owners would be forced to procure Contractor services primarily on price.

Based on this session, the Research Committee developed a Request for Proposals. This report presents the results of the ensuing research. The final product represents an amalgamation of influences, of course, including the contents of the RFP, the guidance of the research team, and the influence of interim results of the research while it was in progress.

The problem statement listed in the CII Request for Proposals (see Appendix A) stated:

“Engineering and Construction services are being treated more and more as commodities. However, the industry has invested heavily to define and implement industry best practices in an effort to maximize value-adding Contractor services.

There may be reasons for this dichotomy, including:

- A shift in the business conditions causing a change in Owner behavior.
- A structural shift in the roles of the Owner and Contractor.

- Contractor supplied services or a component of Contractor supplied services really are commodities

What parts of the engineering and construction service business are truly commodities and what parts are value-added?”

This research project proposed to develop answers to these questions. Specific objectives were to develop a deeper understanding and better communications regarding the value-add of engineering and construction services. The mutual goal was to improve the procurement and marketing decisions by all stakeholders in the capital project delivery process.

The proposal submitted by the academic team (see Appendix B) identified two areas that were critical to the success of the project, but were not specifically identified in the RFP. Specifically, the academic team argued that the terms “commodity” and “value-added” were ill-defined (it became clear very quickly that these terms were also emotionally charged), and also the team argued that this research had significant implications for how contractors marketed their services to owners. Accordingly, the team proposed to develop conceptual models to allow meaningful definitions of the terms, and also to support marketing and selection/procurement activities by owners and contractors. Most importantly, the academic proposal inherently assumed that the distinction between value-added and commodity services ought not to be considered a referendum on the worth or import of the engineering function; put another way, the research would not take a position on whether one or the other sort of service is “good” or “bad.”

1.1.2 Trends

The request for proposals and the discussions at the Board of Advisors meeting previously described reflected some general perceptions of practices at the time. One of the elements of the proposal was to develop some understanding of related trends in the industry. A series of open-ended interviews with owners and contractors were used to develop this understanding. The details of the interview processes will be presented in a subsequent chapter. However, the results illuminate the depth of the emotion evoked by this project, and so will be summarized here.

The “construction industry” is, of course, an extremely amorphous research subject, and the total number of interviews conducted was rather limited because of the length of the interview process. Nonetheless, the results are considered reflective of the sense of CII member companies at the time these interviews were conducted (late 2004 and early 2005), and reflective of the general tone and content of the BOA meeting discussion, the discussions at research team meetings, and discussions with others regarding this research. Relevant trends that seem to be driving the import of this general topic include the following. It is important to note that these represent trends reported in a significant fraction of the interviews conducted; there were exceptions among both owners and contractors to all of the trends reported below.

- Many owner companies have outsourced their engineering functions and moved away from maintaining internal engineering capability on their own over the last decade or two.

- Many contractors perceive that this process has resulted in a transfer of responsibility for capital project acquisition from engineering staff to procurement staff. Several owners agreed.
- Many owner companies reported increasing internal pressure to reduce the cost of acquisition of everything the company purchases over the last decade or so. Further, many reported that procurement practices for many goods and services have dramatically reduced acquisition costs to the company. These practices have arisen largely from a host of internet-supported capabilities (such as consolidation of spend, increased transparency, and reverse auction capabilities), and have been extremely successful in reducing costs in many supply and service categories. Because of these successes, some owners reported that there has been increased pressure to apply these techniques to other areas of spend, including capital facility procurement.
- Many contractors reported increases in the price-consciousness of owner companies. Further, they perceive that this increased price-consciousness has occurred contemporaneously with an increase in demands for services the contractors believed to be of high value, including in particular transfer of risk to contractors and greater speed and agility in the facility.

1.1.3 Owners' Perspectives

Faced with these market trends, Owners worked to “bundle” or aggregate the various engineering and/or construction services offerings from Contractors to obtain competitive bidding on the entire project. This led to integrating undifferentiated materials, design, and modular systems with differentiated engineering and construction services. Owners

were driven toward low cost and became less interested in the “value-added” offerings that Contractors proposed unless that value could be translated into an immediate tangible benefit (lower cost) for them. In their efforts to get more facilities constructed within the constraints of lower capital budgets, Owners demanded (and often obtained) the Contractors’ “A-team” resources while maintaining low cost bids. In other cases, Owners have moved to unbundled contracts that allow them to negotiate directly with all Contractors and Sub-Contractors. The idea is that the Owner assumes all risks and looks to each provider of an unbundled service or good to negotiate a price appropriate for the degree of differentiation provided by the service or good.

1.1.4 Contractors’ Perspectives

Contractors, faced with these behaviors from the Owners, were puzzled by the lack of appreciation of the “value” proposed by Contractors. The Contractors’ highly skilled resources (their employees, design productivity tools, and execution processes such as value engineering) that help the Owner deliver capital project excellence were wanted by the Owners but seemingly “for free”. In most cases, the Contractors valuable, high-end services were being lumped together with the more mundane, common and routine aspects of work. Once aggregated, Contractor services were being competitively bid, sometimes through reverse auctions that offered little opportunity to offer and explain the base proposal and alternatives to the Owner’s technical organization, much less the intangible benefits that differentiated one Contractor from another. Owners also had expectations of Contractors to provide services from low cost, offshore engineering centers, e.g. in India, Philippines or Mexico, where hourly rates are a fraction of those in the U.S. and Europe. Unbundled service buying by Owners may put Contractors in a

quandary of how to deliver value-added services normally associated with integrated planning and control of a project. In addition, unbundling can put Contractors in a position of working with competitors in an awkward amalgamation of proprietary knowledge and processes.

Where had the relationship gone? Where was the communication channel to be able to communicate with the Owners about losing a great opportunity? How can the contact with the Owner's technical or engineering organizations be re-established? Do Owners that have aggressively reduced their internal engineering capabilities to focus on core competencies still have enough engineering capability to interact effectively with Contractors?

Often, Contractors felt that they were discussing their value-add innovations with direct competitors who supplied supplemental or contingent resources to the Owners. With margins reduced, Contractors may feel that they can no longer afford to train their own people and are themselves being forced to downsize, further limiting the opportunity to offer value-added services that promote innovation in the industry.

1.1.5 Current Strategic Responses

Most Owners no longer retain the in-house engineering capability at the levels that Owners once had (confirmed through structured interviews with Owners), and need to rely increasingly on Contractor capabilities. In their drive to reduce costs, Owners may be less able to attract the resources with the experience and skill sets that are really needed to get the work done right so that facilities are designed and built to start on schedule, at the agreed budget, and operate per the project technical and financial objectives.

Because Contractors may not have a clear understanding of what Owners want and are willing to pay for, Contractors are sometimes forced to waste precious time and money pursuing work that they will not be awarded. Contractors do not critically analyze the services they offer to understand those that the Owner perceives are “commodity-like” and those that are perceived as “value-added” so that Contractors can market and sell specific services profitably. Contractors may not appreciate that the degree of differentiation depends on how the specific Owner views them and not on how much the Contractor wants its services to be perceived as value-added.

1.2 The Problem

The RFP suggested we would study what parts of the E&C business are truly commodities and what parts are value-added, and should they purchased and compensated differently. The definition process led us away from the rather pejorative context of categorizing work-types as commodities, and instead to the process of understanding what differentiates. That means the question becomes, what are the *attributes* of a contractor service that add value. Once you know what differentiates, it is up to the parties to decide how much of those attributes they want, or they want to do. In other words, before doing design, know what you want to design, or at least know what you want from the designer in terms of services.

A central problem is a lack of common understanding of **“commodity” and “value-added.”** The import of this problem is that it:

1. Causes owners and contractors to often misunderstand each other.
2. Makes it difficult for owners to approach the market for contractor services.

3. Makes it difficult for contractors to develop responsive proposals and strategic marketing plans.
4. Reduces the chances of an owner receiving highest value-added contractor services.

The problem essentially is that Owners and Contractors are talking two different languages or are using terms that the other does not understand. Owners and Contractors are often unable to work well together in delivering capital projects because of the drive for lower costs in the face of the global competitive marketplace.

1.3 Overview of the Research Report

The project objectives were to:

1. Develop a precise definition of terms.
2. Develop an understanding of marketing and procurement strategies in capital project delivery process.
3. Develop and test conceptual models for use by owners and contractors.
4. Develop implementation materials to support deployment of models.

Chapter 2 provides an overview of the vast array of related literatures. The focus in chapter 2 is on two particular literatures. First, an overview of related construction engineering literature is presented. Although other literatures are introduced and appendices of these literatures are provided, the rest of chapter 2 focuses on the connection to the transaction cost theory literature to the stated problem. Initial definitions are provided.

Chapter 3 provides an overview of the extensive methodologies used in this research project. Methods included:

1. structured group processes with the industry team to create definitions;
2. structured interviews with owners and contractors to understand current practice;
3. workshops with additional owners and contractors using structured group processes at two different locations to explore definitions and relationships;
4. a case study based on interviews, observation and data from many projects; and
5. collecting data on over 100 projects using a research instrument designed by the industry members of the team.

Chapter 4 presents key findings from each of the many methods employed. Additional results are also provided in several appendices.

Chapter 5 provides key conclusions, models, and tools for implementing the findings of the research. A simple tool in an Excel spreadsheet provides both owners and contractors an ability to explore differentiation using a culmination of the definitions, varied research results, and weights based on the extensive project data set.

2 LITERATURE REVIEW

2.1 Engineering, Technical and CII Literature

2.1.1 Engineering and Technical Literature

The value proposition for contractor services, perhaps for engineering design services in particular, has been a frequent, if difficult to understand, topic in the technical literature. The same debate that motivated this research has echoed in the literature. In general, one can detect some confusion about the terms *value* and *value-added*, and in fact there has been substantial discussion along the lines that the contribution of the designer and the contractor in the process is difficult to precisely categorize (e.g. McCartor, 2004; Fernandes, 2005).

Koskela (2000) uses the concept of value as a linchpin of the relatively recent development of an approach to understanding construction called lean construction. Value is an important part of the lean perspective, and Koskela's definition of value as "conformance to customer requirements" is oft-cited and generally accepted as a means of understanding value for construction projects. This definition thus explicitly embodies the concept that value is calculated by the owner of the project based on their calculations of how well the project met their expectations, and also implies that both quantitative requirements (such as an output volume, for example) and qualitative (such as ease of contracting or the suitability of the relationship) requirements. McCartor (2004) echoes these themes, defining value by five characteristics including: fulfilling the desired outcome; doing only what is needed or wanted; making good use of scarce resources, especially as compared to other uses for those resources; making good use of unrecognized resources; and congruency with stakeholder values (here values meaning

principles and standards, so a more moralist interpretation of the word). In fact, the concept that value definition is a matter for owner's to determine is a frequent concept in the literature (e.g. Jaafari, 1996; Alarcon and Mourgues, 2002; Maloney, 2002; Tang et al., 2003; Sandhu and Gunasekaran, 2004; Fujitani, et al., 2005).

The concern that portions of the construction industry may be trending towards “commodities” has also been expressed in the technical literature (e.g. Farr, 2001; Carr and Beyor, 2005; Sturts and Griffis, 2005). Farr (2001) uses stagnation of civil engineering salaries and billing rates, especially as compared to management consultants, to argue that civil engineering services are becoming commodities. He defines commodities as “simple economic goods,” and uses outsourcing to offshore engineering centers, low profit margins, and low inflation of design service hourly rates as evidence that some AE providers have become commodity providers. Both Carr and Beyor (2005) and Sturts and Griffis (2005) use similar reasoning, equating low rates with commodity either directly or by implication. Farr suggests that value (also defined by the customer in Farr's construct) is “the worth in monetary terms of the technical, economic service, and social benefits a customer company receives in exchange for the price it pays for a market offering.” Clearly, Farr's definition of value includes both objective and subjective considerations (this is a frequent theme in the literature also, e.g. Maloney, 2002; Tang et al. 2003, Sanchez et al. 2005). Farr goes on to present a value model in which the elements of customer definitions of value include responsiveness, technical competence, quality, understanding clients' needs, implementing project vision, experience, fees, schedule performance, and local knowledge. Farr concludes by suggesting that engineering firms need to make a strategic decision about whether they

wish to operate in a commodity or value market, and that different marketing and operational characteristics will attach to this decision.

The foregoing makes clear that the general problem of the contribution to value of the design and construction services for a capital facility is frequently presented in the technical literature. However, the continued dominance of price as a determining factor has also been well-established (e.g. Wong 2004; Carr and Beyor, 2005). Given the acceptance of price as a critical selection criterion in the industry, it is perhaps paradoxical that discussions of the value proposition are commonly divorced from the price/cost implications of value contracting. There are some interesting exceptions (e.g. Pregoner et al. 1999; Christodolou, 2004; Riley et al. 2005), but for the most part only value, as distinct from value-added, are treated in these arguments. This distinction was also noted in the discussions with contractors for the present research, as described elsewhere in this report. It is important to keep the distinction between value = benefits, Wong et al. 2000; Kliniotou, 2004) and value-added = benefits compared to associated costs, in mind when considering the literature. In spite of this definitional difficulty, a number of important concepts can be found in the literature.

1. A perspective on value should become a competitive advantage.

It is probably fair to say that there is no universally accepted definition of the concepts of value or value-added in the literature, although as stated previously there does seem to be consensus that value for a particular project is subject to definition by the owner/customer. Sandhu and Gunasekaran (2004) point out that it follows logically that a contractor in a project setting who excels in providing value must become extremely proficient at understanding owner concepts of value, and translating those concepts into

the finished product. Having developed that proficiency, the contractor should then be able to attract higher margins, owing to high levels of customer satisfaction that should logically follow customer satisfaction. Sandhu and Gunasekaran treated a generic project-based industry, rather than focusing specifically on construction, but use a power plant construction project as a case study. Farr (2001) suggests that a value perspective should become a revenue enhancing tool for engineering services, a perspective which is shared by Sturts and Griffis (2005). Such arguments are not uncommon in the literature, but are made on qualitative rather than quantitative arguments. Farr (2001) points out that design fees have increased at a rate well below inflation over the last three decades, and Choi and Russell (2005) found margins in the construction industry to be relatively low compared to other economic sectors. This suggests that, while there would seem to be relative consensus that a value-perspective should increase margins and provide competitive advantage, especially in regards to repeat customers, the strategy has either not been widely adopted or has not been effectively adopted. Christodoulou et al. (2004) make the interesting argument that a culture of price-based selection (or primarily price-based selection) in public sector construction place pressures on margins and perpetuate a price-dominant conception of value in the industry.

Perhaps as a reflection of the value versus value-added problem, Maloney (2002) suggests that provision of projects within budget, on time, and in accordance with the plans and specifications will satisfy the owner's broadest and most widely recognized needs. However, Maloney alleges that repeat business will require attention to additional, relatively intangible features of the "service encounter", such as courtesy, responsibility, and credibility. Tang et al. (2003) present similar arguments. Interestingly, there is a

significant body of literature in which rubrics are sought (or developed) for quantifying subjective aspects of the selection process (e.g. Jaafari, 1996; Jennings and Holt, 1998; Palaneeswaran and Kumaraswamy, 2000; Wong et al. 2000; Alarcon and Mourgues, 2002; Tang et al. 2003; Shr et al., 2004; Wong, 2004; Kululanga and Price, 2005; Minchin and Smith, 2005; Pulaski and Horman, 2005; Sanchez et al. 2005; Oyetunji and Anderson, 2006). In general, these schemes bear little resemblance to each other, suggesting that the quantification rubric is heavily dependent on the sample used to create it. However, from a relative rank perspective, there are certain elements of value which consistently are recognized as important in these efforts, as will be discussed later.

2. Procurement of the lowest cost services (especially design services), where “cost” means “upfront cost” may not be the best strategy in the long run. Further, consideration of factors other than cost, including time, quality and safety, in making these choices is beneficial to the owner in the long run. Because it has been recognized widely that price is an important selection criterion (indeed, in the case of public construction price may be nearly the only criterion), there have been frequent studies of the effectiveness of the resulting procurement. Interestingly, each such study found in the literature concluded that the price-dominant selection was *not the most effective approach*. Because this issue is central to the question of whether, and to what extent, value-added services should be considered by an owner, some elaboration of several examples of recent studies will be provided.

Wong, et al. (2000) extensively surveyed contractors in the United Kingdom in civil engineering and building construction sectors, with the objective of understanding selection practices in use in the UK in these sectors. They found that a number of non-

price selection criteria were in use. Based on anecdotal information, they suggested that the growth of multi-criteria selection indicated an increasing recognition of the importance of various value dimensions in the selection process. Palaneeswaran and Kumaraswamy studied design-build project delivery, and concluded that multi-criteria selection practices were extremely important, and more likely to lead to a satisfactory result for the owner. Sandhu and Gunasekaran (2004) studied power plant procurement from a business-process development perspective. Using process maps, they considered the influence of first-price selection on the overall outcome, and compared this to a value-creation perspective. They concluded that because of the high degrees of coordination between different, fragmented contractors required, a price-dominant approach would be detrimental to the overall effectiveness of the outcome. Wong (2004) related performance to the selection criteria used for UK construction projects, and found that several non-price criteria resulted in improved overall project performance. Christodoulou et al. (2004) studied the total cost (construction plus design) for projects procured with price-dominant selection practices for New York City, compared to the total costs for projects procured with qualifications-based selection for New York State. They concluded that the low-price design procurement were substantially less cost effective when in light of resulting construction costs. Caridi, et al. (2004) studied e-procurement practices leading to price-based selection practices in many industries, and concluded that while e-procurement can be appropriate in some settings, engineering and construction services may not be a good fit. Based on a case study of a pharmaceutical plant e-procured with heavy reliance on reverse auctions, Caridi et al. found that winning

contractors' lower prices were more than offset by increased owner transaction costs in delays, disputes, and interface failures.

3. A number of particular value characteristics (i.e. specific benefit types) have been studied, and found to relate to improved overall performance.

In addition to the studies summarized in item 2 above, a number of individual types of benefits have been studied in recent years. In general, investigators have found several individual types of benefits to be important, either conceptually or quantitatively, to improve overall project performance from a net perspective. Examples include:

Design coordination

Riley et al. (2005) studied the net cost impacts of mechanical, electrical, and plumbing interferences in high-rise construction, finding that there is a significant time requirement to avoid such problems, and a high cost for failing to coordinate effectively. Their results suggest that first cost savings of the design effort may be offset by construction phase interference costs.

Risk

Al-Sobie et al. (2005) studied the potential for contractor default during construction projects. They develop means of predicting contractor default for a project, based on owner risk behavior, contractor characteristics, and project characteristics. They suggest that risk premiums should be accounted for when evaluating contractor bids, and provide a genetic-algorithm approach to such considerations. Langford et al. (2003) made a similar argument based largely on conceptual grounds, arguing that rising risk levels translate to higher transaction costs for the owner, which should be considered in the selection of both contractor and contract strategy.

Use of Information Technology Tools

Thomas, et al. (2004) used the CII database to conduct statistical analyses relating project performance parameters to the use of design information technology tools. They found that projects with exemplary levels of use of information technology tools resulted in construction cost savings and schedule compression for the owner. Kale and Arditi (2005) found that design information technology tools spread throughout practice as a result of both owner/customer pressure and productivity enhancement/peer pressure, and that the productivity enhancement/peer pressure motivation is the more important of the two. This result suggests that design IT tools have inherent competitiveness advantages for the final product. Interestingly, Sturts and Griffis (2005) question whether the evolution of these tools necessitate a dramatic re-structuring of methods of compensation for engineering services, arguing that fee-for-time payment schemes in common usage do not adequately reflect the engineering contribution to the value stream of the project as a result of IT tools.

Sustainability or “Green Building”

Pulaski and Horman (2005) point out those designing and building structures to incorporate sustainability, lower operating costs, or so-called “green” technologies can increase the complexity of the design effort substantially. However, they propose methods for incorporating such consideration into the design solution at key points in the process. Interestingly, they suggest that the importance of sustainability in the design solution may become a more important non-price criterion for selection and project measurement in the future.

4. There are strategic decisions to be made by both owners and contractors regarding the value proposition they will support.

The implications of the value (or value-added, in this case) perspective for both owners and contractors have been discussed extensively in the literature. In regards to owners, the ability to articulate and specify the desired features of the project have been found to be critical to project success. Several investigators have pointed out that supporting such ability requires significant transaction costs, including maintaining engineering expertise in order to communicate requirements (Leung and Liu, 2003; Sandhu and Gunaskekaran, 2004; Fujitani, et al. 2005), conducting multi-stage qualification and pre-qualification practices (Jennings and Holt, 1998; Lo et al., 1998), and the management of the risk of contractor failure and its attendant problems (Al-Sobie et al. 2005). Each of these studies found that owners who were not able to provide these functions achieved less effective project results, typically on a net construction basis (that is, incorporating construction costs, changes, and design costs along with costs for delays and startup problems). This result implies that owners who make a strategic decision not to maintain such abilities must find another means to obtain them on a project-by-project basis.

Similarly, there is recognition (either explicitly or implicitly) in the literature that contractors should decide what kind of market they wish to serve (e.g. Farr 2001). In the case where the projects are of low complexity and/or are extremely well communicated by the owner, the contractor must address reduction of overhead as a strategy for cost-competitiveness. However, if these conditions do not exist, contractors must resource the ability to understand owner requirements and to market this ability appropriately (Farr, 2001; Carr and Beyor, 2005).

2.1.2 CII Literature

The library of past CII projects contains a great many reports that are arguably related to the general topic of commodity/value-added contractor services. This was recognized explicitly in the request for proposals, where it was indicated that a great number of CII practices and best-practices have been developed with the intention of making it possible to increase value for the owners of capital facilities via contractor actions. Because so many of the documents are potentially relevant, it is not intended to provide here a rigorous summary of the relationship of all of the CII documents to the topic at hand. Rather, a few areas that were particularly relevant to the research effort will be reviewed.

Probably the most important concept relating to this topic, as measured by the amount of discussion it engendered at research team meetings, was the so-called “influence curve. This figure is often cited and well accepted by both the CII membership at large and the academic community in general. It relates the influence of decisions made at various stages in the project life cycle (or, conversely, the cost of a change) as a function of time in the life of a project (see Figure 2.1).

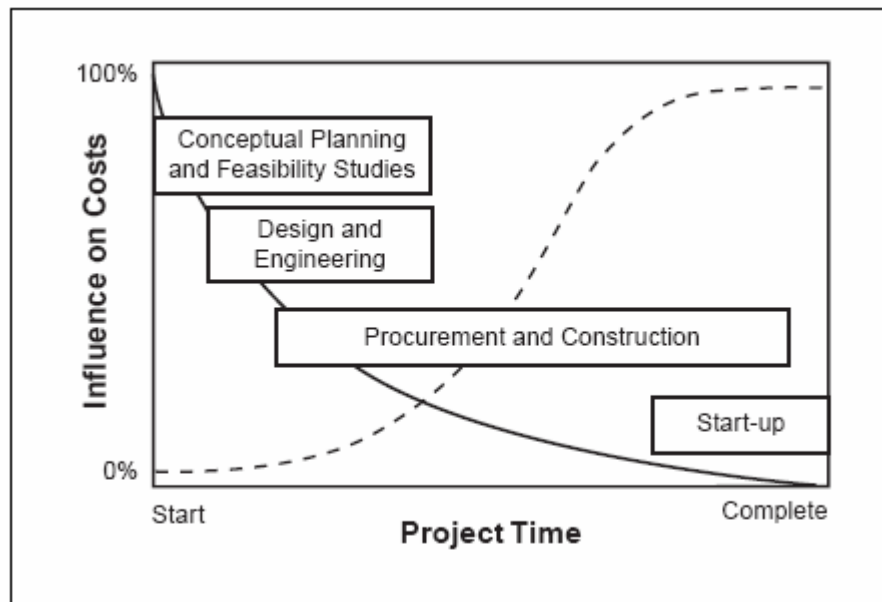


Figure 2.1: The Cost-Influence curve, taken from CII RS 105-1, 1996

This chart, or something very similar, can be found in a number of CII documents, including (for example) 105-11, Source document 102, Source document 97, and Source document 4. The logic of CII 6-2 (1986) and subsequent development of the PDRI is clearly influenced heavily by this concept. If scope definition is clear, and scope is rigidly controlled, then one might expect to improve project performance based on the curve above. The curve, while widely accepted, does not appear to have been analytically verified. Indeed, it is not entirely clear how one would verify it explicitly, as doing so would seem to require conduct of multiple repetitions of the same project with control of the decisions and measurement of the resulting cost differences – something which is difficult to imagine doing. Accordingly, the curve seems to have been developed initially based on conceptual arguments (Garred, 1973), and to have been defended on those terms in the CII literature. For example, the observation that better defined projects (as by higher PDRI) have better cost control experiences (Gibson and Hamilton, 1994) has been taken as suggestive of the validity of the influence curve. This curve would seem to

imply that the earlier the activity comes in the project life cycle, the more its influence on the eventual project outcome. This implication might be taken to mean that more value attaches to earlier decisions.

2.2 Definitions

Because it is essential to our discussion of the literature, we are presenting a major result of this study - the definitions. Table 2.1 contains the 25 definitions that resulted from the early research of the team. See Appendix C for a table of links of definitions to the CII literature.

Table 2.1: Definition of Terms

Term	Definition
1. Owner	The party that holds title to the project.
2. Primary Contractor	The party that is contracted directly with the Owner operator.
3. Subcontractor	The party that has a contract for goods/services with a primary Contractor.
4. Supplier	A party that provides goods/services.
5. Goods	Physical products and materials.
6. Services	Labor-intensive tasks (activities).
7. Extended product	The goods/service package to be delivered.
8. Value	Benefits provided. (Used with modifiers such as market value, perceived value.)
9. Value-Added	Marginal increase in value created by features/functions of a good/service.
10. Net Value-Added	Value in relation to its associated cost. (The same concept as economic value-added.)
11. Differentiation	The dissimilarity of the features and functions of a good or service.
12. Commodity	An undifferentiated good/service.
13. Commoditization	The process of classifying a good/service as a commodity.
14. Standardization	The degree of adherence to a standard. (Output standardization, Process standardization)
15. Customization	The process of making features and functions unique for a potential customer.

16.	Module	A unit containing multiple components.
17.	Procurement	Procedures taken to acquire goods/services.
18.	Strategy	A planned set of linked, coordinated actions to achieve a long-term, overall goal.
19.	Tactic	An action undertaken to achieve a short-term, specific goal.
20.	Competitive Advantage	Realized differentiation in the market place
21.	Market Niche	A differentiated segment of the market.
22.	Project risk	Probability of a loss.
23.	Business Development	Conversion of Owner business needs into project goals.
24.	Spend Type	Sourcing group of like goods or services.
25.	Marketing	Bringing organizational resources to bear on marketplace opportunities to create exchanges

2.3 Key Definitions and Related Model

From the initial chartering of the Team, it became obvious that everyone was associating different meanings for the various terms in the discussion, especially “commodity”, and “value-adding”. The Team thought it vital to the success of the study that precisely defined terms should be used to help aid understanding. The RT205 Research Team invested considerable time in developing a set of defined terms that the Team, CII, and the industry could use. Table 2.2 below provides the definitions of key terms that are important to understanding the rest of the research. Differentiation became a key point of clarity for the Team and industry participants in the workshops. Defining a commodity as an undifferentiated good/service provides clarity for all stakeholders. A mutual understanding that a commodity is undifferentiated allows an Owner and a Contractor to discuss what provides differentiation, how much value is added by the differentiation and what an appropriate cost is for the differentiated service in relation to its benefits.

Table 2.2 Definitions of Key Terms

•Value Benefits provided (used with modifiers such as market value, perceived value.)
•Value-Added Marginal increase in value created by features/functions of a good/service.
•Net Value-Added: Value in relation to its associated cost. (The same concept as economic value-added.)
•Differentiation The dissimilarity of the features and functions of a good or service.
•Commodity An undifferentiated good/service.

The communication problems are depicted in Figure 2.2, the Value-Added Contracting Model. Communication flows from the Owner are typically represented in the downward arrows while the value-add Contractors perceive they can contribute to the Owner's organization is represented in the upward arrows (bolder equals higher value-add). Value-added is achieved most recognizably when the Contractor's marketing and delivery strategies have a closer link to the Owner's marketing strategy for its products and services. The transaction interface between an Owner and a Contractor depicted can actually become a transaction barrier, further resulting in communication breakdowns and failure to produce the results that both parties truly need and desire.

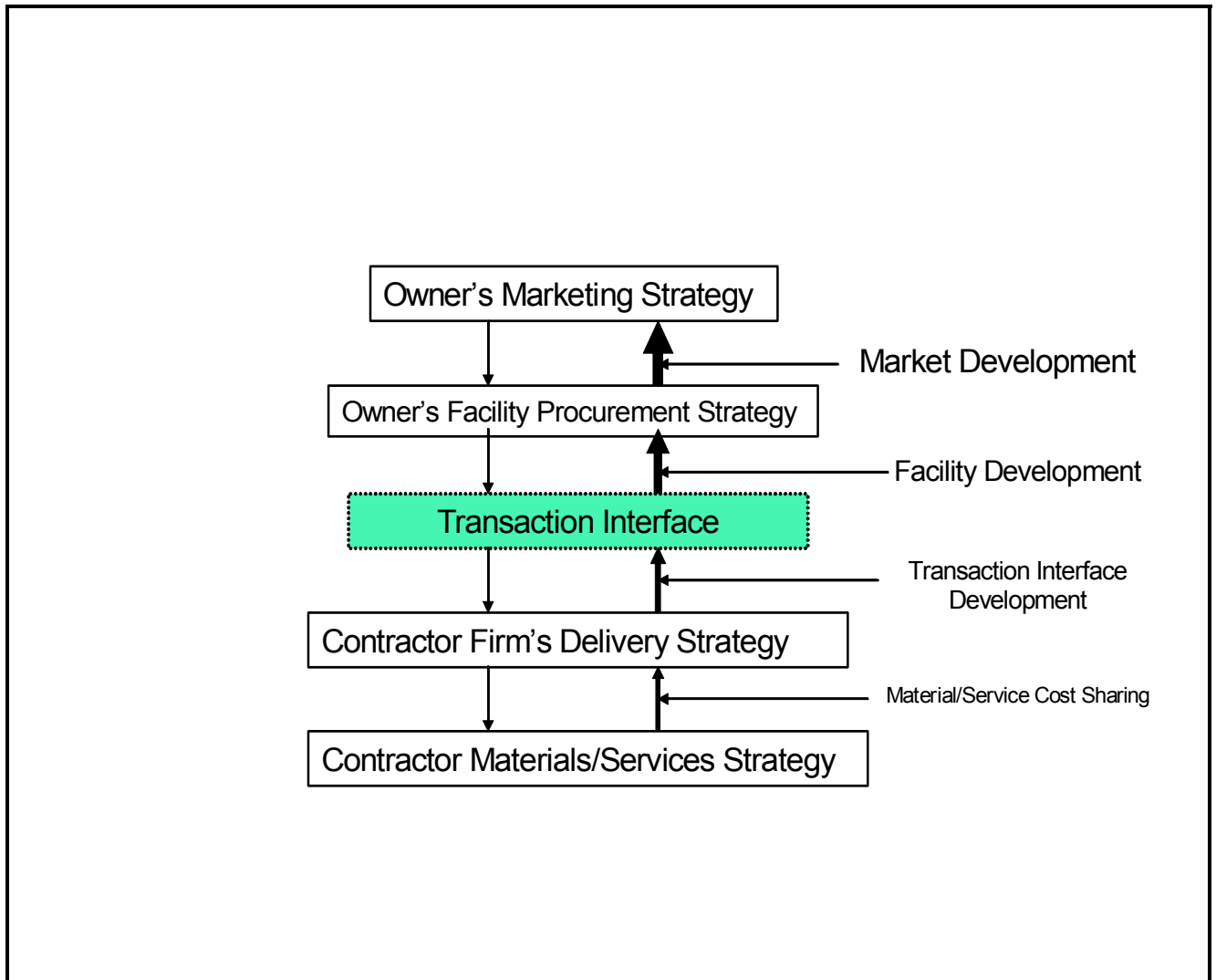


Figure 2.2: Value-Added Contracting Model

2.4 An Overview of Theory Supporting the Analyses

When the research team began the investigation of the ongoing relationship between owners and contractors, there was not a clear understanding of many aspects of the value proposition for awarding contracts. Although there are many factors that may affect the relationship, some specific factors were problematic such as: how the owner's market needs drive the need for a new capital project; the details of the contract, the complexity of the project, owner firm's engineering resources, contractor's engineering resources, owner firms efforts to detail contract, newness of technology, the degree of need for

changes in the contract, the ability to measure the engineering firm's contract performance, the risk associated with the engineering firm being able to 'pirate' owner firms proprietary processes (beyond those precisely specified in the contract), the risk associated with engineering firm buying resources that can only be used by the owner, and causes of contract premium. Even beyond the initial understanding of these and other factors, the interaction between factors and project performance does not seem straightforward. Therefore, the complexity of the issue is beyond normal understanding in the construction and business literature.

The transaction cost analysis model was developed to address buyer-provider relationships, and to provide a framework for these kinds of assessments. Other researchers have found this model to provide the most advanced understanding of the complex area of transactions. The initial studies on transaction cost analyses began in economics where the basic issue was "Why do organizations exist at all?" Coase (1937) analyzed this issue and concluded that organizations primarily exist to share resources through transactions. Coase's original analysis covered just the cost of transactions and labeled it 'transaction cost analyses. However, later studies expanded the analyses beyond cost to include benefits (such as Williamson (1975), Heide and John (1988) and others). To date, transaction cost analysis is by far the most inclusive and sophisticated analysis method for consideration of contracts between organizations to understand the relationships among factors in the contract negotiations and the effects of these factors. Because the academic literature on transaction cost analyses is very complex mathematically, extensive, non-cohesive and in a variety of journals, the following discussion is a rudimentary introduction to provide the basis for the resulting models that

are, fortunately, are relatively easy to understand. Unfortunately, there is no single source where an interested reader can capture the full extent of the depth of transaction costs analyses. Academics not familiar with transaction cost analyses find the literature to be somewhat vague and not complete in any one single literature source or even a short list of sources; therefore, we have chosen to provide the research team's perspective.

To proceed on the analyses, it is necessary to follow a specific format that answers the common questions for applicability: Who?; What?; When?; Where?; How?; Why?; and given these conditions what Should, Could, and Would happen? The analyses begin with 'who' and 'what' and the precise definitions of the terms (Wacker, 2004). The precise definitions are necessary for the following discussion of the model.

2.4.1 More Definitions

Table 2.3 presents some definitions used in transaction cost analyses.

Table 2.3: Definitions Used in Transaction Cost Analyses

<u>Adaptation:</u> When the portion of the contract is not clearly specified at signing, the owner and contractor must adapt to the previously unspecified conditions after the contract is signed. <u>Contract premium:</u> The degree of differentiation caused by the inability to completely specify all project details. This differentiation causes the financial cost to be larger than a completely specified project. <u>Ease of Performance evaluation:</u> If the contract is clearly specified, it enables the performance evaluation the specific project details. <u>Effort to detail specifications:</u> Time spent on detailing project requirements. <u>Governance:</u> How the owner of a contract will control the delivery of the goods/services. Traditional governances are: market (cost competitive), ownership (developing own resources), hybrid (long term relationships, JVs, etc.) <u>Opportunism:</u> When a contract needs adaptation, the degree to which one contract party to takes advantage of the other. <u>Project specifications:</u> The actual project's detailed specifications before contract is signed. <u>Safeguarding:</u> When a buying firm (owner) firm gives contractor access to its specific assets, then there is risk that the contractor may opportunistically exploit these investments. <u>Contractor assets specificity:</u> The specific assets the owner needs does not have available (resources used elsewhere or do not have) to complete the project.
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In all transactions, there are customers (owners) and there are suppliers (contractors). When an owner begins to understand its needs, it attempts to detail those needs. The degree of detail depends on the knowledge the owner has in the specific product (goods/services). The higher the degree of knowledge the more detailed the product specifications are. The less knowledge the owner has, more likely the owner will have to rely on the contractor for the project specification.

2.4.2 An Important Distinction for Complete Project Specifications

To begin this discussion, it is necessary to identify two very different interpretations of the term “Complete Project Specifications”. At one extreme the complete project specifications interpretation may be that the owner has completely specified the requirements of the project in terms of project performance. (Naturally, this interpretation assumes that the owner’s customer markets are static.) For this study, this interpretation will be called **complete project performance specifications**. At the other extreme, a second interpretation of ‘Complete Project Specification’ is the exact detail of every resource that is to be used in the project. (This means that the quantity of every material, labor type, equipment, etc. is completely specified.) For this study, this interpretation will be called **complete project resource specifications**. Both of these interpretations are extreme positions. Owners’ markets are always changing, causing the project performance needs to be dynamic and changing the project performance needs. At the other extreme, even if the exact resource needs were specified, the material, labor, and capital markets are changing causing the project resource specifications to change.

The two extremes present very different implications for what is net-value-added engineering since the complete project specifications mean that the owner has completely specified its project performance specifications. But to contractors, complete project specifications mean complete project resource specifications. Clearly neither of the positions is ever completely specified. Understanding the differences is a key to achieving the project's performance. The owner with a large amount of detailed specification will use a specific governance mechanism determined by the degree of specific project specifications in the contract. The higher the amount of effort to detail the project specifications, the more likely the product specifications will be complete. The less owner effort in detailing the specifications, the less likely the detailed project specifications will be included in the contract. If the product is completely specified, then the ease to evaluate contractor performance will increase. Consequently, effort to detail project specifications is positively related to the ease of contractor performance. The method to control the contract fulfillment is called contract governance. If the project is completely specified, then the form of governance will be market governance better known as a price competitive contract (in the case of the construction industry this will be an owner's commodity pricing strategy. Yet in other cases, such as new technology, it may not be possible to be specific enough in product specification to include everything important in the contract. When the project cannot be fully specified, then the evaluation of contract performance cannot be made. In this case, owner's must use rely on adaptation of the contract and the contract will demand a premium to the contractor. In this case, owners will use design changes after the financial sanction. These changes are made as the project requirements are clarified.

Additionally, when the owner does not have engineering resources to completely specify the contract, the contract will require a contract premium since the owner must rely on the contractor for project specifications. The more the owner relies on the contractor for project specification, the more likely the contractor may take financial advantage of the owner. This financial advantage is called contractor opportunism and is exemplified by charging a higher price or a contract premium. However, opportunism may occur in others ways such as an owner and a contractor entering into a contract when the owner knows in advance that the owner will have to purchase additional project specific resources (called asset specificity) to satisfy the owner's project needs. In this case, owners may require discounts on future projects because the contractor has purchased these project specific assets.

An important thing to note here is that owner efforts (would could be translated to transaction costs) must be expended under either scenario. Once again, we will consider the extreme cases for simplicity, recognizing that intermediate conditions are more likely. If the owner can completely specify the project, it will of course expend significant resources to do so, but it may then be able to measure contractor performance more easily, and have lower transaction costs during and after project execution. Conversely, if the owner cannot or chooses not to completely specify the project in advance, they will save on that portion of the transaction cost, but will have correspondingly higher costs during and after project execution. It is not clear which strategy will be more effective for a given type of project and a given owner-contractor pair.

In many cases, there is a requirement that the contract has to be adapted, or, in other words, a requirement for additional features arises after the contract is signed (adaptation from the table). Contract adaptation frequently causes contract premiums and therefore is a form of opportunism. The inability of the owners and contractors to address how to handle additional contract requirements (how to handle adaptation) before the signing of the contract causes both owners and contractors considerable costs. In some contracts, where the owner and contractor have a long-term relationship, contract adaptation may not lead to opportunism.

There are other limitations on the contract that involves specific assets. Consider the case where the owner has a very specialized process. This process is the owner's important asset and most likely will be a source of the owner's competitive advantage. The owner must protect this asset from the possibility that a contractor might, knowingly or unknowingly, give it to one of the owner's competitors. This protection is called safeguarding since the owner is trying to keep the contractor from transmitting the asset to competitors. Safeguarding is an attempt by owners to avoid contractor opportunism.

To the contractor there are also specific asset risks. In many cases, the contractor may have to buy a specific asset to fulfill the contract. This asset may have very limited uses for other contracts. When the asset is dedicated to a specific contract it is called contractor asset specificity. An owner knowing that the contractor has these assets that only apply to the owner's contracts, may take advantage of the contractor by demanding lower prices or concessions. The owner taking advantage of the contractor's asset specificity is another form of opportunism. In this case, it is owner opportunism based on the contractor's asset specificity.

In summary, the level of detail in a contract depends upon the owner's knowledge of the product. The level of knowledge and effort required to be specific on the product specification is related to ease of contractor performance measurement. The less the effort required, the more likely the contractor will be able to charge a contract premium. The need for contract adaptation allows contractors to be opportunistic after the contract is signed. Both parties need to protect themselves: owners have to protect the assets they own from contractors transferring them to competitors, and contractors have to be wary of the assets they buy for a specific contract.

The specific predictions from transaction cost analyses state that the less an owner can completely specify a project, the more likely the contract will demand a contract premium compared to a project completely specified. Therefore, the conceptual underpinnings are quite clear for negotiation of contracts. Though they may have many confounding factors, in general, the less an owner can specify a contract, the more likely the contract will require a premium and the contract will be a 'value-added contract'. As a side note, the CII project definition rating index is a good beginning for determining the degree that the contract is specified. However, it is not the focus this study.

2.4.3 A Simplification of Transaction Costs Analyses

A simplified version of the application of TCA theory to the capital facilities project domain is displayed in Figure 2.3. This explanation will begin with the center column of concepts and the left set of arrows going down. As suggested by TCA theory, the value of capital projects begins with the owner's market strategy that relates to the owner's market needs. The market dictates the owner's facility procurement strategy, or in other words their capital facility development program. In the procurement strategy, the

owner's engineering staff determines the level of engineering detail required for a particular project. The level of detail may range from general project requirements to exact specifications of each and every material, labor resource, and capital equipment. The more detailed project specifications are, the easier it is to evaluate project performance and the more likely the project will become price competitive. In short, the more a project is detailed, the more likely the project will be a commodity. The contractor may accept these terms and be considered a commodity provider.

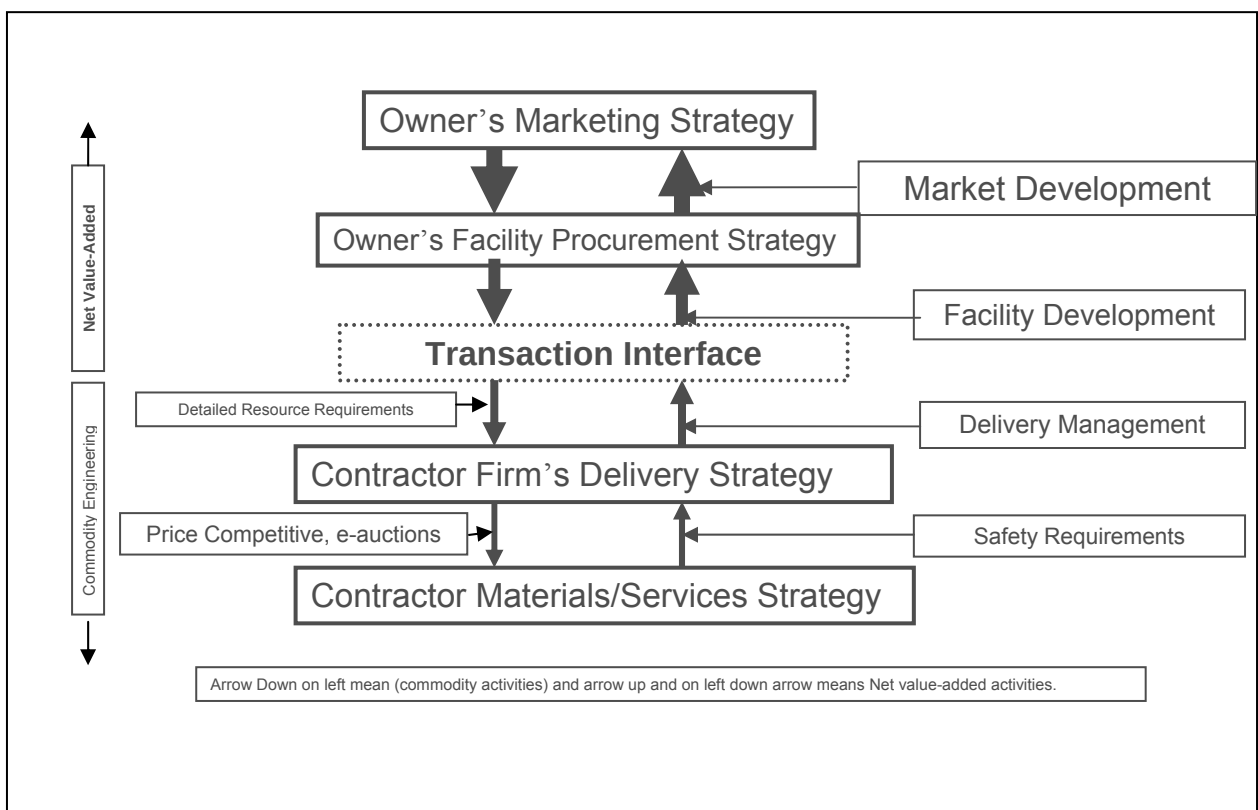


Figure 2.3: A Conceptual Model of Commodity and Net Value-Added Engineering Services

The arrows on the right side of Figure 2.3 depict the differentiators that are expected to add value. Project safety requirements are a necessary but not sufficient factor in all projects. The simplest metric for the safety differentiator would be the contractor's