Understanding Success and Failure in Outsourced Product Development

by

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Submitted to the Department of Mechanical Engineering
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy in Mechanical Engineering
at the
Massachusetts Institute of Technology

September 2011

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Abstract

Companies that develop new products increasingly outsource product design, a trend that has prompted much concern but little evidence on its effectiveness. This dissertation uses a combination of interviews, cross-case analysis, and survey data to examine the meaning, measurement, and causes of success in one type of outsourced development: design and innovation consulting. The first study identifies the many dimensions of success and demonstrates that consultants, clients, and scholars prioritize them differently. Clients emphasize the value and quality of the deliverable, while consultants prioritize design elegance, novelty, and commercial success. Client satisfaction, heretofore little used in outsourcing research, correlates highly with most success dimensions. The second study uses the identified success measures to assess 134 consulting projects. Rates of product commercialization and market success compare favorably to results previously reported for in-house development. Client satisfaction is comparable to that of other service industries but varies greatly across projects. Most outcome measures are robust to measurement timing but depend strongly on the seniority of the respondent and the level of anonymity afforded him or her during assessment. The third study identifies over fifty factors believed to influence project outcomes and distills them into two pedagogical frameworks. The final study combines these factors with theories of customer satisfaction and product development to generate explanatory models of client satisfaction and other project outcomes. Nearly 80% of the observed variation in satisfaction can be explained after the fact, and 36% predicted before the project begins. Contrary to prior reports, design consultancies are least effective at radical innovation. Rather, they excel at *rapid* innovation in familiar product categories, designing products far more quickly than bureaucratic organizations and inexperienced start-ups can. Client satisfaction is unaffected by corporate cultural distance between parties, and actually declined with decreased physical distance and increased manufacturer involvement, challenging conventional wisdom in product development.

The dissertation contributes to understanding of outsourced product development by clarifying key concepts such as success, demonstrating the impact of methodological details on its measure, and developing novel survey methods to gather unique outcome data from a broad range of respondents.

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Acknowledgements

This research would not have been possible without the support of several organizations and literally hundreds of individuals. First, I am tremendously grateful to the MIT-Portugal Program for providing financial support of my education and research, as well as frequent opportunities to share my work with students, faculty, and practicing engineers. It is quite rare to be given as much academic freedom as I was. I chose a topic that I believe will be useful to the mission of Fundação para a Ciência e a Tecnologia; I hope the benefits to the Portuguese people will help to repay my hefty debt. On a personal level, I must thank Chris Magee, Robin Lemp, Gerri Powers, and Terra Cholfin for their assistance in matters related to the Program.

Secondly, I must thank my advisor, Dan Whitney, for his tireless support of my research. Whereas most doctoral candidates struggle to get their advisor's attention, Dan and I met for up to three hours nearly every week. His knowledge is encyclopedic, his eye for detail remarkable, and his passion for product development research unmatched. He was an insightful critic in private and a staunch advocate in public; I am grateful for both. My committee members too were very helpful in guiding my research. Whether by accident or design, they complemented each other perfectly: Warren Seering provided valuable reassurance of the quality of the work while Steve Eppinger challenged me to make it even better.

Even with generous financing and expert advising, I could not have conducted the research without the participation of six design consultancies, three dozen interview participants, and over two hundred survey respondents who gave generously of their time with no incentive other than advance access to preliminary results. I wish that I could publicly thank them, but out of respect for their candor they must remain anonymous. I hope that they will find the results as fascinating as I do, and find practical utility in them as well.

My time at MIT has been made considerably more pleasant by the unflagging support of Leslie Regan, Joan Kravit, and Una Sheehan in the Mechanical Engineering Graduate Office. I am continually amazed at both their wisdom about how to navigate the Institute and their genuine compassion for the students who must do so. Thanks especially to Leslie for helping me arrange my defense on short notice, and to Maria Yang, Richard Wiesmann, and Tomonori Honda for attending it to ensure that I met summer quorum.

Most importantly of all, I thank my family and friends for their support and patient understanding throughout these four years. I look forward to spending time with you again rather than with this dissertation! To Sonya especially, who gave so much and asked so little, and whose companionship has made this whole endeavor worthwhile. Thank you.

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1 Overview

1.1 Introduction and Objectives

Firms that develop, brand, and sell new products have long used selective outsourcing of production and service activities to focus on core capabilities and achieve competitive advantage. Increasingly, these firms are outsourcing front-end development activities such as product design, a trend that has prompted concern from scholars and practitioners alike. Business strategy scholars caution that outsourcing design work may jeopardize the firm's intellectual property, erode its internal capabilities, and even develop its current suppliers into future competitors [1-3]. The trade literature suggests that outsourced product development projects are frequently late, over budget, or fail to meet requirements [4, 5]. Surveys of product development professionals find that many are suspicious of outsourcing product design [6], with nearly a third of those at large firms believing that design outsourcing is a net liability to their company [7].

And yet the use of outsourced product development continues to grow [3, 6, 8, 9], presenting an apparent paradox: Why are firms increasingly outsourcing design if both strategic theory and operational experience caution against doing so? Perhaps they are simply behaving irrationally. Or maybe competitive pressure and/or resource constraints leave firms no choice but to outsource, despite their misgivings. A third explanation is that the reported increase in design outsourcing may be exaggerated. A fourth possibility, one that this dissertation explores, is that outsourcing outcomes, and practitioner attitudes towards them, have been misreported. Perhaps the trade press has painted an unrealistically gloomy picture, by focusing on the wrong measures of success or by asking the wrong people to evaluate them.

Indeed, close inspection of these reports reveals conceptual and methodological shortcomings that may compromise their results. Some of the studies do not define their outcome measures, but rather use vague terms such as "success," "struggled," and "disaster" [4, 10]. Others conflate the causes of poor outcomes (e.g., "3rd party lacked management ability") with their effects (e.g., "project failed to meet requirements") [5]. Few specify the type of design outsourcing they are referring to or reference baseline data on the outcomes of non-outsourced projects. Most use

survey methods, but the response rates are very low (e.g., 2.7% [5]) or unstated [4, 11], casting doubt on the representativeness of the responses.

Presumably peer-reviewed academic research would be more rigorous, but to date very little has been performed on the outcomes of outsourced development projects. Scholars have instead focused on the motives behind firms' outsourcing behavior. In addition to the strategy literature cited above, operations management scholars have sought to explain firms' decisions to outsource particular projects in terms of such factors as product complexity [12], technological uncertainty [13], and firm and supplier capabilities [13, 14]. They have generally not investigated the consequences of those decisions, nor, surprisingly, included them in their decision models. To the author's knowledge, only one academic study has examined outsourced product design outcomes in detail, and it focused on the atypical case of very small firms that received government subsidies to hire a design consultant [15].

Given this dearth of reliable information on design outsourcing outcomes, an initial objective of this dissertation was simply to gather high quality descriptive data. In doing so, it became apparent that measuring project success is far from simple. For starters, *success* means different things to different people. Project benefits may be direct (e.g., a successful new product) or indirect (e.g., knowledge gained that will benefit future work), and performance can be assessed in the near term (e.g., schedule and budget performance) or the long term (e.g., the ultimate return on the client's investment). As a result, practitioners identify many different dimensions of success. Unfortunately, few firms formally evaluate their outsourced development projects [11]. Assessment by an outside researcher is further complicated by the fact that few firms wish to draw attention to their outsourcing behavior, given the negative coverage of "outsourcing" in the popular media.[1] In addition, the measurement and public reporting of project outcomes has personal implications, both political and financial, to most informants that might bias their responses. As a result, a significant portion of this dissertation focuses on building a foundation from which to measure project outcomes: clarifying key concepts such as the meaning of success, developing novel data collection techniques to study what is in many ways a sensitive

[1] In supply chain research the term *outsourcing* simply implies that the activities are performed by a party other than the firm. In the popular media, *outsourcing* is often used as shorthand for *offshore outsourcing*, and has even been used to refer to offshore insourcing [20].

topic [16], and documenting the effects of methodological choices such as measurement timing on the results. This foundation constitutes the dissertation's first contribution, and it is hoped that it will help to spur progress in this field of inquiry.

The second contribution is the descriptive data themselves. They suggest that both project outcomes and practitioner attitudes are better than previously reported but vary significantly between individuals, projects, and firms. Past studies have understated this variation, presenting averages and totals but not ranges or distributions. The present results show that some projects do very well while others struggle, a finding which begs explanation. The few empirical studies conducted to date assign blame for poor outcomes to specific supplier and firm errors such as ignorance of the design brief, poor communication, and lack of commitment to the project [5, 15, 17, 18]. Certainly these do occur in practice, but they may actually be symptoms of underlying causes such as the client's reason for outsourcing the project. Theoretically richer mechanisms such as cultural and organizational distance between firm and supplier have been suggested [1, 17, 19], but these lack empirical support in this domain.

Thus, the third contribution of the dissertation is the identification of factors that can account for the observed variation in project outcomes. Possible explanatory factors are identified from the literature and via original qualitative research, and then organized into two unifying frameworks that can help practitioners to better plan and control outsourcing projects. Finally, the identified factors are combined with theories from two distinct fields of research – new product development and customer satisfaction – to develop models that accomplish the fourth and final contribution: explaining project outcomes. The first model illustrates how commonly used outcome measures relate to one another. This model suggests that client satisfaction is a key outcome that accounts for many otherwise orthogonal dimensions of success. The second set of models explains client satisfaction in detail. Two levels of explanation are possible: one can *account* for satisfaction after the fact, based on the events that occurred during the project, or one can attempt to *predict* satisfaction in advance, based solely on factors known at the start of the project. The latter would aid practitioners in deciding which projects to outsource and which to develop in-house, while the former would help them to manage the projects that they do choose

to outsource. The results suggest that 79% of the observed variation in client satisfaction can be explained *ex post*, and as much as 36% of the variation in satisfaction anticipated *ex ante*.

To summarize, the objectives of this dissertation are:

1. To clarify the meaning of *success* in outsourced product development, by identifying its many dimensions, comparing the perspectives of different types of practitioners, and demonstrating how the various outcome measures relate to each other
2. To describe the distribution of project outcomes in one particular type of outsourced product development: design and innovation consulting
3. To identify and characterize factors which influence project outcomes
4. To use the identified factors to explain the observed variation in client satisfaction and, to the extent possible, predict it in advance

1.2 The Research Setting: Domestic Design Consulting

Part of the confusion about outsourcing effectiveness results from the existence of several distinct types of outsourced product development [14, 20], each with different objectives, different risk factors, and possibly different success rates [7]. Figure 1-1 illustrates three common outsourcing modes. In *integrated design-and-production outsourcing* a single supplier designs and produces the product to meet the client firm's general specifications [21].[2] Integrated design-and-production outsourcing is commonly utilized in the automotive, aerospace, and electronics industries, and performed by companies such as Magna-Steyr, Hamilton Sundstrand, and Flextronics. Such companies are often referred to as original design manufacturers (ODMs). In *design consulting* (increasingly referred to as *design and innovation consulting*) design activities are outsourced to a consultant who does not perform production activities on the product [22]. Production may be outsourced to a third party contract manufacturer or retained within the client firm. Design consulting is commonly utilized in consumer, medical, and industrial products, and performed by consultancies such as Battelle, IDEO, and Wipro.

[2] In academic research, the term *black box outsourcing* has been used to distinguish this practice from more conventional production-only outsourcing [21]. However, this term is not commonly used in industry.

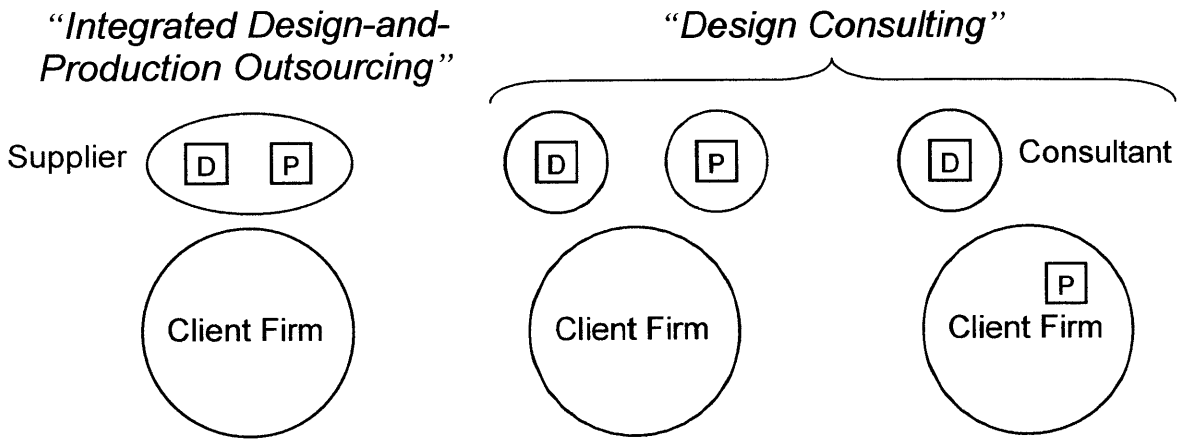

Figure 1-1: Three modes of outsourced product development. Circles represent the boundaries of the respective companies, and the letters "D" and "P" indicate the locations of design and production activities. Diagram adapted from [14].

A second distinction can be made based on whether or not the client firm and the design service provider are located in the same country [20]. Thus a client firm could outsource design activities to a domestic or international design consultant, or a domestic or international ODM. It could also offshore design activities to a captive (i.e., client-owned) development group. Past studies on outsourced product development have sometimes failed to identify which of these many forms of distributed development they are referring to [4, 11, 23, 24], or have commingled them in analysis [3, 19]. Both approaches are imprecise and may lead to false conclusions.

Although most academic research has focused on integrated design-and-production outsourcing [2, 12, 13, 25], design consulting may actually be a better context in which to explore the causes of outsourced design success and failure. First, because design activities are performed independently of production activities, it is possible to isolate the effects of outsourced design from those of outsourced production. Second, design consulting is typically applied at a smaller scale than is integrated design-and-production outsourcing. Project difficulty generally increases with increasing project size [26]; studying large projects such as an automobile or an airliner make it difficult to untangle the effects of scale from those of design outsourcing. Finally, because design consulting projects are relatively small, they turn over quickly, making design consultancies the "fruit flies" of the design outsourcing world [3] and enabling examination of a large number of projects within a reasonable amount of time.

Design consulting is practiced in a range of industries, from software [27] to biotechnology [28], but this dissertation will focus on consumer, medical, and industrial products. Such products are small enough to be studied yet complex enough to be interesting, requiring the coordination of expertise from several functional specialties (user research, industrial design, human factors, mechanical and electrical engineering, etc). Furthermore, the population of consultancies specializing in these types of products is well-defined [29]. Lastly, the author has personal experience working on both the client and consultant sides of this industry, which improves access to research informants and informs his analysis of the data.

1.3 The Research Design

To accomplish the research objectives, while avoiding the pitfalls that have plagued prior research, this dissertation takes a different approach. First, it is empirically grounded. Theory is used to frame the questions and interpret the findings, but the results themselves are data-driven. Second, it focuses on a specific form of outsourced product development, design consulting, as discussed above. Third, data are collected using multiple methods to balance the shortcomings of each method. Qualitative techniques are first used to clarify the key concepts and develop hypotheses, which are then tested using quantitative analysis. Fourth, to improve the reliability of the data, they are collected from multiple perspectives, both client and consultant, currently and formerly employed in the industry, at a range of seniority levels. Together, these methodological choices produce higher quality data, which in turn allows for more valid inference.

The data were collected in three phases. In Phase 1, in-depth semi-structured interviews were conducted with 36 experienced design consultants and clients. The interviews exposed the many different dimensions of success, and hinted that they are prioritized differently by the various types of respondents. The interviews also suggested over one hundred different factors that influence project outcomes, which were distilled into a process-oriented typology featuring 51 key factors in fifteen steps of the development process (Figure 4-1).

To complement the interview data, a second exploratory phase was performed in which the unit of analysis shifted from the individual to the project. Through the participation of one

consultancy, thirty projects were studied in detail. Data were gathered as suggested by the findings of Phase 1, and analyzed both qualitatively and quantitatively to reveal patterns and common themes. The process of gathering the data also served to pre-test the data collection procedures to be used in the final phase.

Phase 3 consisted of a cross-sectional survey of 104 projects performed by ten design and innovation consultancies. For each project, data on project characteristics, mid-project events, and project outcomes were gathered from up to five different client and consultant individuals who had participated in that project. These data form the primary source for the descriptive analyses as well as statistical testing of explanatory hypotheses generated from the literature and the first two research phases.

Table 1-1 summarizes the research approach. The three phases are shown as columns, while the rows represent the key research objectives. Each cell in the matrix features the analyses that were performed during that phase (column) to address that research objective (row), along with the section of the dissertation in which the results are presented. For example, the interview phase yielded a typology of success dimensions which helped to clarify the meaning of success and is discussed in Section 2.4. The dissertation is structured topically rather than chronologically, so that each research objective is addressed in turn. Within each objective, the analysis generally moves chronologically from Phase 1 to Phase 3.

Table 1-1: Overview of the research design. Entries in the cells indicate the analyses used to accomplish each objective.

Research Phases / Research Objectives	**Phase 1** **In-Depth Interviews** ***n* = 36** **March – October, 2009**	**Phase 2** **Cross-Case Analysis** ***n* = 30 projects** **March – September, 2010**	**Phase 3** **Benchmarking Survey** ***n* = 104 projects** **October 2010 – June 2011**
1. Clarify *Success* ▪ Identify meanings ▪ Compare perspectives ▪ Prioritize measures	Section 2.4 ▪ Typology of success measures ▪ Qualitative client / consultant / literature comparison		Section 2.5 ▪ Quantification of meanings used to evaluate projects ▪ Quantification of practitioner mental models of success ▪ Kano analysis of measures
2. Measure Success ▪ Objective outcomes ▪ Client satisfaction ▪ Consultant satisfaction ▪ Effect of methods	Section 3.5.1 ▪ Preliminary willingness to recommend data	Section 3.4 ▪ Objective project outcomes ▪ Consultant satisfaction data	Sections 3.4 and 3.5 ▪ Objective project outcomes ▪ Client satisfaction data ▪ Consultant satisfaction data ▪ Sample type, respondent type, measurement timing
3. Identify Success Factors ▪ Identify factors ▪ Prioritize factors ▪ Unify factors	Sections 4.5 and 4.6 ▪ Success factor typology ▪ Qualitative FMEA ▪ Failure modes framework ▪ Outsourcing motivations framework	Sections 4.5 and 4.6 ▪ Clustering analysis ▪ Quantitative FMEA	Section 4.5 ▪ Quantitative FMEA
4. Explain Project Outcomes ▪ Analyze inter-relationships ▪ Detailed explanation of client satisfaction	Section 5.3 ▪ Hypothesis generation	Section 5.3 ▪ Hypothesis generation	Section 5.5 ▪ Hypothesis testing ▪ Deductive regression models ▪ Inductive regression models

1.4 Dissertation Structure

The dissertation is organized around the four major research objectives, each of which receives its own chapter (Chapters 2 through 5). To avoid overwhelming the reader, motivational evidence, literature review, and detailed description of methods are not presented all at once at the start of the dissertation but rather are gradually revealed on an as-needed basis throughout the four major chapters. For the sake of space, redundant information is generally not repeated, but references are made to prior chapters as appropriate. Supporting materials, including all recruitment materials and measurement instruments, are provided as appendices at the end of the dissertation. Chapter 6 synthesizes the various findings, addresses the strengths and limitations of the work, and suggests directions for future research.

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2 The Meaning of Success in Outsourced Product Development: Academic, Consultant, and Client Perspectives

Prior research on outsourced product development has focused primarily on the motives behind firms' outsourcing decisions, with less attention paid to the outcomes of those decisions. The few existing outcome-oriented studies have reported high project failure rates, but little consensus exists as to what is meant by success *and* failure *and some studies do not define success at all. Such ambiguity hinders explanation of these findings and makes comparisons between studies difficult. To provide conceptual clarity, this chapter identifies and characterizes the many meanings of success in outsourced product development. Academic and practical perspectives are first identified from the literature and from in-depth interviews of 36 design consultants and consulting clients. The perspectives are organized into a typology featuring seven key dimensions of success, and the relative importance of each dimension is determined using a survey of 194 additional practitioners. The results suggest that past research has generally focused on the wrong project outcome measures, overstating the impact of problems during development and the relative importance of return on investment, and omitting key measures such as working relationship quality, project value, and client satisfaction. While each measure has it merits, client satisfaction appears to be a promising summary measure.*

2.1 Introduction

Firms that develop, brand, and sell products have long used selective outsourcing of production activities to achieve competitive advantage. Increasingly, these firms are outsourcing front end product development activities such as industrial design and design engineering as well [1-4]. Although academic research is limited, evidence from the popular and trade literature suggests that firms struggle when outsourcing design. Outsourcing-related problems on Boeing's 787 cost the company $2.5 billion dollars in the third quarter of 2009 alone [5], and have delayed the project by over three years [6]. A nationwide survey of electronics design outsourcing managers

found that 65% had experienced a project that took longer than expected, 46% had experienced cost overruns, and 21% had received a project that failed to meet requirements [7]. Nearly one third of managers at large companies reportedly view design outsourcing as a "net liability" to their companies [8]. Collectively, these cost overruns, schedule delays, and lost opportunities cost firms dearly. By contrast, successful outsourcing projects can create enormous value. Reebok's Pump sneaker, developed collaboratively with the design consultancy Continuum, is said to have generated $1 billion in new sales for Reebok [9]. A better understanding of the causes of failure and sources of success could turn more outsourced design projects from liabilities into assets.

Perhaps surprisingly, design outsourcing outcomes have received little scholarly attention. Research has instead focused on the motives behind firms' decisions to outsource. One stream of literature considers strategic factors such as the dissemination of the firm's intellectual property, the potential erosion of the firm's internal capabilities, and the competitive risk of empowering suppliers [2, 10, 11]. A second, more tactical stream seeks to explain firms' outsourcing decisions in terms of such factors as product complexity [12], technological uncertainty [13], and firm and supplier capabilities [13, 14]. These studies are descriptive rather than prescriptive; they describe what firms actually do, without regard for whether the decisions they make are sound. The author is aware of only two academic studies that report the outcomes of outsourced design projects. Amaral and Parker observed that nearly two thirds of outsourced platform design projects at *Fortune* 1,000 companies "struggled or failed" [15]. Roy and Potter reported that 27% of UK manufacturers receiving a grant to hire a design consultant "experienced problems" during the project [16], and approximately 40% of all projects resulted in a financial loss for the client firm [17].

Unfortunately, the strength of these findings, along with those in the trade literature, is tempered by lack of precision in how success is defined and measured. Some studies do not define their outcome measures, using only abstract terms such as "success" [18], "struggled" and "failed" [15]. Others conflate the causes of failure (e.g., "3rd party lacked management ability" [7]) with their effects (e.g., "project failed to meet requirements" [7]). Such ambiguity makes it difficult to assess the causes of poor project outcomes, and impossible to compare findings between studies.

In addition, all of the studies published to date present only the perspective of the client firm, reporting neither the meaning of success to the design service provider nor the provider's perspective on what enables success. While the client perspective is necessary to understanding these issues, it is insufficient.

As part of a larger effort to document and explain variation in outsourced product development outcomes, this chapter examines the many meanings of *success* in this domain. Specific objectives are to: 1) identify meanings and measures used in past research, 2) identify meanings and measures commonly used by client and consultant practitioners, 3) organize the identified meanings into a typology of key success dimensions, 4) describe how practitioners prioritize these dimensions, and 5) evaluate the suitability of the identified measures for future use in benchmarking studies and quantitative explanatory analysis. By focusing on the meaning of success, the chapter lays the foundation for measuring project outcomes (Chapter 3), identifying success factors (Chapter 4), and explaining variation in outcomes between projects (Chapter 5).

2.2 Literature Perspectives on the Meaning of Success

2.2.1 Outsourced Product Development Literature

Although the concepts of success and failure appear frequently in the design outsourcing literature, they are defined and operationalized in many different ways:

Commercial/financial Performance

One approach defines success in financial terms, measuring whether the project is commercialized, whether it is profitable for the client firm, as well as its payback period [16, 17]. While financial returns are certainly the ultimate objective of any for-profit enterprise, the primary shortcoming of this approach is that few firms track financial performance at the outsourcing project level [19]. Some may have data for the return on investment of the *product* whose design was outsourced (Roy and Potter could obtain this information for 91 of the 221 projects in their sample), but this is influenced by many non-design factors, such as the client firm's ability to distribute and sell the product [20]. In addition, many firms consider product-level financials confidential and will not share them with researchers [20, 21]. A second

drawback of the purely financial approach is that it neglects non-financial benefits such as organizational learning [2], and costs such as the possible impact on employee morale [22]. As a result, few firms use financial returns as the sole measure of project success [20].

Contractual Performance

A second approach defines success as meeting the project's objectives, particularly with regard to schedule, budget, and product performance [7]. A drawback with this approach is that such objectives are typically moving targets, continually renegotiated during the course of the project [22]. Many projects exceed the initial budget or schedule but this should not be considered a failure if the client firm agreed to the revised terms, or if the extension contributes to the ultimate success of the project according to other metrics.

Occurrence of Problems

A third approach assesses the occurrence of "problems" [7, 16] or "interruptions to routine activity" [23] during the project. This can be a misleading metric, as the occurrence of problems does not necessarily imply project failure. Indeed, conflict identification and resolution is an essential aspect of new product development [24]. Learning and design changes are common in the early phases of a design.

2.2.2 Traditional Product Development Literature

In contrast to outsourced product development, the meaning of success and failure in traditional (i.e., non-outsourced) product development has been extensively examined. Based on a review of 61 academic studies and a survey of 50 practicing product developers [25], Griffin and Page identified 75 different success measures used in research and practice and organized them into five categories:

- *Customer-acceptance* measures such as customer (i.e., product end-user) satisfaction and revenue growth.
- *Financial-performance* measures such as attaining profitability goals and return on investment.

- *Product-level* measures such as development cost, time-to-market, and technical performance.
- *Firm-based* measures such as the percentage of sales generated by new products.
- *Program* measures such as the profitability of the firm's entire new product development program.

In a later paper they recommended particular measures for each of several innovation strategies and concluded that customer satisfaction was appropriate for them all [26]. Meanwhile, Hultink and Robbin examined whether the perceived importance of the most commonly used measures differs depending on whether one takes a short-term or long-term outlook [27]. They too concluded that customer satisfaction was the most important and robust measure of product development success.

2.2.3 Customer Satisfaction Literature

Compared to traditional product development, the distinguishing characteristic of outsourced product development is that a significant portion of the design process has been structured as a market transaction rather than an organizational hierarchy [28]. This suggests that standard transaction assessment techniques such as customer satisfaction may be appropriate for measuring outsourced development success.[1] Given this fact, and the strong endorsement of customer (i.e., end-user) satisfaction in the traditional product development literature, it is surprising that none of the studies of outsourced product development have taken this approach.

The assessment of customer satisfaction is both an academic discipline and an industry unto itself. Numerous approaches exist, but central to nearly all is the premise that satisfaction results when the product or service meets or exceeds the customer's expectations [29]. For example, the American Customer Satisfaction Index considers the customer's overall satisfaction, the extent to which his expectations were met, and the comparison of his actual experience with a hypothetical ideal [30].

[1] Note that there are at least two key customers in outsourced product development: the client of the design services and the end-user of the designed product. For clarity, the terms *client satisfaction* and *end-user satisfaction* will be used to refer specifically to these groups. For consistency with the literature, the more general *customer satisfaction* will be used to refer to concepts and theories that could apply to either group.

Kano and colleagues argued that customers' expectations differ for various attributes of a product, and that some attributes may provoke a non-linear response, producing delight if present but no dissatisfaction if absent, or dissatisfaction if absent but no increase in satisfaction if present [31]. The so-called Kano diagram, depicted in Figure 2-1, has been widely adopted to explain end-user satisfaction in product development, but it may also be useful to explain the satisfaction of the client firm in outsourced product development.

Collectively, these three streams of literature provide useful foundations for measuring outsourcing success, but also prompt several questions. What measures do practitioners use to evaluate outsourcing success? What dimensions of success are the Kano performance attributes for client satisfaction with design services? Which measures should scholars use to assess success? Which measures are feasible for practice and research?

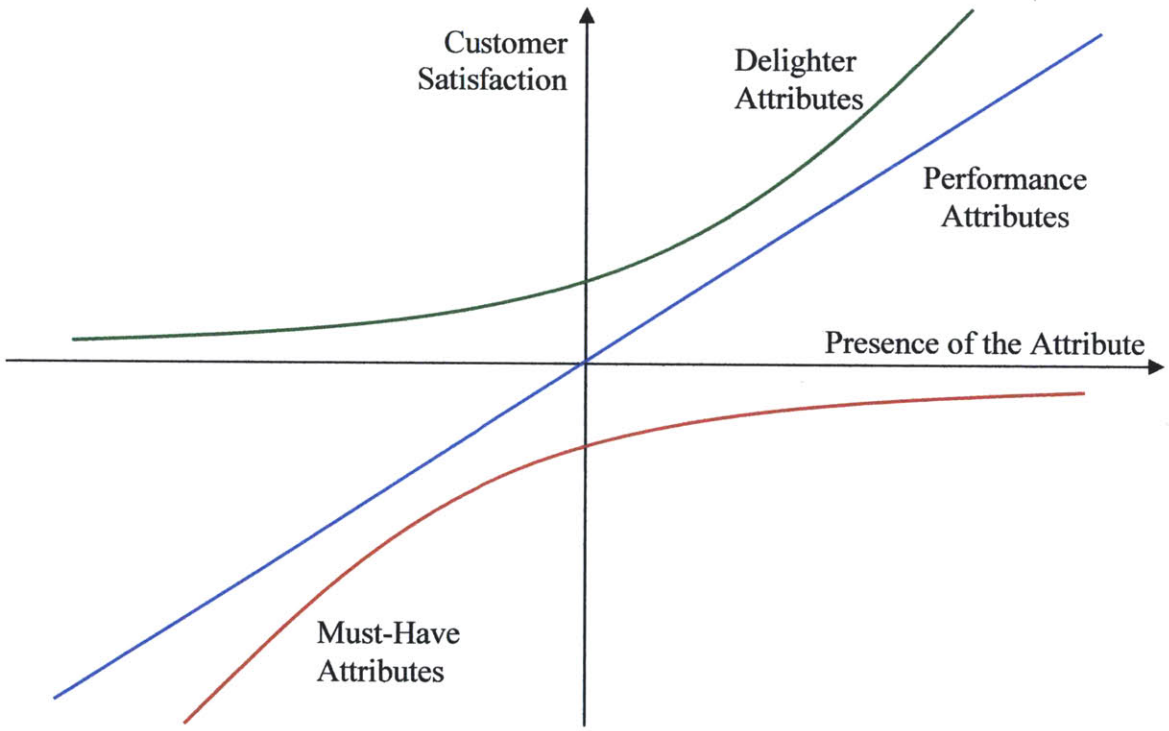

Figure 2-1: The Kano diagram. For Performance Attributes, customer satisfaction increases linearly with the extent to which the product delivers the attribute. For Must-Have Attributes, satisfaction declines sharply with the absence of the attribute. For Delighter Attributes, satisfaction increases sharply with the presence of the attribute, but absence produces no dissatisfaction.

2.3 Methods

To answer these questions, the present study leverages the collective wisdom of experienced professionals, using methods that complement or improve upon past research. Prior empirical studies have primarily surveyed mid-level client personnel [7, 15, 16], but questionnaires are unlikely to elicit the nuance and multiple meanings of success. In addition, surveying only mid-level managers reveals a limited perspective: executives and engineers will likely define and prioritize success differently. Consultants too offer a unique perspective, and may have more experience upon which to base it. Whereas many client personnel experience just a few outsourcing projects in their careers, consultants experience that number every few months.

To address these issues, this study used a combination of in-depth interviews, to generate richer models than surveys can, followed by quantitative analysis of survey data to confirm the models. In each phase, data were collected from both client and consultant respondents, entry-level through C-level, currently and formerly employed in the two sides of the industry. Former clients and consultants should have less of a personal stake in the research findings, and thus may be more candid. The interviews focused on respondents' general beliefs, while the survey asked them to evaluate specific projects.

2.3.1 Interview Phase

The population of interest for this phase was the staff of design consultancies specializing in consumer, medical, and industrial products, as compiled in the BusinessWeek/Core77 Design Directory [32], and the client personnel with whom they collaborate. To ensure a variety of perspectives, a statistically non-representative stratified sampling technique [33] was used to balance variation in employer type, seniority level, and current or former employment status. Respondents were recruited through a combination of word-of-mouth and targeted solicitation of thought leaders within the study population. Of the 48 individuals solicited, 36 agreed to participate, representing a total of 30 companies. Respondents had an average of 14 years experience with consulting (range 3 to 29 years).

Interviews were conducted between March and October, 2009, using an in-depth, semi-structured approach [34]. The interview template is included as Appendix A. The interviews lasted from one to two hours depending on the enthusiasm of the respondent. To encourage candor, 30 of the 36 interviews were performed in a private office or away from the respondent's workplace. Interview notes and audio transcripts were coded and analyzed using a grounded theory approach [35]. Iterative analysis produced the success typology described in Section 2.4. Direct quotations have been edited slightly for readability and to protect confidentiality.

2.3.2 Survey Phase

In this phase, the unit of analysis shifted from the individual practitioner to the consulting project. The population consisted of all projects completed within the prior four years by consultancies specializing in consumer, medical, and industrial product development. Two different samples were used in an effort to reach all corners of the population. First, nineteen consultancies were invited to participate in a client satisfaction benchmarking study. Five agreed to participate, from which a total of 126 recently completed projects were randomly drawn for study. The consultancies identified one to four client and one to three consultant participants of each project to solicit feedback from, yielding a total of 184 client and 104 consultant survey recipients.

The second sample was identified directly by the investigator. Five consultancies were randomly drawn from the fourteen that declined to participate in the benchmarking study. For these, 230 recently completed projects were identified by searching U.S. patent applications for inventors publicly known to be employees of the consultancies and then following the network of patent records to its ends. A total of 784 client inventors on these projects were identified, of which 310 could be located via public records. Of these, 262 were randomly selected to form the patent sample. Consultant inventors were not included out of respect for their employers' decisions not to participate in the study. Although the patent sample respondents were non-random in the sense that their projects had all generated patent applications, analysis of variance of the benchmarking sample results indicated that projects which generated a patent application differed in no other significant way from projects that did not generate an application. Including the patent sample

helped to balance the seniority level of the client respondents. The consultancies participating in the benchmarking study tended to solicit feedback from client project managers and executive sponsors, whereas the patent sample included many junior-level engineers and designers.

The selected recipients from each sample were mailed an 8-page questionnaire about their project, which was developed based on the results of the literature review and interviews and is included as Appendix D. Consultants received a slightly different questionnaire (Appendix E), which was tailored to their perspective as revealed by the interviews. 82 benchmarking client, 74 benchmarking consultant, and 38 patent surveys were returned. Eighteen patent surveys were undeliverable, yielding effective response rates of 44.6, 71.1, and 15.6%, respectively. All of the returned responses were usable, yielding a total sample of 194 practitioners evaluating 104 different projects.

Three distinct analyses were performed, each centered around the same two-part question about the meaning of success:

To what degree do you consider this project a success?

Not very	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Very
Successful	1	2	3	4	5	6	7	8	9	10	Successful

Why or why not? _____

First, the responses to the open-ended question were coded and counted. Next, regression analysis was performed to determine the effect of the content of the open-ended response on the numerical success rating. Finally, regression analysis was performed to explain the numerical rating in terms of other success measures included on the survey. The standardized regression coefficients were used to judge the relative priority given to each success measure by the respondents in determining the overall success rating.

All three analyses were performed separately for client and consultant respondents and the results compared. Client responses from the benchmarking and patent samples did not differ significantly as to the meanings of success, so these two samples were pooled for the analysis and presentation of results.

2.4 Interview Results

The interviews suggest that success is multi-faceted and means different things to consultants and clients. Consultants in particular viewed success as multi-dimensional: a project might do well on one dimension but poorly on another. Clients tended to view success more narrowly, as the achievement of their expectations for a reasonable price. In total, seven distinct dimensions of project success were identified, each having multiple measures. The dimensions and measures are summarized in Table 2-1 and described in detail below. Direct quotations from the interviews are used extensively to give the reader a feel for the raw data. More space is devoted to the consultant perspective, partly because it is more nuanced, but also because it has been under-represented in prior research.

2.4.1 Consultant Perspectives on the Meaning of Success

Dimension 1: Impact on Client's Business Performance

For the consultants, the ultimate dimension of success is that the project increased the client's profits, ideally by increasing product revenues, but also by reducing expenditures.

> *"The biggest measure I use for whether or not we've been successful is, 'did we have an impact in the marketplace?' For me that's the highest bar. If we didn't have an impact in the marketplace, did we help the client make the right decision? Because in some instances, the decision is 'don't go to market.' I think we're great consultants when we say that. We had some impact on their profits, because they would have been unsuccessful in pursuing it, but that's not ultimately what you want to hang your hat on."*
>
> – Consultant CEO

> *"Our ultimate view is 'does the product reach the market and is it profitable?' but some of our successes have been helping clients avoid making huge mistakes. Early on, we're able to show clients 'you know, maybe this isn't going to align to your business goals like you think it is.' We're able to help the company re-direct."*
>
> – Consultant VP of Design

Table 2-1: Dimensions and measures of success. Consultants mentioned far more success measures than either their clients or the outsourcing literature.

Dimensions	Measures	Identified by the: Literature	Consultants	Clients	Variable Name
Business Impact	Product(s) resulting from consulting project commercialized	X	X		TO_MRKT
	Product(s) successful in the market	X	X		MRKT_SUC
	Positive return on client's investment	X			ROI
Design Quality	Consulting project requirements met	X	X	X	REQS_MET
	Consultant's work implemented in downstream development	X	X	X	IMPLMNT
	Amount of rework required on consultant's deliverable		X	X	REWORK
	Product design received patent(s)				PATENT
	Product design received award(s)		X		AWARD
Non-financial Benefits	Client learned something new		X		n/a
	Project makes client personnel look good		X		n/a
Process Efficiency	Consulting project schedule met	X	X	X	SCHE_MET
	Consulting project budget met	X	X	X	BUDG_MET
	Consulting project value to client (benefits relative to cost)		X	X	VALUE
	Extent of problems or sub-optimalities	X	X		PROBLEMS
	Failure to resolve problems during project				PROBS_NR
Relationship Quality	Quality of working relationship		X	X	WORK_REL
	Extent of goodwill trust between client and consultant	X			TRUST
Client Satisfaction	Client's expectations met		X	X	EXPEC_MET
	Closeness of project to hypothetical ideal	a			IDEAL
	Client's overall satisfaction with project		X		SATISF
	Client's willingness to rehire consultant		X		REHIRE
	Client's willingness to recommend consultant		X		RECOMND
	Occurrence/extent of repeat business		X		REPEAT
Consultant Benefits	Profitability of project for consultant		X		PROFIT
	Extent to which project led to additional business		X		LEADIN
	Sales and marketing value of project to consultant		X		PUBLICITY
	Extent to which project enhanced consultant's capabilities		X		CAPABIL
	Impact on consultant staff morale		X		MORALE
	Consultant's overall satisfaction with project		X		CO_SATIS

[a] Ideality has not previously been suggested as an outsourcing success measure, but is a standard concept in customer satisfaction theory

Consultants were quick to note, however, that profitability is not an ideal metric for evaluating consulting projects. Client firms often consider product-level financials confidential. Marketplace impact may not be visible in the short term. Success requires no small measure of luck, as well as the alignment of many factors beyond the consultant's control, such as manufacturing, distribution, sales, and the quality of the client's original product specification. Furthermore, some projects are exploratory in nature and not intended to go to market. For these reasons, consultants aspire to improve their clients' profitability but generally do not evaluate projects by it.

Dimension 2: Quality of the Product Design

Because profitability is hard to measure and subject to many external factors, the consultants focus on the one factor they have the most influence over: the quality of the design itself. At a minimum, the design should meet the client's stated requirements, but consultants are particularly proud if their work is highly elegant, innovative, or robust.

> *"One of the ways I look at success is 'how effective were we in coming up with an innovative solution that met a need, and how quickly and efficiently did we get it through the debug process and commercialize it?' There's so many things that can go wrong in that process: the product might get out quickly but as a shadow of what it was intended to be, or stay close to its intent but take three times longer than it should have. As an engineer I take a lot of pride in the efficient transfer of design intent into a robust manufacturing solution."* – Consultant Director of Engineering

> *"Was the product launch successful? Was the product well received critically? Did the product make a difference to the end user? We're not in the business of making junk. Did it win a design award? We don't design to win the award, but it's a nice acknowledgement."* – Consultant Office Director

Objective appraisals such as patents, design awards, and critical or consumer reviews are signs of design quality but imperfect measures of it, as they generally occur only if the design is commercialized. In addition, patent and award applications require significant investment of

client and/or consultant resources, which may not be invested even if the design is worthwhile. In the absence of third party appraisals, assessment of design quality can be subjective.

> *"Sometimes, what we might consider successful the client might not feel is as successful. That's mainly in industrial design. We might think we have a really good design, but then a key [client] person leaves and a new one comes in and since that person wasn't involved early enough in the process he or she doesn't like the end result."*
>
> – Consultant COO

Dimension 3: Non-financial Benefits

Whether or not a project has a direct business impact, it may yield other benefits to the client firm or individuals within it.

> *"If the client team feels like they learned something new, to me that's the first level of success."*
>
> – Consultant Project Manager

> *"Client success has always been part of our mission statement. It could be that the product was a hit in the market, that's the obvious one, but it might also be that our key contact looked really good, was promoted, was seen as a star within their organization."*
>
> – Consultant Director of Engineering

> *"Success isn't always about coming up with a breakthrough product. Success is sometimes just helping this individual decide, or facilitate, or shake their culture."*
>
> – Consultant Project Manager

Indeed, the expressed purpose of many projects is not to send a product to market but rather to learn about the market or enabling technologies or even the design process itself.

Dimension 4: Efficiency and Effectiveness of the Development Process

Whereas the first three dimensions concern the products of the consulting engagement, a fourth focuses on the process. One commonly cited measure of process success is whether or not the schedule and budget specified in the development contract or otherwise agreed to were met.

Other measures include the quality of the deliverables relative to the project cost (i.e., the value) or timeline (speed-of-execution), and the smoothness of the process (absence of problems). Two factors that inhibit success are unanticipated changes in development scope and disagreements as to when the contractual obligations are fulfilled.

> *"If there's a lot of R&D, new technology involved, that's when projects start out one place and end up somewhere else. Success can be difficult to define on those projects because you don't always end up where the client thought they were going."*
>
> – former Consultant Engineering Manager

> *"There often aren't quantitative specs when you're trying to innovate. 'Give me something really different and innovative,' but how do you measure that to plus or minus tolerance? You can't."*
>
> – Consultant Senior Engineer

Most consultants carefully track schedule and budget performance, throughout the project, but caution that these measures are not as reliable as they might appear to be.

Dimension 5: Quality of the Working Relationship

While satisfaction of the development contract is important, some consultants felt that satisfaction with the relationship was even more critical.

> *"If you were to ask the client, 'what do you remember about the project?' I would be surprised if they said, 'the project was great, it was right on budget, it was right on time.' I think they'd say, 'the project was great, we did good work, and they're a great group of people.'"*
>
> – Consultant Project Manager

Most assess the quality of relationships informally:

> *"I think a reasonable question is, 'am I exchanging casual emails with this person six months later?' If you've established a rapport and you have a relationship that can carry over to other areas, it speaks to the relationship you had on the project."*
>
> – Consultant Engineering Manager

Dimension 6: Client Satisfaction

Because objective metrics such as profitability, design quality, and contractual performance can be difficult to assess, consultants' primary measure of success is client satisfaction.

> *"Are they delighted with the engagement?"* – Consultant COO

> *"It really all comes down to keeping the client happy."* – Consultant Engineer

Satisfaction is typically assessed informally, throughout the project and perhaps in a post-project lunch or phone call. Few consultancies use formal satisfaction evaluation systems:

> *"I would have loved if there was some sort of mechanism where six months later there was actual follow-up. Only on those projects where I was leading it and had a collaborative relationship was that possible. Most of the times, I'm at the meetings, I know the people a little bit, but you don't get that feedback."*
>
> – former Consultant Program Manager

Client satisfaction is a broad concept, encompassing the product, process, and relationship dimensions identified above, but it is manifested in two specific ways.

Repeat business

Few consultants mentioned repeat business without prompting, partly because it was obvious to them,

> *"I just took that for granted, because one of our missions is long-term relationships, that's part of our culture."* – Consultant COO

but also because it is an imperfect metric for evaluating the success of an individual project. The client may have been very satisfied with the work but not have need for additional services.

Willingness to rehire or recommend

Most consultants felt that willingness to rehire or recommend is a better indicator of client satisfaction:

> *"We're big on recommendation letters around here. So if the client is willing to write a recommendation letter for us, or if they say 'we're willing to work with you in the*

future' we'd consider that a success, regardless of whether the product is successful [in the market] or not."

– Consultant VP of Design

Most consultancies have some process for documenting willingness to recommend on successful projects, as client references are a common sales tool. Few, however, systematically measure client satisfaction on all projects. Part of the challenge with self-assessment is that clients may be reluctant to be forthright if the working relationship was strained:

"Very rarely is a client going to come out and tell you 'that project went great,' or 'man, that was a mess.' You're actually more likely to hear that it went well than it went poorly, because if it went poorly there was probably some personality issue and they would prefer not to deal with it again."

– Consultant Director of Engineering

To circumvent this problem, some consultants hire third party audits of client satisfaction, but most cannot afford to do so frequently.

Dimension 7: Benefits of Project to the Consultancy

A striking result of the consultant interviews was how infrequently they cited the benefits of the project to their own company. Upon probing, five aspects of consultant success emerged: the profitability of the project to the consultancy, the extent to which it led to future projects with the same client, its value in marketing the consultancy's services to other clients, the extent to which it developed the consultancy's capabilities, and the extent to which it satisfied the staff.

2.4.2 Client Perspectives on the Meaning of Success

In contrast to the wide range of responses provided by the consultants, most client respondents viewed success as achieving the terms of the contract. Some focused on meeting project objectives, while others focused on schedule and budget performance or value. In addition to these, a few respondents mentioned working relationship quality or the fulfillment of their expectations. None mentioned Business Impact measures or Non-financial Benefits. Exemplary quotations are provided below, for the two most frequently mentioned dimensions (Design Quality and Process Efficiency).

Quality of the Product Design

Whereas the consultants prioritized design innovation and elegance, the clients focused on getting the job done:

> *"Project success means that the project meets all the criteria specified in the design standards, to the satisfaction of the review board."* – former Client Senior Engineer

> *"In my book, if 80% of the objectives were met, it was a success."*
>
> – Client Project Manager

As these quotes suggest, fulfillment of project requirements is measured formally in some companies and informally in others. Most were simply looking to get a workable solution, recognizing that they would have to refine it a bit.

Efficiency and Effectiveness of the Development Process

The most commonly cited measure of process success was schedule and budget performance.

> *"In my experience, most companies are focused on the narrow project specifics, that is, did it get completed on time and within budget? The greater divergence from plan is inversely proportional to how successful the project is regarded."*
>
> – Client Project Manager

Beyond simply fulfilling the contract, many respondents focused on the value they had received:

> *"It all comes down to getting what you paid for. To me it's about value."*
>
> – Client Manager of Innovation

> *"One time we explored using another company and we didn't do it because [the original consultant] was cheaper, so maybe it's just cost. My company is very cost conscious."* – Client Engineering Manager

> *"The bigger consultancies have a lot more overhead. They offer a very broad depth of services, but it's going to cost you. Smaller firms, they might be working out of their house. Better value there. If you're looking for more specialized services, they're more economical. That's been our experience."* – Client Project Manager

Relatively few respondents mentioned broader objectives such as market success or impact on profitability. This may reflect a view that the typical outsourced project is just a small piece of the development process. Alternately, the focus on contract performance may result from a compartmentalization of outsourcing strategy and outsourcing management. Profitability is seen as a consideration for the decision-to-outsource and the specification of requirements. Once those decisions have been made, "the project" begins with the briefing of the consultant (see Figure 4-1), and success requires achieving the specified objectives. For those focusing on value, the project extends upstream to include the process of selecting a consultant and negotiating the contract. Success is regarded as the absence of failure, for a reasonable price, much like ordering a custom machined prototype. Some, however, questioned this approach:

> *"The problem I see with a narrow focus on budget, schedule, et cetera, is that outside consultants are too often concerned with literally producing what the customer wants. I have seen egregious examples where the customer was essentially asking for a stick in the eye, and the consultants were perfectly happy giving it too them and cashing the check! Consulting firms often don't peel enough layers off the onion to determine what the customer really wants. To be fair, I've also seen some very arrogant customers who were entirely dismissive of consultants' attempts to peel back the onion."*
>
> – Client Project Manager

Although the small size of the interview sample makes it difficult to be certain, it appears that client respondents' perspectives on success are shaped by their roles within the firm. Engineers focus primarily on technical performance, project managers on schedule and budget performance, and engineering managers on value. In contrast, nearly all the consultant respondents, whether junior or senior, mentioned multiple dimensions of success. Presumably they are well aware of all of them, because a challenge for the consultant is how to manage client satisfaction when satisfaction means different things to different people within the client organization.

2.5 Confirmatory Survey Results

The interview results reflect respondents' aggregate or abstract conceptualizations of success. In contrast, the survey asked them to assess the success or failure of particular projects. Shifting the unit of analysis in this way provided a means to independently confirm the interview-reported perspectives, and the larger dataset allowed quantification of how they prioritize the various success dimensions when assessing project success.

2.5.1 Consultant Priorities in Assessing Success

To quantitatively analyze the open-ended "Why or why not a success" question, each individual response was first abstracted to one or more codes representing the various success measures embedded in the response. For example, the response *"the product is on store shelves and has won an award"* references two measures of success: getting a product to market and winning a design award. In contrast, the statement *"the primary influences that lessen the success of this project are that the client never allows enough for anything more than cursory design, and the primary contact was not a great collaborator"* indicates failings on two dimensions: the quality of the design solution and that of the working relationship. In total, the 64 coded responses generated 144 mentions of 27 different success codes. The codes are listed in the second column of Table 2-2. Each code is affiliated with one of the success dimensions identified from the interview phase (left column). No additional dimensions were discovered, but several of the codes had not been mentioned in the interviews. These are marked in the table with a dagger.

The third column of the table indicates the percentage of responses that mentioned each code. None of the responses pertained to Non-financial Benefits, and only a few pertained to Consultant Benefits. The most frequently mentioned codes were Problems in project execution, the Quality of the design solution, and the Quality of the working relationship. From these data alone, it is unclear whether these codes were mentioned frequently because they are important to the consultants or because they occur (or fail to occur, as the case may be) frequently in practice.

Table 2-2: Consultant responses to the open-ended "Why or why not a success?" question. None of the responses mentioned Non-financial Benefits.

Dimension	Code	Percentage of Responses Mentioning this Code	Effect on Rating of a Negative Mention	Effect on Rating of a Positive Mention
Business Impact	Product to market	12.5	+ 0.33	+ 1.44
	Product successful in market	6.3	- 3.78**	+ 1.36
	Created new product category†	3.1		+ 1.36
	Project made client firm successful†	3.1		- 0.69
Design Quality	Accomplished project objectives	12.5		+ 0.08
	Consultant's work implemented	3.1	- 1.72	
	Amount of rework required	3.1		+ 1.36
	Design met user needs	6.3		- 0.71
	Design met performance requirements	9.4	- 3.78**	+ 0.87
	Quality/elegance of design solution	18.8	- 1.77	+ 0.92
	Novel/revolutionary design	12.5	- 0.69	+ 1.08
	Won a design award	3.1		+ 1.36
	Client proud of design	6.3		+ 1.40
Process Efficiency	Project schedule met	6.3	+ 0.33	+ 0.33
	Project budget met	9.4		+ 1.08
	Highly efficient process	9.4	+ 0.33	+ 1.40
	Good value	3.1	- 1.72	
	"Clutch" performance†	3.1		+ 1.36
	Problems – project planning	12.5	-1.88**	
	Problems – project execution	21.9	- 0.30	
Relationship Quality	Quality of working relationship	18.8	- 1.10	+ 0.35
	Earned client's trust†	3.1		+ 0.33
Client Satisfaction	Met client's expectations	6.3	+ 0.33	+ 1.36
	Happy client	9.4		+ 1.44
	Repeat business	15.6	- 0.69	+ 0.64
Consultant	Happy consultant	6.3	- 1.24	

† Not mentioned in interviews | $n = 64$ responses | ** $p < 0.01$

To address this uncertainty, the second analysis examined the severity of each code's impact on the respondents' numerical success ratings, calculated as the difference in means between the ratings of respondents that mentioned the code and those that did not.[2] For example, respondents who mentioned in their open-ended response that the project objectives *were* accomplished rated their projects 0.08 points *higher* (on the 10-point scale) than those who made no mention of project objectives. In contrast, respondents who noted that the consultant's work *was not* implemented had ratings that were, on average, 1.72 points *lower* than those who did not mention implementation. The mean differences are listed in the rightmost two columns of Table 2-2, for both positive and negative mentions of the codes. Asterisks in the table indicate whether the differences are significantly different from zero, as determined using the *t*-test.

Figure 2-2 illustrates the results for a few of the codes to show the connection to the Kano satisfaction model. For example, the results suggest that meeting performance requirements is a Must-Have attribute: failing to meet requirements dropped the success rating by an average of 3.78 points, while mentioning that requirements were met raised it by only 0.87 points. Repeat business is a mild Performance attribute, as it had a shallow linear effect.

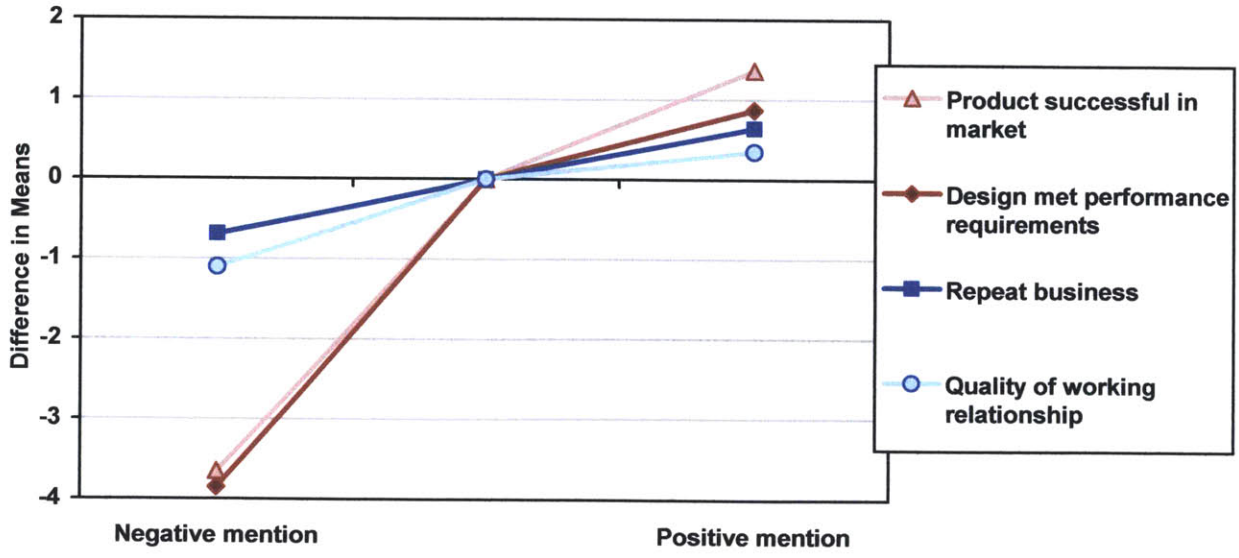

Figure 2-2: Kano-based representation of codes' effects on numerical success ratings.

[2] Equivalently, each difference in means can be thought of as the coefficient of a dummy variable in a linear regression model explaining the numerical success rating.

The strength of the codes' effects on the numerical success rating hint at how consultants prioritize the different success dimensions. The codes having the strongest effects were Product to market, Product success in market, Design met performance requirements, Quality/elegance of design solution, Problems in project planning, and Happy client. This confirms the interview finding that consultants prioritize Business Impact, Design Quality, and Customer Satisfaction over schedule and budget performance or repeat business. A surprising result was the frequency and severity of problems in project planning. Respondents lamented how much more successful the project could have been had it been planned such that they could have done their best work. This stands in contrast to problems in project execution, which are mentioned more frequently but have little impact on the success rating.

A third way to quantitatively assess consultant priorities is to analyze the numerical success rating in terms of the other success measures. Table 2-3 presents correlations between the SUCCESS variable and sixteen other measures that were included on the consultant version of the survey, while Figure 2-3 presents the same information graphically. SUCCESS is highly correlated with other holistic measures such as the consultant's own satisfaction with the project (SATISF), his estimate of the client's satisfaction (EST_SATIS), and his appraisal of how close the project came to a hypothetical ideal (IDEAL). The correlations with the non-holistic product, process, and relationship factors are weaker but are generally in the expected directions. To examine the relative strengths of these factors, controlled for each other, a comprehensive regression model was constructed (Figure 2-4). All factors were hypothesized to positively influence SUCCESS, with the exception of unresolved problems (PROBS_NR), which should negatively influence it. IDEAL and SATISF were excluded from the model as they are both highly correlated with the dependent variable and likely are measuring the same underlying concept.

The model was estimated using ordinary least squares regression (Table 2-4). The standardized regression coefficients ("Std Beta") in the fourth column of the table indicate the effect that a one standard deviation increase in each explanatory variable has on the dependent variable SUCCESS, measured in standard deviations of the dependent variable.

Table 2-3: Spearman's Rho correlations between success measures, as rated by consultant respondents.

	SUCCESS	PUBLICITY	REQS_MET	AWARD	SCHE_MET	BUDG_MET	VALUE	PROBS_NR	WORK_REL	TRUST	EST_SATIS	PROFIT	LEADIN	CAPABIL	MORALE	IDEAL	SATISF
SUCCESS	1																
PUBLICITY	**0.51**	1															
REQS_MET	0.01	-0.01	1														
AWARD	0.41	**0.5**	0.1	1													
SCHE_MET	0.07	-0.19	0.06	0.05	1												
BUDG_MET	0.14	-0.05	-0.14	-0.14	**0.54**	1											
VALUE	0.33	0.29	0.31	0.28	-0.06	0.02	1										
PROBS_NR	-0.16	0.24	0	0.07	-0.16	0.31	-0.36	1									
WORK_REL	0.33	-0.21	0.01	-0.01	-0.07	-0.19	0.03	-0.16	1								
TRUST	0.17	-0.17	0.04	-0.19	0.2	-0.04	-0.11	**-0.42**	**0.38**	1							
EST_SATIS	**0.63**	**0.37**	-0.01	0.15	0.03	0.31	**0.42**	0.07	0.06	-0.03	1						
PROFIT	0.14	0.17	0.05	0.17	0.3	0.26	-0.29	-0.05	-0.08	**0.43**	-0.1	1					
LEADIN	**0.46**	**0.47**	0.16	**0.43**	-0.01	**-0.37**	0.13	-0.17	0.21	0.11	0.26	0.31	1				
CAPABIL	0.36	**0.65**	-0.11	0.36	-0.27	0.02	0.09	0.29	-0.05	-0.18	0.2	0.35	**0.38**	1			
MORALE	**0.53**	0.26	-0.32	0.18	0.09	0.12	0.07	-0.11	0.2	0.17	**0.36**	0.23	0.33	**0.49**	1		
IDEAL	**0.62**	0.14	-0.15	0.24	0.2	0.07	0.19	-0.18	**0.48**	0.2	0.28	0.09	**0.35**	0.14	**0.73**	1	
SATISF	**0.83**	**0.53**	-0.07	**0.52**	0.04	0.09	0.24	0	0.32	0.12	**0.57**	0.06	**0.54**	**0.46**	**0.7**	**0.72**	1

$p < 0.05$, $\mathbf{p < 0.01}$

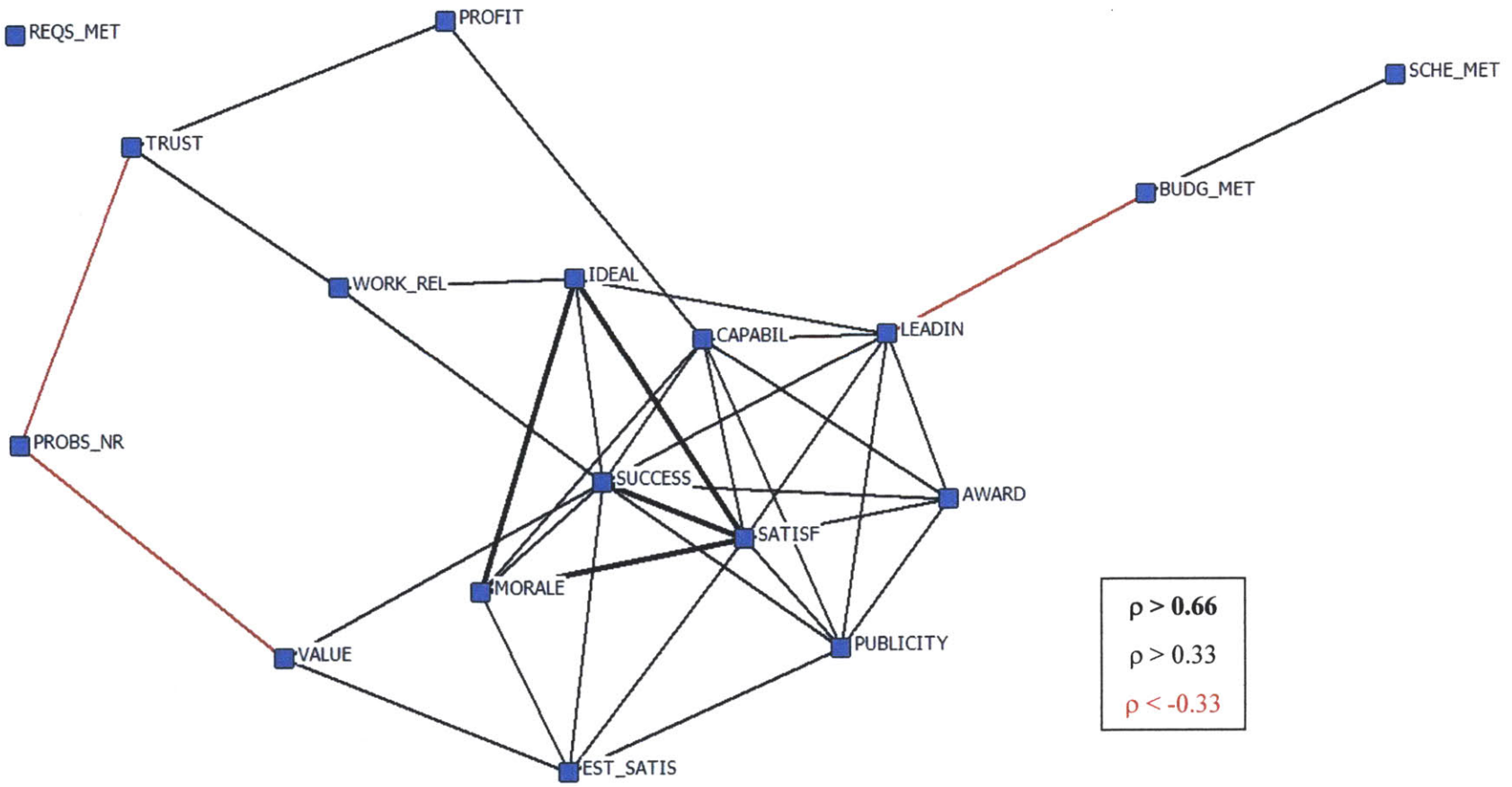

Figure 2-3: Network representation of Spearman's Rho correlations between success measures, as rated by consultant respondents. Only the strong correlations are shown.

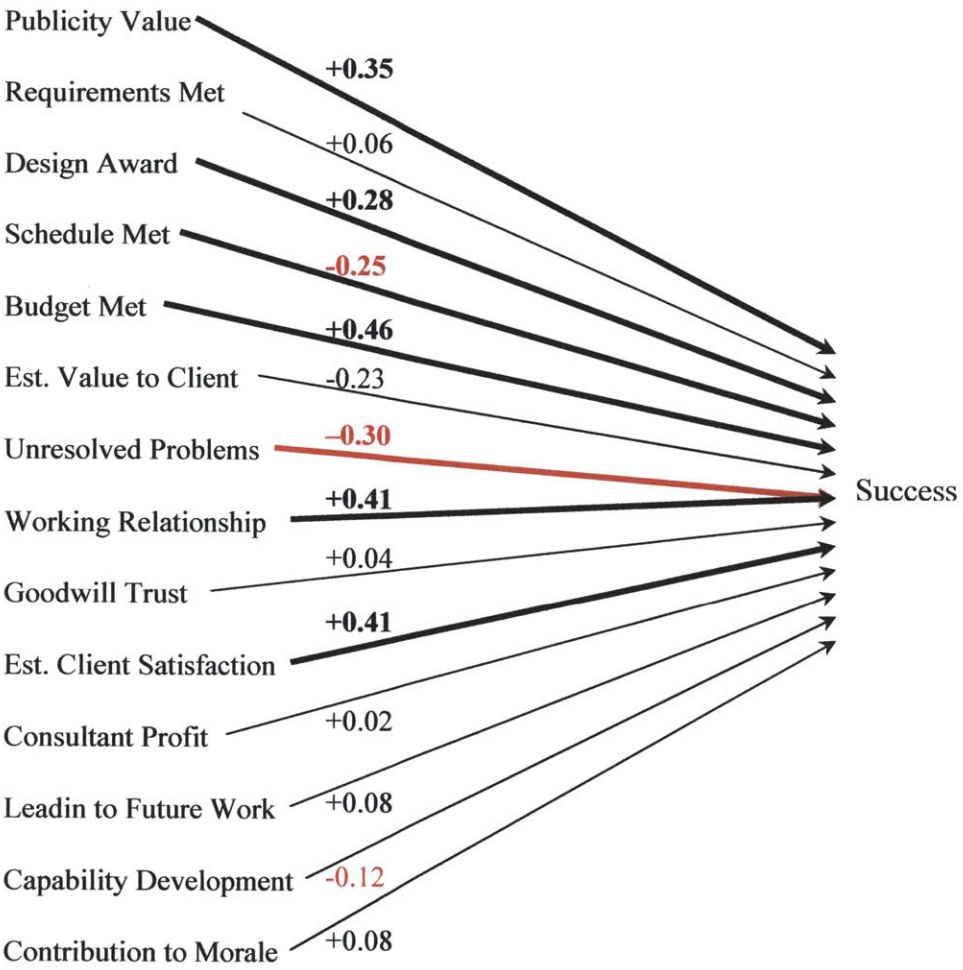

Figure 2-4: A comprehensive model for consultants' definition of success. All variables but unresolved problems were hypothesized to have a positive effect, as indicated by black arrows. The numbers indicate the actual standardized regression coefficients: black for positive and red for negative. Thick arrows and bold numbers were significant with $p < 0.05$.

For example, increasing REQS_MET by one standard deviation while holding all other variables constant increases SUCCESS by 0.062 standard deviations, while increasing PROBS_NR by one standard deviation *decreases* SUCCESS by 0.304 standard deviations. The results suggest that consultants' SUCCESS ratings are driven most strongly by whether the project budget was met, the quality of the working relationship, their estimate of the client's satisfaction, their appraisal of the project's publicity value, the occurrence of unresolved problems, and whether the product won a design award. All of these but PUBLICITY are significant at the 99% confidence level. These six variables represent six of the seven success dimensions identified from the interviews (Table 2-1), confirming that the dimensions represent independent aspects of success. Note that

the PUBLICITY variable encompasses elements of both the Business Impact and Design Quality dimensions: to be useful for publicity, a product must be well designed with significant consultant input, go to market, and ideally be successful in the market. The consultant version of the survey did not specifically ask about commercialization or market success because the clients were expected to be the better source for this information. The data so obtained from the clients were not included in the consultant success model because the consultants would not have used it in formulating their answer to the SUCCESS question (they would have used their own perception of the product's commercial success, which is proxied by the PUBLICITY variable).

Two counterintuitive results are the negative coefficients for SCHE_MET and VALUE. The former is highly correlated with BUDG_MET, so the negative coefficient may simply reflect this multicollinearity. A parsimonious model would leave one of the two out, but both were included in this case to show which has the stronger effect. The negative relationship between VALUE and SUCCESS may reflect the inherent trade-off between VALUE and PROFIT. All else equal, a smaller project budget improves the consultant's perception of the project's value to the client

Table 2-4: Regression output for comprehensive consultant success model.

Dimension	Term	Estimate	Std Beta	*t* Ratio	*p*-value
	Intercept	-0.763	0	-0.58	0.568
Bus. Impact	PUBLICITY	0.436	0.352	2.47	0.023*
Design Quality	REQS_MET	0.159	0.062	0.73	0.477
	AWARD	0.887	0.279	2.90	0.009**
Process Efficiency	SCHE_MET	-0.390	-0.252	-2.15	0.045*
	BUDG_MET	0.780	0.462	3.66	0.002**
	VALUE	-0.412	-0.226	-2.02	0.057
	PROBS_NR	-0.895	-0.304	-2.98	0.008**
Relationship Quality	WORK_REL	0.704	0.410	4.63	0.0002***
	TRUST	0.057	0.041	0.39	0.702
Client Satis.	EST_SATIS	0.443	0.410	3.34	0.0034**
Consultant Benefits	PROFIT	0.027	0.018	0.16	0.877
	LEADIN	0.131	0.083	0.64	0.528
	CAPABIL	-0.156	-0.124	-0.92	0.367
	MORALE	0.125	0.082	0.78	0.444
$n = 74$	$R^2 = 0.907$, $R^2_{adj} = 0.829$			* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$	

but decreases consultant profit. Delivering high value increases the workload and stress on the consultant staff, which could also lower their perception of the project's success. Indeed, responses to other open-ended survey questions suggest that consultants often rated project value highly when they felt the client had milked more work out of them than the budget warranted. In the consultant's mind, the client got great value, but the project was not a complete success because it did not benefit both parties equally.

2.5.2 Client Priorities in Assessing Success

The analysis used for the consultant responses was repeated for the clients. The results of the open-ended response analyses are shown in Table 2-5. Compared to the consultants, there were fewer client responses because many of the clients skipped the open-ended part of the question. Nonetheless, fewer codes were necessary to abstract the client responses, and a large portion of the responses focused on Business Impact and Design Quality. This differs somewhat from the interview results, which prioritized Process Efficiency over Business Impact. Interestingly, very few of the open-ended client responses mentioned budget or schedule performance, just as predicted by the consultant project manager on page 34. There were only a few mentions of Non-financial Benefits, and no mentions of Consultant Benefits.

The strengths of the code effects suggest that Design Quality is the biggest influence on client success ratings. Accomplishing project objectives appears to be a must-have attribute. The quality of the design solution is a performance attribute, having strong effects in both the positive and negative directions. Consultant work that could not be implemented had a strong negative effect. Most of the other effects were in the directions suggested by the interviews. An exception was the Novel/original design code. The negative coefficient in the rightmost column resulted from responses such as *"good concepts, but not product ready to drop into our design cycle"* (novel, but requiring extensive rework).

Table 2-5: Client responses to the open-ended "Why or why not a success?" question. None of the responses mentioned Consultant Benefits.

Dimension	Code	Percentage of Responses Mentioning this Code	Effect on Rating of a Negative Mention	Effect on Rating of a Positive Mention
Business Impact	Product to clinical trials†	3.3		+ 1.38
	Product to market†	20.0	- 1.02	+ 1.42
	Product successful in market†	13.3	- 3.34*	+ 0.89
Design Quality	Accomplished project objectives	16.7	- 2.97*	- 0.85
	Consultant's work implemented	10.0	- 3.70**	
	Amount of rework required	6.7	- 1.89	
	Design met user needs†	10.0	- 1.76	+ 2.41
	Design proved technical feasibility†	3.3		+ 1.38
	Design met performance requirements	7.4		+ 0.37
	Quality of design solution	26.7	- 3.50**	+ 2.16*
	Cost of design solution†	10.0	- 1.76	+ 2.41
	Novel/original design	16.7	+ 0.25	- 0.91
	Product design delighted user†	3.3		+ 2.41
Non-financial	Prepared client for downstream development	3.3		+ 3.44
Process Efficiency	Project schedule met	3.3	- 1.71	
	Project budget met	3.3	- 1.71	
	Good value	6.7	- 3.44*	
	Problems – project planning	6.7	- 0.99	
	Problems – project execution	3.3		+ 0.61
Relationship Quality	Quality of working relationship	10.0	- 2.27	+ 1.00
Client Satisfaction	Met client's expectations	3.3		+ 2.41
	Repeat business	10.0	- 1.91	+ 1.00
	† Not mentioned in interviews	n = 60 responses		* $p < 0.05$, ** $p < 0.01$

Table 2-6 presents correlations between the overall SUCCESS rating and twenty other success measures included on the client version of the survey, while Figure 2-5 displays the correlation network visually. Compared to the consultant case, the various success measures are more tightly intercorrelated. This may suggest that the clients' cognitive models for success are simpler: most measures of success align with each other, whereas in the consultant case they often do not. In the consultant's mind, success on one measure does not necessarily imply success on another. The relationships surrounding SUCCESS are examined in this section, while the other relationships will be covered in Chapter 5.

Figure 2-6 hypothesizes a fairly comprehensive model of the factors influencing a client respondent's SUCCESS rating. The various client satisfaction measures (IDEAL, REHIRE, RECOMND, etc.) were not included as explanatory variables because they likely result from a perception of success rather than cause it. Each explanatory variable was expected to positively influence SUCCESS, with the exception of the amount of rework required on the design (REWORK) and the occurrence of unresolved problems (PROBS_NR). The model was estimated using ordinary least squares regression, with the results shown in Table 2-7. Three terms – VALUE, REWORK, and TRUST – dominate the model, followed by MRKT_SUC and IMPLMNT. All these effects are in the expected direction and are significant at the 95% confidence level. Strikingly, several of the measures used in past studies (ROI, SCHE_MET, BUDG_MET, and PROBS_NR) have small effects after controlling for the other variables. It is possible that these variables influence the client's trust of the consultant, which does have a strong effect on the SUCCESS rating. Indeed, the correlations between TRUST and both SCHE_MET and PROBS_NR are quite high.

Overall, the quantitative analysis appears to confirm the findings from the interviews: clients prioritize quality work and good value over most other factors. A notable difference from the interview results is the greater importance placed on commercialization and market success. One possible explanation is that the interview format kept the analysis focused tightly on the consulting engagement. The survey instrument instructed respondents to do the same, but their responses may have reflected their perceptions of the entire product development project rather than just the consulted portion.

Table 2-6: Spearman's Rho correlations between success measures, as rated by client respondents.

	SUCCESS	TO_MRKT	MRKT_SUC	ROI	REQS_MET	IMPLEMNT	REWORK	PATENT	AWARD	SCHE_MET	BUDG_MET	VALUE	PROBS_NR	WORK_REL	TRUST	EXPEC_MET	IDEAL	SATISF	REHIRE	RECOMND	REPEAT
SUCCESS	1																				
TO_MRKT	-0.12	1																			
MRKT_SUC	**0.56**	-	1																		
ROI	**0.70**	0.33	0.32	1																	
REQS_MET	**0.52**	0.10	0.44	0.33	1																
IMPLEMNT	0.27	**0.41**	-	0.37	0.03	1															
REWORK	**-0.39**	0.07	-0.34	0.18	-0.21	0.26	1														
PATENT	-0.09	0.01	-0.25	0.10	-0.03	0.09	0.23	1													
AWARD	-0.05	**0.43**	0.07	0.17	-0.05	0.25	0.08	0.13	1												
SCHE_MET	**0.57**	0.03	0.09	0.24	**0.48**	-0.03	-0.10	-0.02	0.18	1											
BUDG_MET	**0.43**	0.13	-0.01	0.22	0.29	0.04	0.23	0.07	0.14	**0.54**	1										
VALUE	**0.71**	0.05	0.37	0.38	**0.53**	0.13	0.02	0.00	0.12	**0.42**	**0.43**	1									
PROBS_NR	-0.37	0.10	-0.20	-0.19	-0.32	0.17	0.02	-0.02	-0.15	**-0.49**	**-0.44**	-0.32	1								
WORK_REL	**0.41**	0.02	0.16	0.14	**0.35**	0.14	-0.22	-0.03	0.15	**0.41**	0.20	**0.51**	**-0.36**	1							
TRUST	**0.70**	0.09	0.26	**0.42**	**0.49**	0.15	-0.13	-0.01	0.08	**0.53**	0.29	**0.52**	**-0.50**	**0.68**	1						
EXPEC_MET	**0.80**	0.12	**0.56**	**0.46**	**0.59**	0.24	**-0.37**	-0.04	0.11	**0.51**	**0.39**	**0.61**	**-0.41**	**0.58**	**0.67**	1					
IDEAL	**0.71**	0.14	**0.57**	**0.48**	**0.59**	0.15	**-0.29**	0.01	0.15	**0.49**	0.23	**0.53**	**-0.48**	**0.64**	**0.69**	**0.85**	1				
SATISF	**0.82**	0.11	**0.64**	**0.43**	**0.61**	0.24	**-0.31**	0.03	0.13	**0.55**	**0.40**	**0.68**	**-0.47**	**0.66**	**0.79**	**0.89**	**0.87**	1			
REHIRE	**0.75**	0.03	**0.52**	0.24	**0.52**	0.14	**-0.27**	-0.14	0.18	**0.45**	0.28	**0.64**	**-0.53**	**0.64**	**0.75**	**0.75**	**0.73**	**0.81**	1		
RECOMND	**0.84**	0.03	**0.66**	0.28	**0.50**	0.18	**-0.33**	-0.10	0.08	**0.41**	0.24	**0.64**	**-0.42**	**0.62**	**0.73**	**0.75**	**0.76**	**0.86**	**0.91**	1	
REPEAT	0.33	-0.13	0.18	0.02	0.08	0.03	**-0.36**	-0.05	-0.08	-0.03	**-0.30**	-0.11	-0.09	0.07	0.16	0.20	0.29	0.20	0.29	0.19	1

$p < 0.05$, $\mathbf{p < 0.01}$

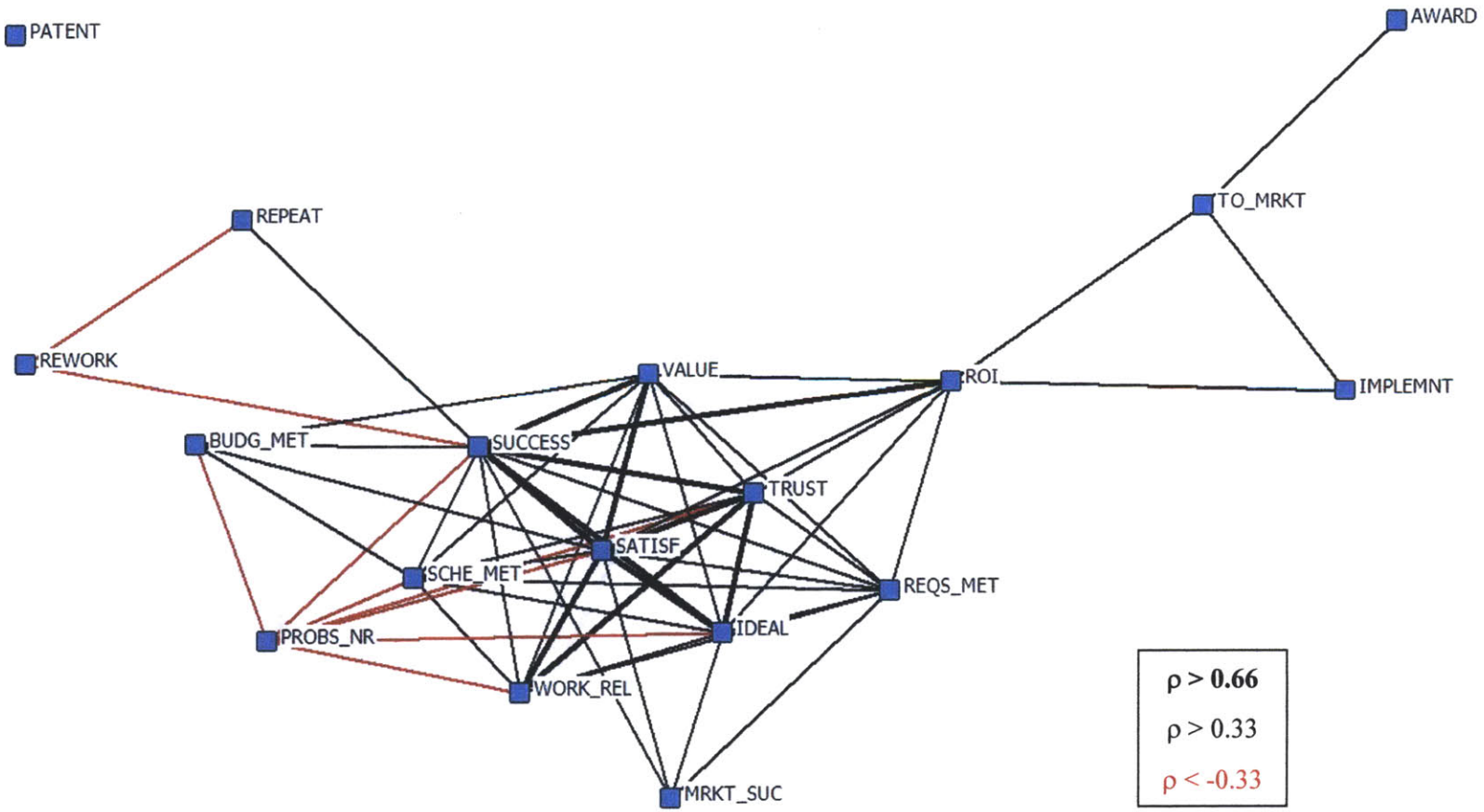

Figure 2-5: Network representation of Spearman's Rho correlations between success measures, as rated by client respondents. Only the strong correlations are shown. The holistic measures EXPEC_MET, REHIRE, and RECOMND are omitted from the figure to allow better comparison to the consultant version. These omitted measures are included in the preceding table, and have correlation patterns similar to SATISF and SUCCESS.

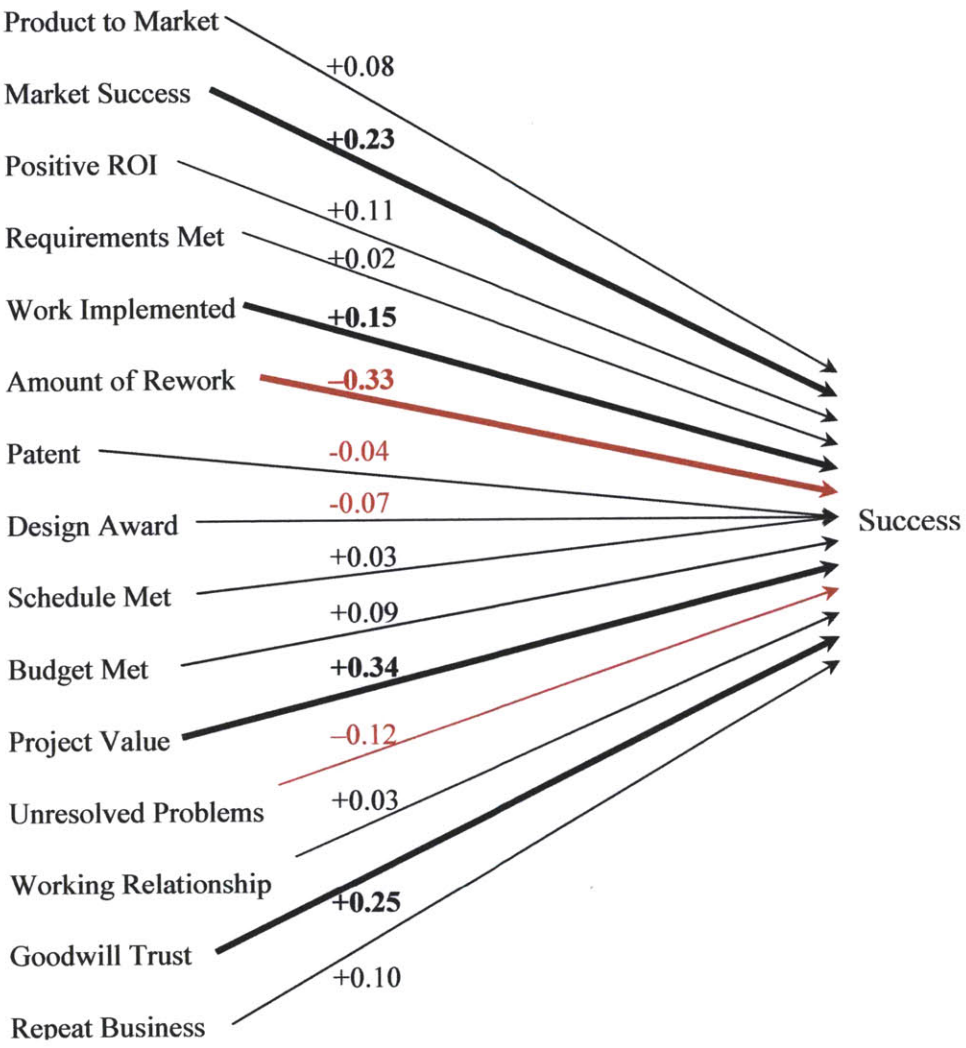

Figure 2-6: A comprehensive model for client's definition of success. All variables but amount of rework and unresolved problems were hypothesized to have a positive effect, as indicated by black arrows. The numbers indicate the actual standardized regression coefficients – black for positive and red for negative. Thick arrows and bold numbers were significant with $p < 0.05$.

Table 2-7: Regression output for comprehensive client success model.

Dimension	Term	Estimate	Std Beta	*t* Ratio	*p*-value
	Intercept	0.954	0	0.80	0.428
Business Impact	TO_MRKT	0.190	0.076	1.14	0.259
	MRKT_SUC	0.249	0.227	3.69	0.0005***
	ROI	0.321	0.106	1.62	0.112
Design Quality	REQS_MET	0.051	0.019	0.26	0.798
	IMPLMNT	0.699	0.153	2.37	0.022*
	REWORK	-1.05	-0.331	-5.29	<0.001***
	PATENT	-0.133	-0.042	-0.72	0.475
	AWARD	-0.253	-0.066	-1.01	0.317
Process Efficiency	SCHE_MET	0.042	0.027	0.34	0.732
	BUDG_MET	0.196	0.085	1.22	0.226
	VALUE	0.607	0.336	4.73	<0.001***
	PROBS_NR	-0.443	-0.116	-1.52	0.135
Relationship	WORK_REL	0.074	0.034	0.42	0.673
	TRUST	0.395	0.245	2.75	0.0082**
Client Satis.	REPEAT	0.139	0.096	1.63	0.109
$n = 120$	$R^2 = 0.839$, $R^2_{adj} = 0.793$			* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$	

2.6 Discussion

The results of the various analyses suggest several themes. First, the interviews revealed that success has several distinct dimensions, each with many commonly used measures that do not all correlate with one another, as shown in Table 2-3 and Table 2-6. When interview respondents were asked to estimate what fraction of projects are successful, most were stymied, hesitating to answer the question and asking the interviewer to clarify what he meant by "success." Yet published studies of outsourced product development have often failed to define their measures of success [15, 18], or have published the results of a subset of measures while implying that they are sufficient [7, 8, 16, 17]. In contrast, scholars of traditional product development have acknowledged the many meanings of success [25], and suggested that some may be more appropriate in certain situations [26, 27]. Unfortunately, many product development studies continue to use vague measures of success. For example, the well-known Product Development and Management Association's Best Practices Study reports new product development success rates in which each respondent answers the question using his own particular definition of

success, which itself is not reported [36, 37]. While this acknowledges the diversity of practitioner priorities, it fails to reveal what they are. In the words of Hart, "much of the literature aimed at discovering what factors are associated with new product success has skilfully [sic] side-stepped the issue of what the essence of new product success is" [38]. The same can be said of more recent research on outsourced product development. The present study brings this essence to the fore, and the results suggest need for greater precision in measuring and reporting outsourcing project outcomes.

Three general approaches are possible. The exhaustive approach, which will be used in Chapter 3, is simply to collect and report data using all relevant measures. While comprehensive, this approach is resource-intensive to gather and time-consuming to interpret. An alternative approach would be to use a single holistic metric, though preferably one with crisper meaning than "success," "struggle," or "disaster." Client satisfaction is one such metric, and the results of the present study suggest that it is highly correlated with most other project outcome measures and is already part of practitioners' mental models. What's more, the science of measuring satisfaction is more theoretically and methodologically developed than that of measuring product development success and failure. Several well-tested instruments already exist, though they have yet to see extensive use in measuring knowledge-based business-to-business services. Client satisfaction with design and innovation consulting will be described in detail in the next chapter, and explained in Chapter 5.

A third approach, intermediate between the exhaustive and the holistic, would be to focus on a few measures that are particularly important for one reason or another. The Kano model provides one means to prioritize project outcomes, as it suggests that competition in the design services market will center around certain performance attributes while other attributes will be necessary simply to compete. These attributes will differ from one type of outsourcing to another, depending on the maturity of the market. For low-cost offshoring, simply meeting project requirements may be a performance attribute, whereas in the higher-end consulting market it is a must-have. An academic researcher might seek to identify the key performance attributes for the market of interest and focus on them. For consulting, two current performance attributes appear to be the quality of the design solution and that of the working relationship (Table 2-5). These

are the measures in most need of academic understanding. A consultancy, on the other hand, might wish to identify delighter attributes to help distinguish itself from its competitors (assuming that it is already delivering must-have and performance attributes). Relatively few delighters were identified in this study, perhaps because the respondents provided the most manifest reasons when answering the "Why or why not a success?" question. Delighter attributes often serve latent needs, those that are unknown to the customer until presented to him.

A second way to prioritize project outcomes is to look at how they influence respondents' ratings of overall project success (Table 2-4 and Table 2-7). The results of these analyses suggest that much of scholarly work to date has focused on the wrong success measures. For example, very few respondents mentioned ROI, only two-thirds of the clients could answer whether the project ROI was positive or not, and even those answers did not appear to strongly influence their assessments of project success. Instead, they were much more likely to think in terms of project value, using the quality of the deliverable itself as the numerator rather than some far-off financial return. Likewise, process efficiency measures such as schedule and budget performance appear to be less powerful predictors of success than prior work would suggest. Interestingly, the consultants seemed to put more emphasis on budget performance than did the clients. This is likely because most projects were contracted on a fixed fee basis. If the budget were exceeded, the consultancy took the financial hit rather than the client firm. Lastly, the results suggest that problems are a component of project success but not a large one. Even focusing solely on unresolved problems, rather than all problems, the measure had little impact on client success ratings and only a moderate impact on consultant success ratings. The difference in priority between the two groups may suggest that the consultants are more attuned to what types of problems are critical and which are merely inconveniences. The results suggest that more research attention should be devoted to measures of value, working relationship quality, and client satisfaction. These have likely been ignored to date because of the limited methods and diversity of respondents used by past research (see Section 2.3).

A third broad theme emerging from the results is the marked difference in how consultants and clients define success. The clients put far more emphasis on value and design readiness, while consultants gave more priority to relationship quality and design elegance or novelty. This is

surprising because the consultants compete on satisfying their clients and should therefore be attuned to what the clients consider successful. The observed differences in priorities may indicate that the consultants are in fact not well attuned to the client perspective. Indeed, Chapter 5 will show that their estimates of client satisfaction on particular projects are not very accurate. Perhaps part of the reason the consultants consider so many dimensions of success is that they do not know exactly which ones they should focus on. They may be working hard to deliver attributes that the client does not particularly value, such as novelty or elegance. The client ends up paying twice for unwanted design details: once in the project budget for the consultant's effort to add them, and then again when the client must rework the deliverable to remove them. Alternatively, it may be that such outcomes are leading-edge delighters that the clients are not yet aware of. Latent needs, as it were. A third explanation, perhaps the most likely of all, is that while design elegance and novelty may not be a priority for the current client, they may be important for the consultant in marketing its capabilities to future clients. Indeed, the high priority placed by consultants on product publicity value (Table 2-4) supports this explanation.

A fourth theme is the difference in priorities by respondent role. While the sample is too small to be certain, there is some evidence of compartmentalization, at both the client firm and the consultancy. Engineers and designers tended to focus on design quality, project managers on process efficiency, and project sponsors on value. As one consultant engineer noted when answering whether the budget was met, "my role in our company is to be immersed in technical detail, not to worry about the budget." Such role-specific priorities highlight the danger of gathering project outcome data from a limited cross-section of respondents (unless, of course, the sample is matched specifically to the research objective). Unfortunately, a larger sample would be necessary to quantitatively demonstrate differences in priorities between the various client and consultant roles.

A final theme in the data is the differences that emerged between respondents' cumulative or abstract definitions of success, as revealed in the interviews, and the priorities they showed in evaluating specific projects in the survey. For example, client respondents rarely mentioned commercialization or commercial success in the interviews, but noted them frequently when evaluating projects. Consultants rarely mentioned the occurrence of problems in the interviews,

but noted them frequently in the survey. This result highlights the importance of collecting data using multiple methods before attempting to define success.

2.7 Conclusions

Although prior research has reported high failure rates in outsourced product development, progress in this field has been hindered by lack of consensus as to the meaning and measures of *success* at the project level. This ambiguity makes it difficult to evaluate design outsourcing success rates and explain the causes of failures. This chapter identified the many meanings of success used in research and practice, organized them into a typology featuring seven distinct success dimensions (Table 2-1), empirically evaluated their relative importance to client and consultant practitioners, and began to assess their suitability for use in explanatory modeling. The study extends the literature by clarifying previously imprecise concepts and by reporting the perspectives of both the client *and* the consultant. The results suggest that past research may have focused on outcome measures that are not particularly important to practitioners.

The validity of the findings is enhanced by the use of a diverse set of respondents as well as multiple methods of data collection and analysis. As with any research, the study is not perfect. In particular, the analysis of the effects of the open-ended response codes on the numerical success rating is statistically weak and sensitive to small changes in the data. A larger dataset would provide more reliable results. Also, while the study began to explore the effect of respondent role on success priorities, it did not investigate the effect of functional affiliation. Finally, the client version of the survey did not contain questions pertaining to Non-financial Benefits, as no clients had mentioned them in the interviews. Given that none mentioned them in their open-ended responses to the "why or why not a success" question either, this may not have been a major omission.

This work sets the stage for measuring project outcomes, which is the topic of the next chapter. In addition, future research on the meaning of success in outsourced product development might shed light on lingering questions, such as exactly how the prioritization of success dimensions differs based on the role or functional affiliation of the respondent, or how the must-have,

performance, and delighter attributes differ between different types of outsourcing. Perhaps most importantly, need exists to relate project-level definitions of outsourcing success to strategic, firm-level, definitions. After all, an efficient execution of a poorly considered strategy may be even worse than a sloppy execution of the right strategy.

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3 The Measure of Success in Outsourced Product Development: Descriptive Data and Methodological Effects

Although the risks and rewards of outsourced product development have been argued extensively in the literature, little hard data on project outcomes exist to inform the discussion, and even these are methodologically suspect. To address this gap, this chapter measures the distribution of project outcomes in design consulting, using established concepts and techniques from the social sciences, and demonstrates how common methodological choices affect these measurements. The results suggest that consulting outcomes are generally good but vary significantly between projects. Relative to this variation, methodological details such as the role of the respondent on the project and the level of anonymity afforded him during assessment have large effects. Client satisfaction and other subjective measures are positively associated with respondent seniority and negatively associated with the level of anonymity, while consultant satisfaction is negatively associated with seniority. Neither client nor consultant satisfaction vary significantly in the two years following the completion of the project, but assessments of relationship quality and of the occurrence of problems improve with time. The finding that methodological effects are of comparable strength to substantive effects highlights the need to account for them when measuring, analyzing, and reporting outsourcing outcomes.

3.1 Introduction

As product development outsourcing becomes increasingly common, a flurry of articles has appeared in the academic and popular press to offer managerial guidance. Many provide well-reasoned analyses of the pros and cons of outsourcing but offer little empirical data upon which to test their deductions [1-5]. Some ground their recommendations using case studies [6-10] or expert opinions [11-13]. Only a handful report quantitative data on project outcomes and client attitudes [14-19], typically under foreboding headlines such as "Design Outsourcing: Beware of Pitfalls" [17], and "Prevent Disasters in Design Outsourcing" [14]. The former found that a third

of outsourcing managers at large firms view outsourcing as a liability, while the latter suggests that two-thirds of outsourced design projects at *Fortune* 1,000 firms struggle or fail.

These results, as well as the skeptical tenor of the entire genre [20, 21], seem to suggest that firms should limit their outsourcing or at least proceed cautiously, and yet other studies find that outsourcing continues to grow [19, 22, 23]. One possible explanation of the apparent paradox is that firms are behaving irrationally. Another is that they have no choice but to outsource, in spite of the risks. For example, Boeing's ill-fated decision to outsource considerable portions of the 787's design resulted in part because the company could not afford the capital cost of developing the entire aircraft itself [24]. A third resolution to the paradox is that either the growth in design outsourcing or the high failure rates have been exaggerated.

Indeed, inspection of the published outcome and attitude reports reveals several methodological limitations that may compromise the validity of their findings. Some studies did not use a random sample [15], and those that did achieved very low [16] or unstated [18, 19, 25, 26] response rates, jeopardizing the representativeness of the results. All the studies collected data from only the client's perspective, often from mid-level managers. Such respondents might be excessively critical of outsourcing if they fear it threatens their jobs or if they did not have a say in the outsourcing decision. The anonymous format of many studies may facilitate such criticism by shielding the respondents from rebuttal. Another potential source of bias in the attitude-oriented studies is that they often ask respondents for cumulative impressions of outsourcing rather than appraisals of specific projects [17, 19], opening the door to hearsay or parroting of conventional wisdom. In addition, few studies use standard measurement items that have been tested for validity and reliability. Lastly, none of the reports provide baseline information about the success or failure of non-outsourced projects. Studies of traditional product development place the failure rate at about 41% [27], which makes the two-thirds figure for outsourcing, if true, less bad than it would first appear.

Because of these methodological issues, as well as the conceptual problems discussed in the previous chapter, very little high-quality data on outsourcing project outcomes exists to inform academic research or practical decision-making. To begin to fill this gap, the first objective of

this chapter is to document project outcomes in one particular type of outsourcing – design and innovation consulting – using rigorous methods adapted from the management and social sciences to avoid the pitfalls that have befallen past research. A random, representative sample was drawn from a well-defined population and data collected from multiple respondents, both consultant and client, associated with each project. The survey instruments were developed based on in-depth interviews with expert practitioners, used standard measurement items from the product development and customer satisfaction literature, and were extensively pre-tested prior to use. These details should improve the validity and reliability of the results.

The second objective is to demonstrate how the methodological issues described above can significantly influence the results. Three specific effects are examined:

- How the data are collected: via a closed-loop client feedback survey administered by the design consultancies and mediated by the investigator, or directly from anonymous client respondents
- Who the data are collected from: clients or consultants; project sponsors, project managers, or project team members
- When the data are collected: immediately after the project up to four years post-project

The third objective is to evaluate whether certain success measures are more robust than others, and hence more suitable for use in descriptive or explanatory analysis. Whereas the previous chapter examined the relative priority of success dimensions to determine what *should* be measured, this chapter examines their feasibility, to determine what *can* be measured.

To accomplish these objectives, project outcomes were measured in three distinct samples using three different techniques. After critically reviewing the literature and describing the research design in detail, the chapter presents results of the three samples side-by-side to illustrate the methodological effects, which are then statistically tested and summarized. Collectively, the three sets of results provide a more complete picture of outsourcing outcomes than has been presented to date.

3.2 Literature Review

3.2.1 Success and Failure in Outsourced Product Development

Only a handful of studies have reported quantitative data on design outsourcing outcomes (Table 3-1). The most rigorous is the work of Roy, Potter, and Bruce [18, 25, 26], who evaluated the impact of a 1980s British government program to stimulate domestic manufacturing by providing subsidies for small manufacturers to hire design consultants. The study found that 65% of the projects were commercialized, with 89% of these generating a positive return on investment for the client firm [18]. 27% of the firms experienced problems with their consultants. The occurrence of problems did not impact commercialization rates but slightly fewer problematic projects made a profit, and those that did had a 20% longer payback period [26]. Many of the problems stemmed from poor design management by the client firms, 70% of whom were using designers for the first time, and 30% only because free money was available [26]. Only 4% of the firms in the sample employed more than 500 people, and none employed more than 1000 [25]. The study's focus on relatively novice, small firms may compromise the generalizability of the findings to larger, more experienced firms. In addition, the outcome measures used may not be the most appropriate. Quantitative financial data could be obtained for only 91 of the 221 projects in the sample [18]. The study focused heavily on the occurrence of problems, but the results of the present study indicate that problems are ubiquitous in consulting (Section 3.4.5) and do not factor strongly in clients' appraisals of project success (Chapter 2).

The only other academic data on outsourced project outcomes come from an ongoing study by Anderson, Parker, and Davis-Blake [28]. Unfortunately, the results of this work have not been extensively documented. A 2008 working paper reports mean values and ranges for project managers' assessments of 55 outsourced product or process development projects [15]. The managers were somewhat satisfied with their working relationships with the suppliers (mean of 3.8 on a 5-point scale) but less so with the performance, quality, cost, and time-to-market impact of the project deliverables (3.3, 3.2, 3.3, and 3.0, respectively). Project performance varied widely, with each measure using the full scale range, but the measures were not strongly correlated – a project might perform well on one measure but poorly on another.

Table 3-1: Summary of previous studies measuring success and failure in outsourced product development.

Study	Sample	Response Rate	Success Dimension	Success Measure	Findings
Amaral & Parker, 2008	~ 100 outsourced projects at *Fortune* 1,000 companies	Unspecified	Unspecified	Unspecified	▪ "Approximately one-third worked seamlessly" ▪ "The other two-thirds struggled or failed"
Anderson, Davis-Blake, & Parker, 2008	Survey of 55 outsourced product or process development projects	Non-random sample	Relationship Quality	Working relationship	▪ Mean score of 3.8 on subjective 1-5 scale
			Design/Production Quality	Performance of deliverable	▪ Mean score of 3.3 on subjective 1-5 scale
				Quality of deliverable	▪ Mean score of 3.2 on subjective 1-5 scale
				Cost of deliverable	▪ Mean score of 3.3 on subjective 1-5 scale
			Process Efficiency	Effect on ramp-up time	▪ Mean score of 3.0 on subjective 1-5 scale
Mokhoff & Wallace, 2005	Web survey of 303 managers involved in electronics outsourcing decisions	2.75%	Design Quality	Requirements met	▪ 21% had experienced a project that failed to meet requirements
			Process Efficiency	Schedule met	▪ 65% had experienced a project that took longer than expected
				Budget met	▪ 46% had experienced a project that cost more than expected
				Problems	▪ 59% had experienced communication problems with their design supplier
Rayner, 2005	"	"	Client Satisfaction	Cumulative satisfaction	▪ "Nearly one-third" of respondents from large companies (sales >$500M) said design outsourcing is a "net liability" to their companies ▪ 13% of those at small companies (<$10M) considered outsourcing a "net liability"
Rothstein 1998	Mail/phone survey of 600 engineering executives	Unspecified	Business Impact	Overall financial performance	▪ 44% agreed that outsourcing improves performance ▪ 15% agreed that outsourcing to non-U.S. firms offers significant advantages
Roy & Potter, 1990 Roy & Potter, 1993 Bruce, Roy, & Potter, 1995	Survey of 221 small and medium-sized UK manufacturers which received a subsidy to hire a design consultant	Unspecified	Business Impact	Products to market	▪ 65% of projects were commercialized
				Return on investment	▪ 89% of commercialized projects generated a positive return-on-investment ▪ Financials only available for 41% of projects
				Payback	▪ Mean payback period for commercialized products was 14.5 months
			Non-financial Benefits	"Indirect benefits"	▪ 70% of projects yielded a variety of non-financial benefits
			Process Efficiency	Problems	▪ 27% of projects experienced problems

Methodological drawbacks to this study include the use of a convenience rather than a random sample and the pooling together of projects from dramatically different industries such as aerospace and consumer products. In fairness, the working paper was not intended to describe project outcomes but rather to relate them to the firms' use of various coordination mechanisms. However, follow-on articles have made descriptive claims. A brief piece in the *Harvard Business Review* noted that nearly two-thirds of the projects "struggled or failed," but did not provide the evidence supporting that assertion [14]. A more recent article in the *Sloan Management Review* implied that outsourcing is problematic but also provided no hard data [6].

A third source of quantitative data on outsourcing outcomes is the surveys frequently conducted by trade journals and professional associations. These have the benefit of using quasi-random samples but the response rates are often so low as to cast doubts on their representativeness. For example, a major study conducted by *EE Times* and *Electronics Supply & Manufacturing* invited 11,000 readers to participate and received 303 responses, or just 2.75% [16]. It is possible that only those with an outsourcing axe to grind, or a lot of time on their hands, took the time to reply. Nonetheless, the results of these studies offer some insights. The *EE Times* study found that 65% of outsourcing managers had at some point experienced schedule delays on a project, 59% had experienced communication problems, 46% cost overruns, and 21% a project that failed to meet performance requirements [16]. Nearly one-third of those at large companies (>$500 million annual revenue) viewed outsourcing as a "net liability," compared to just 22% of those at mid-size firms and 13% of those at small companies (< $10M) [17]. The author presents the one-third figure as a cause for concern, but does not state whether the remaining two-thirds viewed outsourcing as a net asset, were indifferent, or skipped the question altogether. An ASME survey of engineering executives found that 44% agreed that "outsourcing generally improves my company's overall financial performance," but only 15% agreed that "outsourcing to overseas/non-U.S. firms offers significant advantages" [19].

In sum, a small amount of data has been reported in the literature, but its quality is adversely affected by the use of non-random, non-representative, and/or incongruous samples, limited respondent perspectives, non-standard and/or inappropriate outcome measures, as well as low response rates and incomplete reporting of results.

3.2.2 Methodological Issues in the Measurement of Success and Failure

Research on measuring success and failure in new product development has been largely pre-occupied by the conceptual question of *what* should be measured [29-32]. Very little methodological research has been reported on *how* to go about measuring it, that is, how methodological choices affect results. The latter question was historically less relevant, as many companies do not measure product development at all [15, 32]. Now that they are starting to do so, need exists to understand these effects.

The previous chapter identified a number of success measures that are relevant to design and innovation consulting, including product design quality, project value, and client satisfaction. Of these, only satisfaction has a reasonably developed methods literature. Scholars have identified several important measurement issues. First, customer satisfaction results are always negatively skewed,[1] with the majority of respondents highly satisfied [33]. Numerous arguments have been advanced to explain this phenomenon [33]. Perhaps the most convincing is that customers in competitive markets have access to information enabling them to avoid unsatisfactory goods and services, and can switch providers easily if they are still not satisfied [34]. Regardless of the cause, skewness affects data collection, analysis and reporting of results. While many surveys use 5- or 7-point scales, others use 10- or 11-point scales to provide better resolution given that most respondents will only use the upper half of the scale [35, 36]. Skewness also complicates the use of standard statistical techniques that assume normal distributions. Data transformations and/or non-parametric methods may be required. In reporting results, mean values are not an ideal representation of central tendency, but medians and modes show little variation between groups due to the clustering at the top end of the scale.

Second, the mode of survey administration appears to affect results. Customers surveyed in person or via telephone report higher satisfaction than those surveyed by mail or self-administered questionnaire [33]. The reasons for this effect are unclear. Telephone and in-person surveying may produce greater social desirability bias [37], but that bias does not appear to be strong in customer satisfaction [33]. The effect of internet-based surveys is not yet well understood due to their relative novelty and rapid evolution.

[1] In statistics, *negative skew* describes a distribution whose mean is more negative than the bulk of the values.

Third, customer satisfaction typically decreases with time after purchase, in products ranging from automobiles [33] to medical care [38] to houses [39]. Explanations offered include the additional information that becomes available after purchase [38], as well as the persistence of negative memories [33].

Fourth, customer satisfaction results are affected by the questionnaire design. Asking if the customer is satisfied typically produces higher measures of satisfaction than asking if he is dissatisfied [33]. The placement of the measurement items relative to other questions can also impact results [33]. The use of multi-item scales is commonly recommended to improve reliability [40, 41] and reduce skewness [42], but others feel that these unnecessarily complicate measurement and interpretation of results [36].

Other factors that have been shown to influence customer satisfaction include the respondent's age [33], gender [43], cultural origin [44], socio-economic status [43], and mood at the time of the survey [33], but most of the demographic effects are weak [41]. While in principle these variables might be measured along with satisfaction and controlled in analysis, such questions might be viewed as inappropriate on a business-to-business client satisfaction survey. Selection of a random, representative sample is likely a better way to mitigate these effects.

Less clear is the effect of response bias. Early studies found little correlation between survey response rates and satisfaction [33], but others have suggested that respondents tend to be more satisfied than non-respondents [45]. Prevailing wisdom among professional market research firms seems to be that both highly satisfied and highly dissatisfied customers are more likely to reply than those with neutral opinions [46].

Lastly, an interesting finding with bearing on the present study is that the source of sponsorship of a client satisfaction study may have little effect on both response rates and ratings. A study of patient satisfaction with a medical practice found no differences between two randomized sub-samples, one of which received the survey on practice letterhead and the other on that of the university conducting the study [47].

3.3 Methods

The study was conducted in the same research setting described in Chapter 1, using three sequential phases: in-depth interviews to clarify concepts and develop a questionnaire, followed a pilot survey phase to pre-test the questionnaire, and finally a large-scale survey. These phases are described in detail below.

3.3.1 Phase 1: Questionnaire Development

In the first phase, in-depth interviews were conducted with 36 experienced design consultants and clients to identify seven dimensions of project success (summarized in Table 2-1) as well as a process model of a prototypical consulting project (Figure 4-1) that formed the organizing structure for the questionnaire. Measures for the various dimensions were identified from the interviews as well as the product development and customer satisfaction literature. Wherever possible, standard survey items were used to allow comparisons to past results. For example, the client satisfaction dimension was measured using questions from the American Customer Satisfaction Index [35] and the Net Promoter method [36], the working relationship item was taken from Anderson et al [15], and the business impact dimension assessed using the same measures as Roy and Potter [18]. Unfortunately, the exact question wording could not always be reproduced. Repeated requests for a copy of Roy and Potter's survey instrument were not acknowledged, so the relevant items were approximated based on wording from their published articles. In other cases, the existing questions needed adjustment to better suit the consulting context. For example, Anderson et al's question about deliverable quality references "non-defective parts," which may be appropriate for an integrated design-and-production supplier but not for a design consultancy.

While the interviews were primarily exploratory, a small amount of quantitative data was collected as well. After a few interviews had been conducted, as it became clear that client satisfaction is a key dimension of success, preliminary data were collected using the Net Promoter method [36]. Each client respondent was asked how likely he or she would be to recommend the last three consultants he or she had used. To encourage candor, respondents were not required to identify the rated consultants.

3.3.2 Phase 2: Pilot Testing

Following the interviews, the draft survey instrument was used to collect data on thirty projects from one consultancy. The project manager or a project engineer from each project were identified by the consultancy's study coordinator and asked to complete the questionnaire, mimicking the method that would be used in the full-scale survey. As each questionnaire was returned, the respondent was de-briefed by the investigator via phone or in-person interview to identify misunderstandings and other problems with the instrument. Relatively few changes were required, so the resulting data are generally comparable to those gathered in the full-scale survey. However, at least three differences should be noted. First, the respondents were warned of the de-briefing in advance, so they completed the survey knowing that their responses would not be anonymous. Second, the projects are somewhat older than those used in the full-scale study. In an attempt to test the limits of the respondents' recollection, the pilot sample included projects that had been completed from one to four years prior to the survey. The fraction of "I don't know" responses began to increase after two years, so the full-scale study included only projects that finished within two years of the survey. Third, data were collected only from consultant respondents, as the consultancy was not comfortable extending the survey to its clients. For these reasons, the pilot sample data are presented throughout the results but kept separate from the other samples.

3.3.3 Phase 3: Benchmarking and Patent Studies

Sample Selection

The study population for the final phase consisted of all projects completed within the last few years by U.S. consultancies specializing in consumer, medical, and industrial product development [48]. Two separate but related samples were used to maximize coverage of the population. The first sample was implemented as a client satisfaction benchmarking study. Nineteen consultancies were randomly selected from the consultancy population and invited to participate. Five agreed to take part. A study coordinator at each consultancy compiled a list of all projects completed within the prior two years, from which a total of 126 projects (~25%) were randomly drawn for study. To preserve the confidentiality of the consultancies' clients, each project was identified to the investigator using an anonymous code. The coordinators

identified one to four client and one to three consultant participants of each project to solicit feedback from. The coordinators then mailed the questionnaires, included in Appendices D and E, to 184 client and 104 consultant participants. 82 client and 74 consultant questionnaires were returned directly to the investigator, yielding response rates of 44.6 and 71.1%, respectively. The data collected from these groups are referred to as the "Benchmarking Client" and "Benchmarking Consultant" sub-samples in the results. A total of 62 projects were assessed by at least one client respondent, 52 by at least one consultant, and 46 by at least one of each type (the questionnaires had been marked with the project code so that responses about the same project could be matched by the investigator).

The second sample emerged from an attempt to counter the potential biases in the benchmarking study. The worst of these would be if the participating consultancies attempted to positively skew their results by excluding poor projects from the sampling frame or encouraging respondents to provide positive feedback. Several defenses against such behavior were deployed. First, mutual non-disclosure agreements were signed to prevent either the consultancy or the investigator from revealing consultancy-specific results publicly. Second, the consultancies were reminded that use of the sponsoring university's name without institutional approval would constitute a trademark violation. Third, they were encouraged to view the study as a learning opportunity, with the lessons only as valuable as the representativeness of the results. Finally, they were allowed to add key clients that had not been randomly selected onto the respondent list. Feedback was gathered from these clients and reported back to consultancy but not included in these study results.

Nonetheless, at least two other biases remain that could positively skew the results of the benchmarking sample. First, the consultancies that declined to participate may have done so because they anticipated poor results. Second, the client respondents may have been charitable in their responses because they knew that the consultancies would see them. To minimize such bias the respondents were instructed that all responses would be anonymized and aggregated before being reported to the consultancies.

These last two biases could be largely eliminated by removing the consultancies from the sampling process and collecting data directly from the clients. The challenge is locating them. Design consulting, while growing, is still a relatively small industry, so few practicing product developers have direct experience with a recent consulting project. In addition, many client firms prefer not to publicize the fact that they do not design their own products. To randomly locate consulting clients would require a very large, expensive sample, with pre-screening to separate the customers from the non-customers. One might narrow the field by surveying members of a professional association, but few exist that cater specifically to clients of product design services. In addition, any professional association has its own values and agenda, which might introduce additional biases to the sample.

Instead, consulting clients were identified directly from public traces left behind by their projects. Such approaches are commonly used by researchers studying rare or sensitive subjects [49]. For the present purpose, the best trace evidence was government records, specifically, patent applications. The pilot data suggested that nearly 45% of projects yielded a U.S. patent or patent application, which identifies both client and consultant inventors and usually the client firm (the assignee). Better still, statistical analysis of both the pilot and benchmarking samples showed that projects which generated a patent record did not significantly differ on any other dimension from projects that did not generate a patent record. Thus, patent records can provide a reasonably representative subset of all consulting projects.

To generate the patent sample, five consultancies were randomly selected from the fourteen that declined to participate in the benchmarking study, to counter the benchmarking non-response bias. For each consultancy, one or more seed employees were identified from the consultancy's own web site or public press releases. These names were used to search U.S. patent records for projects the employee had worked on. Each patent provided names of client inventors as well as additional consultants, who were used in subsequent searches. Proceeding through the patent network in this fashion produced a total of 230 projects having patent applications filed within the past four years. A total of 784 client inventors were identified, of whom the whereabouts of 310 could be confirmed from public records. From these, 262 were randomly selected and mailed the questionnaire, care of their present employer. Consultant inventors were not included

in the patent sample out of respect for their employers' decisions not to participate in the study. Unlike the benchmarking questionnaires, the patent questionnaires were not marked, so as to provide the respondents complete anonymity and counter the "charitable response" bias. 38 completed questionnaires and 18 non-deliverables were returned after one postcard reminder, yielding an effective return rate of 15.6%.

Non-Response Analysis

Three forms of non-response analysis were performed. First, the benchmarking projects that produced a client response were contrasted to those that did not on the basis of project demographic data provided by the consultancies. This analysis suggested that clients from larger projects were more likely to respond (t-test, $p = 0.039$ for project length, 0.053 for project budget, each two-sided), as were clients whose projects preceded later work between the two companies (Fisher's exact test, $p = 0.058$, two-sided). In addition, the consultants' estimates of the clients' satisfaction were significantly lower for the non-responding projects (Wilcoxon rank-sum, $p = 0.004$), though their estimates for the responding projects did not correlate strongly with the clients' actual satisfaction (Spearman's $\rho = 0.027, p = 0.84$).

Next, intra-project client response rates were calculated for each of the benchmarking projects and regressed against all other variables. This analysis suggested that client response rates were positively associated with repeat business before and after the assessed project (t-test, $p = 0.015$ for before, 0.004 for after, each two-sided), as well as the client team's experience with consultants (Pearson's $r = 0.64, p = 0.014$), the consultancy's experience with the type of product being developed ($r = 0.65$, $p = 0.006$), the consultants' assessment of the stability of requirements throughout the project ($r = 0.58, p = 0.020$), and the consultants' perception of the project's value to the client ($r = 0.68, p = 0.004$). Response rates were negatively associated with the consultants' perception of product novelty ($r = -0.67, p = 0.004$) and unresolved problems ($r = -0.62$, $p = 0.023$). All these effects suggest that clients having a more extensive working history with the consultancy were significantly more likely to respond.

Lastly, all variables from the benchmarking and patent responses were regressed against response promptness (number of days from survey mailing to return postmark), under the

assumption that non-respondents are more similar to tardy respondents than to prompt ones. Later client benchmarking responses were positively associated with the occurrence of problems (t-test, $p = 0.015$, two-sided) and negatively associated with project length ($r = -0.27$, $p = 0.043$). These effects suggest that smaller and more problem-ridden projects may have been less likely to yield a response. Later consultant benchmarking responses were positively associated with the respondent's involvement in planning the project ($r = 0.34$, $p = 0.039$) and negatively associated with their appraisal of the project's success ($r = -0.41$, $p = 0.012$) and their estimates of the client's satisfaction ($r = -0.36$, $p = 0.027$). This suggests that consultants of less successful projects may have been less likely to respond. The patent sample showed no significant effects, but it had only half as many observations to estimate from.

Together, the three non-response analyses suggest that the benchmarking sample is likely biased towards clients with whom the consultancies have an extensive working relationship, is likely biased towards longer projects, may be biased towards client respondents having more experience with consulting, and may be biased towards more successful projects. The one form of non-response analysis that could be performed on the patent sample did not find evidence of non-response bias.

3.4 Descriptive Results

In this section, descriptive demographic and project outcome data from all three major samples (Pilot, Benchmarking, and Patent) are presented. For subjective dimensions such as working relationship quality, consultant and client benchmarking responses are presented separately. Significant differences between samples are called out inline, and analyzed in Section 3.5.1. Other measurement effects are analyzed in Sections 3.5.2 through 3.5.4. Because most of the success measures are ordinal rather than interval, and some are heavily skewed, extensive use is made of non-parametric statistical techniques such as the Wilcoxon rank-sum test (analogous to the *t*-test, for showing difference in central tendency), the Wilcoxon signed-rank test (analogous to the paired *t*-test) and the Kruskal-Wallis test (analogous to one-way analysis of variance).

3.4.1 Project Demographic Data

Demographic data about the projects in each sample are presented in Table 3-2. Client firms ranged from small start-ups to *Fortune* 250 companies (those having revenues ≥ $10B [50]). About 70% had more than 500 employees (not shown), versus just 4% of those in Roy & Potter's study [18]. At the same time, the samples contain more small firms than Amaral and Parker's study of the *Fortune* 1,000 (2008 revenues >$1.6 billion [51]). The high fraction of projects in large firms likely reflects the concentration of product development activity nationally.

37 to 56% of the projects involved consumer products, about one-third were medical products, and the remainder were business-to-business industrial and construction products. About one-third were new-to-the-world and 30% new-to-the-firm, much higher than the 8 and 17.5% typical in new product development [27]. 38 to 57% of the projects were to be manufactured by the client firm, challenging speculation in the literature that outsourced design with internalized production is a rare form of industrial organization [52]. The distribution of manufacturers differs significantly between samples ($\chi^2 = 19.4$, $p = 0.004$), but only because of the non-manufactured products in the benchmarking sample. Projects in the pilot sample were somewhat shorter than the other samples, likely due to non-response bias in the others, but the difference is not statistically significant ($F = 1.28, p = 0.28$).

Table 3-2: Key project demographics for the Pilot, Benchmarking, and Patent samples. Only the distribution of manufacturers differs significantly between samples, due to the non-manufactured products.

Variable	Response	Sample		
		Pilot	Benchmarking	Patent
Client Firm's Annual Revenue	< $1 million	16.7%	8.8%	5.6%
	$1M to $9.9M	3.3%	5.9%	5.6%
	$10M to $99M	3.3%	14.7%	5.6%
	$100M to $999M	20.0%	35.3%	27.8%
	$1B to $9.9B	30.0%	17.6%	27.8%
	≥ $10 billion	26.7%	17.6%	27.8%
Type of Product Being Developed	Consumer durables	20.0%	20.6%	16.7%
	Consumer electronics	3.3%	26.5%	16.7%
	Consumer non-durables	13.3%	8.8%	5.6%
	Industrial & construction	33.3%	11.8%	22.2%
	Medical & scientific	30.0%	26.5%	38.9%
	Services	0%	5.9%	0%
Product Novelty	New to the world	36.7%	30.9%	27.8%
	New to the client firm	26.7%	33.8%	27.8%
	New variant on an existing product	30.0%	35.3%	38.9%
	Incremental improvement	6.7%	0%	5.6%
Product Manufacturer[a]	The client firm	56.7%	38.2%	47.2%
	U.S. production supplier	33.3%	16.2%	19.4%
	International production supplier	10.0%	30.9%	33.3%
	Not a manufactured product	0%	14.7%	0%
Technical Disciplines Involved (% of Projects Including these Disciplines)	Industrial design	50.0%	85.3%	66.7%
	Mechanical engineering	96.7%	70.6%	66.7%
	Interaction design & human factors	10.0%	26.5%	27.8%
	Design research	6.7%	19.1%	5.6%
	Electrical engineering	6.7%	7.4%	0%
	Other	0%	7.4%	16.7%
Project Scope (% of Projects Including these Activities)	User research	20.0%	36.8%	61.1%
	Concept development	56.7%	80.9%	83.3%
	Detail design & analysis	83.3%	51.5%	69.4%
	Manufacturing support	16.7%	19.1%	16.7%
Project Length (Months)	Median	4	6	7.75
	Interquartile range	3 – 9	2 – 17	5.5 – 12
	Overall range	1 – 24	0.5 – 31	2 – 24
[a] $\chi^2 = 19.4, p = 0.004$	*n*	30	68	36

3.4.2 Respondent Demographic Data

To keep the questionnaires short, interesting, and unintrusive, relatively few respondent demographic questions were included, all centering around the respondent's seniority and role on the project (Table 3-3). The pilot sample is skewed towards project managers and team members because research access was gained through the engineering group rather than business development. The benchmarking consultant and patent samples are well-distributed, but the benchmarking client sample is skewed towards the high seniority end. The participating consultancies were most interested in getting feedback from those making the hiring decisions, and had more reliable contact information for them for sales purposes. In addition, on several projects there was more than one client respondent who considered him or herself the project sponsor.

Table 3-3: Respondent demographics for the Pilot, Benchmarking, and Patent samples.

		Sample			
Variable	Response	Pilot	Benchmarking Consultant	Benchmarking Client	Patent
Role on Project[a]	Project sponsor	6.7%	32.4%	48.8%	21.1%
	Project manager	53.3%	43.2%	34.1%	31.6%
	Project team member	40.0%	24.3%	4.9%	47.4%
	Other	0%	0%	12.2%	0%
Involvement in Selecting the Consultancy[b]	Made the decision	~	~	61.0%	18.4%
	Consulted in decision	~	~	24.4%	47.3%
	Not involved in decision	~	~	14.6%	34.2%
Involvement in Negotiating & Planning Project	Led negotiations/planning	20.0%	41.1%	~	~
	Consulted	56.7%	35.6%	~	~
	Not involved	23.3%	21.9%	~	~
Familiarity with Project Contract[c]	Read the contract	80.0%	89.2%	80.5%	47.4%
	Read statement of work	16.7%	8.1%	12.2%	21.1%
	Did not see either document	3.3%	2.7%	7.3%	31.6%
	n	30	74	82	38

[a] $\chi^2 = 34.4, p < 0.001$, "Other" excluded
[b] $\chi^2 = 10.3, p = 0.006$
[c] $\chi^2 = 22.4, p = 0.001$

3.4.3 Business Impact Measures

Product Commercialization

Figure 3-1 presents the commercialization rates for the three samples. In this and other figures, percentages are based on the meaningful responses only, disregarding "I don't know" and other non-applicable responses. Such responses are, however, included as grey bars to the right of the 100% mark to illustrate their relative frequency. As the figure shows, 46 to 58% of projects have already commercialized one or more products, with another 15 to 46% still in development at the time of the survey. The benchmarking sample contained fairly recent projects (surveyed zero to two years post-project, versus one to four years for the pilot sample) so it is not surprising that many are still in development. Including these pending projects, the three samples are significantly different ($\chi^2 = 10.0$, $p = 0.040$), but excluding them they are not ($\chi^2 = 2.22$, $p = 0.33$).

Using the very rough assumption that half the projects still in development will eventually commercialize a product, the overall commercialization rates would be 66 to 69% for the three samples, quite similar to Roy and Potter's 65% figure (projects surveyed three to six years after completion) [18], as well as the Product Development and Management Association (PDMA) Best Practices Study's 70% estimate [26].

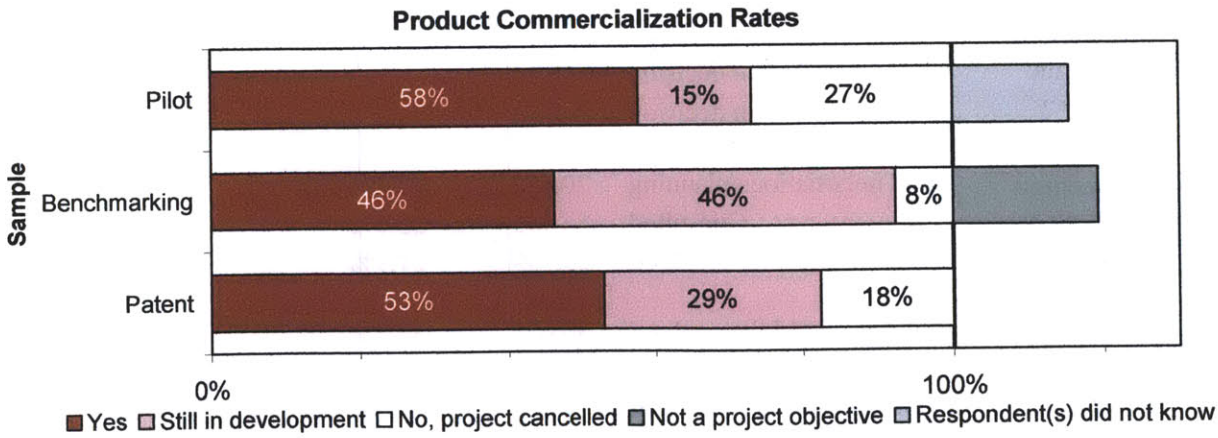

Figure 3-1: Percentage of projects in each sample that have commercialized one or more products.

Commercial Success

For the products that did go to market, client respondents were asked how well the product performed relative to their original objectives for it. A 9-point scale was used to provide greater resolution than traditional binary measures [26, 51-54]. Commercial success varied widely, as shown in Figure 3-2, and was significantly higher for the benchmarking sample than the patent sample (Wilcoxon rank-sum test, $p = 0.019$, two-sided). The pilot sample was not assessed as the consultant respondents could not accurately judge the products' performance or the clients' expectations for them.

As a point of reference, the most recent PDMA Best Practices Study found that 58% of all commercialized projects are deemed successful by the firm launching them [26]. Assuming that scores of 5 and up on the 9-point scale constitute success, 92% of the benchmarking and 67% of the patent sample were successful. If scores of 6 and up constitute success, 71 and 56% were successful. Note that the PDMA survey asks respondents what percentage of products commercialized in the previous 5 years were successful, whereas in this case they were evaluating specific projects, so the measures are only roughly comparable.

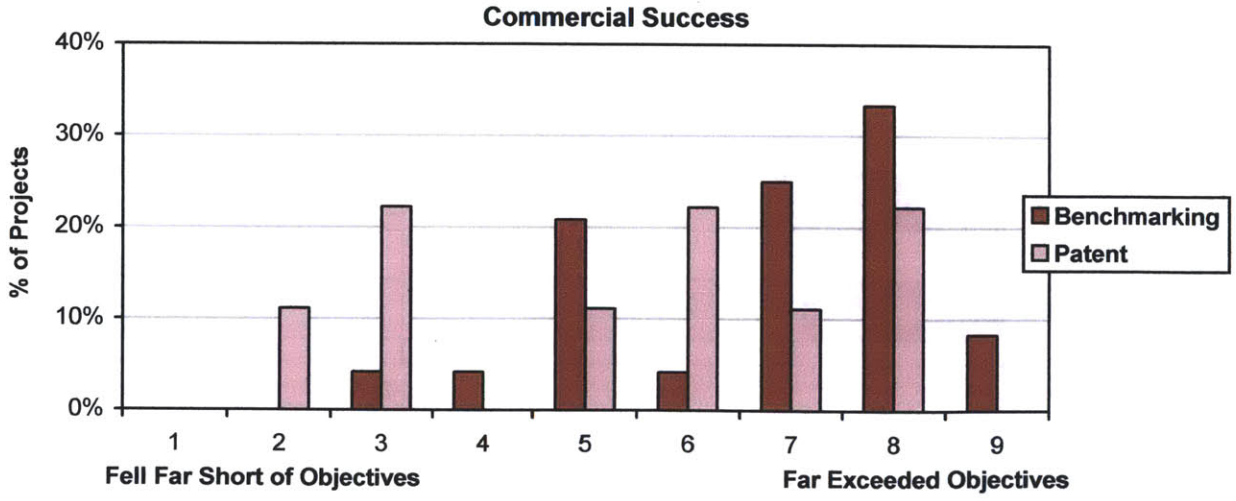

Figure 3-2: Success of commercialized products in the market, for the Benchmarking and Patent samples. The Pilot sample was not assessed on this measure because it had only consultant respondents.

Return on Project Investment

Client respondents were also asked whether the project generated a positive return on its cost. As shown in Figure 3-3, 39% of benchmarking and 33% of patent sample projects had already paid for themselves by the time of the survey, while 48 and 44% had not yet done so but might in the future. 13 and 22% were deemed to have cost the firm more than they would ever benefit it. The difference between samples is not significant ($\chi^2 = 0.845$, $p = 0.66$ including the "Not yet" projects, $\chi^2 = 1.53$, $p = 0.22$ excluding them). For comparison, Roy and Potter found that 58% of the projects in their sample generated a positive return [18].

Beyond the percentages, a notable finding is how many respondents could not answer the question, either because their companies do not track return-on-investment (ROI) or because they did not personally have the data. ROI results are therefore not available for fully one-quarter and one-third of the benchmarking and patent projects, respectively. What's more, responses from multiple respondents on the same project often differed. Majority rule was used to produce the percentages shown below, with ties decided by the most senior respondent's answer. As a result, these data should be viewed as approximations. They are presented primarily to illustrate the challenges involved in measuring a project's financial impact. This finding confirms the experience of Roy and Potter, who could only obtain quantitative financial data for 41% of their sample and qualitative estimates for 40% more [18].

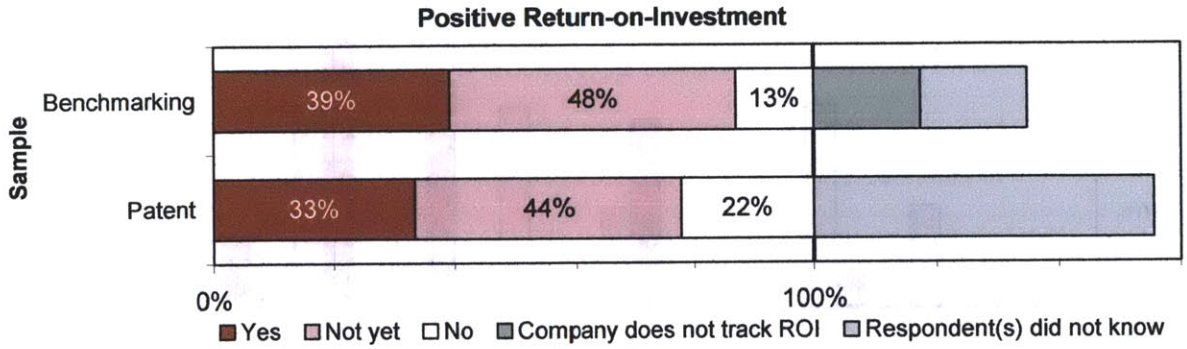

Figure 3-3: Percentage of projects yielding a positive return-on-investment for the client firm. The Pilot sample was not assessed on this measure.

3.4.4 Design Quality Measures

Project Requirements Met

Most projects were judged to have met or exceeded the requirements stated in the project contract (Figure 3-4). 82 to 96% of the projects were rated 4 or 5 on the 5-point scale, by both consultants and clients. No projects were rated below 3. The four groups do not significantly differ (Kruskal-Wallis test, $K = 4.58, p = 0.21$).

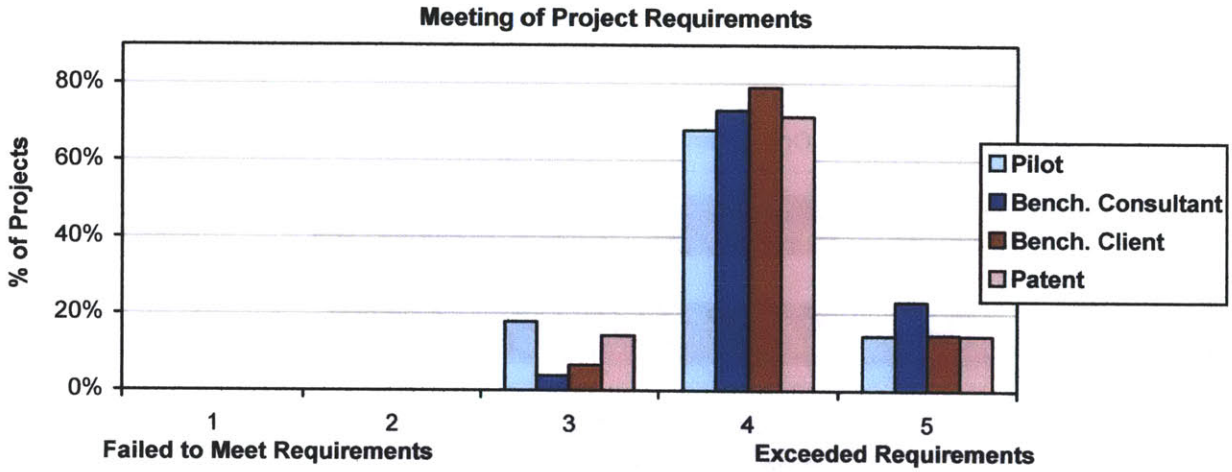

Figure 3-4: Distribution of project requirements performance. The light blue bars represent consultant assessments of the Benchmarking projects, while the burgundy bars are assessments by the clients.

Implementation and Rework of Consultant's Deliverable

In approximately 85% of projects the consultant's work was implemented in the client's broader development project (Figure 3-5). Non-implementation occurred primarily in exploratory projects or in cases in which the broader development project was canceled, halted, or re-scoped due to a market shift. Only in four projects (all in the benchmarking sample) was non-implementation due to the quality of the work itself.

Most projects required at least minor rework but projects in the patent sample required significantly more (Wilcoxon rank-sum, $p = 0.028$, two-sided). Rework data were not collected for the pilot sample as the consultant respondents did not have reliable knowledge. Most could say whether their work had been implemented, but lost visibility into the client's operations after that point.

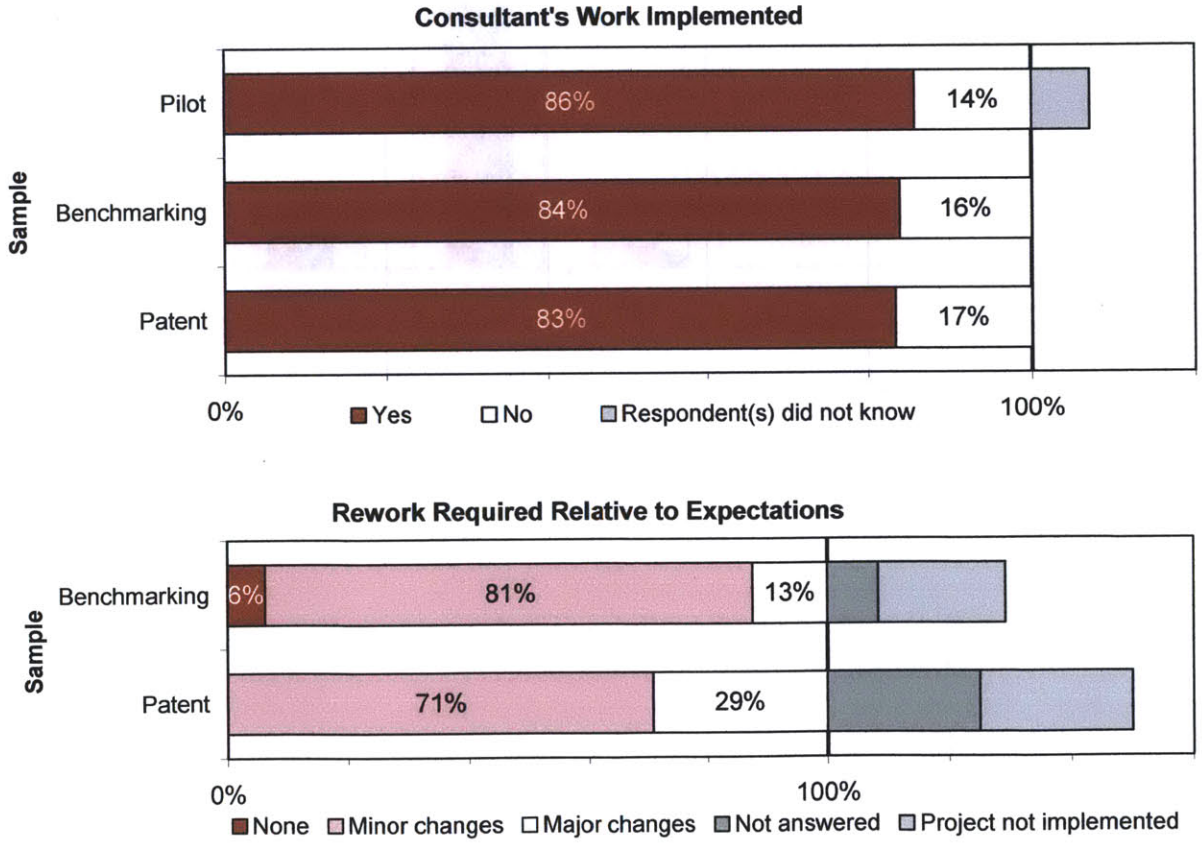

Figure 3-5: Rates of implementation of, and rework required to, consultant's work.

Patents and Design Awards

45% of pilot and 37% of benchmarking sample projects generated a patent record (Figure 3-6). The pilot sample had more granted patents at the time of the survey because they were older projects. About 30% of the benchmarking and patent samples won design awards versus just 4.3% of the pilot sample, a significant difference ($\chi^2 = 6.25$, $p = 0.044$). A possible explanation is that the projects in the pilot sample were more engineering-focused than those in the other samples (Table 3-2), and design awards tend to recognize industrial design achievement. Also, the pilot consultancy tends not to invest heavily in applying for awards. Lastly, the client respondents of the benchmarking and patent samples were in a better position to observe awards than the consultant respondents of the pilot sample (see also Section 3.5.2).

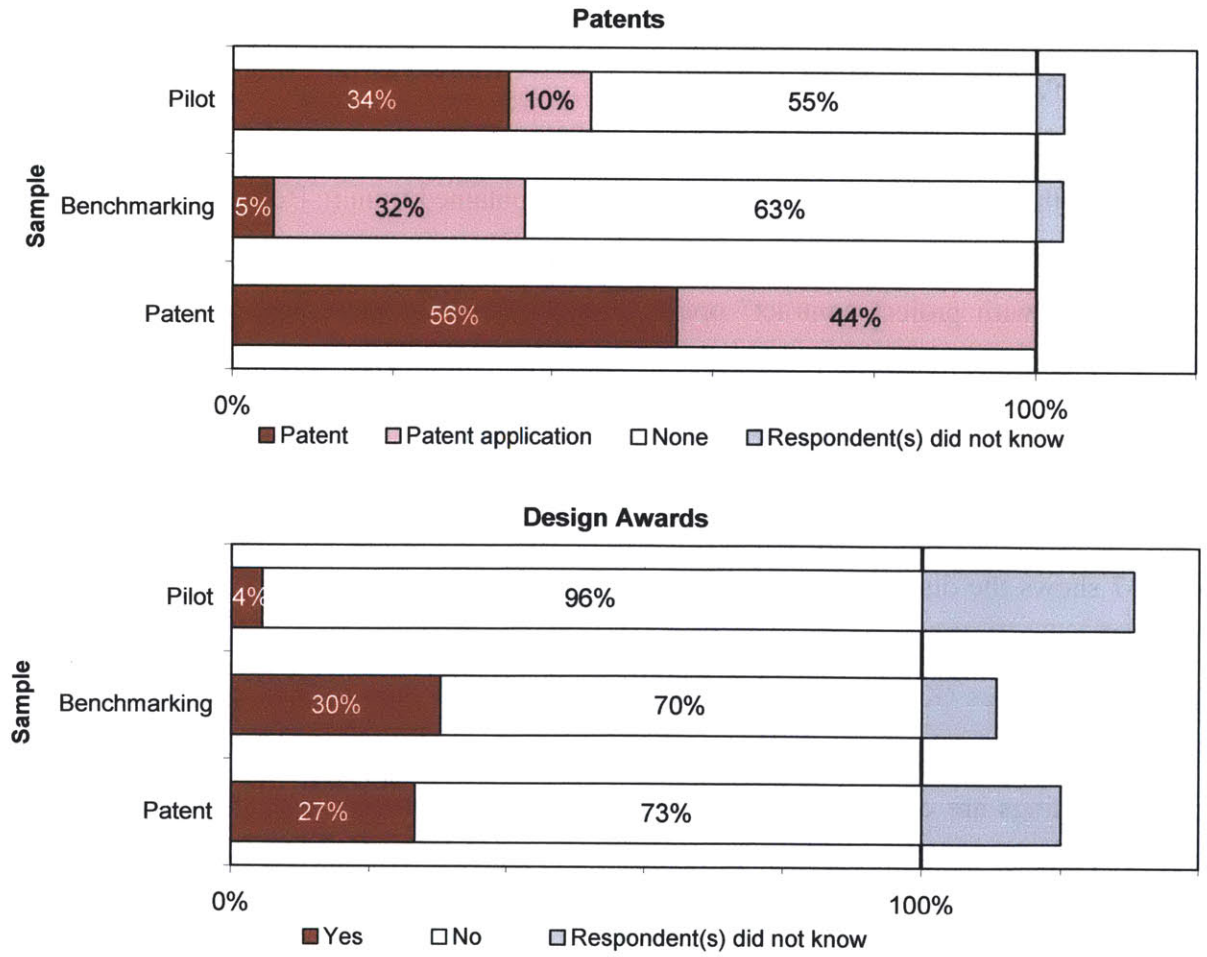

Figure 3-6: Percentage of projects in which a patent or design award resulted from the consultant's work.

3.4.5 Process Efficiency Measures

Schedule and Budget Performance

Both consultant and client respondents were asked to assess when the consulting project was completed relative to the schedule specified in the contract and how much it cost relative to the specified budget. The results are shown in Figure 3-7. 70 to 85% of projects were rated 3 or higher on the 5-point schedule scale, suggesting that they were completed on time or ahead of schedule. None of the four groups are significantly different (Kruskal-Wallis, $K = 2.67$, $p = 0.45$). For budget performance, 73 to 92% of projects were rated 3 or higher, suggesting they came in at or under budget. The high fraction of "3" responses is not surprising given that nearly two-thirds of the projects used fixed-fee contracts. Again, the four samples are not significantly different ($K = 2.03, p = 0.57$).

Perceived Project Value

Respondents were asked to judge the value of the consulting project to the client firm, considering both the cost of the project and the benefits obtained from it. Because this question is somewhat subjective, the results are presented on a respondent basis rather than a project basis. An "unfamiliar with project contract" option was provided for those who did not know the project cost, which roughly 10% utilized. Although the consultants would not be expected to know the full benefits of the project to the client firm, they were asked to estimate project value anyway to allow comparison of perspectives.

Figure 3-7 shows the distributions. Overall, 79 to 91% of consultants and 60 to 88% of clients rated their project's value 4 or 5. Patent sample respondents rated their projects significantly lower than the others (Kruskal-Wallis, $K = 17.9$, $p = 0.0005$). Benchmarking consultants rated project value higher than benchmarking clients did, though the difference is not significant. When their ratings are compared on matched projects, the difference does become significant (see Section 3.5.2). The pilot sample consultants rated their projects slightly lower than both the benchmarking clients and consultants, but this effect was also not significant.

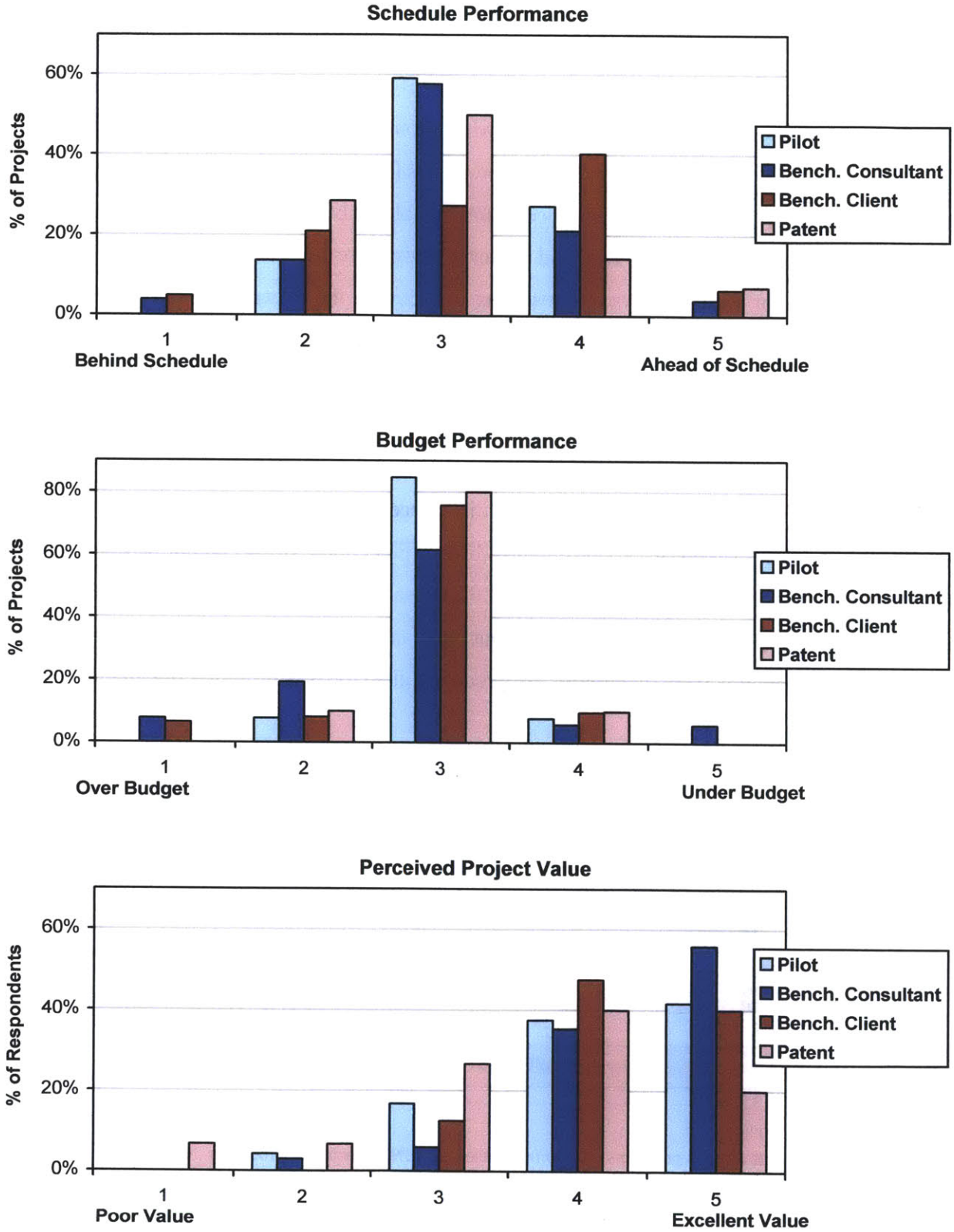

Figure 3-7: Distribution of Process Efficiency measures. Note that schedule and budget performance are reported on a project basis, while the more subjective value ratings are reported per respondent.

Occurrence and Resolution of Problems

39 to 67% of respondents experienced "Some Problems" on their projects and an additional 0 to 3% reported "Serious Problems." While these categories are somewhat vague, they were used to allow comparison to Roy and Potter's study, which found that 16.5% of projects encountered some problems and an additional 10% serious problems [25]. It is not immediately clear why the respondents in the present study experienced more problems but less severe ones. One possible explanation is that the projects in Roy and Potter's study were smaller in scale (the government subsidy only paid for 15 to 30 days of consulting service) but the clients were quite novice (over two-thirds had never used a consultant before). A methodological explanation is that the questions were not worded identically (see Section 3.3.1).

Interestingly, consultant respondents in the benchmarking study reported more problems on those projects than did their clients, though the difference is not significant (Wilcoxon rank-sum, $p = 0.14$, two-sided). Likewise, a significantly higher percentage of the patent sample reported problems than the benchmarking clients ($p = 0.020$, two-sided). This may indicate biases in the benchmarking study (see Section 3.5.1). About half and three-quarters of all consultant- and client-reported problems were eventually resolved. A full analysis is provided in Chapter 4.

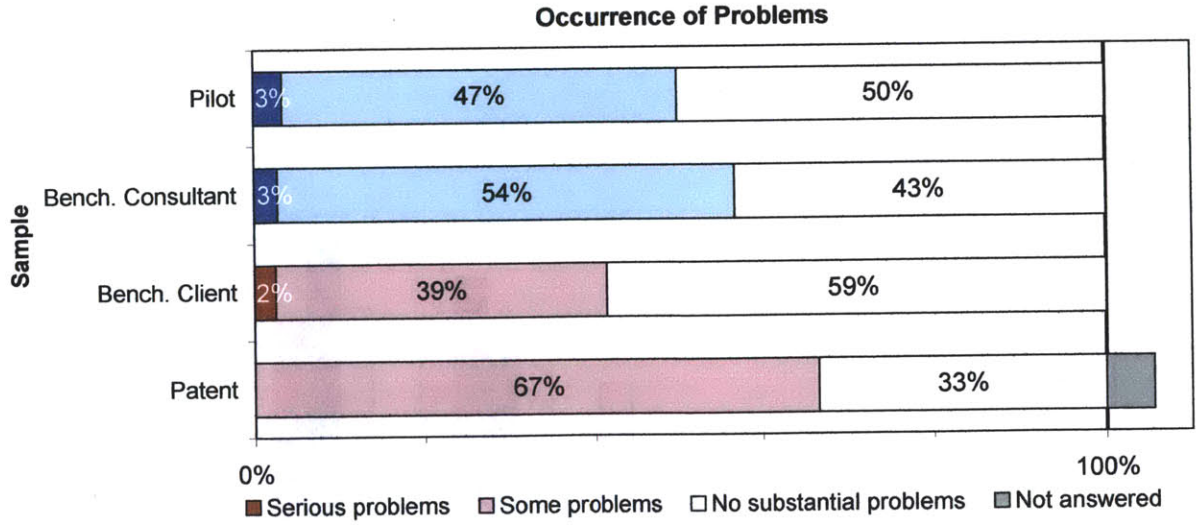

Figure 3-8: Percentage of respondents reporting problems on their projects. Blue bars are used for consultants and red bars for clients. The results are reported on a respondent basis to show the small minority reporting serious problems, which become muted when the responses are averaged by project.

Problems occurred in nearly all phases of the consulting process (Figure 3-9). Communication problems during development topped the list, confirming the need for study of interfirm coordination mechanisms [5]. Patent sample respondents were far more likely than others to flag problems communicating with the manufacturer, despite the fact that 47% of these products were produced by the client firm itself. The greater incidence of manufacturing coordination problems in the patent sample is likely due to these projects being further along in development.

Besides communication, the most problematic phases were those occurring after the formal completion of the project, when the client firm must accept the consultant's work into its organization and refine it. These issues have received little attention in past empirical research. The issues that have been identified, such as poor specification of requirements and development problems by the consultant, persist but at lower levels than previously reported. This may reflect a maturation of the industry, or simply the fact that the present study included more experienced client firms (versus [25]) and more sophisticated design suppliers (versus, e.g., [16]).

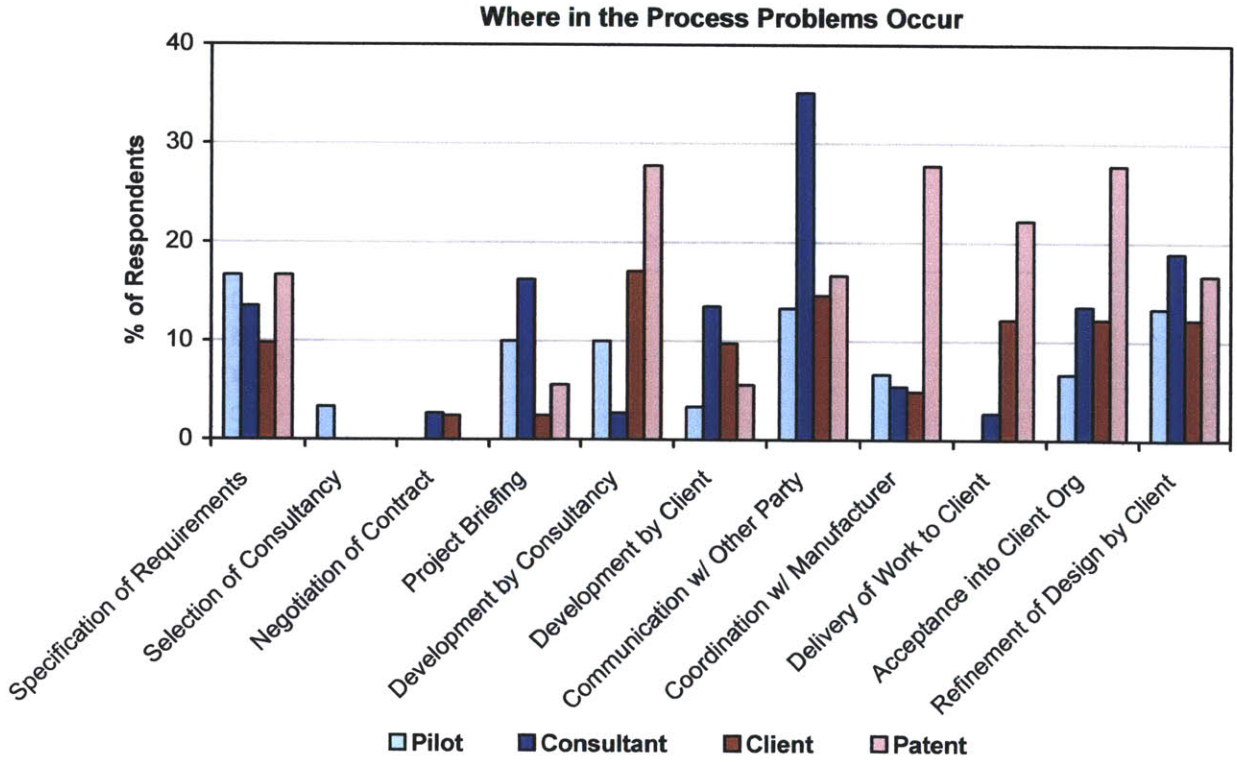

Figure 3-9: Percentage of respondents reporting problems on their project in each phase of the consulting process. Respondents could, and did, indicate problems in multiple phases.

3.4.6 Relationship Quality Measures

Quality of Working Relationship

Most respondents rate their working relationship with the other party well, with 80 to 90% of each group scoring it 4 or a 5 on a 5-point scale (Figure 3-10). The mean scores for the pilot, benchmarking consultant, benchmarking client, and patent groups are 4.27, 4.36, 4.56, and 4.22, each higher than the 3.8 value reported by Anderson et al [15]. What's more, no respondent in the present study assigned a score of 1, whereas that did occur in their study. Although demographic details were not provided, it appears that their study included more international collaborations, in which the greater physical and cultural distances may have adversely impacted the working relationships. Likewise, their study appears to have focused on integrated design-and-manufacturing suppliers rather than design consultants. This may have led to a more arms-length relationship than the partner-like relationships typical in the present study.

The benchmarking clients rated their relationships significantly better than both the patent clients (Wilcoxon rank-sum, $p = 0.010$, two-sided) and the benchmarking consultants ($p = 0.050$), suggesting that the benchmarking sample may provide a non-conservative estimate.

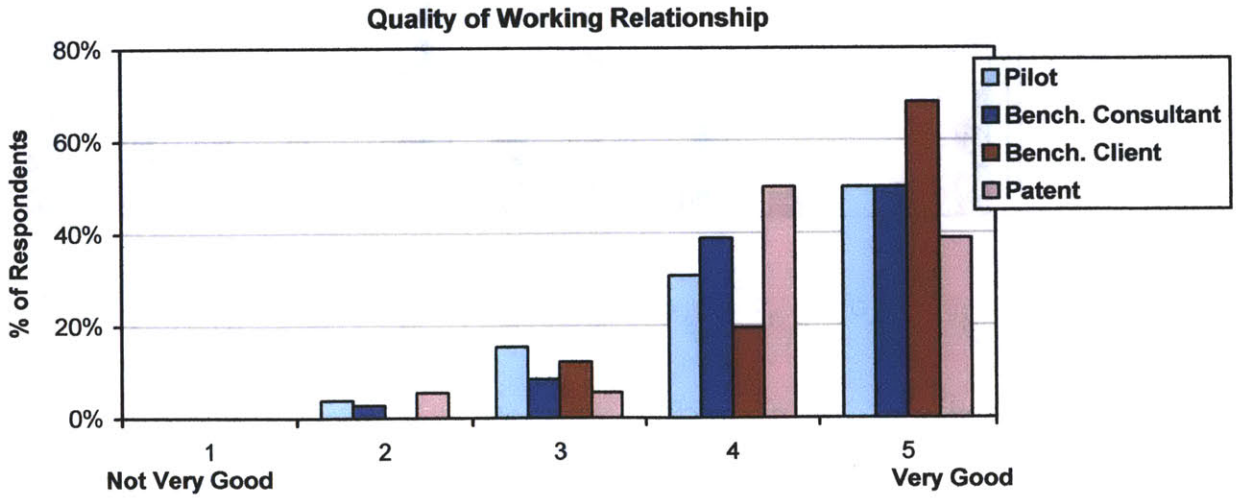

Figure 3-10: Quality of working relationship.

Goodwill Trust

Trust takes many forms, from competency trust – the confidence that the other party can do what it is assigned – to goodwill trust, the confidence that the other party will always act in the first's best interest [55]. Respondents were asked to evaluate the latter on a 5-point scale, producing the striking results shown in Figure 3-11. Client respondents generally trusted their consultants, though the patent sample did so significantly less than the benchmarking sample (Wilcoxon rank-sum, $p = 0.019$, two-sided). Consultants, on the other hand, were dramatically less trusting than the benchmarking clients ($p < 0.001$ for both benchmarking and pilot consultants) and somewhat less trusting than the patent clients ($p = 0.005$ for the benchmarking consultants, $p = 0.093$ for the pilot consultants). This finding contradicts an oft-repeated theme from the outsourcing strategy literature, that clients should be wary of suppliers "holding up" the deliverable until a ransom (in the form of increased prices or a contract extension) is paid. It appears that in the consulting industry the client firms hold the upper hand, which is not surprising given that design consultancies are small, relatively abundant, and somewhat interchangeable (in terms of services offered, if not value or quality). Consultant interviewees told anecdotes of client firms refusing to pay invoices for services rendered, or scapegoating the consultancy for problems in development. Such egregious acts were relatively rare. More common were instances of client firms pressuring the consultancies for more work than the project contract warranted.

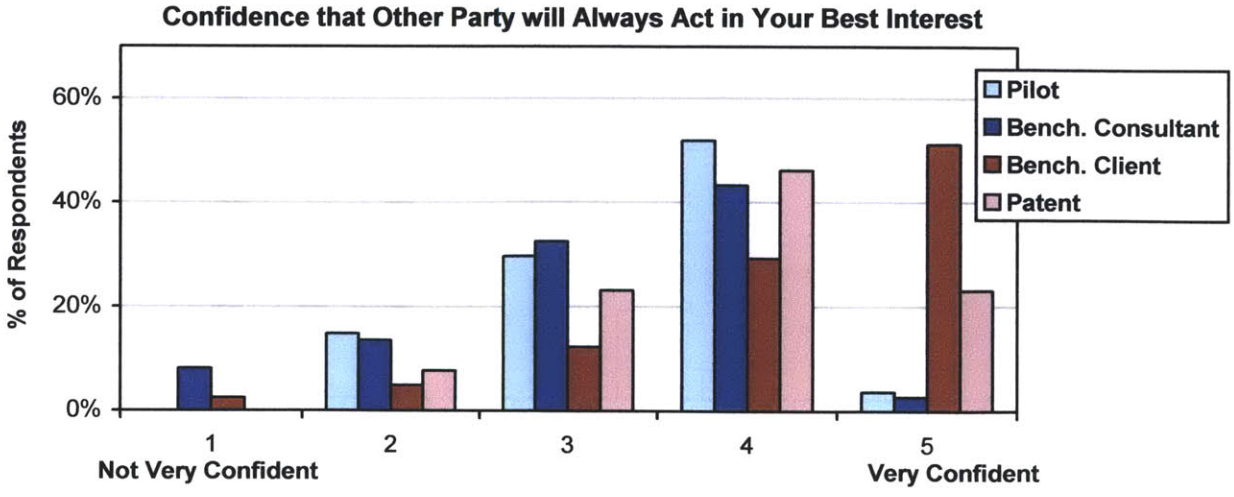

Figure 3-11: Distribution of goodwill trust across the four groups.

3.4.7 Client Satisfaction Measures

Client satisfaction was assessed with the same questions as two widely used measures, the Net Promoter Score [35] and the American Customer Satisfaction Index [34]. It was also approximated using the occurrence of repeat business after the assessed project.

Net Promoter Score

Clients were asked how likely they were to recommend their consultancy to a friend or colleague (Figure 3-12). The benchmarking sample scores are significantly higher than the patent sample (Wilcoxon rank-sum, $p < 0.001$, two-sided). The strong negative skew of the benchmarking distribution is typical of customer satisfaction in competitive markets [33]. The more uniform distribution of the patent sample is less common and suggests that dissatisfied individuals may have been more likely to return the survey. 61% of the benchmarking sample and 32% of the patent sample rated their consultancy a 9 or 10 and would be considered "Promoters" under the Net Promoter rubric. 10 and 29% provided scores of 6 or lower and would be considered "Detractors." Subtracting the percentage of Detractors from the percentage of Promoters yields the Net Promoter Score (NPS), which is +51% for the benchmarking sample and +3% for the patent sample. These values are very good and fairly poor, respectively, compared to those of other industries [56]. For example, the brokerage and investments industry has an NPS of +35%, whereas the health insurance industry trails most others with a score of -5%.

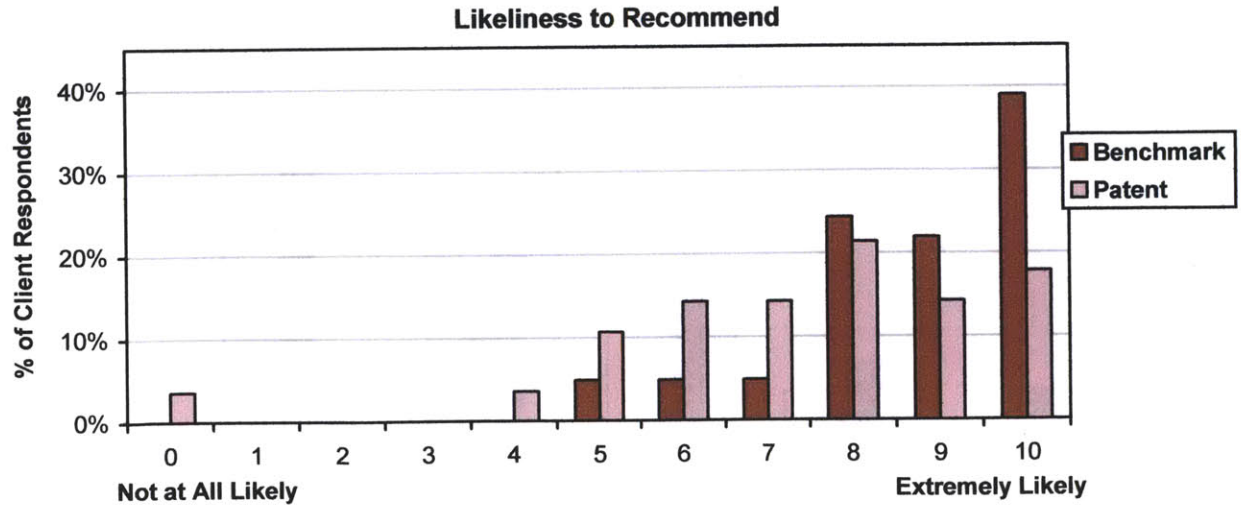

Figure 3-12: Client respondents' likeliness to recommend their consultancy to a friend or colleague.

American Customer Satisfaction Index Measures

Data were also collected using the three measures that comprise the American Customer Satisfaction Index (ACSI): the extent to which the client's expectations were met, how well the consulting service compared to a hypothetical ideal, and the client's overall satisfaction with the consulting service (Figure 3-13). The patent sample significantly lags the benchmarking sample in all three measures (Wilcoxon rank-sum, $p = 0.0004$, 0.0014, 0.0007, all two-sided).

Although the exact weighting factors used for averaging the three measures to form the ACSI are industry-specific and proprietary to the survey's developer, they differ minimally from equal weighting.[2] Using equal weighting, the resulting scores for the benchmarking and patent samples are 80.7 and 66.7, respectively. Like the Net Promoter scores, these two values differ significantly ($t = 3.35$, $p = 0.0015$, two-sided) and are very good and fairly poor, respectively, relative to published benchmarks [57]. For example, the most recent ACSI surveys place express delivery services at 83, full-service restaurants at 81, hospitals 77, the health insurance industry 73, wireless carriers 71, the airline industry and cable television at 66, and the U.S. federal government at 65. High performing companies such as FedEx and Apple score in the mid to upper 80s, while low performers such as Comcast and United Airlines score in the low 60s. Unfortunately, very little data is publicly available for business-to-business services, and even less for highly customized knowledge-based services such as innovation consulting.

Figure 3-14 presents score distributions for the consultancies participating in the benchmarking study as well the consultancies used for the patent sample. Two cautions must be made in interpreting these results. First, consultancies 1, 6, 7, and 9 had only a handful of respondents each (the exact numbers are withheld to maintain confidentiality). Secondly, different consultancies had different proportions of client project sponsors, managers and team

[2] For example, the U.S. Department of Labor annually publishes weighting factors derived from ACSI data for non-regulatory federal agencies. In 2010 these averaged 0.33, 0.28, and 0.39 for the Expectations, Ideality, and Overall Satisfaction measures (http://wdr.doleta.gov/directives/attach/TEGL6-00Attach.pdf). Using these values rather than equal weights alters the results of the present analysis by just 0.2%, an order of magnitude less than the sampling error. To avoid infringing on proprietary ACSI methods, the present study uses equal weighting of the three measures, which are themselves in the public domain (Fornell et al, 1996). The resulting index is hereafter referred to simply as a "Satisfaction Index" and is expressly not an "ACSI score," which can only be calculated by licensees of ASCI, LLC.

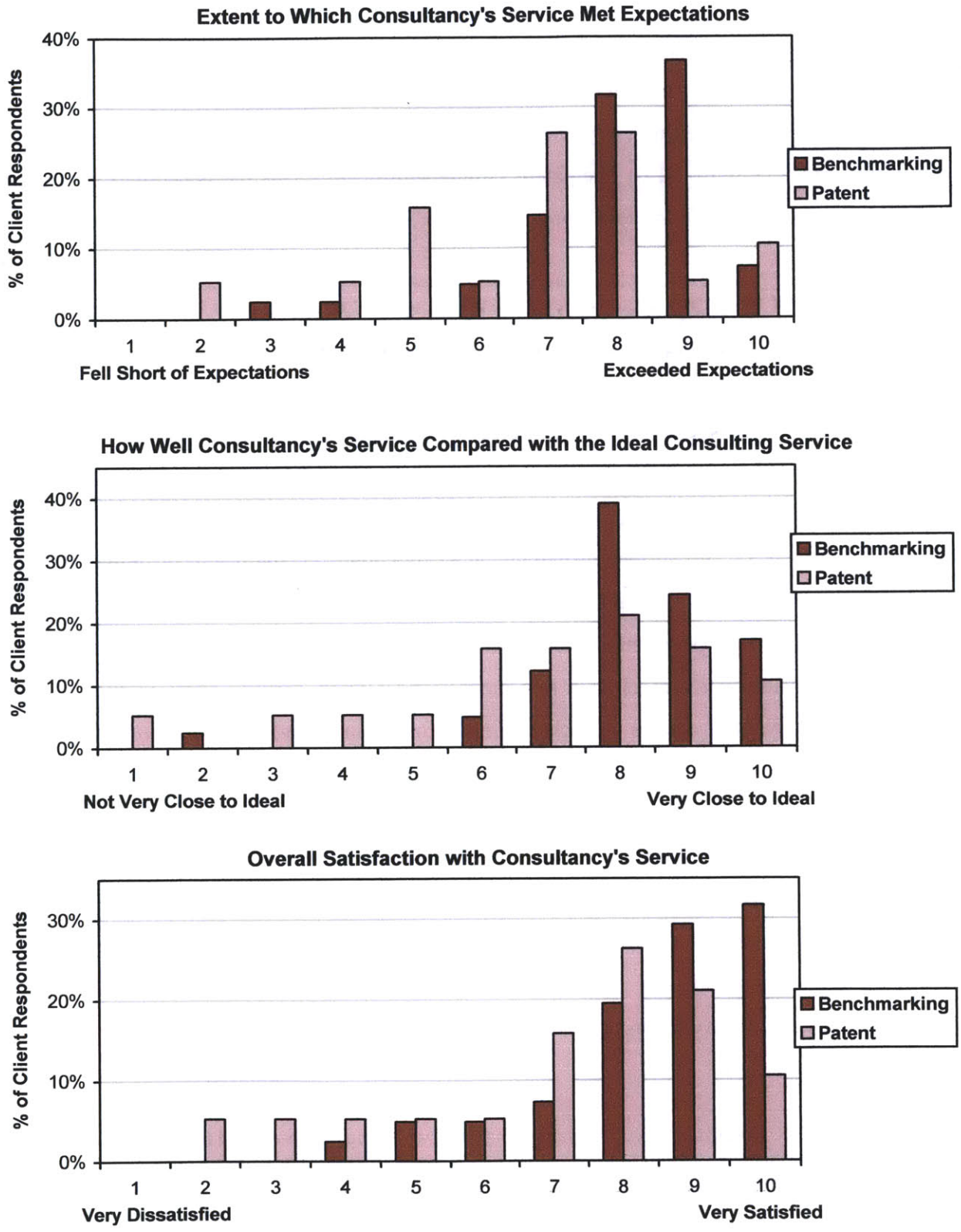

Figure 3-13: Distribution of the three items comprising the American Customer Satisfaction Index: meeting of expectations, the ideality of the Project, and overall client satisfaction.

members. As will be shown in Section 3.5.2, respondent role has a dramatic effect on client satisfaction. To allow more meaningful comparisons between consultancies, a role-adjusted version of this figure is presented as Figure 3-15. Disregarding consultancy 1 for small sample size, the median scores generally range from the upper 60s to the upper 80s.

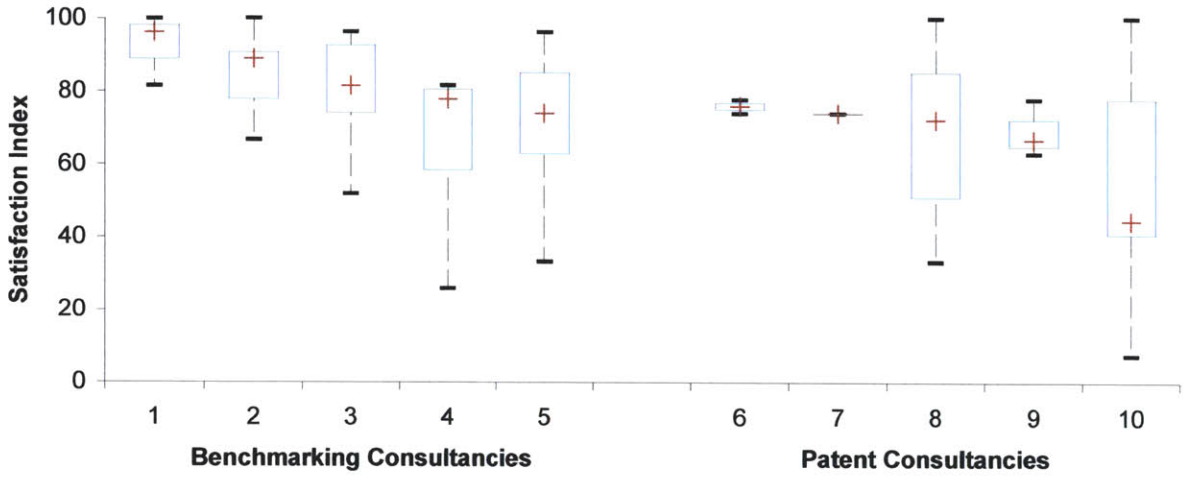

Figure 3-14: Variation in client satisfaction between consultancies in the Benchmarking and Patent samples. Each box plot represents a particular consultancy. The burgundy cross is that consultancy's median score, the blue horizontal lines represent the 75th and 25th percentiles, and the dashed black line the range. The consultancies are ordered by median score within each sample.

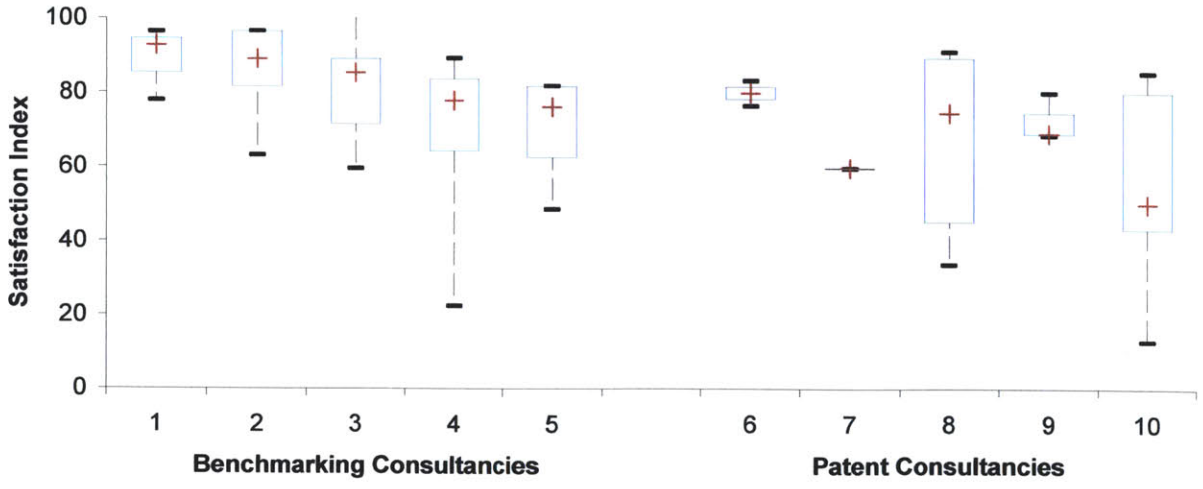

Figure 3-15: Variation in client satisfaction between consultancies, adjusted for the effect of respondent role. The consultancies are labeled identically to the previous figure.

Repeat Business

Although not a perfect measure of client satisfaction, repeat business is symptomatic of it [41]. 47 to 65% of the projects were followed by additional projects, with an additional 7 to 9% pending at the time of the survey. The pilot sample had less repeat business than the other two but the difference is not highly significant ($\chi^2 = 5.13$, $p = 0.077$, pending projects disregarded). Two factors may explain the difference. First, the non-response analysis suggested that repeat clients were more likely to respond in the benchmarking sample, potentially skewing that number upwards. Second, the nature of the pilot consultancy's business is such that it depends less on repeat business than some of its peers. Some firms strive to develop long-term relationships with a relatively small number of key clients. Others strive for a broad range of clients, both to stimulate their staff and to reduce dependence on any one client.

Few benchmarks exist for what constitutes a good level of repeat business from a customer satisfaction perspective.

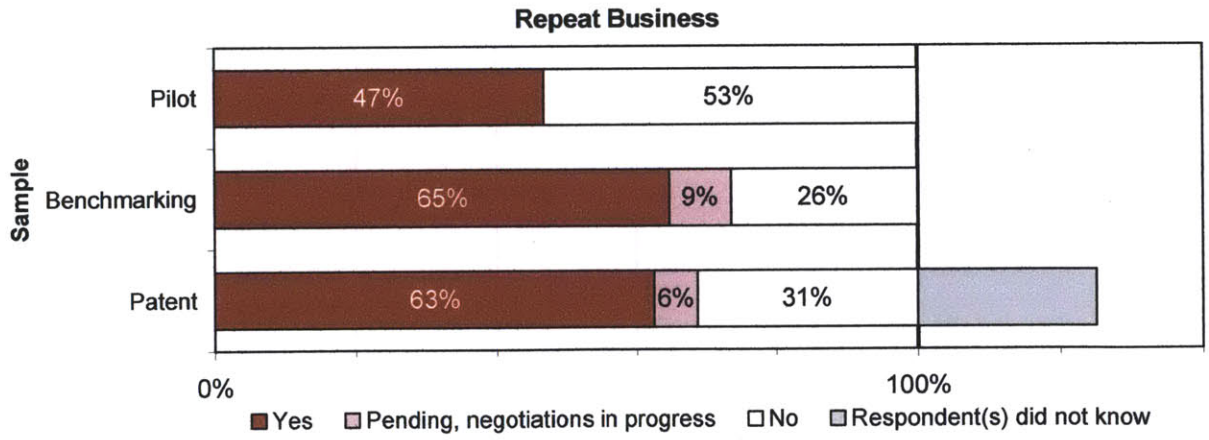

Figure 3-16: Percentage of projects that preceded additional projects between the two companies. Pilot and Benchmarking sample data provided by the consultancies, Patent sample data by the patent respondents.

3.4.8 Consultant Benefit Measures

Consultant satisfaction was estimated using adaptations of two of the ACSI measures (Figure 3-17). The resulting distributions are less skewed than is typical for customer satisfaction, but then these are not customers. If skewness results from choice in a free market, the results suggest that consultants are less free to choose their clients than clients are to choose them. Other consultant benefits, such as project profitability and publicity value, were assessed relative to the "average" project and produced fairly normal (in the statistical sense of the term) distributions (Figure 3-18).

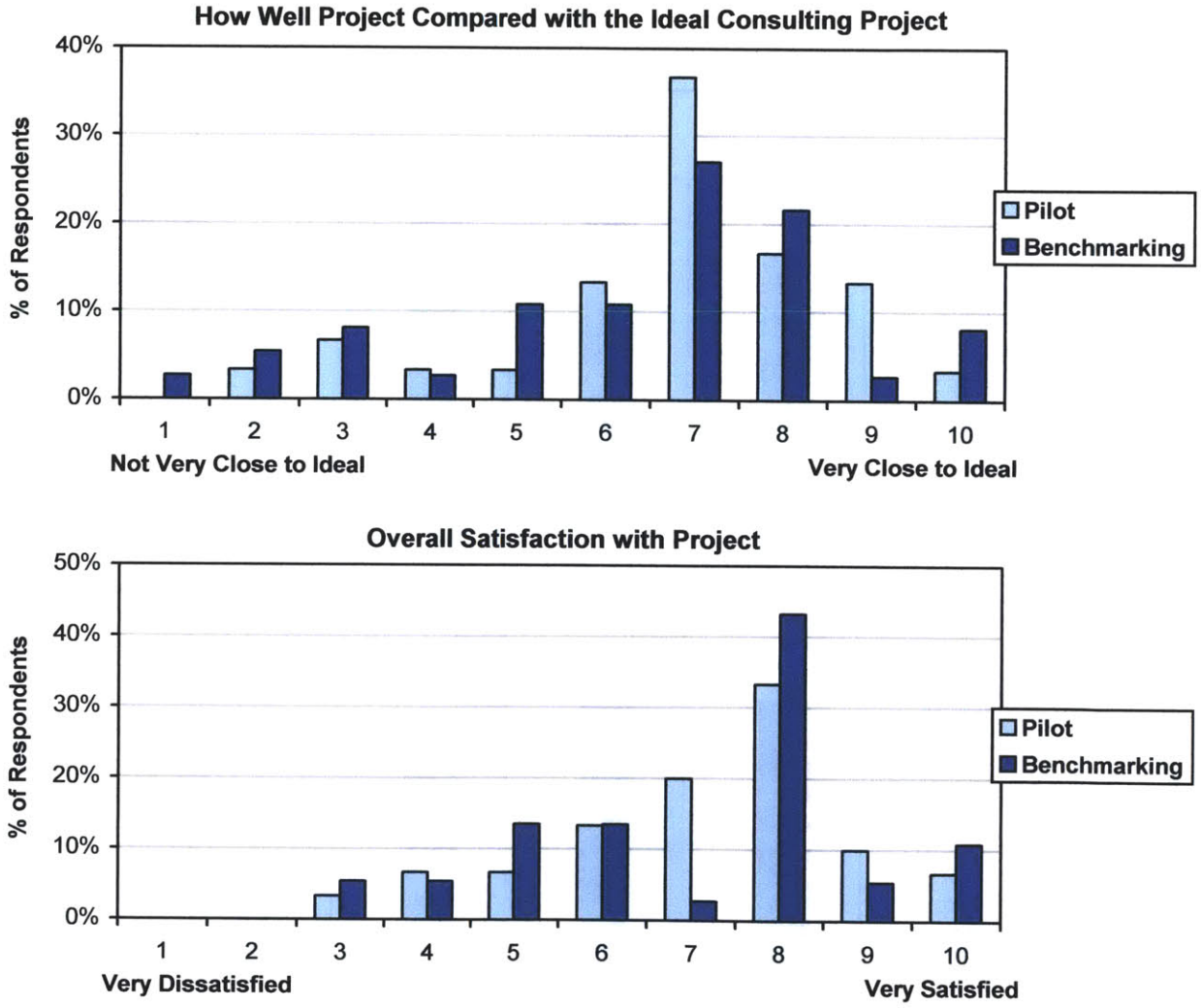

Figure 3-17: Distribution of consultant responses to two measures of consultant satisfaction, for the Pilot and Benchmarking samples. The samples are not statistically different on either measure (Wilcoxon rank-sum, p = 0.40 for ideality and 0.93 for overall satisfaction).

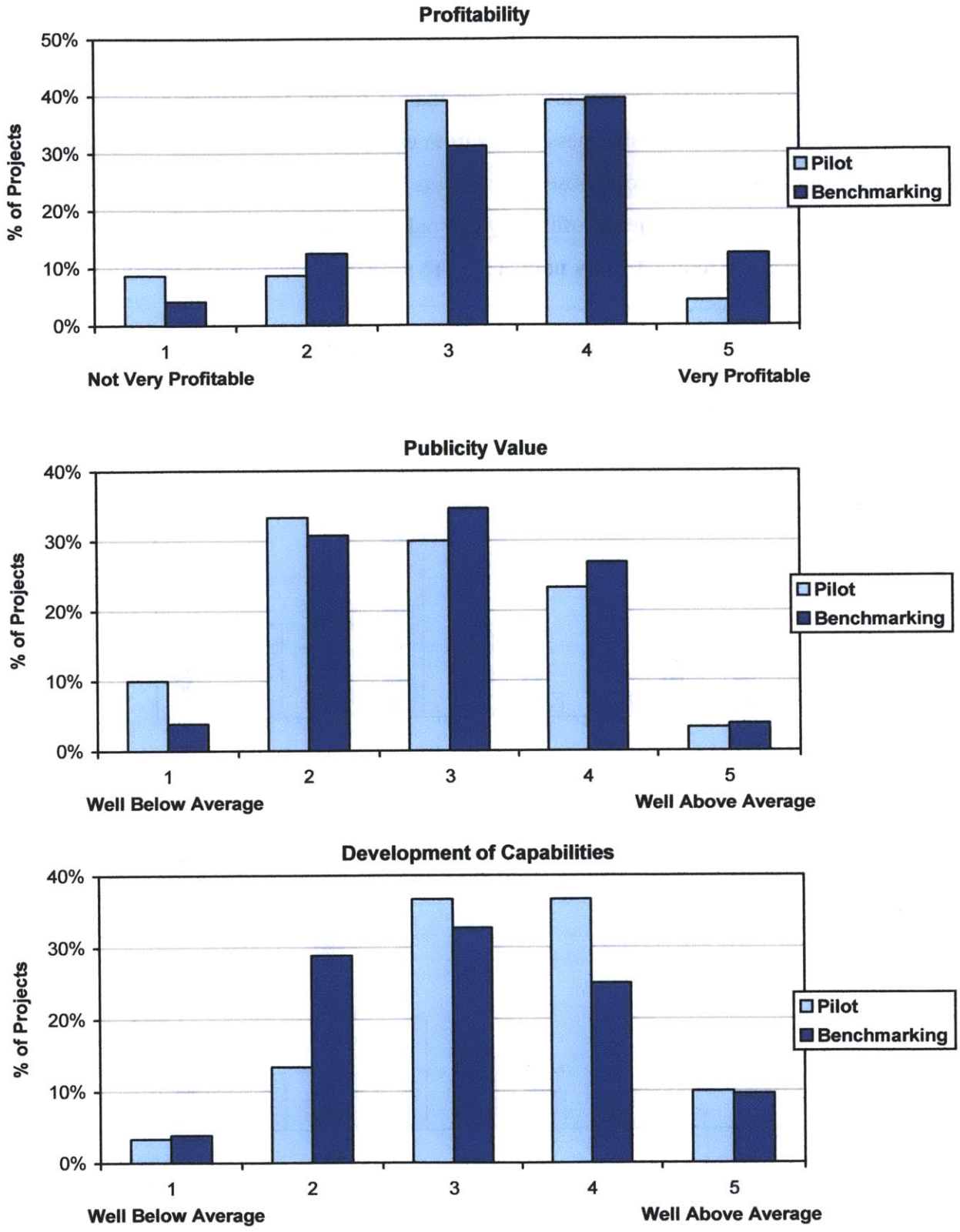

Figure 3-18: Three measures of project benefits to the consultancy. The results samples do not differ between samples, with only capability development approaching significance (Wilcoxon rank-sum, $p = 0.14$).

3.5 Methodological Results: the Impact of Measurement Choices

3.5.1 How You Ask: the Effect of Incentives and Consequences

Benchmarking vs. Patent Study

The similarities and differences in the results obtained from the benchmarking and patent samples in Section 3.4 suggest that measurements of project outcomes are influenced by the manner in which the data are collected. The two samples differed minimally on project demographic variables (Table 3-2), and did not differ significantly on objective project outcomes such as product commercialization rate, implementation of the consultant's work, design awards, or repeat business (Table 3-4). These facts suggest that the projects in the two samples were similar. The patent sample did, however, produce significantly worse results on every subjective outcome measure, such as perceived value, the occurrence of problems, working relationship quality, and client satisfaction (Table 3-4). Some of the difference between samples can be attributed to the greater seniority of the benchmarking respondents (Table 3-3), the effect of which is discussed in Section 3.5.2.

The reasons for the remainder of the difference are less certain. It may be that the consultancies who chose not to participate in the benchmarking study knew that their clients were less satisfied, though this seems unlikely given that the patent projects did no worse on objective measures. The consultancies who did participate may have (intentionally or unintentionally) solicited feedback from individuals with whom they had particularly good relationships, or those who were particularly familiar with the projects, whereas the patent sample was chosen randomly by the investigator. The benchmarking consultancies may have also (intentionally or unintentionally) done something to encourage more positive responses.

Most likely the difference is due to the different incentives and consequences experienced by the benchmarking and patent clients. While the explicit incentive was identical – advance access to these very results to help them benchmark their use of consultants – the benchmarking clients may have been influenced by an additional, implicit incentive: the opportunity to provide their consultancy with feedback. The patent clients, whose responses would not be shared with their consultancies, did not have this opportunity. Perhaps more importantly, their anonymity freed

Table 3-4: Summary of differences between Benchmarking and Patent sample clients. Significant differences are highlighted in bold.

Success Dimension	Success Measure	Benchmarking Mean or %	Patent Mean or %	n_b, n_p	Test Statistic	p-value
Business Impact	TO_MRKT	85.7%	75.0%	28, 24	n/a	0.483[a]
	MRKT_SUC	**6.75**	**5.33**	**24, 18**	**S = 306**	**0.037[b]**
	ROI	75.0%	60.0%	24, 10	n/a	0.431[a]
Design Quality	REQS_MET	4.08	4.00	62, 27	S = 1222	0.563[b]
	IMPLMNT	83.9%	83.3%	62, 36	n/a	0.999[a]
	REWORK	**2.03**	**2.29**	**49, 23**	**S = 1054**	**0.028[b]**
	AWARD	30.4%	26.7%	56, 30	n/a	0.806[a]
Process Efficiency	SCHE_MET	3.20	3.00	62, 27	S = 1154	0.281[b]
	BUDG_MET	2.87	3.00	62, 20	S = 900	0.350[b]
	VALUE	**4.28**	**3.60**	**79, 30**	**S = 1237**	**0.002[c]**
	PROBLEMS	**1.44**	**1.67**	**82, 36**	**S = 2490**	**0.020[c]**
	PROBS_NR	13.2%	22.2%	76, 36	n/a	0.273[d]
Relationship Quality	**WORK_REL**	**4.56**	**4.22**	**81, 35**	**S = 1756**	**0.010[c]**
	TRUST	**4.22**	**3.85**	**82, 26**	**S = 1127**	**0.026[c]**
Client Satisfaction	**RECOMND**	**8.71**	**7.11**	**82, 38**	**S = 1643**	**<0.001[c]**
	EXPECT	**8.05**	**6.89**	**82, 38**	**S = 1691**	**<0.001[c]**
	IDEAL	**8.22**	**6.89**	**82, 38**	**S = 1747**	**0.001[c]**
	SATIS	**8.51**	**7.21**	**82, 38**	**S = 1713**	**<0.001[c]**
	SAT_INDEX	**80.7**	**66.7**	**82, 38**	**S = 1685**	**<0.001[c]**
	REPEAT	71.0%	61.5%	62, 26	n/a	0.455[a]

[a] Fisher's exact test, two-sided, calculated on a project basis, non-applicable and pending projects excluded

[b] Wilcoxon rank-sum test, two-sided, calculated on a project basis

[c] Wilcoxon rank-sum test, two-sided, calculated on a respondent basis

[d] Fisher's exact test, two-sided, calculated on a respondent basis

them from the consequences of providing a poor rating. The benchmarking clients faced the risk that the investigator might breach the confidentiality promised them by revealing their project's identity to the consultancy or the consultancy's identity to the world. Such a breach could bring harm to the respondent or the consultancy. Even if they trusted the investigator, they may have been charitable because they knew that the consultants would receive their (anonymized) feedback, a form of social desirability bias. Either of these considerations (risk or charity) may have prompted the benchmarking respondents to answer more positively than they otherwise

would have, or the dissatisfied not to reply to the survey at all. As a result the benchmarking sample likely overestimates actual client satisfaction.

The patent sample, on the other hand, likely understates satisfaction. The dissatisfied patent respondent had nothing to lose by participating. No one would know what he said, he could vent his frustrations, and he would receive results that might help him improve his next consulting experience. Meanwhile, the satisfied patent client had little to gain from participation. His consultancy would not receive his feedback, and the study results incentive was less valuable because he was already satisfied with his present consultancy.

Interview Phase vs. Benchmarking/Patent Phase

To further test the effect of anonymity and consequence, the benchmarking and patent study results were compared to results obtained from the interview phase, in which the client respondents rated a total of eighteen consulting projects without providing any clue to the consultants' identities (Figure 3-19). Their ratings were significantly lower than those from the benchmarking sample (Wilcoxon rank-sum, $p = 0.005$, two-sided) but no different from those from the patent sample ($p = 0.79$), which seems to confirm the effect.

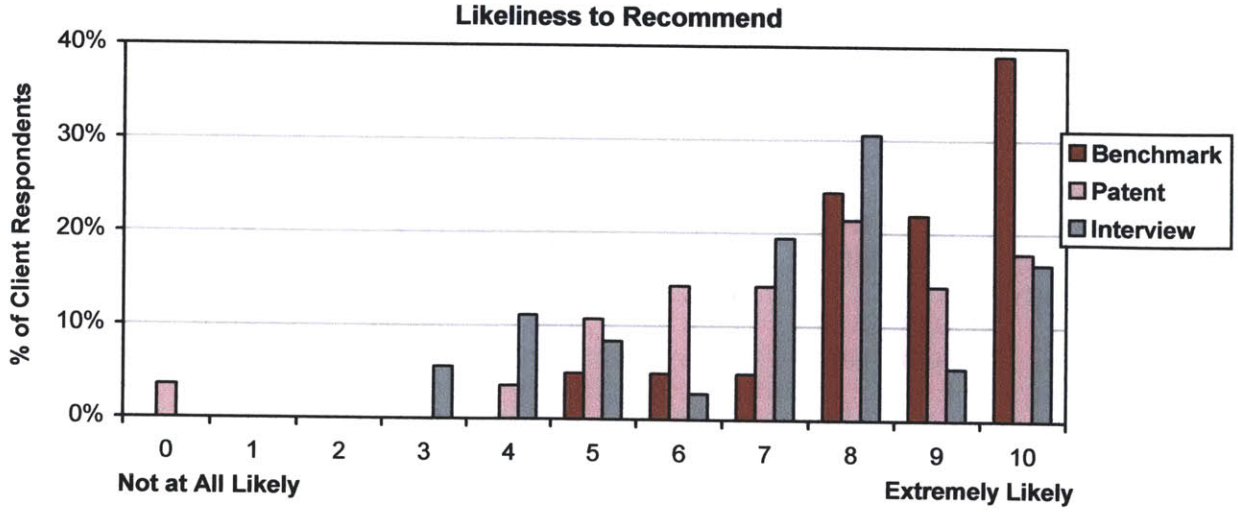

Figure 3-19: Client likeliness to recommend the design consultancy, for the Benchmarking, Patent, and Interview samples.

3.5.2 Who You Ask: the Difference between Consultant and Client Views

Differences between consultant and client respondents were discussed throughout Section 3.4, but were more precisely tested by analyzing the subset of 46 projects having both client and consultant respondents (Table 3-5). Paired analysis of the objective, project-level outcomes suggests that consultants rate the completion of requirements slightly higher, clients are significantly more likely to indicate that the project won a design award, and both groups rate schedule and budget performance similarly. These results are not terribly surprising, as the client is more likely to know about awards received after the consulting engagement ended, and schedule and budget performance are relatively unambiguous.

The more subjective, individual-level outcomes such as trust and satisfaction could not be meaningfully paired. Averaging responses by project tended to attenuate the differences, while pairing all possible combinations of client and consultant respondents for each project magnified them. As such, these outcomes were tested using the Wilcoxon rank-sum (pooled variance) test. The results suggest that consultants rate the project value significantly higher than clients, trust the clients significantly less, and are significantly less satisfied. The trust difference was discussed in Section 3.4.6. The difference in perceived value is not particularly surprising. The

Table 3-5: Comparisons of consultant and client evaluations of identical projects. Only the measures that were assessed by both groups are shown. Significant effects are highlighted in bold.

Success Dimension	Success Measure	Consultant Mean or %	Client Mean or %	*n*	Test Statistic	*p*-value
Design Quality	REQS_MET	4.17	4.02	46	$S = 42.5$	0.064[a]
	AWARD	**0.25**	**0.28**	**46**	**$S = 10.5$**	**0.031[a]**
Process Efficiency	SCHE_MET	2.96	3.01	46	$S = 21.5$	0.758[a]
	BUDG_MET	2.80	2.78	46	$S = 3.5$	0.943[a]
	VALUE	**4.54**	**4.16**	**56, 63**	**$S = 3928$**	**0.002[b]**
	PROBLEMS	1.56	1.42	68, 66	$S = 4161$	0.135[b]
	PROBS_NR	30.0%	15.9%	60, 63	n/a	0.085[c]
Relationship Quality	WORK_REL	4.45	4.56	68, 65	$S = 4215$	0.218[b]
	TRUST	**3.18**	**4.12**	**68, 66**	**$S = 5583$**	**<0.001[b]**
Client/Consultant Satisfaction	**IDEAL**	**6.38**	**8.09**	**68, 66**	**$S = 5541$**	**<0.001[b]**
	SATIS	**7.26**	**8.36**	**68, 66**	**$S = 5317$**	**<0.001[b]**

[a] Wilcoxon signed rank test, two-sided, paired projects
[b] Wilcoxon rank-sum test, two-sided, $n = 68$ consultant and 66 client respondents
[c] Fisher's exact test, two-sided, n = 60 consultant and 63 client respondents

interview phase suggested that clients often consider only the direct cost of the project, which is nominally higher than internal development, but fail to consider the indirect costs of internal development such as hiring and training the necessary resources.

The difference in satisfaction is interesting and can be explained by several factors. First, as mentioned in Section 3.4.8, the consultants are not customers and have less choice over who they work with. Second, the two groups form their expectations for the project from different sets of experience. The consultants' comparison set consists of other consulting projects, much like those in this study. The clients' set may include projects with other types of design service providers, such as independent contractors and low-cost offshore providers. If these other elements in the reference set perform worse than the consultancies, it may elevate the clients' evaluations relative to those of the consultants, who are only evaluating consulting projects. Third, the consultants experienced different incentives and consequences for participating in the study. In particular, the consultants were instructed that their anonymized responses would be shared with their employer but not with the clients. A breach of this confidentiality was less likely than it was for the client benchmarking respondents, since the investigator did not know the identities of the client firms. Thus, the consultants did not need to worry about offending their clients and could be more forthright.

3.5.3 Who You Ask: the Effect of Respondent Role

The results of many success measures were significantly affected by the respondent's role on the project. Client appraisals generally improved with seniority – project sponsors were more satisfied, less likely to indicate problems, etc. – while consultant appraisals improved with seniority on some measures and worsened with seniority on others. The effects are illustrated in Figure 3-20 through Figure 3-24. Results of statistical tests for differences are provided in Table 3-6.

Design Quality Measures

Design quality measures were only moderately affected by respondent role (Figure 3-20). Senior client benchmarking respondents rated requirements performance higher and rework lower.

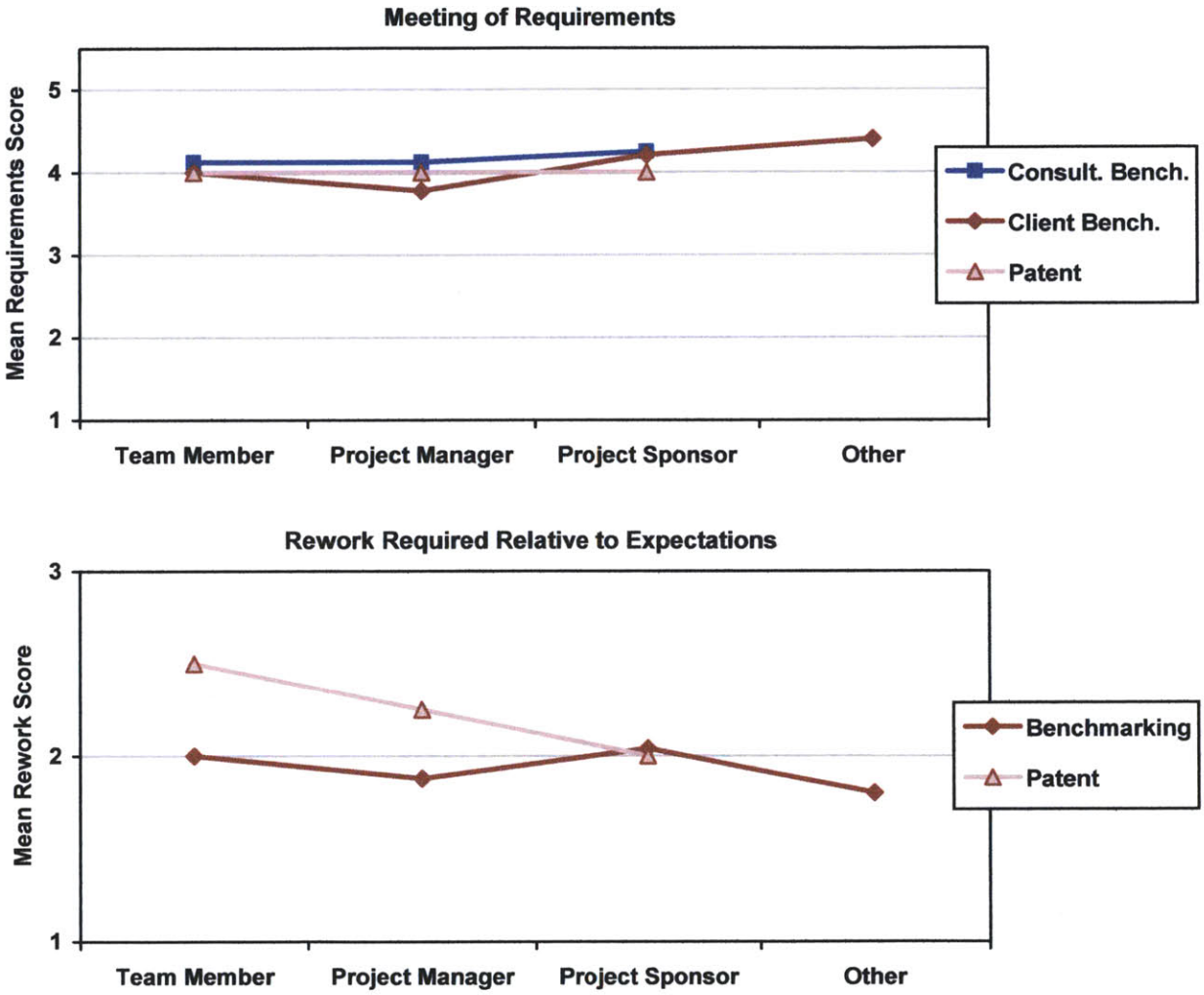

Figure 3-20: Comparison of design quality assessments by respondent role, type, and sample. Note that a higher score means "better" for meeting requirements but "worse" for rework required. For the rework measure, "1" indicates no rework, "2" indicates minor rework, and "3" indicates major rework, all relative to the respondent's expectations.

Process Efficiency Measures

The effects of role on process efficiency measures are complex (Figure 3-21), though some of the variation is measurement noise due to small sample sizes, particularly in the patent sample. Two interesting effects stand out. First are the favorable ratings provided by respondents in the benchmarking sample who indicated their role on the project as "Other." These individuals were generally senior client managers (e.g., a functional department manager) who were not on the core project team but held a stake in the project's outcome. Second, consultant evaluations of both value and problems decline with seniority. Presumably the team members are in a better position to observe problems, and more confident of the value of their work product.

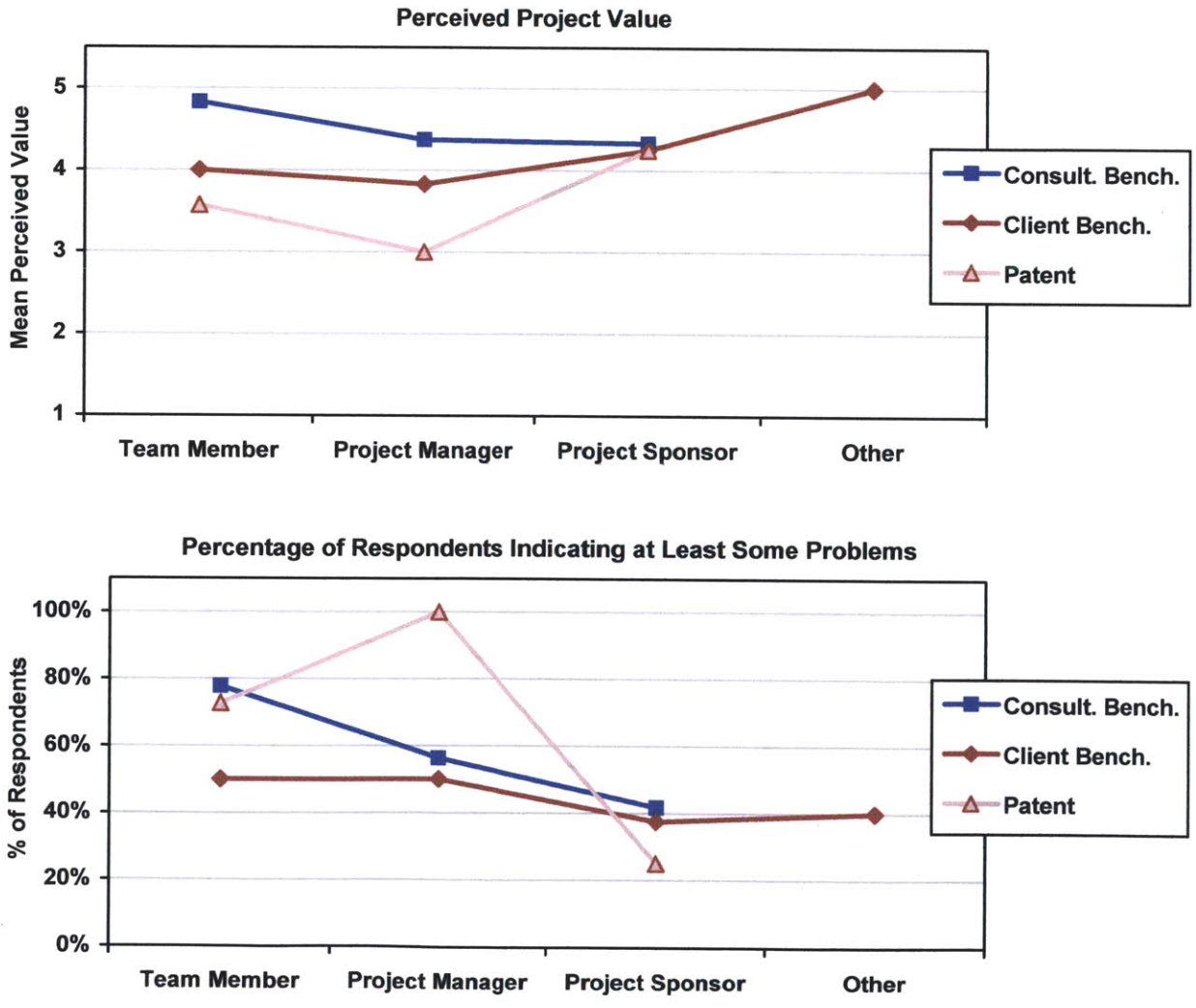

Figure 3-21: Comparison of process efficiency measures by respondent role, type, and sample.

Relationship Quality Measures

As shown in Figure 3-22, the effect of role on working relationship quality was quite similar to that of perceived project value, but the level of trust differed notably in one regard: consultant team members were less trusting than any other type of respondent. The reasons for this result are uncertain. It may be that the team members bear the brunt of clients' untrustworthy actions (e.g., sudden changes of client requirements that demand revision of the consultant team members' work) but have little power to influence them. In the interview phase, junior consultants were often more cynical than their seniors, and former consultants particularly so. They may simply have been less guarded, or perhaps the cynics leave the industry before rising to positions of seniority.

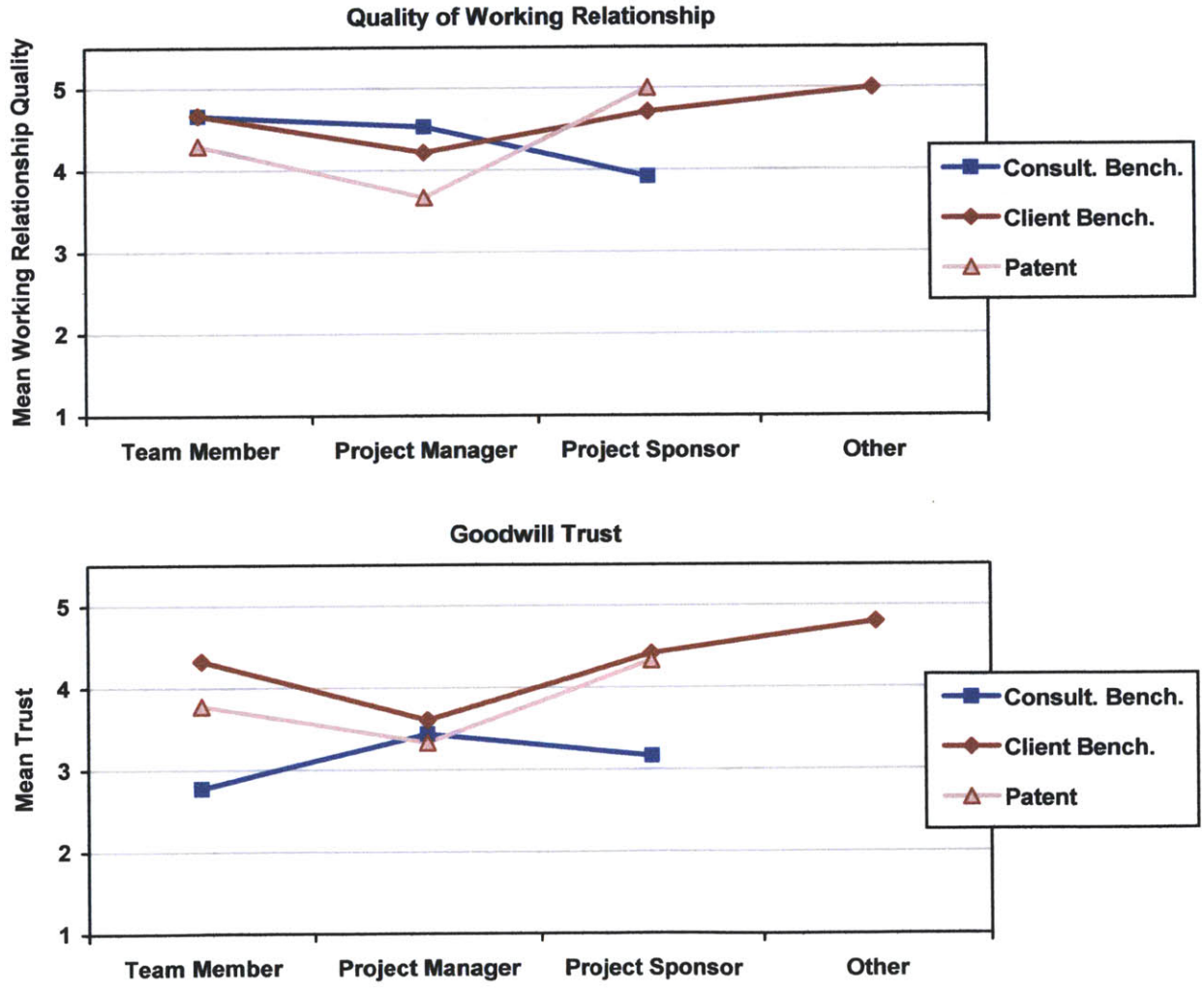

Figure 3-22: Comparison of relationship quality measures by respondent role, type, and sample.

Satisfaction Measures

Client satisfaction generally improved with role in both samples, but the patent scores were lower at every seniority level (Figure 3-23 and Figure 3-24). The effect of role on client satisfaction is examined in detail in Chapter 5. The difference in Satisfaction Index between team members and sponsors is roughly 10 points, which is large relative to the variation that has been reported between companies and industries (Section 3.4.7).

For reasons that are not completely clear, consultant satisfaction declined significantly with seniority (Kruskal-Wallis, $K = 6.36$, $p = 0.042$).

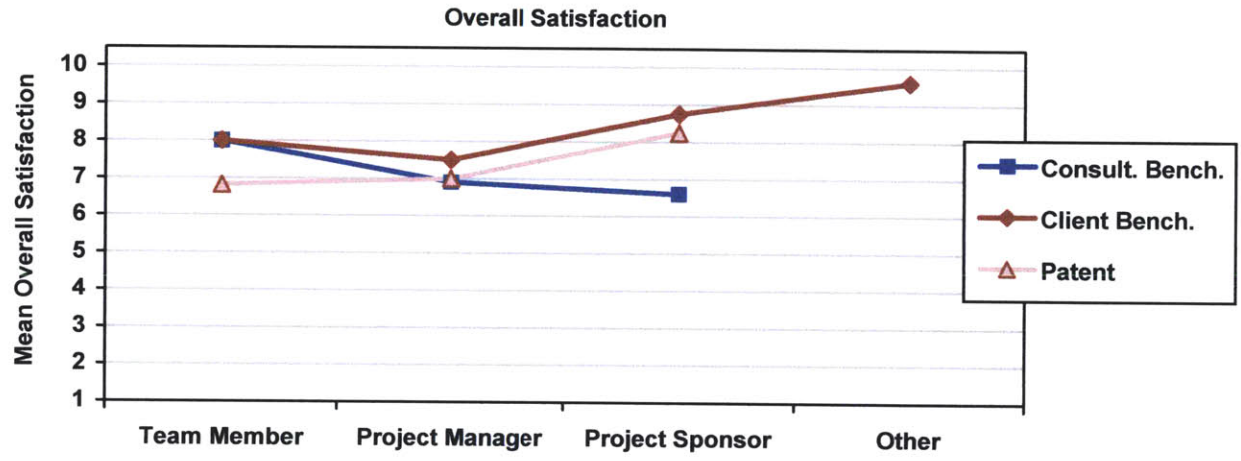

Figure 3-23: Comparison of overall satisfaction by respondent role, type, and sample.

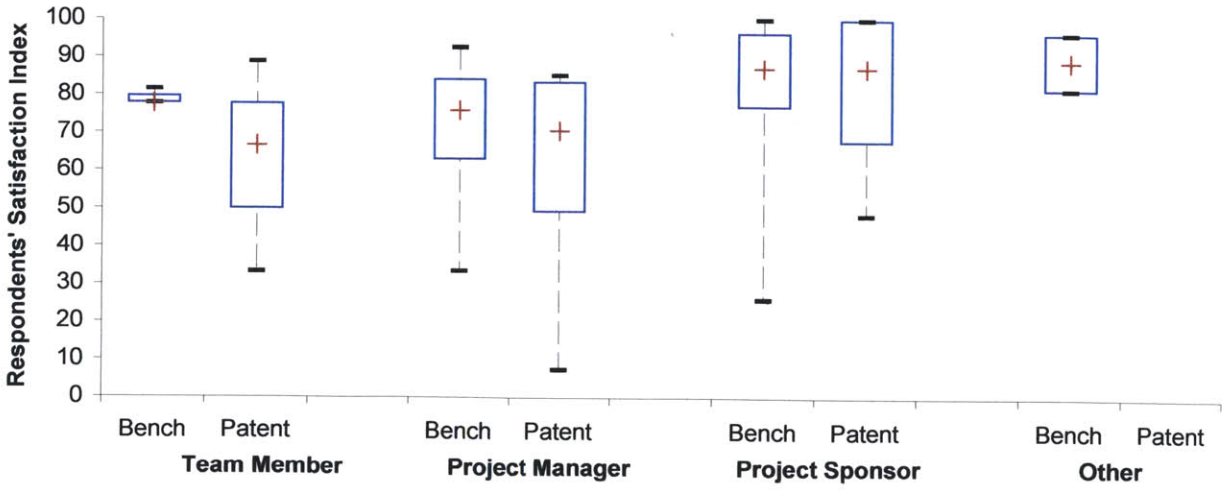

Figure 3-24: Comparison of client satisfaction index by role and sample.

Table 3-6: Test statistics for the effects of respondent role on each success measure. The effects themselves are illustrated on the previous four pages. The number of observations varies from test to test due to "I don't know" and other non-applicable responses. Cells marked with a "~" were not tested because that type of respondent did not evaluate that measure.

Success Dimension	Success Measure	Consultant			Client		
		n	Statistic	*p*-value	*n*	Statistic	*p*-value
Business Impact	TO_MRKT		~			a	
	MRKT_SUC		~		51	$K = 4.57$	0.206[b]
	ROI		~			a	
Design Quality	**REQS_MET**	71	$K = 0.845$	0.656[b]	**110**	$\boldsymbol{K = 13.1}$	**0.004[b]**
	IMPLMNT		~		118	$\chi^2 = 5.85$	0.119[c]
	REWORK		~		**93**	$\boldsymbol{K = 9.63}$	**0.022[b]**
	PATENT		~		78	$\chi^2 = 4.35$	0.114[c]
	AWARD	52	$\chi^2 = 0.219$	0.896[c]	99	$\chi^2 = 3.78$	0.286[c]
Process Efficiency	SCHE_MET	70	$K = 0.290$	0.235[b]	112	$K = 7.36$	0.061[b]
	BUDG_MET	66	$K = 3.74$	0.155[b]	99	$K = 0.986$	0.805[b]
	VALUE	68	$K = 4.97$	0.084[b]	**110**	$\boldsymbol{K = 24.7}$	**<0.001[b]**
	PROBLEMS	74	$K = 4.99$	0.083[b]	**117**	$\boldsymbol{K = 8.58}$	**0.035[b]**
	PROBS_NR	62	$\chi^2 = 3.24$	0.198[d]		a	
Relationship Quality	**WORK_REL**	**71**	$\boldsymbol{K = 11.6}$	**0.003[b]**	**118**	$\boldsymbol{K = 26.1}$	**<0.001[b]**
	TRUST	73	$K = 3.95$	0.139[b]	**108**	$\boldsymbol{K = 36.6}$	**<0.001[b]**
Client & Consultant Satisfaction	**RECOMND**		~		**120**	$\boldsymbol{K = 36.3}$	**<0.001[b]**
	EXPECT		~		**120**	$\boldsymbol{K = 16.8}$	**<0.001[b]**
	SAT_INDEX		~		**120**	$\boldsymbol{K = 20.0}$	**<0.001[b]**
	IDEAL	**74**	$\boldsymbol{K = 7.75}$	**0.021[b]**	**120**	$\boldsymbol{K = 15.9}$	**0.001[b]**
	SATIS	**74**	$\boldsymbol{K = 6.36}$	**0.042[b]**	**120**	$\boldsymbol{K = 22.8}$	**<0.001[b]**
Consultant Benefits	**PROFIT**	**54**	$\boldsymbol{K = 14.2}$	**<0.001[b]**		~	
	LEADIN	72	$K = 1.84$	0.398[b]		~	
	PUBLICITY	71	$K = 2.93$	0.232[b]		~	
	CAPABILITY	71	$K = 3.45$	0.178[b]		~	
	MORALE	**70**	$\boldsymbol{K = 11.5}$	**0.003[b]**		~	

[a] χ^2 test could not be computed in these cases because of low expected cell counts

[b] Kruskal-Wallis test

[c] χ^2 test, non-applicable and pending responses excluded

[d] χ^2 test

3.5.4 When You Ask: the Effect of Measurement Timing

Of all the outcome measures, only a few were significantly influenced by the timing of the measurement (Table 3-7). Increasing the length of time between the end of the project and the assessment increased the likelihood that the project had received an award but decreased the likelihood that the consultant's work had been implemented.[3] Presumably the clients only indicated non-implementation once enough time had passed for them to be certain the work would not be utilized. Increasing the measurement lapse also decreased the reporting of problems (both total and unresolved) by both clients and consultants, improved both parties' appraisals of their working relationship, and increased the consultants' trust of the clients. These effects suggest that respondents' memories of their projects improve with time, as minor problems and relationship difficulties are forgotten. Other variables showing such a ripening effect included the clients' perception of the product's novelty, the unity of the client stakeholders during the project (as perceived by both clients and consultants), and the consultants' appraisals of the client teams' technical, managerial, and communication skills.

Measurement timing had very little effect on other success measures, particularly the satisfaction measures. The fact that client satisfaction remained constant while the identification of problems decreased with time seems to confirm a finding from Chapter 2: problems do not factor heavily in clients' appraisals of project success. The factors that were shown to influence perceptions of success – value, rework, and trust – all show little relationship with measurement timing. Thus, it appears that the measurement of client satisfaction is relatively robust to timing, at least within two years post-project. While it is possible that a lurking variable suppressed an actual effect, the fact that very few explanatory variables were significantly affected by timing makes this unlikely.

[3] Dichotomous outcomes were estimated using logistic regression, which is more reliable but less intuitive than ordinary linear regression. The effect strength can be assessed as follows: the antilog of the estimated regression coefficient shown in the table is equivalent to the factor by which the odds of the outcome occurring increase with a one month delay in measurement timing. For example, a one month delay increases the odds that a project has won an award by $e^{0.0972} = 1.102$ times. A year's delay increases the odds by $1.102^{12} = 3.21$ times.

Table 3-7: Effect of measurement timing on the various success measures, for the Benchmarking sample. The estimated coefficients represent the effect of a one month delay in measurement on the mean response. The coefficients are not directly comparable because different measures used different scales. Estimates in italics are logistic regression coefficients. Standard errors are reported rather than test statistics because the linear and logistic regression techniques use non-comparable statistics.

Success Dimension	Success Measure	Consultant			Client		
		Estimate	Std Error	*p*-value	Estimate	Std Error	*p*-value
Business Impact	TO_MRKT		~		*-0.0132*	*0.0391*	0.736[a]
	MRKT_SUC		~		0.0020	0.0510	0.968[b]
	ROI		~		*0.0293*	*0.0391*	0.453[a]
Design Quality	REQS_MET	-0.0047	0.0101	0.642[b]	-0.0050	0.0081	0.545[b]
	IMPLMNT		~		***-0.116***	***0.0594***	**0.036[a]**
	REWORK		~		-0.0149	0.0102	0.151[b]
	PATENT		~		*0.0202*	*0.0417*	0.627[a]
	AWARD	*0.0710*	*0.0653*	0.256[a]	***0.0972***	***0.0495***	**0.040[a]**
Process Efficiency	SCHE_MET	0.0069	0.0179	0.700[b]	0.0029	0.0194	0.882[b]
	BUDG_MET	-0.0001	0.0196	0.995[b]	0.0004	0.0124	0.978[b]
	VALUE	-0.0143	0.0133	0.287[c]	0.0073	0.0112	0.515[c]
	PROBLEMS	***-0.134***	***0.0432***	**< 0.001[d]**	***-0.101***	***0.0377***	**0.005[d]**
	PROBS_NR	*-0.0855*	*0.0461*	0.0637[e]	***-0.208***	***0.0816***	**0.011[e]**
Relationship Quality	**WORK_REL**	**0.0528**	**0.0135**	**<0.001[c]**	**0.0259**	**0.0114**	**0.026[c]**
	TRUST	**0.0425**	**0.0176**	**0.018[c]**	0.0144	0.0167	0.391[c]
Client & Consultant Satisfaction	RECOMND		~		0.0073	0.0235	0.756[c]
	EXPECT		~		0.0019	0.0237	0.937[c]
	SAT_INDEX		~		0.0850	0.256	0.741[c]
	REPEAT		~		*-0.0476*	*0.0465*	0.300[a]
	IDEAL	0.0794	0.0408	0.055[c]	0.0101	0.0241	0.676[c]
	SATIS	0.0558	0.0349	0.115[c]	0.0110	0.0259	0.673[c]
Consultant Benefits	**PROFIT**	**0.0455**	**0.0223**	**0.047[b]**		~	
	LEADIN	0.0359	0.0184	0.057[b]		~	
	PUBLICITY	-0.0024	0.0206	0.908[b]		~	
	CAPABIL	-0.0050	0.0232	0.830[b]		~	
	MORALE	0.0235	0.0182	0.202[b]		~	

[a] Logistic regression, estimated on a project basis. Pending projects treated as No's for TO MRKT and ROI.

[b] Ordinary least squares regression, estimated on a project basis

[c] Ordinary least squares regression, estimated on a respondent basis

[d] Logistic regression, estimated on a respondent basis. Treated as dichotomous to simplify interpretation.

[e] Logistic regression, estimated on a respondent basis.

3.5.5 Summary of Measurement Effects

Nearly every success measure was influenced by one or more of the investigated measurement effects (Table 3-8). A notable exception was return-on-investment, but many respondents could not meaningfully answer this item, and the inter-rater agreement of those that did was only fair. Budget performance appears robust but there was little variation on this measure.

Table 3-8: Summary of which measurement effects impact which measures. Significant effects are marked with an "X" and marginally significant effects with an "x". Entries marked with a tilde ("~") were not tested.

Success Dimension	Success Measure	Benchmarking vs. Patent	Consultant vs. Client	Respondent Role	Measurement Timing
Business Impact	TO_MRKT		~	~	
	MRKT_SUC	X	~		
	ROI		~	~	
Design Quality	REQS_MET		x	X	
	IMPLMNT		~		X
	REWORK	X	~	X	
	PATENT	~	~		
	AWARD		X		X
Process Efficiency	SCHE_MET			x	
	BUDG_MET				
	VALUE	X	X	X	
	PROBLEMS	X		X	X
	PROBS_NR				X
Relationship Quality	WORK_REL	X		X	X
	TRUST	X	X	X	X
Client Satisfaction	RECOMND	X	~	X	
	EXPECT	X	~	X	
	SAT_INDEX	X	~	X	
	REPEAT		~	~	
Client/Consultant Satisfaction	IDEAL	X	X	X	x
	SATIS	X	X	X	
Consultant Benefits	PROFIT	~	~	X	X
	LEADIN	~	~		x
	PUBLICITY	~	~		
	CAPABIL	~	~		
	MORALE	~	~	X	

3.6 Discussion

The descriptive and methodological results suggest several important findings. First, despite implications to the contrary in the popular press, outsourced product development is not necessarily a "disaster." This study examined one particular type of outsourcing – design consulting – and found that rates of product commercialization and market success compared favorably to benchmarks from traditional product development. Even the patent sample, which likely underestimated satisfaction due to non-response bias, produced scores comparable to those of major industries such as the airlines and cable television. Customers may well grumble about the airlines, but they continue to fly, and usually get to their destinations in one piece. Few would characterize the airline industry as a disaster, and neither is the domestic design consulting industry.

Having said that, the data do indicate large and significant variation in outcomes between projects. Even within projects, some respondents were far less satisfied than others. Prior reports have generally obscured this variation by presenting limited summary data. The variation is significant because it suggests that the poor project outcomes can be improved upon, by better project management and/or better project planning (i.e., deciding which projects are well-suited for outsourcing and which are not). These topics are addressed in turn in the next two chapters.

One aspect of project management is responding to problems. Prior research has focused on problems as a success measure, but may have overstated their impact. The present results suggest that problems are abundant but not necessarily detrimental. Indeed, a project that is entirely absent of problems is either solving a trivial need or is over-resourced and inefficient. While the product development literature has disparaged over-use of "fire-fighting" [60], limited use of fire-fighting is generally more cost-effective than complete prevention. The relative scarcity of "serious problems" suggests that the developers were able to suppress most of the problems that did ignite. Likewise, the fact that consultants reported more problems than clients may indicate that the consultants resolved them before the clients noticed. Nonetheless, about one-third of problems went unresolved, suggesting opportunity for improvement. The next chapter examines the issue of problem generation and resolution in more detail.

The relatively small size of this study makes it difficult to pinpoint precise values for any of the measurements, but the benchmarking and patent samples likely represent upper and lower bounds, respectively. All the biases in the benchmarking study push it towards over-estimating success, while most of those in the patent study lead to under-estimation.

The magnitude of the difference between the benchmarking and patent samples is large relative to the variation within the samples and represents the study's most significant methodological finding. Despite examining ostensibly the same class of projects, the two samples produced client satisfaction results at the upper and lower edges of what is normally observed in the ACSI for companies and industries. For explanatory research, this is something of a boon. Use of the two samples enabled collection of data with much greater variation than would have been gathered from either one alone, making regression and other explanatory analyses much more powerful. For descriptive research, the power of sampling design is more troubling. Results depend heavily on the incentive structure and must be interpreted accordingly. Design service providers should be aware that third-party audits of client satisfaction will likely produce optimistic estimates, particularly if inadequate incentives and protections are offered to the dissatisfied. Self-administered customer feedback systems will likely be even more biased.

Similar implications apply to the next-most powerful methodological effect, the role of the respondent. Project sponsors rated projects significantly better than project team members on several measures. This is a significant finding because much of prior research has used a fairly limited cross-section of respondents. A review of 47 studies of traditional product development performance found that none compared the responses from different levels within the organization [61]. Scholars commonly target senior managers on the grounds that they have more autonomy to participate and a broader view of the relevant issues. Surveys in the trade press generally gather data from lower-level employees who are more likely to be reading such magazines. The results of the present study show that surveying either group exclusively introduces bias. At a minimum, researchers should report the roles of their informants to aid readers in interpreting their results. Better yet would be to gather feedback from multiple respondents to get a more complete picture. Practitioners looking to assess customer satisfaction would also be wise to solicit feedback from multiple levels. While project sponsors have the

most direct influence on future hiring decisions, most project managers and some team members indicated that they had been consulted in the decision, so their opinions do matter. More research is needed to tell if the junior clients' dissatisfaction is due to something the consultancies can correct, or if it is the inevitable result of these individuals' lesser role in the hiring decision. It is also unclear whether the junior respondents carry negative attitudes forward as they progress in their careers. An interesting comment came from a patent respondent whose project was actually several years older than its application date suggested: "I was a very junior person at the time of the project, but have learned from it now."

The results obtained from consultant and client respondents differed considerably for subjective measures such as satisfaction, perceived project value, and trust, but far less so for measures of working relationship quality and contractual performance. Studies using client respondents exclusively may generate reliable estimates for these outcomes, assuming that respondent role is accounted for. Nonetheless, the supplier perspective remains under-represented throughout extended enterprise research and merits further exploration.

Finally, measurement timing has some effect on results. Assessments of working relationship quality and the occurrence of problems generally improved with time. The latter suggests that Roy and Potter's survey, conducted three to six years post project, likely under-stated the actual rate of problem occurrence. On the other hand, the present study's estimates of commercialization rates and return-on-investment are imprecise due to the large number of projects still in development. This presents a challenge to the researcher: late measurement timing provides a better view of the projects' effect on the business, but near-term measurement yields better insight into the causes of those effects. Longitudinal study designs, with multiple measurements during and after the project, would be ideal, but few have been utilized in quantitative product development research to date.

Overall, the results highlight the many challenges inherent in measuring success and failure. Despite its growth, design consulting remains relatively rare and its customers hard to locate, making it difficult to achieve the scale needed for highly accurate results. Rigorous customer satisfaction measures such as the ACSI strive for 250 respondents for each rated company [35],

but a typical consultancy might only perform forty projects per year. Even when customers can be located, data collection is often frustrated by companies' failure to track project outcomes and reluctance to disclose what information they do have. Another challenge is that success and failure is a sensitive topic whose measure has consequences for the research informants. A concern in the benchmarking sample was that consultant project managers might view the study as a means for their employer to evaluate their performance, and therefore be tempted to influence the results. To mitigate this risk, project manager identities were not collected, even though this has been shown to be a strong explanatory factor in other research, and the results were thoroughly anonymized before being reported back to the consultancies.

Lastly, the analysis of results is made difficult by the dearth of comparable data in the literature. Results from the trade literature are suspect for all the methodological reasons listed above. Scholars of product development have largely eschewed descriptive quantitative research, perhaps because it is so challenging. The PDMA study, while ground-breaking and highly useful, may be criticized for its heavy reliance on respondents' cumulative recollections. For example, the finding that product development success rates have been fixed at 58-59% for the last twenty years may simply be a measurement artifact: if half the respondents answered 50% and half two-thirds, the result would be 58.4%. Criticisms aside, the PDMA is a non-profit organization with noble intentions. Customer satisfaction research, on the other hand, has been largely co-opted by for-profit satisfaction consultants and market research firms. Although the ACSI was originally developed at the University of Michigan, its proprietary nature prevents its widespread use. The Net Promoter method, while a commercial enterprise in its own right, has at least been completely open with its methodology [62], inviting others to use the technique freely and only charging for the accessories. Market research firms likely have the knowledge to resolve open academic questions such as the nature of customer satisfaction response bias, but they aren't publishing their secrets. The present study, while imperfect, publicly reports data and methodological findings to begin to fill this void. It is the investigator's hope that it might help future researchers further advance the state of knowledge.

3.7 Conclusions

Whereas Chapter 2 examined the importance of conceptual clarity when measuring and reporting project outcomes, this chapter examined the methodological issues, by critically reviewing past research, identifying best practices from the social and management sciences, gathering original empirical data, and then using that data to demonstrate the sizable influence of measurement choices on results. The work contributes to scholarship by providing relatively unique data for both the product development community, which has not measured outsourced product development success extensively, as well as the customer satisfaction community, which has only begun to investigate knowledge-based business-to-business professional services. The study also developed a novel indirect method of identifying research informants via trace evidence in public records. The results contribute to practice by providing a public domain source of baseline project outcome data, and by demonstrating the strong methodological effects that must be considered when measuring customer satisfaction.

The chief limitation of the study is its small size, which compromises the accuracy of the results. A second limitation is that the patent sample projects, while not statistically different from the benchmarking projects on demographic measures, are not truly representative of all consulting projects. Sampling from patent applications excludes projects that did not go well enough to yield anything worth patenting, as well as those whose scope did not include technical or aesthetic invention. More and more, design consultancies are focusing on front-end user research and design strategy activities. While these may generate insights that eventually lead to a patent, the detailed design is so far downstream that the consultant researchers are rarely listed as inventors, so these projects would not have been located. A third limitation is the somewhat low response rate of the patent sample. Two points should be made. First, the addresses used for the respondents were identified from sales directories and similarly sources and not confirmed before mailing. Many consisted of simply the respondent's name, company name, and the investigator's best guess as to which of the company's many locations he or she worked at. While some of the invalidly addressed ones were returned as undeliverable, others probably were not, so the actual response rate may have been somewhat higher. Second, due to limited funds and a desire not to unduly harass the respondents, only one postcard reminder was used after the initial questionnaire mailing. Best practices recommend at least three reminders, the second of

which should include a duplicate copy of the questionnaire [63]. Nonetheless, even the 15.6% response rate obtained compares reasonably with other research. Hart achieved only 18.7% [31] and the PDMA just 2.7% [53]. A leading market research firm finds that response rates of 10-25% are common in business-to-business satisfaction surveys [46]. A final limitation of the study is that the client satisfaction measures used were developed primarily for business-to-consumer products and services, and may not be ideal for business-to-business. Unfortunately, few standards exist in this area.

The study suggests several avenues of future research. Additional data would improve accuracy and may provide additional insights. More rigorous testing should be performed to ensure the reliability of the measures used. The present study focused on design consulting, which is only one form of outsourced product development. Useful comparisons could be made to other types, such as integrated design-and-manufacturing outsourcing or low-cost offshoring. Comparisons also need be made to traditional, non-outsourced, product development. A useful question might be to ask client respondents if the project would have been more or less successful if it had been performed in-house. It would also be interesting to apply some of the less conventional measures to traditional product development. How would client respondents rate their trust of their co-workers? How satisfied are product development directors with their own teams? What fraction of in-house product development projects experience problems?

Most importantly, need exists to explain the causes of the substantial variation in outcomes between projects. The next chapter begins to do so, by identifying success factors, which are then tested in Chapter 5.

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4 Factors Influencing Project Outcomes

Design consulting outcomes are highly variable but the causes of this variation are not well understood, in part because past research has presented only the client's view of the problem. Consideration of the consultant's perspective offers additional insights and improved understanding of root causes. This chapter summarizes the findings of three dozen in-depth interviews with both design consultants and clients. The results confirm some previous findings (internal divisions within the client firm, poor communication between parties), identify new ones (inadequate client capabilities, failure to transfer design intent), and combine them into a comprehensive model of outsourced development that includes negotiating project scope, continuously managing expectations, and carefully re-integrating the design output into the client firm's operations. The model is corroborated by analyzing the problems reported by consultant and client respondents in a survey of over one hundred projects. From there, two conceptual frameworks are developed to offer insight into the mechanisms underlying commonly reported problems. These models illustrate how the single-sided perspective can lead to misdiagnosis of causes, and suggest that past research has greatly understated the influence of client firm characteristics and outsourcing motivations on project outcomes.

4.1 Introduction

The previous two chapters focused on the meaning and measure of success in outsourced product development and found that design consulting outcomes are generally good but vary significantly between projects. The current chapter starts to explain this variation, by identifying factors that may influence project outcomes from the literature as well as original empirical research. The identified factors will be formally tested on the measured outcomes in the next chapter.

While speculation on the sources of success and causes of failure abounds, only three academic studies have empirically assigned causes to the outcomes of specific projects. Roy and Potter, in their study of U.K. design consultants [1], found that "the problems most associated with project

failure were inadequate briefing of the consultant and internal disagreements [within the client firm] about the aims or value of the projects." Amaral and Parker found that the most common reasons for failure in outsourced platform design projects were misaligned objectives within the client firm or between the firm and its design service provider,[1] unanticipated rivalries between multiple vendors, and poor version control [2]. Anderson, Davis-Blake, and Parker, in an ongoing study of interfirm coordination mechanisms [3], report complex and sometimes conflicting relationships between communication intensity and several project outcome measures. For example, co-locating employees was found to improve product quality but worsen schedule performance.

The strength of these findings is tempered by a key methodological detail: all three studies gathered data from client personnel exclusively. While the client perspective is critical to understanding the problem, the other side of the story – the design service provider's perspective – was not represented. This is significant for several reasons. First, client personnel have a limited view of the outsourcing engagement. From their vantage point they can observe the effects of variation in project and provider characteristics but not the effects of variation between client firms. Second, they may base their judgments on a small number of observations. Most client personnel have experienced only a handful of outsourcing projects in their careers, whereas design service providers perform that many every few months. Third, client personnel may be unduly critical of outsourcing if they fear it threatens their jobs. Thus, the results of these studies may be biased.

Client-side bias is also evident in reader surveys conducted by the trade press [e.g., 4]. These studies typically blame poor outsourcing outcomes on failings by the design service provider, such as poor communication or lack of project management ability [5]. Certainly these do occur, but they may be symptoms of more systemic, structural phenomena such as geographic or cultural barriers. The assignment of blame to actors rather than structure is likely an artifact of the survey format, which is unlikely to produce complex or nuanced explanations.

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[1] Amaral and Parker's paper, like many others, did not specify whether the projects were outsourced to consultants or original design manufacturers. The term *design service provider* (or *provider* for short) will be used as a catch-all, when it is unclear which type of company the literature is referring to, or when the statements could apply equally well to both.

While largely absent from the trade surveys, the provider perspective is voiced via journalistic interviews [6, 7] and consultant-authored books and articles [8-10]. These provide richer accounts but are no less biased. The interviewees or authors are typically founders and spokespeople of major design consultancies. They naturally want to represent the outsourcing model in the best possible light.

Thus, all research to date has taken either the client or the provider perspective exclusively, but neither can present a complete picture by itself. The present study uses a joint perspective to elucidate a richer understanding. In-depth interviews were conducted with both client and consultant personnel in order to identify the most significant factors influencing project success and failure, compare and contrast the client and consultant perspectives, and develop conceptual frameworks to help scholars and practitioners understand and improve project outcomes.

The findings are organized using a process model of design outsourcing, described in the next section. After introducing this model, the results of the literature review and interviews are presented in turn. Between the two, over fifty major factors were identified and characterized. While comprehensive, the list is somewhat unwieldy. To improve understanding, two different conceptual models are developed that abstract the factors to simpler frameworks. The first focuses on the activities performed during the process, identifying a handful of characteristic failure modes and illustrating how a single-sided perspective can lead to misdiagnoses. The second framework focuses on the actors performing the process, particularly the client firm. Root cause analysis suggests that many pitfalls can be traced back to the client's motivation for outsourcing the project. The framework identifies several paradigms (need for extra capacity, specific technical expertise, or a fresh perspective) and highlights the particular hazards associated with each. Confirmatory analysis of thirty projects suggests that some paradigms may be more successful than others.

Overall, the results confirm many previous findings but suggest that existing literature understates several important factors, including characteristics of the client firm, contract negotiations, and the transfer and reintegration of the design at the end of the project.

4.2 A Process Model of Outsourced Product Development

Both the literature review and the empirical results are structured using a prototypical model of outsourced development (Figure 4-1). The Client Firm starts with a Vision for the project and *Specifies* it into Requirements. The firm identifies a Design Provider, *Negotiates* a contract, and *Briefs* the provider on the requirements (in some cases, requirements are specified jointly during negotiation). The provider *Develops* a Design, *Coordinating* as necessary with the Production Supplier(s). Meanwhile, the requirements may *Drift* due to external (e.g., actions by competitors) or internal (e.g., a change in management) factors. Continuous *Feedback* helps ensure alignment of Expectations and development but is complicated by Distance (physical, cultural, etc.) between parties. After development the provider *Transfers* the design back to the client firm, which *Reintegrates* it into its organization and *Refines* it as necessary. The firm then *Releases* completed Specifications to the production supplier. Ideally, *Follow-Up* between all parties occurs throughout this process. The literature suggests that problems can occur in several of these stages, but the results of the present study indicate that problems occur in them all.

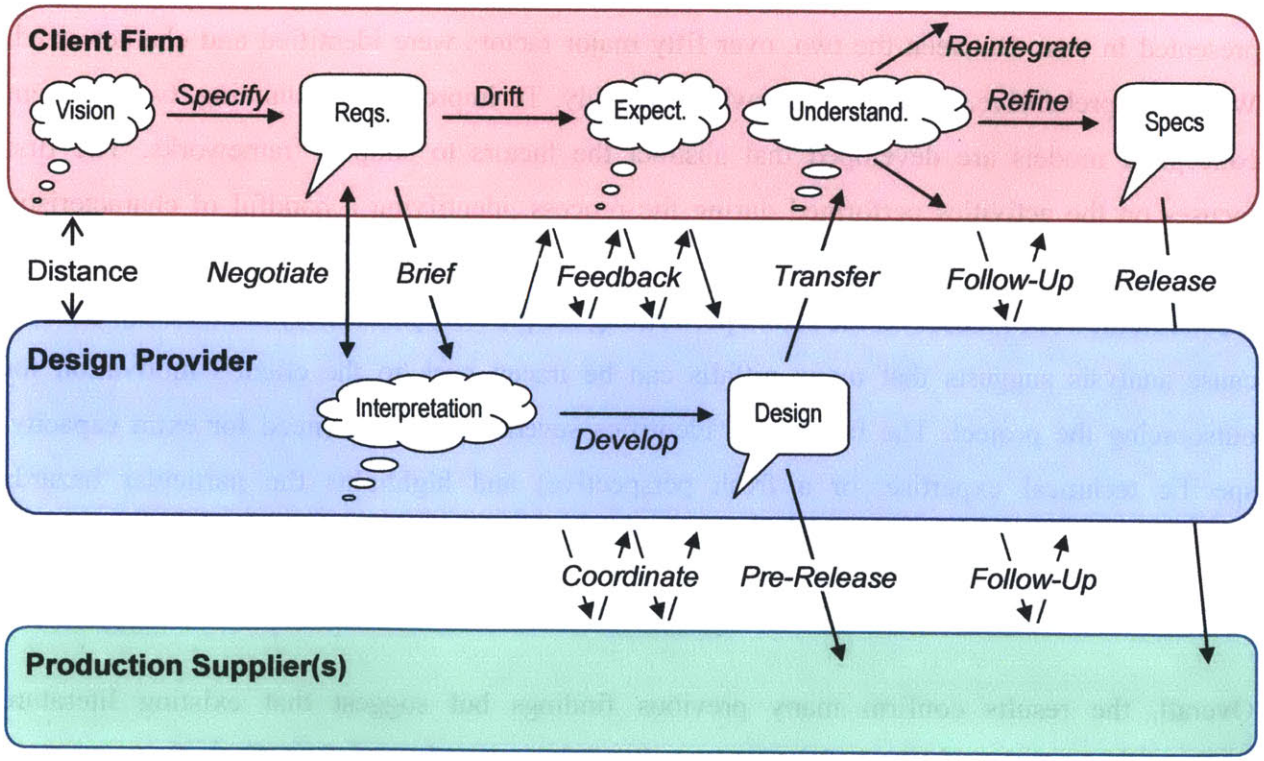

Figure 4-1: A prototypical process model of outsourced product development. In the case of integrated design-and-production outsourcing, the Design Provider and the Production Supplier are the same company. Not all events necessarily occur in every project.

4.3 Literature Review

Prior empirical research has focused on factors related to the specification of requirements, the capabilities of the design provider (consultant or original design manufacturer, depending on the study), the quality of the briefing, and the extent of feedback during development. Theoretical literature on product development and systems engineering suggest additional factors related to distance, feedback, and reintegration. In the following review, the identified factors are organized topically, based on the concepts shown in Figure 4-1.

4.3.1 Factors related to the Client Firm

Client firm size may affect project outcomes, but the nature of the relationship is unclear. Roy and Potter [1] found that severe problems "were much more likely to occur in the firms with under 50 employees and especially affected the smallest firms with under 10 employees." The authors attributed this to lack of experience and lack of time on the part of the employees. On the other hand, Rayner [4] reported that managers at large firms (sales >$500 million) view design outsourcing less favorably than those at mid-sized ($10 million to $500 million) and small companies. He attributed this to the fact that larger firms were more likely to outsource complete systems, partner with original design manufacturers rather than consultancies, and outsource overseas rather than domestically. Although not stated, the implication is that outsourcing of partial systems, to design consultants and domestic providers, is viewed more favorably.

4.3.2 Factors related to the Specification of Requirements

Poor specification of requirements has been frequently cited as a cause of poor project outcomes. The client firm must know what it wants to accomplish [7], develop mature specifications [6, 11], and achieve consensus about both the product specifications and the objectives of the outsourcing engagement [1, 2].

4.3.3 Factors related to the Design Service Provider

The trade literature in particular assigns blame for poor outcomes to inadequate technical, managerial, and communication capabilities on the part of the design provider [5-7]. Numerous articles advise client firms to "shop around" and choose their provider carefully [1, 6, 7, 12], but the interview results presented later in this chapter indicate that shopping for the best price can be counter-productive.

4.3.4 Factors related to the Distance between Parties

Knowledge transfer theory suggests that increasing the distance between the client firm and the design service provider will adversely affect project outcomes. Physical distance hinders communication [13], as do language barriers. Cultural distance complicates coordination because each party may be unfamiliar with the other's norms and values, while organizational distance weakens project management by disabling mechanisms such as hierarchy, standard procedures, and management by objective [14]. Organizational barriers may also reduce mutual respect and trust between parties, limiting information flow across firm boundaries [12].

4.3.5 Factors related to the Briefing

Related to specification, poor *transfer* of requirements to the design provider compromises development. None of the projects in Roy and Potter's sample that had a "poor" design brief were implemented profitably, a finding echoed anecdotally [6, 7, 12].

4.3.6 Factors related to Discontinuities in Development Team Membership

Consistent project team membership is critical for in-house product development [15], and is no less so for outsourced development. Several companies in Roy and Potter's study expressed concern that they had briefed the project with senior consultant personnel, who then passed the work on to "an inexperienced junior person." Arguing from a theoretical basis, Baldwin and Clark [16] note the risk that a design provider will reassign its personnel to other clients at the conclusion of development, making follow-up or re-engagement with the original team difficult.

4.3.7 Factors related to Development

Roy and Potter report that only 20% of projects in which design work was "poor" were implemented profitably by the client firm. Problems with the work included failing to satisfy the brief, being impractical to manufacture, or exceeding the project schedule.

4.3.8 Factors related to Drift in Requirements

Anecdotal evidence suggests that client firms' requirements often shift during the course of the project. "A common problem is that a company will see a competitor bring out a new product, which inclines them to bring out a copycat version" (Paul Priestman, quoted in [7]). Internally, the client firm may undergo a change in senor management or a financial downturn [17].

4.3.9 Factors related to Feedback

"Poor communication" is an oft-repeated theme that deserves clarification. To manage expectations, the design provider must continuously communicate the status of development, including the inevitable changes that occur as initial uncertainty is resolved [1, 6, 7]. Simultaneously, the client must continuously communicate the status of its expectations, especially any changes in project requirements [ibid., also 12]. The use of boundary spanning objects [18] and personnel [19], as well as information technology tools [14], have been recommended to improve coordination across organizational barriers. In an ongoing project, Anderson and colleagues [3] are specifically investigating the effects of various coordination mechanisms on project outcomes.

4.3.10 Factors related to Reintegration

The reintegration of the design into the client firm can be hindered by both personal and organizational resistance. "Just bringing in an outside designer without preparing the organization for this, which is what some companies do, can work very badly. The 'not-invented-here' syndrome often means that [outside] designer-inspired ideas are rejected" [7]. In addition, the firm may unwittingly reject the design if its architecture does not match that of the

organization [20]. Sanchez and Mahoney [21] noted that "although organizations ostensibly design products, it can be argued that products design organizations, because the coordination tasks implicit in specific product designs largely determine the feasible organization designs for developing and producing those products." If the product design developed by the design service provider does not match the existing organization design, either the organization must adapt to the product – a challenge, given that organizations are slow to change [22] – or the product will be altered to match the organization, perhaps losing essential architectural structure or the originality which motivated outsourcing its design in the first place.

4.3.11 Factors related to Refinement

Lastly, project success is favored by the client firm's commitment to carrying it through. Roy and Potter [1] observed several examples of projects "which only yielded commercial returns because the firm was willing to persist with the work even when the consultant's proposed design was unsatisfactory."

4.4 Methods

The study was conducted using the same research setting and design described in previous chapters. In the interview phase respondents were first asked several open-ended questions intended to reveal factors that influence project outcomes for better or for worse. They were then surveyed using a closed-form questionnaire, which asked how frequently they encountered various pitfalls suggested by the literature. This allowed assessment of factors that the respondents deemed unimportant or had forgotten to mention in the interview. The interview template and questionnaire are included as Appendix A.

Interview notes and audio transcripts were coded and analyzed using grounded theory [23]. Both direct and indirect responses were considered. For instance, a respondent might deny the occurrence of a particular problem but note the measures taken to prevent it. The indirect responses help to provide a more complete picture, hinting at latent beliefs as well as those that the respondent withheld because of gamesmanship or social desirability bias. The author's thesis

supervisor reviewed the emergent coding schema and resulting theory throughout the process to provide an objective second opinion.

The coded interview data and the questionnaire results were then analyzed to identify the most significant factors influencing project success and failure. In the spirit of failure modes and effects analysis, the frequency, severity, and likelihood of detection were all considered in rating factors as Significant, Moderate, or Minor risks. Explanatory models were then derived from these results as well as from existing theory.

Data from the pilot (Phase 2) and benchmarking/patent (Phase 3) studies were used to validate and quantify the findings from the interview phase. The problems reported in each study were compiled and compared to the list of risk factors identified from the interviews. To validate the explanatory frameworks, the responses of highly dissatisfied clients and their consultants were examined in greater detail to determine the origins of their dissatisfaction.

4.5 Identification of Factors Influencing Project Outcomes

4.5.1 Interview Results

The interview participants identified dozens of factors that influence project outcomes. Figure 4-2 depicts the fifteen most frequently mentioned. For ease of interpretation, all are worded as risk factors, but the original comments were actually a mix of cautions and positive recommendations. Consultants focused on the management of the client's expectations, as well as the challenges posed by novice clients. Clients focused on traditional supply chain concerns such as the consultant's capability, the quality of the specification, and physical distance between parties. The consultants tended to mention more factors each, so the fraction of consultants mentioning any particular factor is generally higher than for the clients.

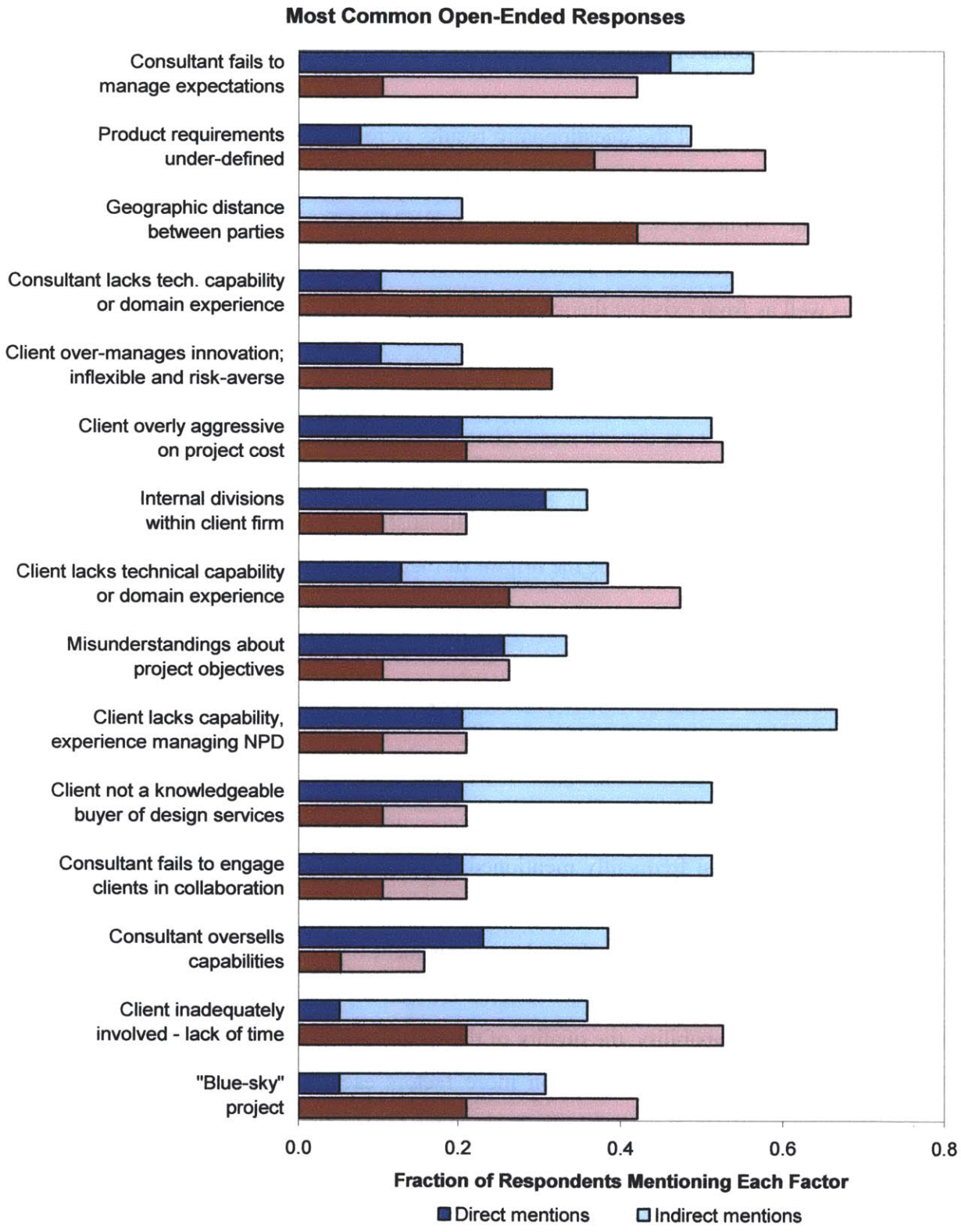

Figure 4-2: Frequently cited factors. Dark shades indicate direct mentions and light shades indirect mentions. For each item, the upper (blue) bar indicates consultant responses and the lower (red) bar client responses.

Many of these factors were also rated highly in the closed-form questionnaire (Figure 4-3). A striking finding is that most of the highly-rated factors are directed at the client firm rather than the consultancy. Both consultant and client respondents considered the client's project management, communication, commitment, and stakeholder unity to be more of a concern than those of the consultancy.

Given the small sample size, these figures should be considered illustrative rather than definitive. In addition, many other factors were identified beyond those shown in the figures. Rather than attempt to quantify them, the factors were organized typologically and assessed qualitatively. Table 4-1 compiles 51 of the more significant factors reported by the empirical literature and by the consultant and client informants. The relative risk of each factor is presented, allowing comparisons to be made between the three perspectives. The interviews confirm many of the factors reported in the literature, refine others, and add new ones. Those that significantly extend or refine the literature are discussed in further detail in the subsequent sections. Direct quotations from the interviews are used extensively to give the reader a feel for the raw data. They have been edited slightly for readability and to protect confidentiality.

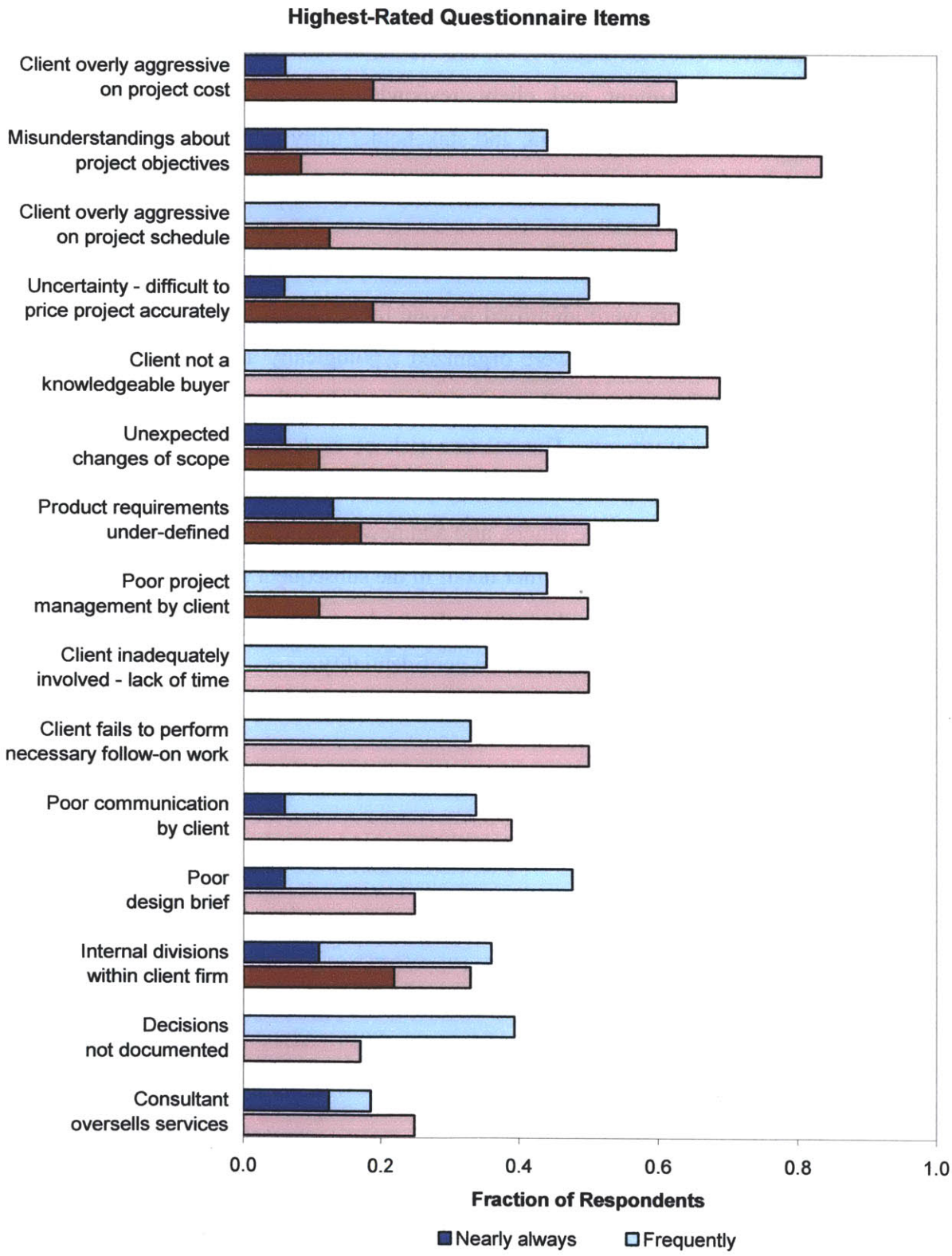

Figure 4-3: Most frequently encountered risk factors. Dark shades indicate the fraction of respondents choosing "5" and light shades "4" on the 5-point scale. Blue bars indicate consultants and red bars clients.

Table 4-1: Risk factors in outsourced product development. Empty cells were not mentioned, while cells marked with a dash were deemed to be negligible risk.

According to the:	Literature	Consultants	Clients
Client Firm			
· Lacks capability, experience, and/or processes for *managing* new product development		**Significant**	**Significant**
· Lacks experience with, is not a knowledgeable *buyer* of, design services		**Significant**	**Significant**
· Attempts to over-manage, over-schedule innovation; is inflexible and overly risk-averse		Moderate	**Significant**
· Lacks technical capabilities and/or domain experience		Moderate	Moderate
· Project team does not include or consult all stakeholders	[1]	Moderate	Moderate
· Project team lacks leadership, authority, and/or influence within client organization		Moderate	Minor
· Client firm is very large or very small	[1, 4]	-	-
Specification of Requirements			
· Project lacks definition; client cannot specify what it wants	**[1, 6, 7]**	**Significant**	**Significant**
· Divisions within the client firm over project objectives	**[1, 2, 7]**	**Significant**	Moderate
· Project is about blue sky, radical innovation		Minor	Moderate
· Project has high technical risk; over-constrained requirements		Moderate	
Negotiation			
· Client is overly focused on cost and schedule, neglecting quality		**Significant**	**Significant**
· Misunderstandings about project objectives		**Significant**	**Significant**
· Inherent development uncertainty; difficult to price project		**Significant**	**Significant**
· Consultant oversells their capabilities or the likelihood of project success	[6]	Moderate	Minor
Consultant			
· Lacks technical capabilities and/or domain experience	[5, 6]	Moderate	Moderate
· Lacks project management capability	[1, 5]	Minor	-
Distance between Client Firm and Consultant			
· Geographic distance	[1]	Minor	**Significant**
· Corporate cultural distance		Moderate	Minor
· Organizational distance: standard processes, incentives	[12]	Moderate	Minor
· Misalignment of objectives	[1, 2]	Minor	Moderate
· International distance	[6]	-	Moderate
Briefing			
· Poor briefing, due to difficulty of encapsulating client's tacit knowledge		Moderate	**Significant**
· Poor briefing, due to client ignorance or carelessness	**[1, 6, 7]**	Moderate	Minor
· Poor briefing, due to client deliberately withholding information so as not to constrain creativity		Moderate	Minor

Risk factors in outsourced product development (continued).

According to the:	Literature	Consultants	Clients
Discontinuities in Team Membership			
· Discontinuities in client project team		Moderate	Minor
· Discontinuities in consultant project team	[1]	Minor	Minor
Development			
· Unexpected changes of scope	[7]	Moderate	Moderate
· Consultant personnel insufficiently engaged due to lack of time	[1, 12]	Moderate	Minor
· Design impractical; ignores constraints	[1, 12]	Minor	Minor
· Design work poor	[1]	-	Minor
· Consultant ignores the brief, "does own thing"	[1, 12]	-	-
· Rivalries between multiple vendors	[2]	-	-
Drift in Requirements			
· Client adds or changes requirements, compromising budget; scope creep	[7]	Moderate	Minor
· Changes in client's senior management or financial situation	[7, 17]	Minor	Minor
Feedback			
· Client does not communicate frequently enough, police the brief, and/or provide prompt replies to questions	**[1, 6, 7, 12]**	**Significant**	Moderate
· Consultant does not communicate frequently enough and/or manage client's expectations	**[1, 5-7]**	**Significant**	Moderate
· Client inadequately involved due to lack of time	[1]	Moderate	**Significant**
· Client inadequately involved because consultant and/or client personnel do not enjoy collaboration		Moderate	Minor
· Personality conflicts; poor working relationship		Moderate	Moderate
· Development decisions and/or scope changes not documented		Moderate	Moderate
· Poor version control	[2]	-	-
Transfer of Design to Client Firm			
· Deliverable does not include design history or intent		Moderate	Moderate
· Transfer of design too abrupt, a handoff mentality		Moderate	Minor
· Poor transfer due to consultant negligence		Minor	Moderate
Reintegration of Design into Client Firm			
· Client personnel resist design; Not-Invented-Here	[7]	Moderate	Moderate
· Client organization resists design		Moderate	Moderate
Refinement of Design by Client Firm			
· Client fails to perform necessary follow-on work	[1]	Moderate	Moderate
· Client makes changes that compromise the design intent		Moderate	
Follow-up with Consultant			
· Client fails to involve the consultant after the design transfer		Moderate	Minor
Production Supplier			
· Consultant not put in contact with supplier early in project		Moderate	Moderate

Factors related to the Client Firm

Capabilities. Respondents noted three client capabilities that improve the likelihood of project success: capability in *managing* new product development, experience with *outsourced* product development, and *technical* expertise sufficient to specify requirements, monitor development, and refine the delivered design. Firms lacking these capabilities include start-ups and holding companies, as well as established process- and service-driven companies with little experience in physical product development.

Corporate culture. While novice firms lack experience, established firms may suffer from several cultural factors. Client respondents in particular noted that highly structured companies try to overly prescribe or schedule creative innovation:

> *"Everyone's gone to a Six Sigma mindset, where you try to make sure that eight of ten projects actually go to market. That's a good approach for line extensions, but if you really want explosive innovation it's not going to get you there."*
>
> – former Client Project Manager

Consultants stressed that innovation is an iterative, free-flowing activity, and that success is favored by a client culture that is flexible, open-minded, and trusting:

> *"Our process is very open and flexible and we need a client who works that way too. A lot of it is apparent during the sales process. If they're really focused on cost and deliverables from the get-go, that's a big warning sign to me. . . The clients that are the most rigid actually need our help the most, but they may not be receptive to the way that we work."*
>
> – Consultant Project Manager

> *"Certainly we have to put schedules together, but if their anxiety and fear compel them to micromanage the process, it's not going to be a successful engagement."*
>
> – Consultant Project Manager

Both consultants and clients noted that large bureaucratic client firms often are not nimble enough to keep up with the smaller consultancy. In particular, some firms tend to involve too many people in decision making.

Project team. Although development is outsourced, the composition of the client-side project team remains critical. All key stakeholders must be included or at least consulted.

> *"It's having the right people in the meetings. When there's supposed to be someone who's providing technical depth on their side, they have technical depth. They're familiar with the company, it's not just some new person. I think a clear sign that failure is going to happen is when it's just the marketing posse, or some subset of their organization that itself doesn't have the power to make it happen."*
>
> – former Consultant Project Manager

To mitigate the risk that the project will not ultimately be accepted by the client organization, the client's team should include a "diplomat" who is deeply familiar with, and ideally powerful within, the organization and its politics. Strong client team leadership is also critical. Problems often occur when the consultant's key contact is not the true decision maker.

> *"Too many clients have project managers, not project leaders. I say it that way for a reason. If you're going to be successful you have to drive the project with a leader. In larger companies project managers are basically schedule facilitators and documentation providers to management. Status updates, budget updates, meeting minutes. They're not the one who is going to drive actual decisions. When there's a disagreement between disciplines, they're not in a position of authority to manage that conflict and negotiate a consensus decision."* – Consultant Engineering Director

A "heavyweight project manager" [24] is often more effective.

Factors related to the Specification of Requirements

Internal divisions. Prior studies noted internal divisions within the client over project objectives, but the interviews suggest that divisions run much deeper. In many firms, functional specialists do not even communicate with each other, let alone achieve consensus on project objectives:

> *"It doesn't even seem to be necessarily endemic to larger companies. We've worked with some very small start-ups, there may only be a handful of people. Those people don't communicate. How hard is it? You're right there! There are only three of you!*

But you'll get different answers from different people, whoever happens to pick up the phone is going to give you a different answer." – Consultant Design Director

"The only time the whole [client] team gets together is when we [the consultancy] hold a design review. We joke that we should sell our services as 'design mediators' or management consultants." – Consultant Engineering Director

"Blue sky" projects. Firms often engage a consultant when they seek a dramatically original, "outside the box" solution, but the respondents noted that these projects often disappoint. The client firm may overestimate the likelihood of success. The lack of constraints makes it difficult for the consultant to manage the client's expectations. Even if the consultant develops a radically innovative solution, the client firm may be unable or unwilling to reorganize sufficiently to implement it [20].

High technical risk projects. Whereas "blue sky" projects have too few constraints, high technical risk projects have too many. In extreme cases, the client's vision may defy the laws of physics. In others, the vision may be achievable, but only with the application of significant resources. Given that consultants are usually costlier than in-house development resources, such projects may not offer good value. A third type of technical risk involves "needle in a haystack" projects, in which the solution lies with locating just the right material or production vendor to meet the requirements. The "right material" may not actually exist, but the client may feel that the consultant simply did not look hard enough.

Factors related to the Negotiation

Excessive cost focus. While the literature emphasizes the importance of "shopping around" for a suitable consultant [1, 7, 12], both consultants and clients agreed that client firms compromise development quality by focusing on cost rather than value during contract negotiation. Some treat design services as a commodity, considering only the price of the contract to the exclusion of factors such as consultant capability or prior history with the firm.

"Clients shop for design services like they're shopping at Wal-Mart."

– Consultant Senior Engineer

"Whoever signed the proposal may not have even read it. They skip to the last page where it shows the cost. Proposals average three to eight pages, depending on the program. That's their chance to see that we understand what they've asked us to do. We don't ever get a lot of back and forth on the language of the proposal, it's just numbers. 'You need to take $5,000 off this program.'"

– Consultant Engineering Director

In extreme cases, respondents told stories of clients using reverse auctions to solicit bids for contracts. Others use strong-arm purchasing tactics to drive down costs.

"The issue I would run into was getting what I thought was a realistic estimate [from the consultant] and then automatically being told [by client management] to go back and tell them they had to cut 20% off the cost." – former Client Project Manager

The trouble with this approach is that the consulting market is competitive to begin with. Many consultancies claim to offer similar services (if not quality), and the competition between them generally keeps price gouging in check. Consultants rarely pad quotes because jobs are bid out to multiple competitors. When the prospective client demands a price cut, the consultant must remove design, prototyping, and/or testing iterations, increasing project risk.

Aggressive project schedule. As with insufficient budget, client respondents reported that projects often fail because their firms allot too little time for development.

Misunderstandings about project objectives. While the literature highlights misaligned objectives between client and consultant, simple misunderstandings are even more frequent. The parties must invest significant effort during the negotiation, briefing, and early development phases to ensure that the client's vision has been adequately specified and transferred. The better consultancies formalize this into their processes, using alignment phases, boundary box exercises, and the like.

Uncertainty. Given the inherent uncertainties in innovation and product development, it can be difficult to price the project appropriately. Some consultants bid uncertain projects on a time-and-materials basis, or on a per-phase basis, with the upfront understanding that later phases will have to be re-bid after initial development. Transaction cost economists would caution the client

against the risk of hold-up, but this appears to be rare in this industry due to the relatively low asset specificity and the great number of seemingly well-qualified alternative suppliers.

Consultant oversells. Former consultants observed that their firms sometimes overstated the likelihood of innovation success, particularly on blue sky projects.

> *"Certain firms hire a lot of really good salespeople, not just the people who are drumming up new business, but well-spoken practice leaders who can go in and sell you anything. There's a lot of those at [consultancy withheld], and I think that's why it can command top dollar."* – former Consultant Engineering Director

Currently-employed consultants accused their competitors of overselling their capabilities:

> *"I think a lot of companies have been burned expecting more out of their consultants than their consultants were expecting to provide."*
>
> – Consultant Vice President of Design

Factors related to the Distance between Parties

Geographic distance. Clients in particular stated that geographic distance between parties compromises coordination. Some choose to use only local consultants.

> *"Even though we work in a fairly 24-hour world, the fact that you can just drop in rather than emailing and making PowerPoints, I think you get to a solution faster with the local guys, or within a day's travel."* – Client Senior Engineer

Cultural distance. Significant differences in corporate culture make it difficult for clients and consultants to relate to one another, impairing trust and communication:

> *"We're a fairly conservative company, and one of the consultants had a mohawk, and they were lying on the floor during the meeting to 'get a different perspective.' It was a little goofy, and of course people were looking at that and wondering 'what are we spending our money on?'"* – former Client Project Manager

Factors related to the Briefing

Use of "blinders" to foster creativity. The literature attributes poor briefing to client ignorance or carelessness. The interview respondents confirmed this, but identified an additional problem: clients will sometimes deliberately withhold information so as not to constrain the consultant's creativity. This practice appears to create more problems than it solves.

> *"A lot of clients will come in, 'we're hiring you guys because you're an innovation firm, we're hiring you for fresh thinking, so we don't want to tell you anything, just dream' and we say 'no, that will be a disaster unless you're really looking for all the possibilities.' Our philosophy is that if we do that, we're going to come up with some wow-bang idea that doesn't move your business."*
>
> – Consultant Chief Operating Officer

To be sure, excessive constraints can suppress creativity, but this effect is less due to the awareness of the constraint than it is to organizational pressure to adhere to the constraint:

> *"Even people who are prone to being creative can find themselves limited [by managerial pressure]. So we don't even push the boundaries anymore. Because the last twenty times we were slapped down for pushing it."*
>
> – Client Senior Industrial Designer

Consultant personnel are less stifled by the client's history and political pressures; they are more likely to challenge constraints than let them limit their creativity. However, if the consultant is unaware of rigid constraints, he or she will likely propose something that the client considers "impractical" [1]. A good balance is to provide the constraints, but encourage the consultant to propose both conservative and free-thinking solutions.

Factors related to Discontinuities in Development Team Membership

Client-side Discontinuities. Both empirical and theoretical literature stress the risk of discontinuities on the consultant side, but the interviews suggest that discontinuities on the client side are more frequent and more serious.

> *"You may start off talking to the president of the company, and once you shake hands and they sign the check, you never see that person again, and now you're dealing with*

a project manager or director of engineering, somebody who's down in the trenches and has a very different idea of what this project should be."

– Consultant Design Director

"Client turnover is a huge problem for us. Marketing teams churn so frequently, you can go through three marketing directors in one project. The vision for the project came from the first, then the next guy comes in and he's got a completely different vision, and then the third person is not even sure the project should be done at all."

– Consultant Engineering Director

Factors related to Feedback

Client involvement. Infrequent communication and poor expectations management are significant problems, but true success requires more than frequent status reports and design reviews:

"We're really looking for collaboration *with the client. It's great to have the clients that really get in there and want to be a part of what's going on, versus the ones that don't give you much feedback, and you don't know until ten years later whether they liked working with you or they didn't."* – Consultant Engineering Director

Unfortunately, several factors work against extensive client involvement. For example,

"Customers can get lazy. Management thinks 'I'm spending all this money to have this taken care of,' so they start to expect that it's taken care of, and don't put a lot of resources, a lot of thought to it. What management doesn't see is the amount of effort I have to put in. For it to work well, I still have to spend a lot of time on it."

– Client Project Manager

To address this, some consultancies contractually stipulate the level at which key client personnel must be dedicated to the project. A more troubling finding is that some consultants do not enjoy the collaboration that they espouse publicly:

"A lot of people at [consultancy withheld] talk about collaboration, but don't actually like collaborating with the client. They don't like the intensity of that much time with them, they don't like to travel, they like the lifestyle of 'you give us the brief, we do our magic, and then we hand it off to you.'" – former Consultant Project Manager

Clients should emphasize their desire to be involved and select consultants who will do so. Other things being equal, use of a local consultancy makes client involvement much easier.

Decisions not documented. Even if feedback is sufficient, problems occur if it is not documented:

> *"Scope changes are inevitable. But when they get the bill, they tend to forget about those re-directions, and that sets up conflict."* – Consultant Project Manager

Some consultants use formal documentation programs, particularly for medical projects, but:

> *"No one wants to pay for that! And it's really boring. And you turn into an [aerospace subcontractor, identity withheld], where everything has an ECO, and everything takes longer, and everything's expensive."* – Consultant Project Manager

If nothing else, major development decisions should be documented in email or meeting minutes.

Factors related to the Transfer of the Design

Prior research has stressed the importance of the briefing in transferring knowledge from client to consultant at the start of the project, but has largely neglected several factors related to knowledge transfer at the end of the project, from consultant to client. The consultant may develop an excellent design, but if it is transferred poorly the client may not fully understand it, causing them to question its value or experience difficulty in refining it. Two issues are common:

Transfer too abrupt. Ideally, the transfer of knowledge and responsibility is gradual, but budget and time pressures may reduce it to a design review and handoff of CAD files:

> *"I always feel that it's very abrupt. It's like 'here's the packet of stuff, here are the files' and then the door is closed. It's not as collaborative as I would like it to be."*
> – Client Senior Industrial Designer

> *"When it gets to this phase, you're typically out of budget. There's never a 'knowledge transfer' phase in the budget, but there should be."* – Consultant Engineering Director

Some consultancies do include "deployment" phases in the budget, but these are among the first things cut if the client demands a sharpening of the quote.

Deliverables do not include design history or intent. The problem with abrupt, "throw it over the wall" handoffs is that typical design transfer media such as engineering drawings, CAD models, and prototypes are inadequate to fully capture the consultant's developed knowledge. They readily convey form, but are less able to describe function, let alone design intent:

> *"I have no clue what their design thoughts were when they came up with it. It had five gears. Why five? Why not six? Why not a belt? Did they analyze the fatigue stress? I have no idea!"*
>
> – Client Project Manager

Some consultancies make a point to deliver more comprehensive information, including meeting minutes, bills-of-materials, email correspondence, etc. Others stressed the impossibility of transferring so much data, or questioned whether the client would even want it:

> *"How do you teach all that? Until you've walked a mile in my shoes? It's not like I would sit down and write a document saying 'this is all the stuff we thought about.' I don't know that there's an intent to teach them everything we've learned. They didn't hire us for that. They hired us for a thing, the design."*
>
> – Consultant Engineering Director

The difficulty of transferring design history ex post highlights the importance of client involvement during the development:

> *"Constant engagement, ask their opinion, get their input, get them to help make decisions, those are all key. Communicate the theory, not just the solution. When you develop a concept, what are the benefits, what are the risks? Detailing those, articulating those, constantly reminding your client why this makes sense, why it's a robust solution and why that robustness or innovation are worth some of the potential trade-offs or risks that you're taking to achieve it. And how decisions that they might make [later] will impact that."*
>
> – Consultant Engineering Director

Factors related to Reintegration

Organizational inertia. Even if the consultant develops a suitable design and transfers it well, it may be rejected by the client firm because of resistance by the personnel or by the structure of the organization itself. Rejection is likely if the design is transferred to the wrong part of the

organization, or requires refinement by a group other than the one sponsoring the project, or novel coordination between parts of the organization, or the creation of a new group altogether:

> *"It has so much to do with who your audience is. We did some fairly innovative development work, and had a great result, because we delivered it to the 'Advanced Concepts Group,' whose sole purpose was to go out and discover new technologies. If we had given that same presentation to the engineering group, who were the CAD guys and the quality people, it would have been dead on arrival. There wouldn't have been any interest."*
>
> – former Consultant Engineering Director

> *"The reason one project didn't get implemented was that the organizational power for new product development resided in R&D. We were working with an innovation group that was based in Marketing. We proved that it was a new, novel idea for their category, but no one within R&D was willing to back it up, so the project failed."*
>
> – Consultant Project Manager

> *"The consultancy will come up with a service design or user experience concept and they'll have a beautiful scenario drawn out with all the various touch points laid out, but the reality is that it the current user experience is such a mess because of how the company has sliced and diced itself. And unless that company – and I've never seen it happen – reorganizes itself around the experience of the customer, it's not going to work because their silos aren't structured properly."*
>
> – former Consultant Project Manager

Such organizational issues can be the most difficult to solve. As a start, clients should do a better job of mapping their organization and its constraints at the beginning of the project, so that the consultant has an idea of what is possible and what is not.

Factors related to Refinement

Client compromises the design intent. Consultants lamented that clients sometimes hurt the commercial success of products by making changes that compromise the design:

"I think clients are a lot better at executing to cost than they are to holistic design intent. And it's not just the aesthetics [that get compromised], it's the brand, it's usability and ergonomics, it's line logic. And there are lots of reasons why it happens. The engineers on the client team don't recognize that it's the right thing to do, they haven't been exposed to it, they don't value it. It makes their lives more difficult. They don't have a budget for it. Their management staff doesn't promote it. You can do the best job in the world transferring the design intent, but if you don't have management buy-in, and technical team buy-in, your chance of success goes down."

– Consultant Engineering Director

In addition to impacting market success, these changes are wasteful in that they discard consultant effort that the client already paid for. Minimizing this waste requires consistency on the client's side. If it truly values only certain aspects of the design, this should be communicated during negotiation so that the consultant can reduce the cost of the contract. Alternately, if the client does value the design intent, it must incentivize its own downstream personnel to preserve it.

Factors related to Follow-Up

Client fails to involve consultant. Consultants stressed that many of the problems discussed above can be mitigated by continuing to involve them, even at a low level, during downstream development, but some clients view projects as transactional rather than relational:

"Some clients deal with you like a deli-counter. They place their order and take it to go. They don't really see you as a partner in it, it's none of your business. So you hand it off and you have no clue what happens later." – Consultant Project Manager

"The expectation is that it's a one night stand. You don't expect a phone call in the morning." – Client Senior Engineer

Factors related to the Production Supplier

Consultant not put in contact with supplier. To keep designs practical and speed downstream development, the client should put the consultant in touch with the intended production supplier (or internal production resource) as early in the process as possible. Clients sometimes defer identification of a production supplier, intending to "shop the design around" to several contract manufacturers after development, but this prevents the designer from optimizing the design for the supplier's capabilities. A related problem occurs when the client encourages the consultant to identify suppliers on its own, but does not provide its approved vendors list. Development is performed with the assistance of a supplier who may not ultimately be involved in production.

4.5.2 Confirmatory Results: Phase 2 Pilot Study

To corroborate the interview results, the thirty pilot survey respondents were asked to describe any problems they had experienced on their project, as well as the problems' relative severity on a 5-point scale and whether or not each problem was resolved (Table 4-2). Many of the risk factors from Table 4-1 are represented, and only a few new ones added. One respondent noted that the basic product concept was fundamentally unmarketable. Similar comments were made in the interviews, though not frequently enough to merit inclusion in Table 4-1. Another project experienced trouble during prototype testing when it was realized that the product requirements contained an erroneous specification. The client accepted the blame and extended the project to fix the design. A third respondent cited a colleague's stubbornness for delays in development. Two projects generated complaints that the client personnel were not interested in the project. Similar comments were made during the interviews, but an item on the questionnaire asking about client indifference was rated lowly by both client and consultant respondents. Lastly, one respondent on a cost-down project noted that the client never implemented their recommendations because the client engineers were too busy fighting other fires.

Severity scores ranged from 2 to 5, and twelve of the 26 problems were eventually resolved. Given the small number of observations, it is impossible to meaningfully quantify the relative risk of the factors. It is clear, though, that problems are diverse in origin. The 26 identified problems stem from eighteen different risk factors.

Table 4-2: Problems identified in the Phase 2 pilot study projects. Problem severity was assessed on a 5-point scale, with "5" indicating "very severe" and "1" indicating "not very severe."

	Number of Mentions	Average Severity	Fraction Resolved
Client Firm			
· Lacks capability, experience, and/or processes for managing new product development	1	5	0
Specification of Requirements			
· Project is about blue sky, radical innovation	2	3.5	0.5
· Product direction fundamentally flawed from a marketing perspective†	1	4	0
· Specification contained erroneous information†	1	4	1
· Project has high technical risk; over-constrained requirements	1	3	1
Consultant			
· Lacks technical capabilities and/or domain experience	2	3.5	0.5
· Inflexible, unwilling to consider alternative solutions†	1	3	1
Briefing			
· Poor briefing, due to client deliberately withholding information so as not to constrain creativity	2	3.5	0.5
· Poor briefing, due to client ignorance or carelessness	1	2	1
Development			
· Design work poor	2	3.5	0.5
Feedback			
· Client inadequately involved due to lack of interest†	2	4	0.5
· Personality conflicts; poor working relationship	1	4	0
· Client inadequately involved due to lack of time	1	3	1
Reintegration of Design into Client Firm			
· Client personnel resist design; Not-Invented-Here	1	3	1
Refinement of Design by Client Firm			
· Client fails to perform necessary follow-on work	2	3.5	0
· Client makes changes that compromise the design intent	2	2.5	0
· Client never implements design†	1	3	0
Production Supplier			
· Consultant not put in contact with supplier early in project	2	3	0.5

† Not listed in Table 4-1.

4.5.3 Quantification of Risk Factors: Benchmarking/Patent Study Results

In an attempt to quantify the risk factors, the 94 problems reported by respondents in the Phase 3 benchmarking/patent study were compiled (Table 4-3). As in the pilot study, the results are very diverse. This is not particularly surprising, as any problem occurring frequently would be recognized by the consultants over time and controlled for. Nonetheless, several themes emerge. Many of the problems identified by consultants related to requirements – their specification and stability – or feedback. Client complaints were often about specific design details, for example the use of metric rather than English fasteners. Interestingly, few client interview respondents identified design quality as a problem, but when client survey respondents were asked to assess particular projects they frequently identified flaws in the consultant's design work.

It is instructive to note which problems could be resolved and which could not. Among the latter were under-defined requirements, internal divisions within the client firm, Discontinuities in team membership, poor communication by the consultant, poor management of expectations, and poor refinement by the client. Poor design work by the consultant was resolved in slightly less than half of the cases. In contrast, many of the problems that occurred early in the process, such as inadequate briefing, were resolved, though doing so may have compromised project budget or schedule. Overall, 64% of problems rated 4 or 5 in severity were resolved, 69% of those rated 3 were resolved, and 85% of those rated 1 or 2 were resolved.

Table 4-3: Problems reported in benchmarking/patent study projects by consultant and client respondents. The numeric columns have the same meanings and units as in the previous table.

	Consultant			Client		
	#	Sev.	Res.	#	Sev.	Res.
Client Firm						
· Lacks capability, experience, and/or processes for managing new product development	1	4	1			
Specification of Requirements						
· Project lacks definition; client cannot specify what it wants	4	3.25	0.25	1	1	1
· Project has high technical risk; over-constrained requirements	3	3.5	1	2	4	1
· Divisions within the client firm over project objectives	1	3	0	1	4	1
· Product direction fundamentally flawed from a marketing perspective				1	3	1
Negotiation						
· High project cost relative to deliverables†				1	2	1
· Unclear how best to add value†	1	2	1			
Consultant						
· Lacks technical capabilities and/or domain experience				2	4	0.5
Distance between Client Firm and Consultant						
· Organizational distance: standard processes	1	4	1	1	4	1
Briefing						
· Poor briefing, due to difficulty of encapsulating client's tacit knowledge				2	1.5	1
Discontinuities in Team Membership						
· Discontinuities in client project team	1	3	0			
· Discontinuities in consultant project team				1	5	0
Development						
· Consultant's design work poor				11	3.73	0.45
· Design impractical/costly to manufacture				4	3.5	0.5
· Poor project management by consultant†				1	4	1
· Development work performed out of order†				1	3	1
· Problems with client's development work†	1	3.5	1	2	5	1
· Consultant staff overloaded†	1	5	0			
· Client's preferred consultant staff unavailable†	1	1	1			
· Unspecified development problems†	1	4	1	6	3.5	0.6
Drift in Requirements						
· Client adds or changes requirements, compromising budget; scope creep	2	4	0.5	2	2.5	1

† Not listed in Table 4-1.

Problems reported in benchmarking/patent study projects (continued).

	Consultant			Client		
	#	Sev.	Res.	#	Sev.	Res.
Feedback						
· Consultant does not communicate frequently enough and/or manage client's expectations				3	4	0
· Client inadequately involved due to lack of time				1	4	n/a
· Client inadequately involved because client personnel did not wish to collaborate	1	4	1	1	5	1
· Personality conflicts; poor working relationship				1	3	1
· Disagreements between parties on substantive issues†	1	5	0	1	3	1
· Coordination of multiple designers difficult†	1	4	1	1	4	1
· Poor decision making by client†	1	3	0	1	3	1
· Micromanaging by client†	1	5	0			
Transfer of Design into Client Firm						
· Misaligned expectations about degree of completeness†	1	3	1	1	2	1
· Deliverable does not include design history or intent				1	2	1
· CAD problems				1	2	1
Reintegration of Design into Client Firm						
· Client personnel bitter about outsourcing†				2	4.5	1
· Client personnel resist design; Not-Invented-Here	1	3	0			
· Client attempts to assimilate design to fit pre-conceived expectations†				1	3	1
Refinement of Design by Client Firm						
· Client makes changes that compromise the design intent	3	4	0.5	1	2	1
· Other poor design work by client†				2	4.5	0
Production Supplier						
· Consultant not put in contact with supplier early in project	1	3	1			
· Chosen supplier could not produce design†				2	3	1
· Poor work by manufacturer†				1	4	1
· Communication problems with manufacturer†				1	3	0
· Unspecified manufacturing problems†	1	4	0	1	4	1

4.6 Explanatory Models

The typological approach utilized in Section 4.5 is fairly exhaustive, but with over fifty major factors as well as dozens of minor ones not depicted in Table 4-1, it is a bit unwieldy. To improve understanding it is helpful to abstract reality to generate streamlined models. Two approaches are presented. The first, referred to below as the Failure Modes Framework, emphasizes the actions or activity stages of the process depicted in Figure 4-1 on page 126 (i.e., the verbs in italic text). Conceiving the process as a sequence of activities facilitates understanding by allowing one to focus on the subset of factors relevant to each stage in turn. The second approach, referred to as the Outsourcing Motivations Framework, emphasizes the actors and structure in Figure 4-1 (i.e., the non-italicized nouns). This approach conceives the myriad factors as stemming from a much smaller number of root causes.

4.6.1 Failure Modes Framework

Conceptual Development

Chapter 2 indicated that client satisfaction is highly correlated with most project outcomes as well as the client's overall rating of project success. Starting from the common assumption that satisfaction results when expectations are met or exceeded [25], Figure 4-1 can be simplified into a chain of activities linking the client's expectations to its understanding of the consultant's design (Figure 4-4). In a successful project, the client firm *specifies* its vision into requirements and *briefs* the consultant appropriately. The consultant forms an interpretation of the requirements and *develops* a design. Any *drift* in the client's expectations or the design development is continuously managed by extensive feedback. Finally, the design is *transferred* back to the client firm and the client's understanding of it compares favorably with its expectations, creating satisfaction.

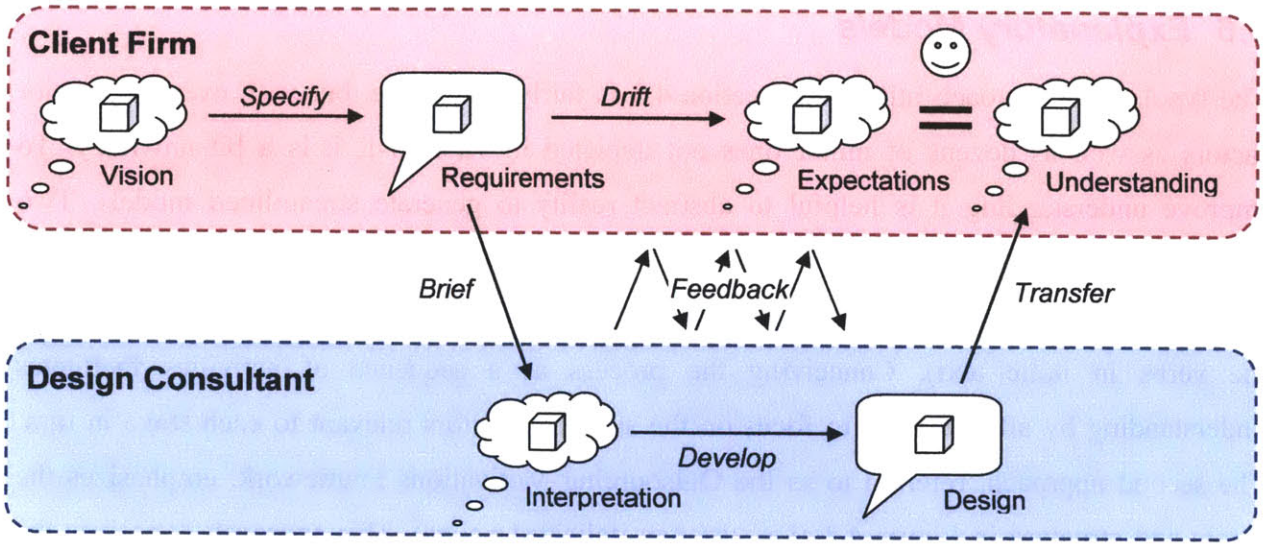

Figure 4-4: A simplified process model illustrating the chain of activities linking client expectations and consultant deliverables. In this case the client's vision of a generic cube is successfully specified, briefed, developed, and transferred, while drift of their expectations is minimized through feedback.

In less ideal cases, missteps in any of the activities lead to a discrepancy between expectations and understanding, creating dissatisfaction. Figure 4-5 depicts several possible failure modes. Solid arrows represent well-executed process steps, while dashed arrows represent a misstep that breaks the chain between expectations and understanding. According to this model, nearly all failure modes can be mitigated or eliminated by proper use of feedback during development.

Some failure modes result from several distinct causes. For example, a misstep can occur during development because the consultant lacks capability, or because of the emergence of technical problems not anticipated by either party at the outset of the project. Likewise, drift of client expectations may be caused by unanticipated shifts in the marketplace [7], or because of turnover within the client project team. Accurate diagnosis of failure modes by a single party can be difficult, as certain modes can resemble others from certain vantage points. For example, from the client's perspective poor briefing, poor development, and poor design transfer all look the same. As depicted in Figure 4-5, the client asks for a cube and seems to get back a cylinder. This may explain why surveys of client personnel frequently indicate problems with the design provider's work (e.g., Table 4-3 or [5]). To ascertain the true cause of failure, both parties' perspectives should be considered.

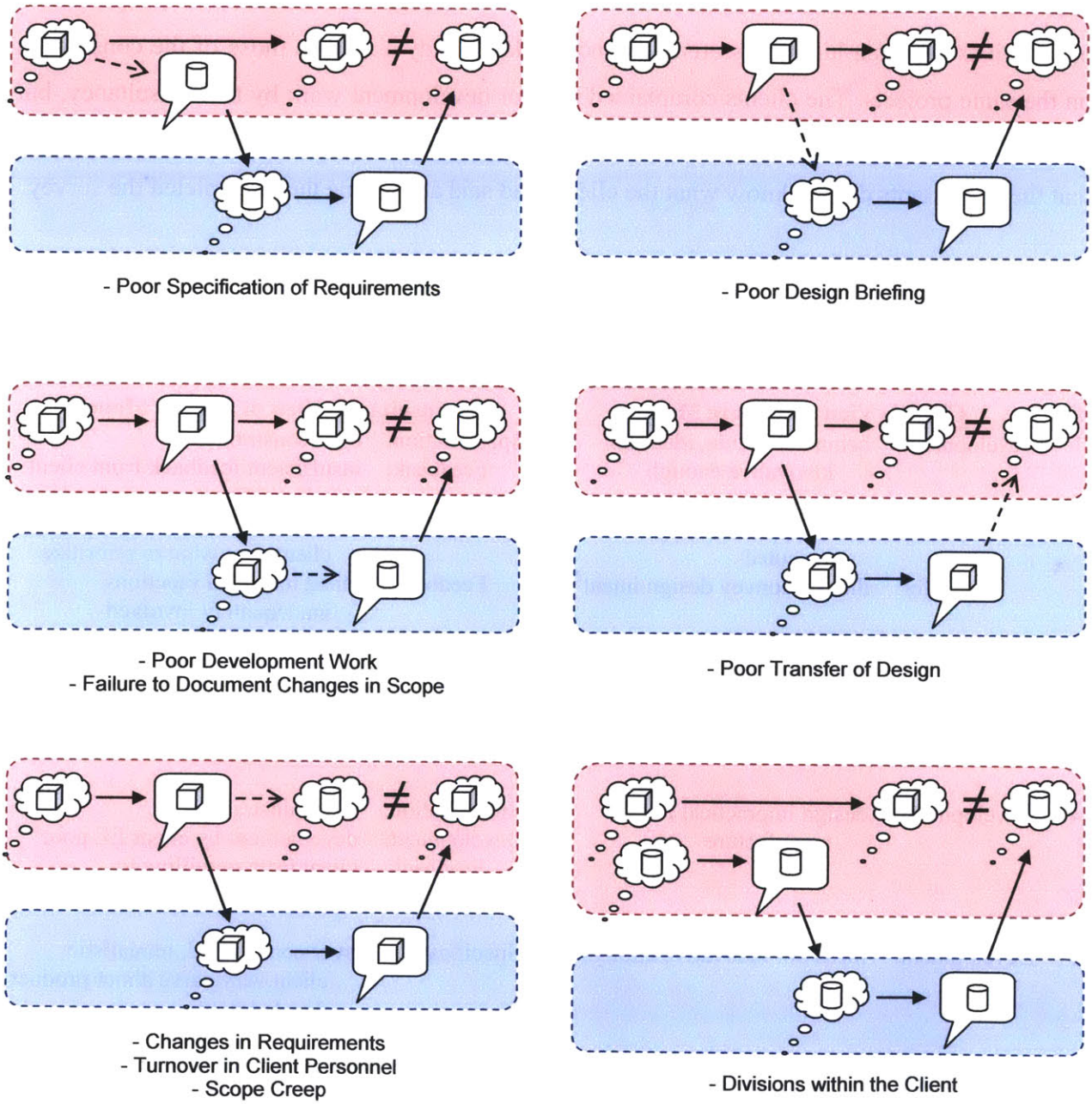

Figure 4-5: Common failure modes in design consulting and their causes. In each case the client's understanding of the consultant's design does not equal its expectations for it. The cube and cylinder are abstract representations of the vision, requirements, design, etc.

Empirical Evidence

The interview and survey results both suggest that each of the illustrated failure modes occurs in practice. To demonstrate how the modes can be misdiagnosed, Table 4-4 compares the perspectives of seven highly dissatisfied benchmarking study clients to those of the consultants on the same projects. The clients complained of poor development work by the consultancy, but the consultants generally attributed cause to poor specifications or insufficient feedback. Note that the consultants did not know what the clients had said at the time they completed the survey.

Table 4-4: Comparison of perspectives on the origins of client dissatisfaction. The left column presents the views of seven clients who were highly dissatisfied, while the right column presents those of their consultants.

#	Client's View of Failure Mode		Consultants' View of Failure Mode	
1	Development:	behind schedule, ideas not innovative enough	Specification: Feedback:	over-constrained[1] insufficient feedback from client
2	Development: Transfer:	some functionality not executed did not convey design intent[2]	Specification: Feedback:	over-constrained, divisions within client over what to prioritize client technical functions inadequately involved
3	Development: Feedback:	performed out-of-order consultants are poor listeners	Development: Feedback:	client is cheap, project budget only allows for cursory design key client contact was a poor collaborator
4	Development:	design impractical to manufacture	Specification: Development: Feedback:	over-constrained development by client EE poor client team unwilling to collaborate
5	Development:	ideas not innovative enough	Specification:	over-constrained, unrealistic; client very naïve about product development
6	Feedback:	very little communication from consultant	[Consultant was unaware of any problems]	
7	Development: Feedback:	poor work by consultant poor project mgmt. by consultant	Specification: Feedback:	under-defined, divisions within client different management styles

[1] A second client respondent on this project also noted that the client firm's vision for the project was "aggressive yet vague, with perhaps unrealistic expectations"

[2] A second client respondent on this project noted that problems occurred in translating the concepts into a design due to an "internal performance issue"

4.6.2 Outsourcing Motivations Framework

Conceptual Development

A second approach to improve understanding of the factors influencing project outcomes is to distill the symptoms of failure down to their root causes. Table 4-5 does so for just one of the commonly cited problems, poor design work by the consultant, using the "5 Why" technique [26]. For example, poor design work may result if the consultant is not qualified for the job, which may in turn result because the client firm is not a knowledgeable buyer of design services, which may in turn by due to the fact that the client does not outsource routinely. Alternatively, poor design work may result from a poor brief, which may result from lack of time by the client, due to a shortage of resources. Thus, while poor design work is ostensibly the fault of the consultant, its causes can often be traced back to characteristics of the client firm, its reasons for outsourcing, and the inherent nature of product development. The same is true for many other symptoms of failure, though the full analysis is not included for the sake of space. This analysis suggests the possibility of identifying common outsourcing archetypes and focusing attention on the particular hazards associated with each.

Client motivations for outsourcing are varied, but most stem from the root causes identified in Table 4-5. Some need additional development resources [15, 27-29]. Others need specialized expertise [30, 31]. These two cases have been previously referred to as outsourcing for *capacity* and outsourcing for *knowledge*, respectively [11]. Unlike production outsourcing, however, design outsourcing may also be motivated by a deliberate desire to disconnect the design from the client's organizational and product legacies so as to encourage innovation. Prior research suggests that a firm's organization evolves to match the architecture of its primary products [20]. Communication channels, information filters, and strategies develop that help the organization handle complexity but may prevent it from conceiving or even recognizing new product architectures [ibid.]. Similarly, a firm's values and cost structure [32], core capabilities [33], and design process bureaucracy [24, 34] may all inhibit innovation. In light of these tendencies, a client may choose to hire a design consultant even when it has the capacity and knowledge necessary to do the work itself. It is outsourcing for *originality* or a fresh perspective.

Table 4-5: Root cause analysis for poor design work by the consultant. Each successive column offers possible explanations for the issues cited in the column to the left of it.

Original issue	First Why?	Second Why?	Third Why?	Fourth Why?
▪ Consultant design was work poor	▪ Consultant was not qualified for the job	▪ Client chose wrong consultant	▪ Client is not a knowledgeable buyer of design services	▪ Client does not outsource routinely
		▪ Consultant oversold capabilities	▪ Consultant was hungry for work	▪ Workflow is unsteady
		▪ Necessary qualifications not well understood	▪ Inherent uncertainty of product development	
	▪ Problem was over-constrained, intractable	▪ Problem poorly specified	▪ Client lacks technical capabilities	
			▪ Client lacked time to do it well	▪ Client short on resources
			▪ Internal divisions w/in client firm	▪ Organizational politics, etc.
		▪ Inherent uncertainty		
	▪ Consultant was not well briefed on project requirements and constraints	▪ Client lacked time to do well	▪ Client was short on resources	
		▪ Client did not wish to over-constrain	▪ Client sought a fresh perspective	▪ Organizational inertia, values, culture, etc.
		▪ Inherent challenges of knowledge transfer		
	▪ Insufficient schedule or budget allotted for project	▪ Client prioritized cost over quality	▪ Client is not a knowledgeable buyer	▪ Client does not outsource routinely
			▪ Client prioritizes wrong metrics	▪ Organizational management systems
	▪ Internal divisions within the consultancy	▪ Client did not actively police development	▪ Client lacked time to do so	▪ Client short on resources
			▪ Client did not know better	▪ Client does not outsource routinely
	▪ Consultant was negligent	▪ Client chose wrong consultant	▪ Client is not a knowledgeable buyer	▪ Client does not outsource routinely
	▪ Inherent uncertainty of product development			

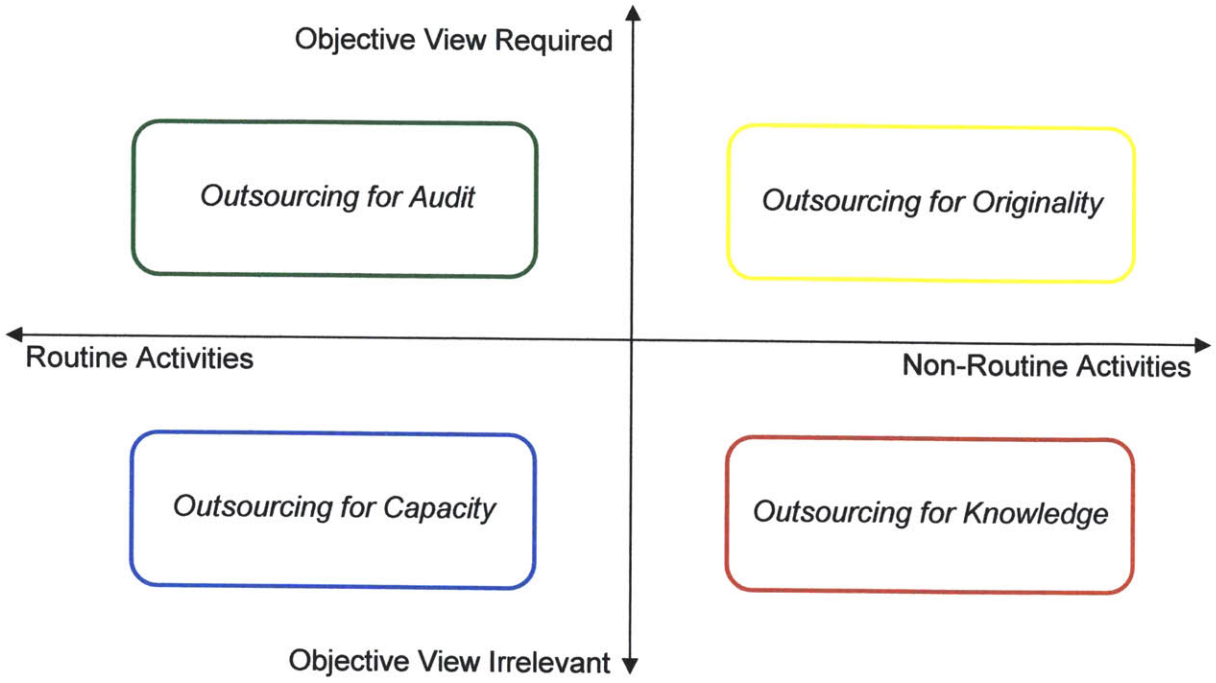

Figure 4-6: Common motivations for outsourcing product development activities.

Other situations in which a client firm possessing knowledge and capacity might hire a design consultant include need for an independent second opinion or *audit*, or a desire to leverage the *prestige* of the designer [31]. Figure 4-6 classifies the outsourcing motivations according to how routine the work is and the degree to which it requires an objective, outside view. The dimensions are meant to be continuous rather than binary, and combinations of motivations are possible.

The root cause analysis suggests that each outsourcing motivation entails certain risks (Figure 4-7). A client outsourcing for additional capacity is competent but is likely to be short on time, which may compromise involvement of all stakeholders, as well as the quality of the specification, briefing, feedback, design transfer, and refinement. Because the firm has internal development capabilities, it may be unfamiliar with hiring design services, may take its own knowledge for granted during briefing, and may resist reintegration of a design that does not adhere to its standard practices. If its outsourcing motivation is to save money, it may shortchange the project budget or partner with an incompetent low-bid consultant.

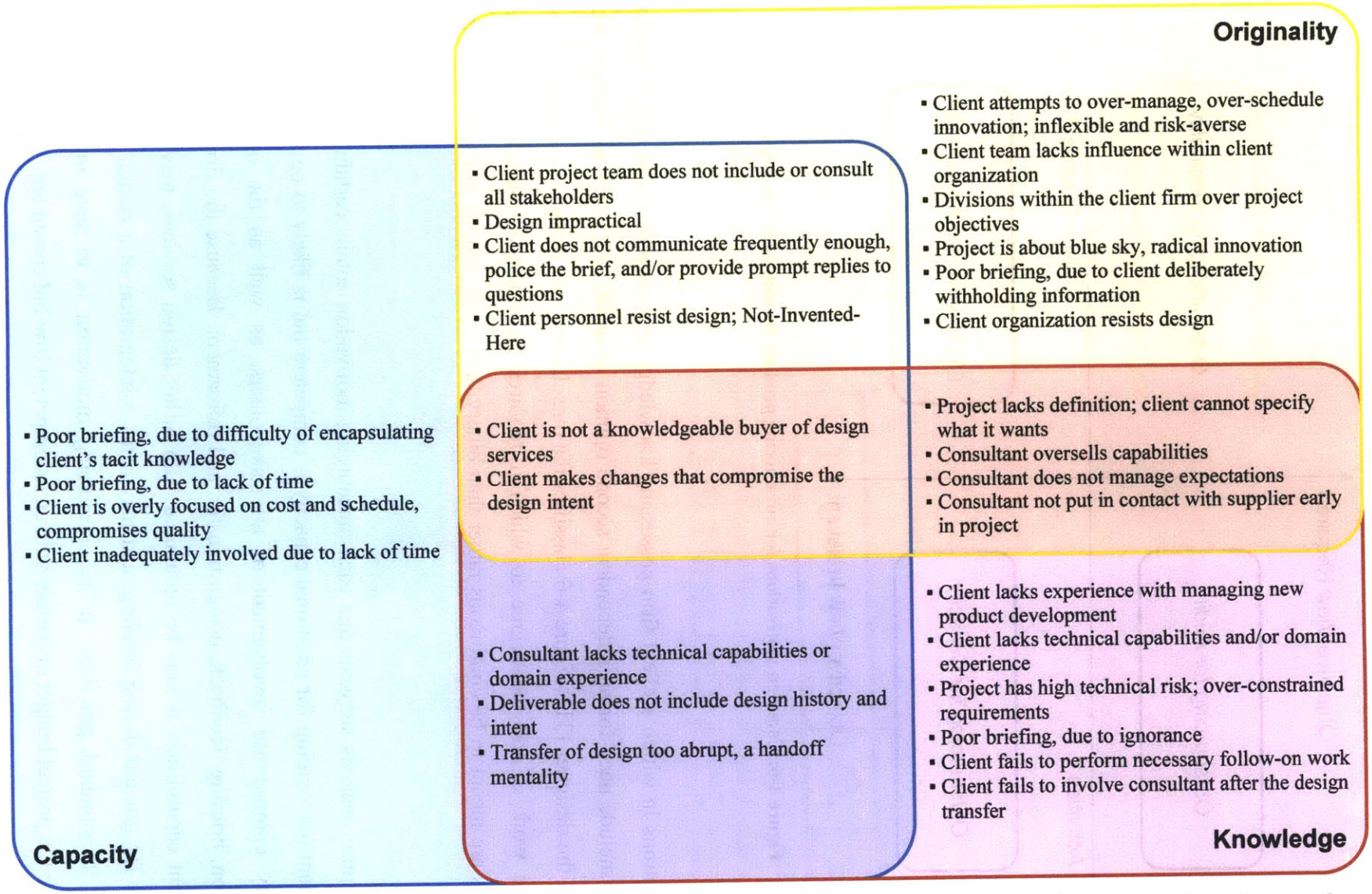

Figure 4-7: Particular risks associated with outsourcing for capacity, knowledge, and originality. Factors in overlapping areas are shared by more than one outsourcing motivation. Outsourcing for audit or prestige are not shown due to their relative rarity.

In contrast, a client outsourcing for technical knowledge may have difficulty specifying requirements, choosing a suitable consultant, briefing and guiding development, and refining the design. Misunderstandings during negotiations are likely due to the knowledge gap between parties. The consultant may overstate its expertise, either because the client cannot articulate exactly what it needs, or because an unscrupulous consultant takes advantage of the client's limited knowledge. The client firm may be unfamiliar with the product development process, requiring additional guidance from the consultant before and after the transfer of the design.

A client who is knowledgeable and has sufficient capacity but is outsourcing for originality likely suffers from internal strife or excessive organizational inertia. The project may originate from one part of the organization but lack universal support. The vision may be vague, and the client may overestimate the likelihood of radical innovation, or the consultant may overstate it. The client may withhold important constraints during the briefing or fail to re-direct the consultant from wrong paths during development. The consultant may fail to exploit the client's expertise or manage its expectations, perhaps yielding a design the client considers impractical. Finally, the client's organizational inertia may limit its ability to re-integrate and implement the design after the project.

By identifying the client's motivation for outsourcing at the start of the project, both client and consultant can be aware of the particular risks associated with it, simplifying project management and improving the chance of a successful project.

Empirical Evidence

To corroborate the outsourcing motivation framework the projects in the pilot study were first examined qualitatively to see if the categories of outsourcing for capacity, knowledge, and originality were valid and comprehensive. Twenty-five of the thirty projects clearly fit one of these three categories. Most were outsourcing for knowledge. Ten were from companies with little product development experience (start-ups and a large financial services company). Eight others were experienced with product development but needed industrial design (four projects) or mechanical engineering expertise (four projects). Three projects were clearly capacity-driven.

The clients could have done the work but the necessary personnel were already fully booked. Four projects were from knowledgeable clients seeking an original perspective.

The remaining five projects did not perfectly fit any of the three paradigms. Two were a mix of knowledge and capacity: the client needed industrial design expertise and mechanical engineering capacity. The final three looked like capacity projects but respondent comments made it clear that they were motivated not just by need for additional resources but for resources that could move faster than the client organization was capable of. Development in large organizations is often slowed by bureaucracy, over-reliance on standard processes, internal politics, and the like, whereas the smaller, nimbler consultancies can move much faster. In such situations a client firm might outsource development for *speed*.

The qualitative analysis confirmed that the framework is reasonably comprehensive, but its validity was unproven as the investigator might simply have been seeing the patterns in the data that he was looking for. For a more objective test, agglomerative hierarchical clustering was used to group the thirty projects into self-similar clusters based only on the explanatory (i.e., non-outcome) variables from the survey (e.g., client firm size, experience with product development and consulting, product novelty, extent of product requirements known at the start of the project, etc.). The resulting dendogram is shown in Figure 4-8. The algorithm quickly recognized projects from the same client firm (likely due to the company demographic variables) and grouped them together early in the agglomeration process. Four of the five biggest clusters, each shown in a different color in the figure, are recognizable as particular outsourcing paradigms. The clients in the lower three clusters all sought product development process expertise. The blue cluster consists of projects from the aforementioned financial services company, the orange are physician-inventors, and the teal are all start-ups. The green cluster includes engineering capacity and speed projects, though projects S and Q4 were motivated by need for technical expertise. The red cluster is a bit of a mix. The lowest three projects were all originality-driven, while the rest were primarily seeking industrial design expertise. An exception is project H, which was technical and speed-driven. All the red projects were for large client firms. Although the classifications are not perfect, the clustering algorithm identified similar groups to the qualitative analysis.

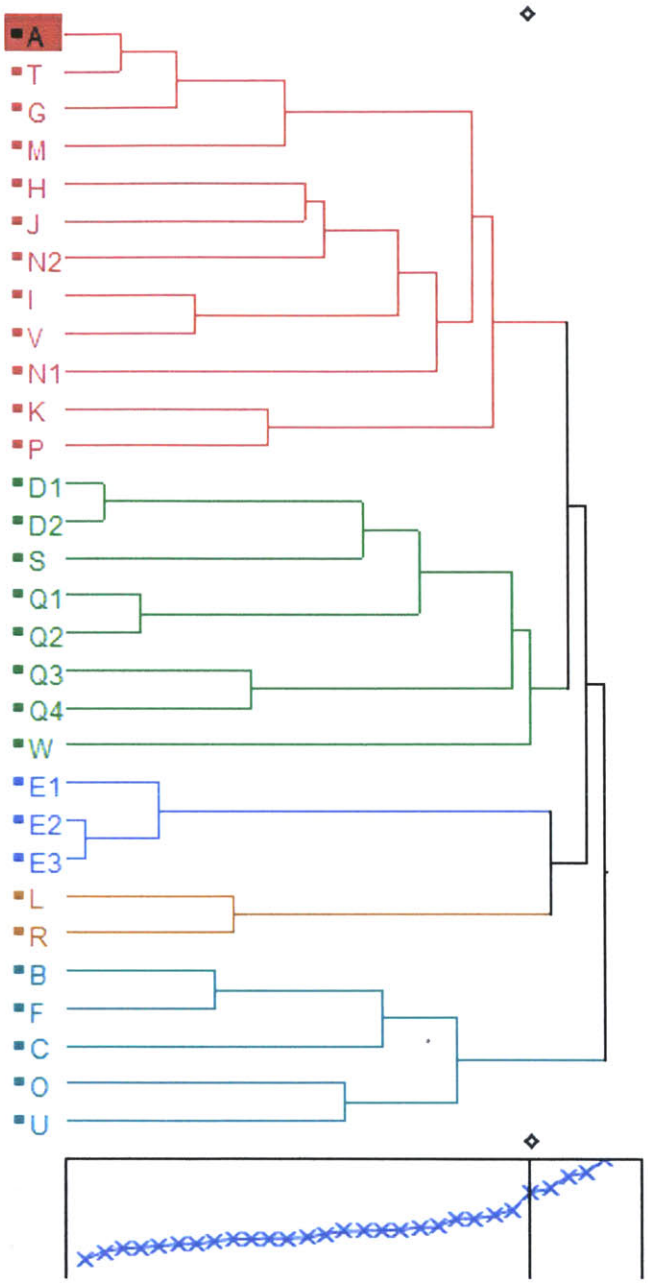

Figure 4-8: Dendogram produced by hierarchical clustering of the projects in the pilot study, using the Ward distance algorithm and all independent variables. Projects are identified using a letter to represent the client firm and a number if that firm had multiple projects in the sample. The sharp knee in the scree plot at bottom suggests five distinct clusters, which are indicated by color. The highlighting of observation A at the top is a software artifact and is not intended to convey any meaning.

To examine whether the framework has predictive power, the identified clusters were compared on the occurrence of problems and the consultant's appraisal of project success (Figure 4-9 and Figure 4-10, respectively). Note that none of the project outcome variables had been used to form the clusters in the first place. Two clusters in particular stand out as having poor outcomes. Projects K and P (the lowest two in the red cluster, both blue sky projects for large client firms) both experienced problems and were rated quite poorly by the consultants. The teal cluster, comprised entirely of start-ups, also fared poorly. In contrast, the two other knowledge-driven clusters, the large financial services company (blue cluster) and the physician-inventors (orange), did quite well. Comments made by the respondents suggest possible reasons for the difference. First, because the stakes were much higher for the start-ups, the client personnel were more emotionally invested and tended to over-react to minor setbacks. Second, the start-ups were more likely to meddle in development or second-guess the consultants' decisions. The physician-inventors and the financial services company seemed to be more aware of the relative expertise that each party brought to the project and respected the consultant's recommendations.

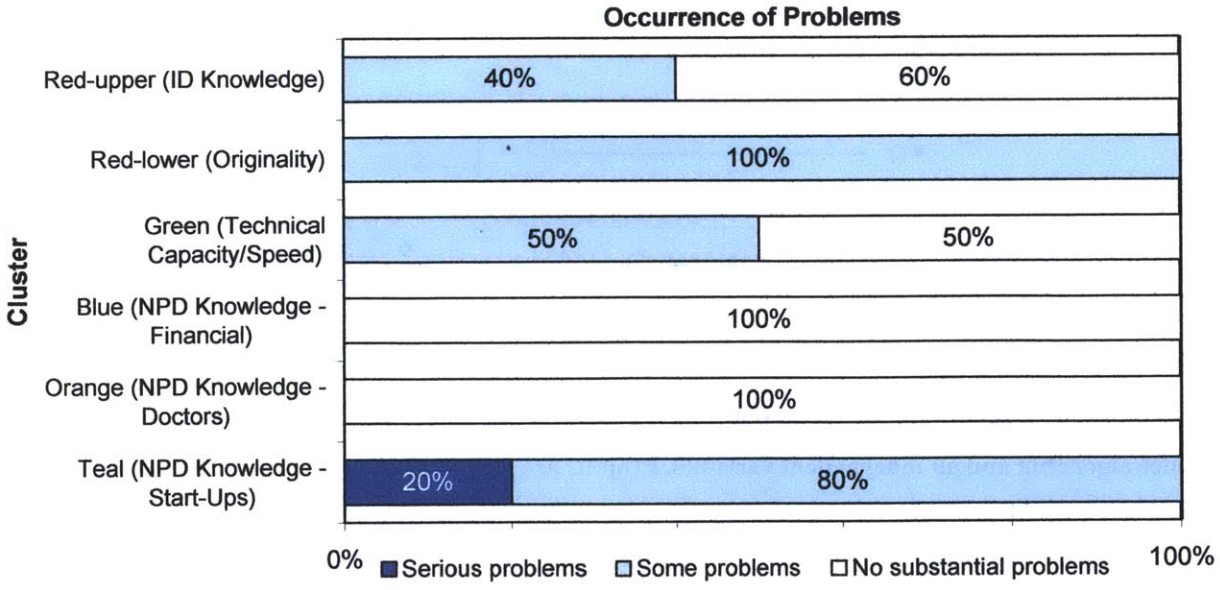

Figure 4-9: Occurrence of problems by cluster. Projects K and P were split out of the Red cluster on theoretical grounds and are referred to as the "Red-lower" cluster.

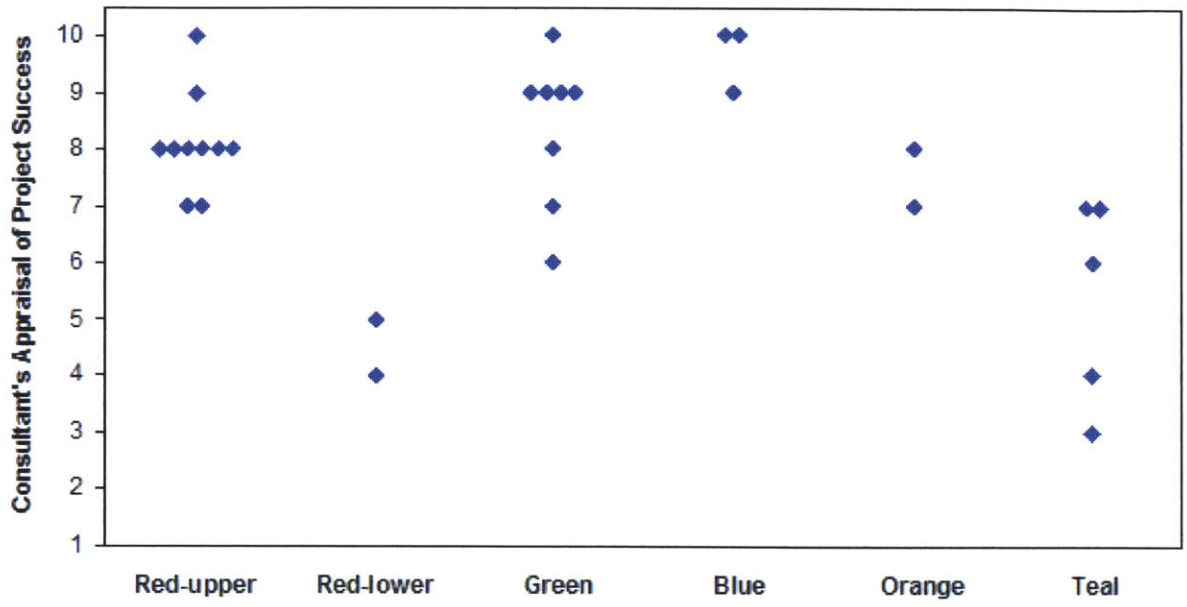

Figure 4-10: Project success by cluster. Each dot represents one of the thirty projects.

The clustering results suggest that the outsourcing motivation framework might be refined slightly for better predictive power. Start-ups might be split out from the knowledge group, and the originality group split into blue sky projects and those that are more tightly focused. Doing so suggests that outsourcing motivation does influence project outcomes (Figure 4-11, Figure 4-12). Projects in which the consultant added unique value (Speed, Knowledge, or Well-Focused Originality) did better than those in which the contribution was less unique (Capacity, Knowledge/Capacity), ill-defined (Blue-sky Originality), or unappreciated by the client firm (Start-ups). These results echo the opinions of the interview participants, who felt that outsourcing for knowledge was more likely to produce success than outsourcing for capacity or originality (Figure 4-13). The effect of outsourcing motivation on project outcomes will be more rigorously tested using the benchmarking/patent study data in the next chapter.

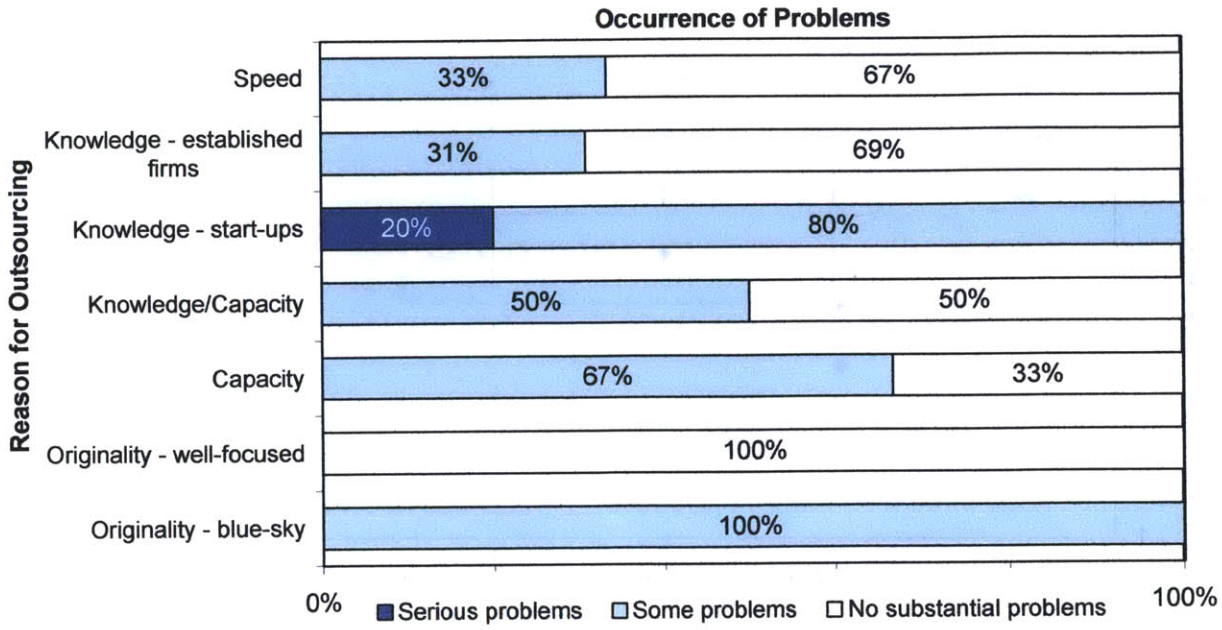

Figure 4-11: Occurrence of problems by outsourcing motivation, with Knowledge and Originality split into two distinct subgroups suggested by the clustering analysis.

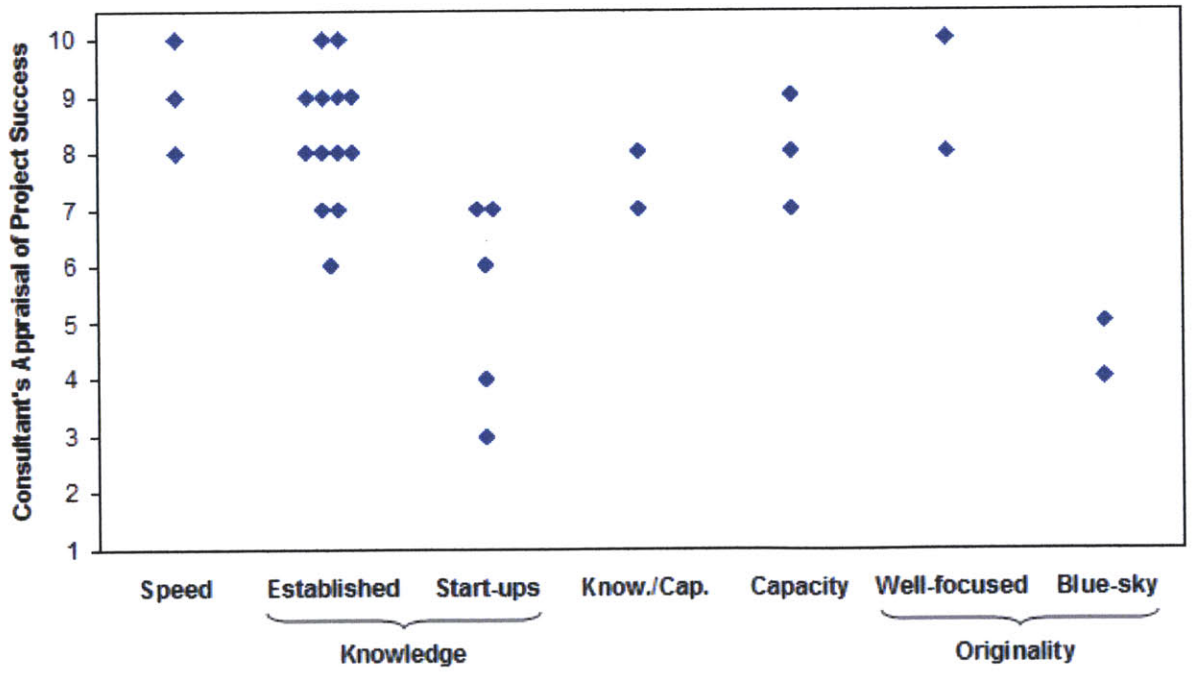

Figure 4-12: Project success by outsourcing motivation, with Knowledge and Originality split into two distinct subgroups suggested by the clustering analysis.

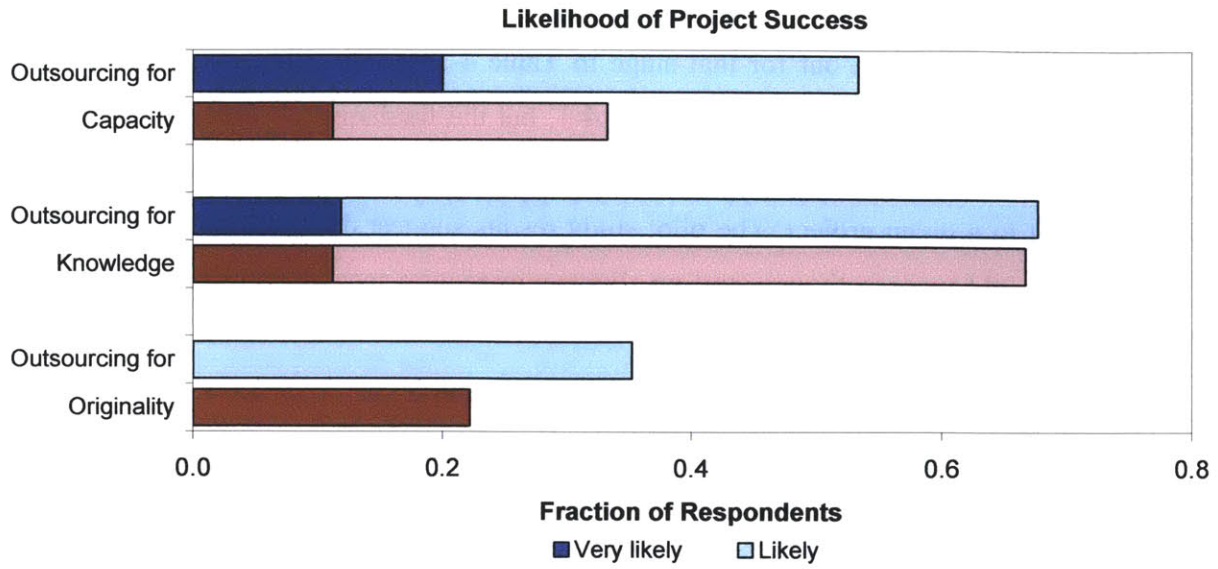

Figure 4-13: Perceived likelihood of success of each of the three major outsourcing motivations, according to the interview participants. Dark shades indicate the fraction of participants answering "5" and light shades "4" on the 5-point scale. For each item, the upper (blue) bar indicates consultant responses and the lower (red) bar client responses.

4.7 Conclusions

Drawing from the wisdom of experienced design professionals, this chapter developed a process model of outsourced product development and used it to organize the factors influencing project success and failure. Although the superficial manifestations of failure are highly idiosyncratic, most stem from a small number of root causes. To maximize success, a client firm should: 1) invest the time to carefully *specify* project requirements and objectives, 2) negotiate with the consultant as a *partner* rather than a vendor, 3) provide the consultant with *all* of the design constraints (including its own organizational structure and politics), 4) *actively participate* in the development process, and 5) commit to *shepherding* the innovation back into its organization. Consultants must foster these activities, and in particular strive to *enfranchise* client personnel throughout the development process.

The failure mode framework provides a simple tool for clients and consultants to focus their development efforts. The ultimate objective throughout the project should be to align client

expectations and consultant deliverables. At each stage of the process, particular attention can be paid to the risk factors called out for that stage in Table 4-1. Admittedly, actual development projects are less linear than suggested by Figure 4-1, but the fundamental principles still apply. Similarly, the outsourcing motivation framework provides a means to filter the list of risk factors to those relevant to a given project. The pilot study results suggest that each of the outsourcing motivations can yield success, though start-up clients may require special attention.

The validity of the findings is supported by the use of multiple data collection techniques and diverse respondents, as well as the general agreement with prior research. In particular, the results confirm previous findings that internal divisions within the client firm, poor specification and briefing of requirements, and insufficient communication between parties are all significant risk factors. Discrepancies between the present findings and those of past studies are likely due to the significant differences between study populations. The present study found more evidence of reintegration problems than did Roy and Potter [1], but they were expressly studying small and medium-sized client firms for whom organizational inertia would be low. Conversely, the present study found less evidence of consultant incompetence, perhaps because the design consulting industry has matured in the last twenty years. The results did not replicate Amaral and Parker's findings of version control problems and vendor rivalries [2]. Their article does not define their research setting precisely, but it appears to have included highly complex projects with many suppliers. Their finding may be particular to that type of outsourced development.

The study extends the literature in several ways. First, it organizes previously disparate findings into a comprehensive typology and distills them to mechanistic conceptual models. The outsourcing motivation framework extends Fine and Whitney's model by adding a second dimension (the need for objectivity) that is relevant to design outsourcing but not production outsourcing. Second, the results offer a relatively rare look at the consultant's perspective on the causes of success and failure. Prior academic research has focused exclusively on the client's perspective. The joint view taken in this study enabled identification of under-reported risk factors (e.g., client inexperience, excessive cost focus) and generation of alternative explanations for previous observations. For example, consultants are often accused of creating "impractical" designs. The traditional, client-centric perspective attributes this to poor work by the consultant,

or perhaps an inadequate briefing by the client. From the joint perspective, an impractical design is also a symptom of an inflexible client. That is, the underlying problem may be the client organization's inability to adapt to what the market demands. Similar alternative explanations can be developed by inverting the traditional wisdom for other phenomena. A poor briefing may be caused by the client's negligence, but it could also be caused by the consultant's failure to explain what it needs to know. All of these phenomena were observed in the interview and questionnaire data.

The nuance offered by the joint perspective and the detail obtained from in-depth interviewing are the study's greatest strengths. Its chief limitations are the risks of recollection error or deliberate deception by the respondents. Recollection error was mitigated by validating the interview findings with project data from the benchmarking/pilot study. Deliberate deception was mitigated by including both current and former employees in the interview sample. Those no longer selling or buying consulting services should have less interest in promoting or criticizing the consulting model. A secondary limitation is that the study population consists primarily of domestic consultants and clients. While international outsourcing may bring additional challenges, it certainly does not diminish those identified herein.

The project risk factors identified in this study suggest several broader themes. First, client firms often turn to outsourcing to address their internal limitations – of capacity, expertise, or organizational agility – but these very limitations are what compromise outsourcing outcomes. The client firm that is short on resources may be unable to effectively manage the consultant's progress, the firm short on expertise will be unlikely to refine the consultant's design, and the firm seeking to escape its own inertia will be re-confronted with it when it attempts to reintegrate the design. Outsourced product development is a tool, not a panacea. Second, the difficulties that firms have in pre-specifying requirements, and the need they exhibit for constant collaboration, call attention to the limitations of traditional systems engineering approaches to multi-party development. If firms struggle to specify requirements on relatively simple consumer and medical products, one can imagine the challenge of doing so for highly complex products. Even the proponents of modularity concede that design rules can only be formulated *ex ante* for relatively mature product categories [16]. The traditional solution for new-to-the-world products

has been physical co-location and concurrent engineering [27], but these are not always feasible. Thus, need exists for new approaches for performing dynamic product development in a distributed manner.

A start is to recognize that outsourced design is incompatible with traditional purchasing approaches. Many of the identified risk factors stem from arms-length, transaction-based engagements and the commoditization of design. The findings suggest that innovative design cannot be pre-specified, cannot be modularized [16], cannot be handed off. Rather, consultant and client must maintain a constant dialog throughout the project. Perhaps the key to improving outcomes in outsourced product development is not to think of them as *outsourced*, but as *collaborative*. The findings suggest that collaborative projects succeed where outsourced design projects fail.

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5 Explaining Project Outcomes

Prior chapters have identified dozens of outsourced product development success measures and scores of factors that may influence success. To begin to explain the outcomes of particular projects, a conceptual framework is first developed that hypothesizes causal relationships between the project outcomes themselves. Empirical testing using quantitative survey data confirms 17 of 27 hypothesized relationships, accounting for as much as 68% of the variation observed in each outcome measure. Because client satisfaction is both a central concept in the framework and an under-studied outcome in the literature, detailed models are developed that use intermediate outcomes such as project value and working relationship quality as well as exogenous factors such as the client's reason for outsourcing the project to explain nearly 80% of the observed variation in client satisfaction. The models confirm predictions from customer satisfaction theory (namely that perceived value is the most powerful influence on satisfaction) but challenge conventional wisdom about new product development. In particular, the results suggest that organizational, cultural, and physical distance between parties is not necessarily detrimental, and may even help. Although design consultancies have been widely portrayed as "creativity experts," clients outsourcing for originality had lower satisfaction than those outsourcing for other reasons. The consultancies were much more effective at rapid innovation, developing familiar products far more quickly than bureaucratic organizations and inexperienced start-ups can.

5.1 Introduction

The ultimate goal of this dissertation is to explain success and failure in outsourced product development. The results of the preceding chapters hint at the complexity of doing so. Chapter 2 identified seven dimensions of success, each having several commonly used measures. Chapter 4 identified over fifty different factors that are believed to influence success. A comprehensive explanation would examine the effect of each success factor on each success measure (e.g., the effect of client stakeholder unity on product commercialization, the effect of physical proximity

on schedule performance, etc.) but this would require consideration of over a thousand first order effects, to say nothing of higher order interactions. Such an approach would be neither efficient for the investigator nor practical for the audience. Need exists for parsimonious models that provide fundamental yet actionable understanding of key effects, while avoiding the oversimplification that has plagued past research (e.g., the use of binary unidimensional measures of "success"). The previous chapter provided three means of organizing the success *factors*: typological classification, process-based failure modes, and root-cause-derived outsourcing paradigms. The present chapter organizes the success *measures* into an integrated framework and then explains the central element – client satisfaction – in detail.

The framework reduces the complexity of explanation by assuming that the success measures are not independent but rather are causally interrelated. For example, the occurrence of problems during development may adversely impact schedule performance, which may in turn impact the commercial success of the product, and so forth. Such relationships are hypothesized from existing theory and qualitative interviews and combined into a causal network model that is simple enough to be readily understood yet rich enough to capture the multi-dimensional nature of success. The framework is tested using quantitative data from the benchmarking study, suggesting that the endogenous relationships between success measures account for up to 68% of their variation, depending on the measure. To account for the remaining variation, exogenous success factors can be added as appropriate to form more detailed models.

While each success measure has its merits, client satisfaction is the logical place to begin the detailed explanation. First, it is the linchpin of the causal framework, relating traditional product development foci such as process and product performance to outsourcing-specific concerns such as project value and repeat business. Second, the results of Chapter 2 suggest that client satisfaction is a holistic measure, highly correlated with most other measures of success. Third, customer satisfaction is an established field of inquiry with sophisticated conceptual models and well-tested measurement approaches. Fourth, client satisfaction is highly relevant to practitioners. Clients implicitly seek to maximize their own satisfaction, while consultants explicitly try to optimize it parallel to their own interests. To do so they must be able to estimate client satisfaction accurately, yet data from the benchmarking study described in Chapter 3

suggest that consultants' current estimates are poor, explaining just 3% of the variation in actual satisfaction. Improved models would help them to better estimate and manage client satisfaction. Finally, the science of customer satisfaction would benefit from the investigation, as it has focused little on business-to-business professional services to date.

Two approaches are taken to explain client satisfaction. First, a parsimonious model is hypothesized from customer satisfaction theory and tested using the survey data. The model explains 73% of the variation, impressive by academic standards but somewhat impractical in that the key explanatory variables are no easier to measure than satisfaction itself. To provide greater utility, key exogenous factors are identified from the survey data and verified using cross-validation. The resulting models suggest that nearly 80% of the variation in client satisfaction can be explained after the fact using data obtained from both client and consultant respondents. 72% can be explained using data provided by the consultants alone, yielding estimates with half as much error as current practice. Lastly, 36% can be explained using only factors that would be known to the client and consultant at the start of the project. This prediction model can help client and consultant practitioners to assess project risk and plan accordingly for it.

5.2 Literature Review

Given that most of the success measures identified in Chapter 2 have analogs in traditional product development and customer satisfaction, it is possible to hypothesize relationships between measures based on past research.

5.2.1 Traditional Product Development Literature

Scholars of new product development have identified and utilized scores of success measures [1], but are only beginning to understand the relationships between them. Early research tended to consider the objectives of single technical functions in isolation [2]. While exploring a range of explanatory variables, many studies used just a single measure of project success [3]. Such a

narrow focus is surprising given that scholars have long preached to practitioners the need to consider multiple perspectives [4].

Nonetheless, early studies connected product performance (then conceived as an explanatory variable rather than an outcome in and of itself) with commercial success [5-7]. Later work confirmed this finding and showed that product performance (i.e., design quality) is also positively associated with end-user satisfaction [2]. Others were quick to note that product performance does not come for free, but must be traded off against development process measures. Increasing product performance generally requires more development resources, and thus may worsen schedule performance, product unit cost, and development cost [5].

Another stream of research examined the effects of development process performance on commercial performance. Perhaps unsurprisingly, reducing product unit cost increases sales [2]. The marketing literature has emphasized the impact of speed-to-market on market share [6, 7], while technology management scholars counter that shortened development schedules compromise product performance [8] and may offer no overall commercial benefit [9]. Tatikonda and Montoya-Weiss found that faster time-to-market improved end-user satisfaction but not, paradoxically, sales [2].

Recent work has attempted to unite these findings into comprehensive causal models. Loch, Stein, and Terwiesch conceived a sequential model in which *development process performance* influences *development outcome performance*, which in turn influences *business performance* [10]. Mallick and Schroeder adapted the model to the project level and found empirical support for four of ten hypothesized relationships [11]. Increased development time was positively associated with product unit cost, which was in turn negatively associated with project return-on-investment (ROI) and market share. Market share was positively linked to overall commercial success, which was conceived as a separate and ultimate outcome in the framework. Table 5-1 summarizes the empirically tested relationships between various process, product, and commercial performance measures.

Table 5-1: Empirically tested relationships between various success measures in traditional product development. The "+" symbol indicates a positive association, the "–" symbol a negative association, and "0" a null result. Outcomes higher in the table are thought to influence those lower in the table. The numbers in square brackets are citations to the study that tested the relationship.

		1	2	3	4	5	6	7	8	9	10	11
1	Development cost	X										
2	Time-to-market		X									
3	Product performance	0 [11]	0 [11]	X								
4	Product unit cost	0 [11]	+ [11]		X							
5	Value to customer					X						
6	Customer satisfaction		– [2]	+ [2]	0 [2]		X					
7	Market share			+ [12] 0 [11]	– [11]			X				
8	Met sales goals		0 [2]	+ [12] + [2]	– [2]				X			
9	ROI			+ [12] 0 [11]	– [11]					X		
10	Product profitability			+ [12] + [13]		+ [13]					X	
11	Overall commercial success		0 [9]					+ [11]		0 [11]		X

5.2.2 Outsourced Product Development Literature

As discussed in Chapters 2 and 3, scholars of outsourced product development are just beginning to understand how to define and measure success in this domain. As a result there is little reliable data on project outcomes, and nearly no evidence on the relationships between success measures. Several clues can be obtained by scrutinizing what few results have been published. Secondary analysis of Roy and Potter's data [14] suggests that projects experiencing problems were no less likely to commercialize their products ($\chi^2 = 0.028, p = 0.866$, based on Table 2a), and were only somewhat less likely to generate a positive ROI ($\chi^2 = 0.535, p = 0.465$). However, projects in which the consultant's design work was poor were significantly less likely to generate a positive ROI ($\chi^2 = 6.58, p = 0.010$).

Anderson, Davis-Blake, and Parker have reported preliminary data on the effects of various interfirm coordination mechanisms on several project outcomes measures [15]. Although they do not report the correlations between their outcome measures, the different coordination mechanism effects reported for each suggests that the outcomes are interrelated in complex ways. For example, the use of co-located personnel was associated with reduced project cost but increased project duration, which suggests the counter-intuitive result that project cost and duration are negatively correlated with each other. Other coordination mechanisms had strong effects on some outcomes but no effect on others. In light of these surprising results, it is unfortunate that the interrelationships between outcome measures have not been reported.

5.2.3 Customer Satisfaction Literature

Scholars of customer satisfaction have extensively examined the relationships between key concepts such as customer expectations, product performance, satisfaction, and loyalty but only partial consensus has been reached. The widely-used confirmation/disconfirmation paradigm posits that satisfaction results when the customer's perception of product (or service) performance meets or exceeds his expectations [16].[1] The pure formulation is somewhat flawed in that it predicts that a customer who expects poor performance and receives it will be satisfied. Two types of adjustments are commonly made to improve the model. One is to replace or supplement expectations (predictions of what *will* happen) with other comparison standards [17], such as experience-based norms (what *could* potentially happen, in the best-case) [18] or ideals (what *should* happen, based on considerations of fairness of exchange) [19]. The second adjustment is to add direct causal links from expectations to satisfaction [20], perceived performance to satisfaction [21], and/or expectations to perceived performance [22], as shown in Figure 5-1. Debate over these details has consumed the literature for thirty years, and it seems that no one model fits all situations [21]. The relative strengths of the various paths depend on the type of product or service and the customer's experience with it [22].

[1] Using the standard terminology, *confirmation* occurs when performance exactly meets expectations. *Disconfirmation* results from a difference between performance and expectations. Performance exceeding expectations generates *positive disconfirmation*, while performance falling short of expectations produces the grammatically awkward but nonetheless standard *negative disconfirmation*.

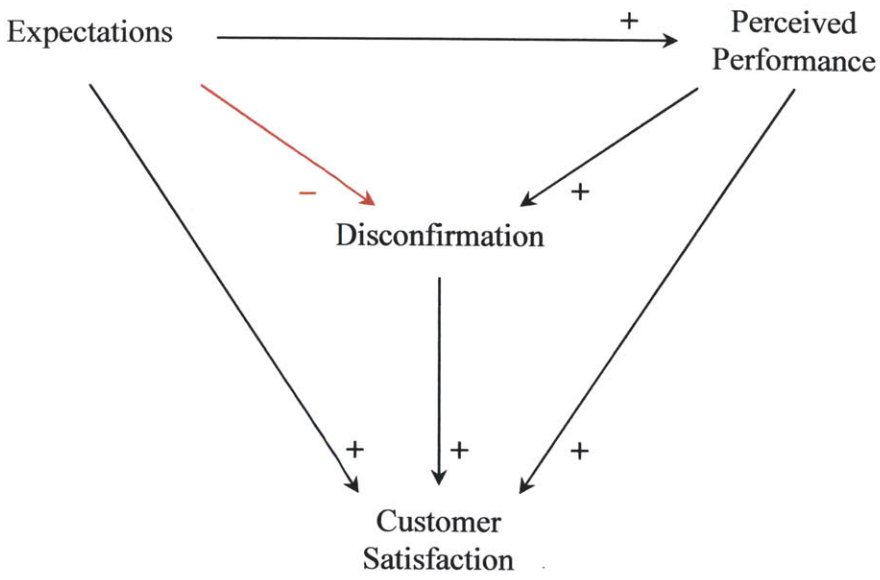

Figure 5-1: Antecedents of customer satisfaction. The basic confirmation/disconfirmation model consists of the three central paths. More refined models add one or more of the three peripheral paths.

For example, all three paths to satisfaction might be active in a frequently consumed but heterogeneously delivered service such as restaurant table service. Customers have well-formed expectations and can evaluate performance accurately, leading to possible disconfirmation. In more complex situations such as automobile repair or medical care, performance is harder for the customer to evaluate (flat tires and extreme pain notwithstanding), so satisfaction judgments derive heavily from expectations, which might be formed directly from experience or indirectly from advertising or hearsay. Confirmation/disconfirmation models have performed well for many consumer products and services but appear to break down in situations in which the customer does not have well-formed expectations [23].

An alternative paradigm, value-percept disparity theory, eliminates the expectations and disconfirmation constructs and posits that satisfaction results directly from the perceived value of the product or service to the customer [24]. Johnson, Nader, and Fornell demonstrated that a simple value-percept based model explained customer satisfaction with bank loans much better than a disconfirmation model [23]. They argued that because bank loans are complex, intangible, heterogeneous, and infrequently consumed, the consumer could not form meaningful expectations.

Compared to the variety of models proposed to explain the antecedents of satisfaction, the consequences of satisfaction are more generally agreed upon. Customer satisfaction is positively associated with loyalty (i.e., repeat business), though the association is not perfect as a satisfied customer may not have need for future consumption or a dissatisfied customer may be trapped by a lack of alternatives [16]. More precisely, satisfaction influences behavioral intention (i.e., willingness to repurchase) [20], which in turn influences actual repurchase behavior. Other consequences of dissatisfaction include complaints, either directly to the product or service provider, or to friends and colleagues (i.e., word-of-mouth) [16]. The relationships between complaints, complaint management, and loyalty are an active subject of debate [25].

In sum, past research on product development, outsourced product development, and customer satisfaction suggests concepts and relationships pertinent to the present study. These are utilized to frame specific hypotheses in Section 5.3.

5.3 Conceptual Framework & Propositions

5.3.1 Relationships between Success Measures

Causal relationships identified from the three streams of literature are now combined with understanding gained from exploratory interviews to model the relationships between key success measures identified in Chapter 2. The hypothesized causal network, depicted in Figure 5-2, is organized along two dimensions. Horizontally it consists of two interconnected halves: the left side includes measures common to traditional product development while the right includes measures unique to outsourced development. Vertically the measures are grouped into approximately sequential stages, as suggested by product development and customer satisfaction theory. Following the model of Loch et al. [10], measures of product development performance are expected to influence measures of development outcome performance, which in turn influence measures of business performance.

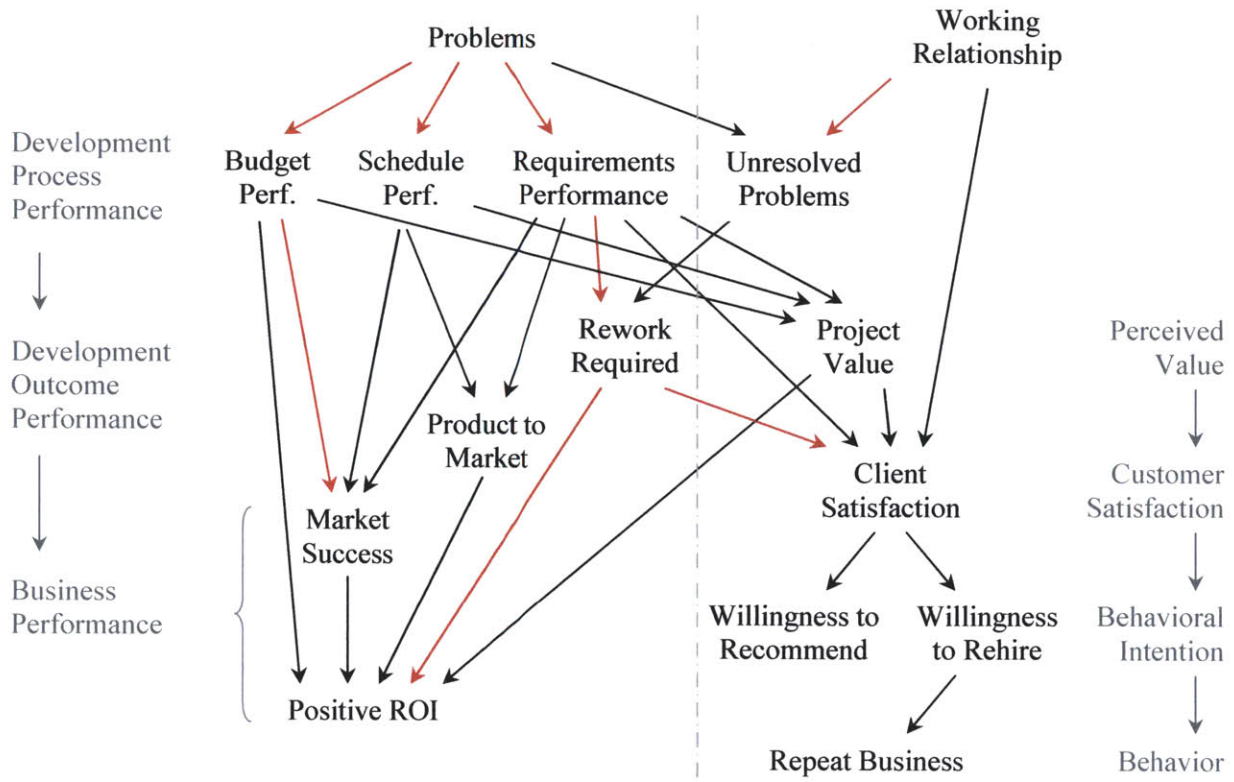

Figure 5-2: Causal relationships hypothesized between project success measures. Black arrows represent a hypothesized positive association, while red arrows represent a hypothesized negative association. Measures to the left of the dashed grey line are common to traditional product development, while those to the right are unique to outsourced product development. The grey labels and arrows at the sides are standard concepts and relationships from product development and customer satisfaction theory.

On the right side, value is hypothesized to drive satisfaction [24], which drives behavioral intention [20], which in turn influences behavior [26, 27]. Most measures are also likely influenced by one or more of the exogenous factors identified in Chapter 4, but these are omitted for now for visual and conceptual clarity.

Specific hypotheses are now derived in turn. Starting from the upper left, unexpected problems occur for a variety of reasons, discussed in Chapter 4. The resolution of these problems requires investment of time and resources, which adversely affects schedule and budget performance. If resources are diverted from other development activities, the meeting of project requirements may also suffer. If problems are extensive, it is unlikely that all will be resolved by the end of the consulting project.

Moving down a stage, fulfillment of requirements reduces the amount of rework that the client must perform to the consultant's deliverable and increases the likelihood that a product will be commercialized. Schedule performance should also be positively associated with commercialization, as an on-time product launch is more likely to hit a market opportunity. A project that misses its window may be canceled to save production ramp-up costs.

Although not included in past models [10, 11], development process measures may also impact business performance measures directly. A design that meets requirements should be more likely to succeed in the market (assuming the requirements were well-specified). Schedule performance is hypothesized to improve market success by reducing time-to-market [6, 7]. Budget performance is hypothesized to adversely affect market success through its negative impact on product performance (not shown explicitly) [5]. Budget performance should positively influence ROI by reducing the client's investment. Rework increases the investment, reducing ROI. Rework may also be indicative of poor design work, which has been shown to reduce ROI [14]. Lastly, market success is hypothesized to increase ROI by increasing revenues.

On the right side of the diagram, higher quality of the working relationship between client and consultant is hypothesized to improve the likelihood that the problems which do occur will be resolved by the end of the consulting project. Unresolved problems should increase the amount of rework required. The perceived value of the project to the client should be positively influenced by the meeting of requirements, as well as budget and schedule performance. These correspond to two components of performance utilized in the American Customer Satisfaction Index (ACSI): the meeting of requirements indicates successful *customization* of the consultant's service to meet the client's needs, while the achievement of schedule and budget commitments reflects the *reliability* of the consultant's service [28]. Budget performance should also positively influence project value by reducing direct project costs. By similar arguments, project value should be positively associated with ROI.

Johnson et al. have suggested that perceived value is the primary determinant of customer satisfaction in complex services [23], but the ACSI model includes direct links from both value and performance to satisfaction [28]. In the present model, a direct link is hypothesized from

requirements performance to satisfaction, but not from schedule and budget performance as these typically show little variation (Chapter 3) and the qualitative interviews suggested that they are less important in practitioners' mental models of success (Chapter 2). A direct link is hypothesized from rework to satisfaction. While rework is expected to be closely related to requirements performance, it may have an independent effect on satisfaction for two reasons. First, the visibility of requirements and rework differ between client personnel. Project sponsors and other high-level personnel are more familiar with the original contractual requirements but less so with the details of their attainment and the rework required. Project engineers are painfully aware of rework but may be less familiar with the project contract. Both paths are included to allow prediction of satisfaction across multiple client roles. A second reason to hypothesize independent effects has to do with the timing of the satisfaction measurement. Measurements taken shortly after the project may be influenced more by requirements performance, as the extent of rework required may not yet be fully appreciated. Later satisfaction measurements might be more heavily influenced by rework due to recency effects.

Finally, satisfaction is hypothesized to be positively influenced by working relationship quality. Prior models of complex knowledge-based services have not included relationship factors [23, 29], but they figure prominently in models of retail service quality [30]. The interviews suggested that relationship quality is a distinct dimension from process efficiency and design quality. Consultants in particular believed that a client might well be satisfied on a project with poor objective results if the relationship was good (Chapter 2). Given that relationship quality is evaluated subjectively, even emotionally, it would likely have an independent effect on satisfaction from performance (an observed quantity) or value (a calculated quantity). In addition, a good working relationship likely indicates frequent feedback between the two parties (Figure 4-1), increasing the likelihood that the client's expectations for the project deliverables were well-managed.

Client satisfaction is hypothesized to positively influence behavioral intentions such as the client's willingness to rehire or recommend the consultant. Patterson, Johnson and Spreng demonstrated a strong association between client satisfaction and repurchase intentions in management consulting [29]. Reichheld, a management consultant himself, has argued that the

link between satisfaction and willingness to recommend is so strong that the latter can be used to measure the former [31, 32]. Lastly, the client's willingness to rehire is hypothesized to positively influence actual repeat business, as suggested by the theory of reasoned action [27].

Altogether, 27 testable hypotheses are illustrated by the arrows in Figure 5-2.

5.3.2 Detailed Model for Client Satisfaction

A detailed causal diagram for client satisfaction is depicted in Figure 5-3. In addition to the four endogenous relationships included in Figure 5-2, three exogenous and one methodological influence are hypothesized. The three exogenous factors all relate to client expectations. Expectations are not modeled explicitly, for both conceptual and methodological reasons. First, it remains unclear whether expectations, ideals, and/or equity comparisons should be assessed [17]. Second, design consulting clients are a mix of highly experienced and novice individuals. The former will have well-formed expectations, while the latter will not [23]. Including both in a single construct will distort the true effect.

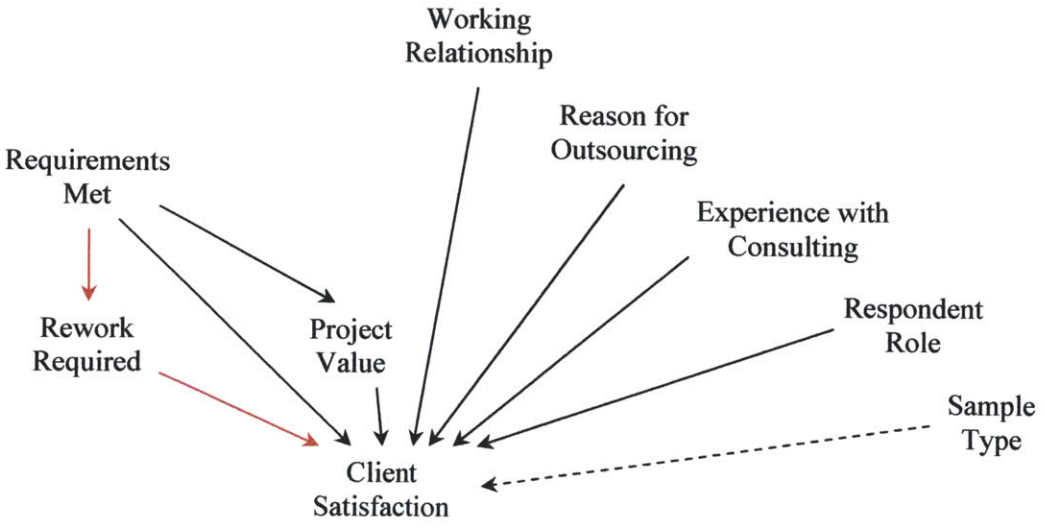

Figure 5-3: Detailed causal diagram for client satisfaction. The arrow from sample type is dashed to indicate that this is a methodological control rather than a substantive effect.

Finally, accurate assessment of expectations requires pre-purchase measurement of them [29]. Given the nature of the present research design, it was not possible to do so (particularly for the patent sample, whose respondents were identified via records generated by the project). Post-purchase measurements of expectations in complex services have been shown to be artifacts of perceived performance [23]. Analysis of ACSI data suggests that the links between post-purchase estimates of expectations and satisfaction are weak and can be removed [25].

For these reasons, the expectations construct is replaced by three factors that influence expectations but are conceptually more precise and easier to measure. The first is the client firm's reason for outsourcing the project. The outsourcing paradigms described in Chapter 4 generate very different expectations for project deliverables. The client outsourcing for capacity will have strong ideals of how the project should be performed. Specifically, it should be done the *same* way the client would have done it. The client outsourcing for originality expects a design, and perhaps even a development process, that is markedly *different* from what it would have come up with. These are both strong ideals that are easily disconfirmed upon receipt of the consultant's design. In contrast, the client outsourcing for knowledge is inexperienced in the activity being performed and will have less well-formed ideals. These differences suggest that the outsourcing paradigms will have unique patterns of satisfaction. In the capacity case, the best the consultant can do is to meet the client's ideal; it is unlikely that he will exceed the client's own performance (unless the client is actually outsourcing for *speed* rather than capacity). As a result, client satisfaction with capacity is expected to range from fair to poor. In the originality case, the consultant might delight the client with a novel design or disappoint with an unoriginal or original-but-impractical design. Simply meeting the ideal seems less likely. In the knowledge case, satisfaction will derive less from disconfirmation and more from perceived performance (if the client has sufficient knowledge to assess performance) and/or the quality of the working relationship. A wide and continuous range of satisfaction is expected. The following two hypotheses are proposed:

Hypothesis 1 (H1): Clients outsourcing for knowledge will be more satisfied than those outsourcing for capacity or originality.

H2: Clients outsourcing for speed will be more satisfied than those outsourcing for knowledge, capacity, or originality.

The second expectations-related factor influencing satisfaction is the client firm's experience with design consulting. Clients with greater direct experience should form more realistic expectations than those who base their expectations on indirect knowledge. Because design consulting is a relatively small industry, a novice client will have difficulty obtaining word-of-mouth recommendations and must base his expectations on the consultant's own marketing communications, which may overstate the likelihood of success (Chapter 4). As such, the inexperienced client's expectations may be unrealistically high, leading to greater disconfirmation and lower satisfaction. The exploratory interviews identified client inexperience with purchasing design services as a risk factor (Chapter 4), and prior research on management consulting has found that client satisfaction is positively associated with the experience of individuals in the organization with similar purchase situations [29]. As such, it is hypothesized that:

H3: Clients who usually outsource projects similar to the one being assessed will be more satisfied than those that do not.

The third exogenous factor is the respondent's role on the project. More senior employees will likely have more realistic expectations due to their greater experience and greater familiarity with the particular project contract. More importantly, they were more involved in the hiring decision and purposefully structured the project to meet their desires. They are true customers, whereas a less-involved junior employee is merely a consumer of their purchase. In addition, cognitive dissonance theory suggests that the project sponsor may overestimate project performance so as not to create conflict with her pre-purchase expectations [16]. The low-level team member, having not been involved in the hiring decision, has no such dissonance to resolve and can rate performance more critically. For all these reasons, it is hypothesized that:

H4: Client satisfaction will increase with increasing respondent seniority.

Lastly, the results of Chapter 3 suggest that respondents in the patent sample will be significantly less satisfied than those in the benchmarking sample due to selection, non-response, and/or "charity" biases. Thus, sample type is included in the model to control for these effects.

5.4 Methods

The study was conducted using the same research setting and design described in previous chapters. The hypotheses derived in Section 5.3 were tested on the Phase 3 benchmarking/patent survey data using ordinary least squares regression. Two levels of analysis were used. The conceptual framework was tested at the *project* level. Project-level measures of each project outcome were generated by averaging the responses of all respondents from that project. Problems, working relationship quality, and requirements, schedule, and budget performance were assessed by both client and consultant respondents. Rework, value, product commercialization, commercial success, and ROI were assessed only by clients as consultants do not have good visibility of these outcomes. Averaging multiple responses provided greater resolution for regression while allowing use of relatively coarse, easily answerable measurement scales. It also made the measures more robust to outlying individual responses. Repeat business is less ambiguous and was therefore obtained from a single source: the consultancy study coordinators for the benchmarking projects and the client respondents for the patent projects.

The detailed client satisfaction models were tested at the *individual* level. While project-averaged satisfaction has utility as a success measure, satisfaction is an individual-level construct and should be explained as such. Each client respondent was treated as a unique observation, allowing inclusion of individual-level explanatory variables such as the respondent's role or familiarity with the contract. After testing the formally derived hypotheses, inductive models were created using stepwise regression with all the success factors identified in Chapter 4. A plausible hypothesis could have been formulated for each of these variables *a priori*, but the stepwise approach is far more efficient. The resulting models were validated using n-1 cross-validation, and the cross-validated R^2 values used for claims of explanatory power.

Missing explanatory variables in multiple regression models were imputed using the mean value for that variable. Cases missing the dependent variable were omitted, as were those missing the explanatory variable in a single regression analysis. As a result, not all models in the conceptual framework have the same number of observations.

5.5 Results

5.5.1 Relationships between Success Measures

Results of the regression models are shown in Figure 5-4 and Table 5-2. Seventeen of the 27 hypothesized relationships were supported, and all but two of the non-significant relationships were in the hypothesized direction. Starting at the upper left, the occurrence of problems was found to adversely affect schedule and requirements performance as hypothesized but not budget performance. The null result is likely due to the limited variation observed in budget performance (Chapter 3). 62% of projects used fixed-fee contracts, so these clients paid what they expected to regardless of problems. Greater occurrence of problems did increase the likelihood of unresolved problems, as hypothesized.

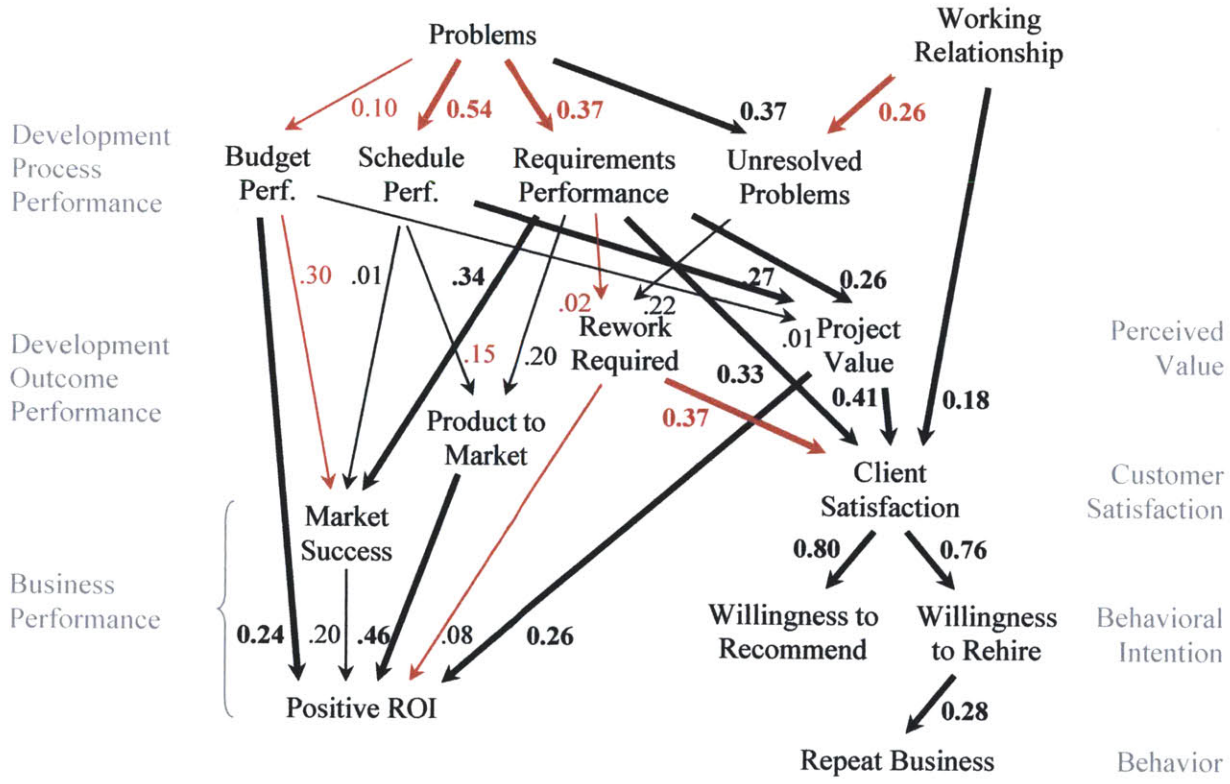

Figure 5-4: Results of hypothesis tests for relationships between success measures. The numbers are the standardized regression coefficients. The color of the arrows indicates the hypothesized direction of the relationship: black for positive, red for negative. The color of the coefficients indicates the direction estimated by the regression model. Bold numbers and thick arrows indicate relationships significant at $p < 0.05$, representing confirmed hypotheses.

Table 5-2: Details of regression models for relationships between success measures.

Dep. Var.	Term	Estimate	Std Beta	*t* Ratio	*p*-value	*n*	R^2
Budget Performance	Intercept	3.10	0	16.7	<0.0001	89	0.01
	PROBLEMS	-0.117	-0.105	-0.97	0.333		
Schedule Performance	Intercept	4.69	0	18.3	<0.0001	96	0.29
	PROBLEMS	-1.00	-0.541	-6.23	<0.0001***		
Requirements Performance	Intercept	4.65	0	31.5	<0.0001	96	0.13
	PROBLEMS	-0.354	-0.367	-3.82	0.0002***		
Unresolved Problems	Intercept	0.383	0	1.30	0.196	97	0.28
	PROBLEMS	0.281	0.367	3.83	0.0002***		
	WORK REL	-0.137	-0.256	-2.67	0.009**		
Rework	Intercept	2.14	0	3.90	0.0002	74	0.05
	REQS MET	-0.019	-0.017	-0.15	0.882		
	PROBS NR	0.300	0.222	1.89	0.063		
Product to Market	Intercept	1.39	0	1.89	0.062	88	0.04
	REQS MET	0.345	0.203	1.71	0.092		
	SCHE MET	-0.141	-0.154	-1.30	0.198		
Market Success	Intercept	3.47	0	1.06	0.298	43	0.20
	REQS MET	1.54	0.336	2.15	0.038*		
	SCHE MET	0.012	0.005	0.03	0.975		
	BUDG MET	-1.24	-0.295	-1.96	0.057		
ROI	Intercept	-1.79	0	-2.25	0.029	62	0.46
	BUDG MET	0.293	0.236	2.17	0.035*		
	VALUE	0.241	0.265	2.61	0.012*		
	REWORK	0.152	0.077	0.75	0.458		
	TO MRKT	0.499	0.461	4.46	<0.0001***		
	MRKT SUC	0.106	0.196	1.84	0.071		
Value	Intercept	1.07	0	1.19	0.236	97	0.22
	REQS MET	0.510	0.263	2.42	0.018*		
	SCHE MET	0.280	0.272	2.37	0.020*		
	BUDG MET	0.020	0.012	0.12	0.906		
Satisfaction	Intercept	-16.7	0	-1.08	0.283	97	0.68
	WORK REL	5.57	0.182	2.81	0.0060**		
	REQS MET	15.8	0.333	5.21	<0.0001***		
	VALUE	10.1	0.413	6.14	<0.0001***		
	REWORK	-16.7	-0.375	-6.12	<0.0001***		
Willingness to Recommend	Intercept	2.42	0	5.33	<0.0001	97	0.64
	SAT INDEX	0.076	0.800	13.1	<0.0001***		
Willingness to Rehire	Intercept	2.67	0	5.47	<0.0001	97	0.58
	SAT INDEX	0.072	0.764	11.59	<0.0001***		
Repeat Business	Intercept	1.02	0	1.56	0.123	90	0.08
	REHIRE	0.210	0.276	2.69	0.0085**		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Neither requirements performance nor unresolved problems had a significant effect on rework, though the latter is nearly significant ($p = 0.06$). The lack of relationship between requirements performance and rework is surprising and may indicate the difficulty of specifying requirements accurately in advance. Most projects met or exceeded contractual requirements yet still required rework relative to what the clients expected (descriptive results in Chapter 3). The original contractual requirements may not have been detailed enough, or the product's true needs may have shifted during development, or the clients may simply have underestimated the nearly inevitable revisions required when re-integrating an outsourced design. Alternatively, the null result may indicate a difference between "doing the job" and "doing the job right." Consultants may have fulfilled the letter of the contract while neglecting its spirit. Client responses to open-ended survey questions suggest that this occurred in only one or two cases.

Neither requirements performance nor schedule performance were found to significantly influence product commercialization. As with rework, the null result for requirements performance may reflect inaccuracy of initial product requirements. It may also reflect the fact that requirements performance is just one small part of getting a product to market. Schedule performance was found to have a (non-significant) negative association with product commercialization. Detailed review of the data showed that several of the projects completed ahead of schedule were on development projects that the client halted or canceled due to market changes. Those that continued to commercialization often took longer than expected.

Requirements performance was significantly associated with commercial success, and budget performance nearly so ($p = 0.057$), but schedule performance was not. The near-zero coefficient is striking and echoes the inconsistent findings from past research [2, 6, 7]. Any marketing gains through time-to-market may be offset by reduced technical performance [8, 9].

Project ROI was significantly associated with budget performance, product commercialization, and project value but not commercial success or rework. The weak link between commercial success and ROI is likely a methodological artifact: only 43 projects had sent products to market and earned a valid commercial success score. The other 54 projects were assigned the mean value for the multiple regression analysis, muting the strength of the actual effect. When the

regression was performed using only those projects that had commercialized products, the regression coefficient for market success was closer to 0.37. The hypothesized negative link from rework to ROI was not supported. The additional costs of rework were likely offset by improved product performance, but these paths were not modeled.

On the customer satisfaction side of the framework, all but one of the hypotheses were confirmed. Budget performance was found to have a negligible effect on project value, probably due to the relative lack of variation in budget performance discussed previously.

The R^2 values in the rightmost column of Table 5-2 indicate the amount of variation in each outcome measure that is explained by the hypothesized relationships with the other outcomes. For example, the model for budget performance, which consisted solely of an effect due to problems, explained only 1% of the variation observed in budget performance, a very poor explanation. In contrast, problems alone explain 29% of variation in schedule performance, a fairly good result for a single explanatory variable. In general, the customer-satisfaction outcomes were better explained than the product development outcomes. An exception is repeat business, for which only 8% of variation was explained by the client project teams' average willingness to rehire the consultant. When only project sponsors' opinions were considered, willingness to rehire explained 13% of the variation in repeat business (n = 47, t = 2.64, p = 0.012), a slight improvement. Note that the evaluated projects were generally completed within the last two years, so some of the clients may not yet have needed additional services. For the subset of projects more than a year old, project-averaged willingness to rehire explained 13% of repeat business variation (n = 54, t = 2.60, p = 0.012), and sponsor willingness to rehire explained 24% ($n = 17, t = 2.16, p = 0.047$).

5.5.2 Detailed Models for Client Satisfaction

Deductive Model

Results of the detailed client satisfaction model derived from customer satisfaction theory in Section 5.3.2 are shown in Table 5-3. In contrast to the limited model for satisfaction included in Figure 5-2, this model was tested at the individual level to allow inclusion of the respondent role

Table 5-3: Regression results for the detailed model of client satisfaction derived from customer satisfaction theory.

Term	Estimate	Std Beta	*t* Ratio	*p*-value
Intercept	9.31	0	0.83	0.408
REWORK	-14.9	-0.353	-5.88	<0.0001***
REQS MET	10.6	0.329	5.31	<0.0001***
WORK REL	7.46	0.321	5.19	<0.0001***
VALUE	4.87	0.219	3.25	0.0016**
USUAL	3.04	0.125	2.09	0.039*
SAMPLE: BENCHMARK vs PATENT	1.97	0.105	1.70	0.091
REASON: SPEED	5.08	0.101	1.36	0.178
REASON: ORIGINALITY	-3.24	-0.089	-1.54	0.126
REASON: CAPACITY	-1.20	-0.038	-0.64	0.523
REASON: KNOWLEDGE	-0.057	-0.002	-0.03	0.975
ROLE	-1.23	-0.063	-0.90	0.369

$R^2 = 0.73$, $R^2_{adj} = 0.70$ $*p < 0.05$, $**p < 0.01$, $***p < 0.001$

$n = 119$ client respondents (one outlier omitted)

variable. The model explains 73% of the variation in client satisfaction, only slightly better than the limited model. The four explanatory variables from that model were all highly significant.

Only one of the three exogenous factors had a significant additional effect. Client experience with consulting, measured by whether they usually outsourced projects similar to the one being assessed, was positively associated with satisfaction as hypothesized (hypothesis H3). Neither the respondent's role nor the sample type had a significant independent effect on satisfaction, which is surprising given the strong direct correlations observed in Chapter 3. The likely explanation is that respondent role and sample type influence both the explanatory and dependent variables similarly. As was seen in Chapter 3, senior respondents were more satisfied, but they were also more likely to rate the project value highly, the working relationship highly, and so forth. To verify that the explanatory variables are in fact independent of each other, variance inflation factors were calculated for each. The highest value was 2.18, well below the typical cutoff of 10, indicating little multicollinearity [33].

The effects of outsourcing motivation were all in the hypothesized directions, but none were significant. Their effects were likely subsumed by more powerful factors such as rework and

requirements performance. For example, clients outsourcing for originality or capacity rated rework higher than those outsourcing for knowledge (Kruskal-Wallis test, $p = 0.039$) and were also less satisfied ($p = 0.097$). Rework shows up as the stronger effect in the regression model, but this is less practically useful because rework is not known in advance, whereas outsourcing motivation is.

To verify that outsourcing motivation has an effect on its own, a second regression model was created that omitted rework, requirements performance, working relationship, and value (Table 5-4). This model finds support for hypotheses 2, 3, and 4. On average, clients outsourcing for speed had satisfaction scores 16.6 points higher than those outsourcing for knowledge, 18.4 points higher than those outsourcing for capacity, and 22.1 points higher than those outsourcing for originality. Satisfaction was higher for knowledge than capacity and originality, but not significantly so (as evidenced by the overlap of the 95% confidence intervals for those terms), thus disconfirming hypothesis 1.

Table 5-4: Regression results for deductive model of client satisfaction, exogenous factors only. The estimates for the outsourcing reasons are all relative to the ID knowledge/ME capacity paradigm, which is a relatively neutral base case. 95% confidence intervals are shown to make explicit the differences between outsourcing motivations.

Term	Estimate	95% CI	Std Beta	*t* Ratio	*p*-value
Intercept	51.8	40.1 to 63.5	0	8.78	<0.0001
USUAL	7.53	3.27 to 11.8	0.309	3.50	0.0007***
SAMPLE: BENCHMARK	1.92	-1.52 to 5.36	0.102	1.10	0.272
REASON: SPEED	13.8	3.42 to 24.1	0.275	2.64	0.0096**
REASON: ORIGINALITY	-8.27	-14.6 to -1.97	-0.228	-2.60	0.0106*
REASON: CAPACITY	-4.59	-10.3 to 1.08	-0.147	-1.60	0.112
REASON: KNOWLEDGE	-2.77	-8.28 to 2.74	-0.097	-1.00	0.322
ROLE	5.68	1.97 to 9.39	0.291	3.04	0.003**

$R^2 = 0.32$, $R^2_{adj} = 0.28$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

$n = 119$ client respondents (one outlier omitted)

Three Inductive Models

To supplement the models derived from satisfaction theory, three additional models were identified from the data itself. The first model, shown in the left column of Table 5-5, sought to explain client satisfaction *ex post*, using all available information. As in the customer satisfaction deductive models, value, rework, and requirements performance all had strong effects. Working relationship quality was displaced from the model by two related client assessments of the consultant project team: its consistency of team membership and its technical competence. Consistency in particular had a strong effect, as perceived *inconsistencies* were strongly associated with client *dissatisfaction*. A fifth success measure, the extent of problems perceived by the client, adversely affected satisfaction but less strongly than the other success measures.

The remaining four factors are characteristics of the project rather than outcomes of it. Client satisfaction decreased with increasing part count of the product being developed. Part count is commonly used as a measure of product complexity [34, 35], but in this case an additional force may be responsible. High part count products tend to be highly technological, whereas low part count products tend to compete on appearance, usability, and/or production process efficiency. The consultancies in the study are experts at user-centered design and would be expected to add more value in market-oriented products than high-tech products.[2] Perhaps for similar reasons, satisfaction was negatively associated with the extent of product requirements known to the client firm at the start of the project. That is, after accounting for all other factors in the model (value, problems, etc.), projects starting with just marketing requirements produced greater satisfaction than those starting with technical requirements or detailed technical specifications. Three forces may have been at work. The consultants may add more value during the "fuzzy front end" of product development, as suggested above. In addition, more extensive requirements represent more well-formed expectations, which are more easily disconfirmed upon inspection and/or testing of the consultant's deliverable. Finally, clients having extensive project requirements tended to be outsourcing for capacity, and therefore been harder to delight, or were seeking specific technical expertise which the consultant may or may not have had.

[2] Other consultancies do specialize in specific high-technology areas, however none were included in the study sample.

Table 5-5: Inductive models of client satisfaction.

	Explanation Model			Estimation Model			Prediction Model		
Term	Estimate	Std Beta	*p*-value	Estimate	Std Beta	*p*-value	Estimate	Std Beta	*p*-value
Intercept	-0.520	0	0.973	0.451	0	0.978	32.0	0	0.022
VALUE	9.18	0.411	< 0.0001						
CONS. TEAM CONSISTENCY	6.48	0.302	< 0.0001						
REWORK	-12.0	-0.251	< 0.0001						
REQS MET	6.10	0.173	0.0108						
PROBLEMS (according to client)	-6.17	-0.170	0.0044						
PARTS	-0.109	-0.164	0.0062						
REQUIREMENTS (a/t client)	-3.08	-0.161	0.0046						
REASON: ORIGINALITY	-8.48	-0.157	0.0058				-12.1	-0.224	0.037
CONS. TEAM TECH. COMP.	2.69	0.147	0.0295						
CONS. EXP. w/ ACTIVITY	6.97	0.131	0.0236						
STABILITY OF REQUIREMENTS				-12.4	-0.675	< 0.0001			
ADEQUACY of BUDGET (a/t cons.)				11.8	0.584	< 0.0001			
CLI. EXP. w/ CONSULTING (a/t cons.)				6.97	0.512	< 0.0001			
ROLE				9.56	0.481	< 0.0001			
PROBLEMS (according to consultant)				-18.3	-0.507	< 0.0001			
MANUFACTURER				5.70	0.488	< 0.0001			
INVOLVEMENT IN NEGOTIATION				7.90	0.387	0.0023			
PROJECT SCOPE: FINAL PHASE				5.83	0.336	0.0070			
CONS. EXP. w/ PRODUCT TYPE				3.37	0.217	0.0281			
SAMPLE: BENCHMARKING							11.0	0.528	< 0.0001
CLIENT EXP. w/ NPD (a/t consultant)							9.24	0.438	0.0003
EXTENT OF MFG INVOLVEMENT							-11.5	-0.396	0.0012
PHYSICAL DISTANCE (miles)							0.0082	0.365	< 0.0001
CLI OFFERING: DISCRETE PRODS							-7.16	-0.313	0.0030
EMPOWERMENT OF CLIENT PM							9.25	0.232	0.021
n		119			66			119	
Root Mean Square Error		7.71			7.27			14.4	
R^2		0.87			0.85			0.52	
R^2_{adj}		0.84			0.80			0.46	
$R^2_{cross\text{-}validation}$		0.79			0.72			0.36	

Clients outsourcing for originality were significantly less satisfied than those outsourcing for other reasons. As discussed previously, outsourcing for originality generates simultaneously vague yet easily disconfirmed expectations. What's more, few client firms outsource for originality routinely, so their expectations may be inflated by consultant marketing [36-39] or even academic research [40, 41]. While the occasional success may bring client delight, on the whole this outsourcing paradigm appears to be less successful than the others. Lastly, satisfaction was higher on projects in which the consultant was more experienced with the activity it was hired to perform, as assessed by the consultants themselves. This effect is actually stronger than the numbers suggest, as it was mean-imputed for all the projects in the patent sample.

While this particular explanatory model provided the greatest power, variants on it did nearly as well. Additional variables appearing frequently in the stepwise regression included: the consultant team's communication skill, as assessed by the client (positively associated with satisfaction), the length and budget of the project (positive association), projects focusing on industrial, rather than consumer or medical products (negative association), the client's trust of the consultant (positive), the client firm's age (negative), and the identity of the consultancy.

The second model, shown in the middle column of Table 5-5, estimates client satisfaction using only information that would be known to the consultant by the end of the project. Because the data were taken primarily from the consultant surveys, this model omits the patent sample projects as well as sixteen from the benchmarking study for which consultant responses were not available. The most powerful variable is counter-intuitive: client satisfaction decreased with increasing stability of requirements throughout the course of the project, as assessed by the consultants. This surprising result is likely due to the same forces driving the negative effect of the extent of requirements known at the start of the project that was seen in the previous model. Clients with stable requirements have very strong expectations that are easily disconfirmed.

Satisfaction increased with budget adequacy, with the client's experience with consulting, and with the consultant's experience with the type of product being developed. Satisfaction also increased with client role and involvement in project planning and negotiation.[3] Client satisfaction decreased sharply with the extent of problems perceived by the consultants, much more so than with problems perceived by the client in the previous model. It may be that consultants are more attuned to what types of problems are serious and which are not.

The final two factors are surprising. Satisfaction increased with increasing organizational distance between the client firm and the manufacturer of the product being designed. On average, and accounting for all other factors in the model, clients were more satisfied with projects with an international contract manufacturer than a domestic manufacturer, and more satisfied with projects with a domestic contract manufacturer than those manufactured by the client firm itself. This result should be interpreted with care, and likely not at face value. It seems unlikely that clients would be more satisfied with greater manufacturer organizational distance *per se*. Rather, they may be more satisfied with the type of products whose production is internationally outsourced. These include simple products such as housewares but also complex products such as consumer electronics that are now produced almost exclusively overseas. In contrast, medical and industrial products are more often produced domestically and by the client firm. Industrial products in particular produced less satisfaction than other types, which may account for the observed effect. Another explanation is that client firms having production capabilities generally also have design capabilities, and are therefore outsourcing for capacity or originality, which tend to produce lower satisfaction. The fact that the regression algorithm prioritized manufacturer type over these other factors is likely a measurement artifact: manufacturer type had three ordinal levels (client firm, domestic third party, overseas third party) whereas product type had thirteen nominal categories. Nonetheless, the effect demonstrates that increasing manufacturer integration is not *necessarily* correlated with better outcomes.

Lastly, client satisfaction increased the further through the development process the project extended. That is, all else equal, clients were more satisfied with a project that included detail

[3] Role and involvement were actually provided by the clients, but since they would typically be known to the consultants as well they were included in the estimation model.

design and manufacturing support than one that stopped after user research or concept development.

Cross-validation suggests that the estimation model can explain over 70% of the variation in actual client satisfaction, a marked improvement over consultants' current estimates. As part of the consultant survey, each respondent was asked to estimate the average satisfaction of the client stakeholders. The responses of multiple consultants on a given project were averaged, and the average estimates regressed against the actual average satisfaction from the client survey (Table 5-6). Overall the estimates are quite poor (top row of the table), accounting for just 3% of the variation, with a mean error of 14.5 satisfaction index points. Interestingly, when separate regressions were performed for each participating consultancy (lower rows), dramatically different estimation accuracy resulted. The best performing consultancy in terms of satisfaction was also the most accurate at estimating satisfaction. The worst performing in terms of satisfaction was also the worst at estimation. While the individual consultancy sample sizes are small and therefore susceptible to sampling error, it may be that an ability to accurately estimate satisfaction improves one's ability to deliver it. If so, the estimation model in Table 5-5 may help consultant practitioners to better manage client satisfaction. If they feel the project is experiencing problems, or is short on budget, the client may well be dissatisfied.

Table 5-6: Regressions of consultant-estimated project-averaged client satisfaction against actual project-averaged client satisfaction. Only one of the four consultancies estimated client satisfaction with any accuracy, though it had a very small sample size and so this result may simply be due to chance.

Model	Intercept	Estimate	*p*-value	*n*	R^2	*RMSE*	Mean Satisf.
All Consultancies	106.2	-3.04	0.206	56	0.030	14.5	80.4
Consultancy A	58.1	2.94	0.104	[a]	0.092	7.40	82.9
Consultancy B	77.8	0.61	0.931	[a]	0.001	10.7	83.0
Consultancy C	-51.7	16.7	0.0005	[a]	0.964	1.85	92.6
Consultancy D	153.1	-10.3	0.073	[a]	0.347	19.3	63.0

[a] Individual consultancy sample sizes withheld to preserve consultancy anonymity

The third model, shown in the rightmost column of Table 5-5, attempts to predict satisfaction before the project even begins, using only variables that would be known during project negotiation. Only two of the factors are intuitive: satisfaction increased significantly with the client's experience with new product development, as assessed by the consultant, and with the degree to which the client project manager was empowered (reported by the client). So-called "heavyweight project managers" [42] may be better able to manage the client organization to provide resources needed by the consultant, better able to provide timely feedback to the consultant, and may even be able to help shepherd the consultant design back into the client organization.

Counter-intuitively, satisfaction decreased with increasing involvement of the manufacturer in the project. This may reflect similar phenomena as the manufacturer distance result from the estimation model: simpler products require less manufacturer involvement while producing greater client satisfaction. It may also be a statistical anomaly. Even so, it suggests that increased manufacturer involvement is not *necessarily* essential for success.

Satisfaction was also negatively associated with physical distance between the client and the consultant. Several explanations are possible. Clients may choose to use a more distant consultancy only when there is good reason to do so: a particular expertise or a pre-existing relationship that outweighs the coordination disadvantage of increased distance. In contrast, an inexperienced client or someone simply needing a "hired gun" may default to using a local consultant, who may not be best-suited for the job. Alternatively, increased distance may motivate both client and consultant to work harder to overcome it. More research is needed to fully explain this counter-intuitive result.

As with the explanation model, clients outsourcing for original perspectives were less likely to be satisfied. Lastly, satisfaction was significantly lower for clients whose firm's primary offering is discrete (i.e., assembled) products rather than bulk (continuous, process-driven) products or services. This can be explained in terms of the reason-for-outsourcing framework. Clients whose primary business is not discrete products are generally seeking consumer understanding or "productization" knowledge – general knowledge that the consultancies can

readily provide. For example, projects in the patent study included drug delivery devices for pharmaceutical companies and packaging for a large food company. In contrast, clients whose primary business is discrete products are likely outsourcing for capacity or originality, reasons associated with lower satisfaction (Table 5-3).

5.6 Discussion

The various models suggest that consulting project outcomes can be very well explained and even partially predicted. Testing of the overarching conceptual framework (Figure 5-2) demonstrated that ultimate outcomes such as return-on-investment and client loyalty are driven by intermediate outcomes such as problems, requirements performance, and perceived value. The framework illustrates why practitioners report so many distinct dimensions of success: in addition to traditional product development measures, clients of outsourced development must also consider rework and project value, while consultants must balance client satisfaction against measures of their own success (profit, capability development, etc.). In addition, the key measures vary throughout the course of the project. In the midst of development, relationship quality and schedule/budget performance will be front of mind. Towards the end of the project, focus shifts to requirements performance and value. After the project, clients focus on the quality of the deliverable – measured in terms of rework required – while consultants eagerly wait to see if a product will come to market. Thus each measure has its purpose, and each might be thoroughly examined as was done for client satisfaction. Such examination is left for future work.

The results of the hypothesis tests suggest that product commercialization and commercial success might be the best place to continue explanation. Whereas all but one of the hypotheses on the client satisfaction side of the framework were supported, very few of those pertaining to commercialization were. Several factors may account for the difference. First, the science of customer satisfaction is more developed than that of product development, with more certain conceptual relationships and more refined measurement instruments. Second, the product development side of the framework may have been hindered by statistical issues. In particular,

the scales used for commercialization and positive ROI were quite crude, consisting of just three levels: yes, not yet, and no. In addition, commercial success could only be modeled for the products that had already gone to market, and the survey was conducted fairly early relative to commercialization timelines. Third, it may be that customer satisfaction is inherently more explainable. Product development outcomes are factual, and subject to many random and chaotic influences. Satisfaction is a cognitive judgment that may account for these idiosyncrasies, attenuating their influence. Finally, it may be that client satisfaction is already the prevailing outcome concept among practitioners, and so the other success measures they suggested are geared towards it. It is possible that a more focused examination of commercialization might yield additional intermediate success measures that would improve *ex post* explanation of commercial success. Prediction of commercial success would remain quite difficult, as it is subject to many factors that are beyond the control of the consultants and clients, such as the actions of the client's competitors.

Turning now to the detailed models of client satisfaction, the results clearly indicate that project value, requirements performance, and rework are the key drivers of client satisfaction. Each has a strong effect independent of the others, suggesting that practicing consultants must balance all three to deliver satisfaction. Satisfaction is likely to be mediocre for both "boutique" consultancies that deliver high quality but poor value, as well as "low-cost" consultancies that deliver value but not quality. Beyond these three factors, the quality of the working relationship appears to have its own independent effect. While this will come as no surprise to practicing consultants, prior academic models of professional services have not included it, but may well benefit from doing so. At present it is unclear whether working relationship quality affects satisfaction by influencing client assessments of performance or their expectations (Figure 5-1). Additional research, with explicit pre- and post-purchase measurements of expectations, might shed light on the mechanism.

The inductive models demonstrate that it is possible to explain, estimate, and even predict client satisfaction with reasonable accuracy. The three models presented in Table 5-5 are not meant to be definitive, but rather illustrative of what is possible. A savvy consultancy might improve on them by studying its own projects in detail. Client firms too might benefit from statistical

analysis of their own projects. Longitudinal examination of projects would allow more accurate collection of both near- and far-term outcomes and their influences. Inclusion of just one company's projects would control for many exogenous factors.

For academics, the inductive models suggest several interesting findings. Several effects that were thought to be well understood, such as the positive influence of early and extensive manufacturer involvement in product design, the importance of mature initial specifications in systems engineering, and the detrimental effects of physical distance in distributed development all had the opposite effects on client satisfaction in design consulting. Other variables that would be expected to have strong effects, such as product novelty or client firm size, had little effect. Still other variables that have not been previously studied, such as working relationship quality and the client's reason for outsourcing, had significant effects. These findings suggest that conventional wisdom about the design consulting industry is mistaken. It is not a form of systems engineering, in which products are pre-specified, modularized, and divided up among multiple parties for development [43]. The data suggests the best results occur when requirements are developed jointly by client and consultant and revised frequently throughout development. Though it was not included in the models in Table 5-5, the degree to which the consultants felt their clients treated them as partners rather than vendors was positively associated with client satisfaction. While consultancies can and do provide additional development capacity, this is not their best value add.

Nor, despite recent suggestions to the contrary, is the industry most effective at radical innovation [38, 44], "creative generalism," knowledge brokering [40], "design-inspired innovation" [41], or other forms of originality-for-hire. In both the *ex post* explanatory and *ex ante* predictive models, clients outsourcing for originality were less satisfied than those outsourcing for other reasons. As one experienced client interviewee noted,

> *"You can't, in my opinion, outsource [creative] innovation. If you're the experts and you don't know how to do it, just because some other guy has a pedigree, he ain't going to be able to do it any better."* – Client Director of Engineering

The effectiveness of outsourced creativity has likely been overstated in both consultant marketing and academic analysis of the industry [40, 41, 44].

Where the industry does shine is in providing expertise, much like other professional services such as law, accounting, or medicine. The models suggest that satisfaction was higher on projects in which the consultant was experienced in the activity being performed and the type of product being developed. As one client engineering director put it, "the best use of outsourced design is when you are outsourcing to somebody who has real expertise or capability in something in which you are merely knowledgeable." Several effective paradigms were observed in the data. Most effective of all was speed – the ability to perform a task the client may be capable of, but far more quickly. The client can appreciate the quality of the work and the fact that his own firm could not have met the schedule. A second particularly effective model is that of the "time-shared" development group. Several client firms in the sample do not maintain internal development teams because they do not require enough development work to support them. Instead, they build long-lasting relationships with a key consultancy who services them and other key clients as necessary. The consultancy develops sufficient expertise in each client's products, markets, and production capabilities, while maintaining enough variety to satisfy its own staff, and is effectively a time-shared resource between the various client firms. A third role in which the consultancies add high value is the understanding of product users – everyday people. This is a specific expertise, indeed the root of the industrial design profession, yet one that is broadly applicable. Products as diverse as computer peripherals, housewares, and disposable food packaging are all used by the same types of people, and understanding of these users applies equally well to all the products. The data suggest that client satisfaction was highest for consumer products, particularly non-durables, and lowest for industrial products. The latter are not used by everyday people but rather by specialists, and require understanding of special needs and regulatory constraints. The data also indicate higher satisfaction for low part count products – those whose value derives from market orientation rather than technological superiority.

Market orientation may also partially explain the unexpected result that client satisfaction is not hindered (and may even be helped) by limited manufacturing involvement. Because many of these products are "high-touch" and moderate- to low-tech, the engineering to manufacturing interface is less critical than the industrial design to engineering interface. Given that it is nearly impossible to fit all the contributors to product development under one roof, the consultancies

emphasize the design-to-engineering interface over the engineering-to-manufacturing interface. For low- to moderate tech products, the consultant design engineers are more than capable of designing the product for standard manufacturing processes. Indeed, this strategy was advocated by Dean and Susman decades ago [45], but was lost in the clamor for physical co-location of design and manufacturing personnel.

Lastly, the results of the inductive models challenge conventional wisdom about design outsourcing as a whole. While physical distance is often cited as one of the downsides of outsourcing and offshoring, in this study it actually improved satisfaction (within the limited range of distance in the sample, generally capped at a 2900 mile cross-country trip). Similarly, corporate cultural distance has been suggested as a cause of problems in distributed development [46], but the data suggests it has little effect (when assessed by the clients) or even a positive effect (when assessed by the consultants). Big lumbering clients are highly dissimilar to the consultancies yet do quite well when outsourcing for speed or user-centered expertise. Small start-ups are perceived to have similar cultures yet often fail to respect the consultants' expertise and leave unsatisfied. These findings suggest that scholars of other types of outsourced product development may need to look for alternate explanations of the causes of poor outcomes. Perhaps distance does matter above 2900 miles, or perhaps it is actually the time zones that hurt. Corporate cultural distance may not be a problem, but ethnic cultural distance may be. Or perhaps distance is not the problem at all, but rather the client's cost-saving motivations for offshoring. The results of the present study suggest that examining client satisfaction with such forms of outsourcing, which has not been done to date, may generate useful understanding.

5.7 Conclusions

The present chapter developed a framework illustrating how the various success measures in design consulting influence one another. The model consists of elements from both product development and customer satisfaction theory, united by three key measures: project value, requirements performance, and design quality (as assessed by rework). Detailed models of client satisfaction demonstrated that satisfaction can be explained, estimated, and even partially

predicted. Several of the explanatory and predictive factors defy conventional wisdom. In particular, outsourcing for originality does not appear to be effective, and organizational, cultural, and physical distance are less problematic than commonly assumed.

These counter-intuitive results were enabled by several unconventional details of the study design. First, a broad range of potential explanatory variables were simultaneously considered in statistical analysis. More focused hypothesis testing might have taken the distance effects for granted and not bothered to check them. Second, to guard against random effects or relationships that were perceptual rather than real, data were gathered from multiple respondents per project and the project-averaged results used in analysis. In the benchmarking sub-sample, both client and consultant perspectives were considered. Such efforts are quite rare in product development research. Tatikonda and Montoya-Weiss claimed that "obtaining multiple respondents for each project for data this detailed [less so than the present study] and a sample size this large [comparable to the present study] is essentially infeasible" [2], but with an effective study design it can be accomplished. Lastly, a variety of methodological controls, including sample type, respondent role, measurement timing, and response promptness were included in the analysis to help bring out the real relationships in the data.

The chief limitation of the study is that all the data were collected after the completion of the consulting projects, making it impossible to accurately measure client expectations. Other measures may suffer hindsight or recollection bias as well. A second limitation is that the cross-sectional, single time point design prevented accurate assessment of both near- and far-term project outcomes and influences. A shorter-term measure was made, enabling more accurate collection of project characteristics and development performance, at the expense of long-term outcomes such as commercial success. Third, the individual-level satisfaction models utilize as many as three observations (respondents) from the same project, which could lead to minor distortions as the individual responses are not truly independent of each other. Lastly, measures of contract performance, value, and return-on-investment were made qualitatively rather than quantitatively. Hart, among others, has shown that qualitative assessments are generally valid and far easier for the academic researcher to access [47].

The study makes valuable contributions to both the academic understanding of design consulting and its practice. For the scholar of customer satisfaction, the study provides relatively unique data on satisfaction in business-to-business professional services. The results confirm the predictions of value-percept based satisfaction models but suggest that working relationship quality may have an additional, independent effect. For scholars of product development, the study suggests that client satisfaction might be a useful tool with which to understand other types of outsourced product development. It also suggests need for a more careful evaluation of the strategies and tactics of design consultancies. These companies are often cited as expert product developers [44], yet little quantitative research has been conducted on them. The present results suggest that the industry is indeed effective, but not for the reasons commonly assumed.

For the practicing consultant or client, the conceptual framework provides a useful means of simplifying the daunting task of explaining project outcomes. In addition, the detailed client satisfaction models provide both specific insights and a demonstration of the power of simple statistical analyses to predict outcomes. Just as the Oakland Athletics used statistical thinking to gain competitive advantage over their rivals [48], a progressive consultancy or client firm might do the same to optimize its project outcomes.

The study suggests numerous avenues for further investigation. A larger study would allow better consideration of multi-valued nominal explanatory factors such as the identity of the sponsoring department within the client firm, the technical disciplines involved in development, or the identity of the consultancy. A larger study would also allow the use of more sophisticated modeling techniques such as structural equations modeling to refine the specification of the conceptual framework. Pre-project measurements would enable direct inclusion of client expectations and disconfirmation constructs. These variables might help to explain the dramatic differences in satisfaction observed between multiple client respondents on the same project. The present client survey assessed only three individual-level variables: role, involvement in project planning, and familiarity with the project contract. These explain part of the intra-project variation but some individuals still appear unusually dissatisfied. Inclusion of additional individual-level variables might help to define what makes them so. Finally, it should be recalled

that client satisfaction is just one of fifteen success measures in the conceptual framework. Detailed models could be developed for each of the others to provide additional insights.

5.8 Chapter References

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6 Summary, Contributions, and Future Work

6.1 Summary

This dissertation set out to improve understanding of success and failure in outsourced product development. Although this topic is discussed extensively in both academic and industrial circles, imprecise use of the terms *outsourcing* and *success* has hindered communication and created misunderstandings, including a perception that outsourced product development is frequently unsuccessful. To establish clarity, the dissertation began by distinguishing several distinct modes of outsourced product development, including integrated design-and-manufacturing outsourcing (also known as black-box outsourcing or original design manufacturing) and design consulting (also known as design and innovation consulting). Further distinctions were drawn between domestic outsourcing and international outsourcing (or *offshoring*). Domestic design consulting was then chosen for detailed investigation, because it allowed isolation of the effects of outsourcing design separate from production; because it allowed for study of many projects, each of moderate complexity; and because informants were reasonably accessible to the investigator. All the results in the dissertation pertain specifically to design consulting, though some generalize to other types of outsourced product development as well.

Having specified the type of outsourcing that would be investigated, the first empirical study clarified the meaning of success in this domain. Consultant, client, and scholarly perspectives were described and synthesized to identify seven distinct dimensions of success: the impact of the project on the client's business performance, the quality of the product design, the non-financial benefits to the client firm, the efficiency and effectiveness of the development process, the quality of the relationship between client and consultant, the client's overall satisfaction with the project, and the benefits of the project to the consultant. Each dimension encompasses several commonly used measures of success. Consultants and clients prioritize these measures differently, which may lead to misaligned objectives and wasted effort. Scholarship on outsourced development has focused primarily on measures that are not prioritized highly by either consultants or clients, such as schedule performance and the occurrence of problems. The

different meanings of success used by each of these three groups highlights the need for conceptual clarity in research and in practice.

In addition to conceptual imprecision, a second factor that complicates understanding of outsourcing effectiveness is the dearth of published data on project outcomes. To fill this gap, the second study used the identified success measures to assess the outcomes of 134 recently completed projects. The results suggest that outcomes in domestic design consulting are generally good but vary significantly between projects. In addition, many outcome measures are significantly influenced by the seniority of the respondent and the incentives and protections afforded him during assessment. These results suggest that previously reported results should be interpreted cautiously, as most studies used limited cross-sections of respondents and did not incentivize participation by both satisfied and dissatisfied individuals.

Even when these methodological effects are controlled for, significant variation in project outcomes persists. The third study sought to identify factors that might explain this variation. Although several factors had been suggested in the literature [1-7], relatively few of these resonated with the author's personal experience working on both the client and consultant sides of the industry. Most academic characterizations of the design consulting industry seemed inaccurate, biased perhaps by over-reliance on senior consultant testimony [8-11]. Rather than simply testing the literature's propositions, or relying on the author's own potentially biased perspective, an inductive approach was used to identify potentially superior factors. The results of interviews and cross-case analysis were extensive, suggesting over fifty major factors and scores of minor ones, many of which do not appear in the literature. While it is impossible to reduce the complexity of consulting project planning and management to a few simple guidelines, two frameworks were described that can help practitioners order the chaos. The first describes the consulting process as a sequence of activities, allowing focus on one subset of factors at a time. The second framework examines the client's reason for outsourcing the project, and filters the complete set of factors to yield more manageable subsets for each outsourcing motivation. Clustering analysis of the data suggested that a handful of distinct paradigms describe most consulting projects. Some of these, such as outsourcing for originality, second

opinion, or development speed, are relatively unique to design outsourcing compared to production outsourcing.

With conceptual and methodological foundations in place, the fourth study began to explain the outcomes of particular projects. First, elements from product development and customer satisfaction theory were combined to hypothesize causal relationships between intermediate project outcomes such as schedule performance and perceived project value, and ultimate outcomes such as commercial success and repeat business between consultant and client. These relationships alone account for up to 68% of the observed variation, depending on the outcome. Additional success factors were then incorporated to improve explanation of client satisfaction. While not the only measure of project success, it factors heavily in consultants' definitions of success, and is highly correlated with the factors that clients prioritize most: value, rework, and trust. Detailed regression models were developed that could account for as much as 79% of the variation in client satisfaction. Models built only from data obtained from the consultants could explain 72%, which could reduce consultants' error in estimating client satisfaction by half. Finally, 36% of the variation in satisfaction can be predicted before the project even begins, a finding with strong implications for consulting project planning. Due to space limitations, the other project outcomes were not examined in such detail, but rather are left for future work.

6.2 Key Findings and Implications

The dissertation's key conceptual, methodological, and substantive results are reviewed in turn. The findings themselves are highlighted in bold, while supporting discussion and existing evidence are in plain text. References are provided to the section in which the result is presented and/or discussed.

6.2.1 Conceptual Findings

- **Consultants and clients define and prioritize success very differently: consultants tend to reference a broad range of indicators while clients focus narrowly on deliverable quality and value (Chapter 2).** This result is surprising because experienced consultants should align their definitions to those of their clients to ensure client satisfaction, repeat business, and/or referral to new clients. The abundance of factors considered by the consultants in evaluating success may indicate that they do not know exactly which they *should* focus on. This lack of alignment may contribute to unsatisfactory project outcomes. Comments from the benchmarking study suggest that objectives are not grossly misaligned (e.g., consultant cutting corners to preserve its profit margin), but rather are subtly so. For example, most consultant practitioners take great pride in design elegance and novelty, but the clients generally prefer production readiness. In both the interviews and the survey responses, consultants frequently complained that the client had failed to preserve key elements of the design during refinement after the consulting engagement. It is debatable whether the consultant delivered more elegance than the client needed or the client failed to protect the elegance it had sought and paid for, but in either case value was destroyed. Exceptions to this general trend do occur, of course, including cases in which the client was outsourcing for an original design and the consultant believed it was outsourcing for capacity and delivered a design that the client deemed unoriginal. Again, value was destroyed. The implication of this finding for practitioners is to make sure that objectives are clearly understood at the start of the project, including what types of design elements the client values and will preserve, and which would be a waste of development effort. The implication for scholars is that perspectives on success will differ depending who is asked.
- **Client satisfaction correlates highly with most consulting project outcomes (Section 2.5.2) and is already part of consultants' mental models of success (Section 2.5.1).** Compared to other holistic measures, client satisfaction has greater conceptual clarity and a more refined methodological literature (Section 3.2.2). Satisfaction has not been

utilized to date in research on outsourced product development, but it appears to be a highly relevant and useful variable.

- **Client-identified problems do not correlate highly with client assessments of overall project success or with client satisfaction (Sections 2.5.2 and 5.5.2).** Problems and "interruptions to routine activity" have been proposed as important concepts in design consulting [3] and distributed product development [4], but their importance may have been over-stated. While about half of all projects experienced problems (Section 3.4.5), half to three-quarters of these were resolved (Section 4.5.3), and the remainder had little effect on client appraisals of project success (Section 2.5.2).
- **Working relationship quality has an independent effect on customer satisfaction in complex, heterogeneous, infrequently consumed services (Section 5.5.2).** Theories of customer satisfaction in knowledge-based services are not well developed. Prior models have not included a working relationship construct [12, 13], but it appears to have an effect on satisfaction, independent of perceived performance and value.

6.2.2 Methodological Findings

- **Nearly all project outcome measures are significantly influenced by the role (i.e., project sponsor, project manager, team member, other) of the respondent on the project (Section 3.5.3).** Past research in traditional product development has tended to use just one type of respondent [14], as have the few studies of outsourced product development that specified the roles of their respondents [5, 11, 15]. Other studies have not provided respondent characteristics at all [2, 3]. The present study suggests that the use of any one group alone will produce bias, not only in subjective outcomes such as client satisfaction, but also in seemingly objective outcomes such as the meeting of project requirements and the extent of rework required to the project deliverable.
- **Nearly all subjective outcome measures are significantly influenced by the system of incentives and protections afforded the respondent during assessment (Section 3.5.1).** Specifically, confidential closed-loop client feedback studies may generate significantly more favorable results than anonymous open-loop measurements in which client responses are not shared with the consultant. Scholars of customer satisfaction have

hypothesized such effects but not demonstrated them [16]. Prior studies that attempted to do so found little evidence of such an effect [17]. It remains unclear which method (closed- or open-loop feedback) produces less biased results. The implication for descriptive research is obvious: results depend heavily on methods. The implication for explanatory research is more beneficial: use of a combination of closed- and open-feedback approaches may generate greater variation in the gathered data, allowing for more powerful statistical analysis.

- **Unlike customer satisfaction with most products and services, client satisfaction with design consulting services does not appear to vary within the first few years after the project (Section 3.5.4).** Most customer satisfaction research indicates a decline in satisfaction with time post-consumption [18], but the observed results were very stable. The difference may be due to the relative fluidity of the "product" of consulting services. Whereas a new car is relatively unchanging, and thus only novel to the buyer for a few months after purchase, the product of design services change over a several year period, starting perhaps as a conceptual design, maturing into a physical product, then transforming into financial return for the client. This metamorphosis implies that the customer is actually evaluating a different product at each point in time. Additional research is warranted to better understand this interesting finding. For the moment, the implication is that client satisfaction is a timing-robust measure of success.
- **Use of client perspectives alone can lead to misdiagnosis of project failure modes (Section 4.6.1).** Much research on outsourced product development has assigned blame for poor project outcomes to failings by the design service provider, such as poor design work and ignorance of the brief. The failure modes framework developed in Section 4.6.1 illustrates that one party alone cannot accurately assess the source of failure, as certain modes resemble others when viewed from a single perspective. Comparison of client and consultant commentary on the same projects confirms this model. The implication of this finding is that past indictments of supplier design work may be biased by measurement artifact.

6.2.3 Substantive Findings

- **Design consulting outcomes compare favorably to benchmark data from traditional product development (Section 3.4).** While much of the discussion of outsourced product development highlights the risk of "pitfalls" [19] and "disasters" [2], rates of product commercialization and commercial success in domestic design consulting compare favorably to the best available data for conventional (i.e., in-house) product development. Consulting is just one type of outsourced product development, and it is possible that other types have worse results, but the finding highlights the need for precision when discussing outsourcing effectiveness.
- **Levels of client satisfaction with design consulting are comparable to those of other services (Section 3.4.7).** Although very little data is publicly available for satisfaction in business-to-business or knowledge-intense services, the results of the benchmarking and patent samples are comparable to high- and low-performing business-to-consumer service industries, respectively, in both American Customer Satisfaction Index and Net Promoter Score results. Again, satisfaction may differ for other types of outsourced product development, but these results challenge the air of suspicion that surrounds outsourced product development in the trade press.
- **The occurrence of problems does impact schedule and budget performance, but these in turn do not have strong effects on perceived project value (Section 5.5.1).** While problems may not be as central a concept as some have suggested, they may be valuable in explaining development process performance. They may also be useful in that they are concrete manifestations of more abstract phenomena such as client capability or outsourcing motivation. During the interview phase, respondents sometimes had trouble describing general characteristics of successful or unsuccessful projects. Most had no trouble, however, in describing the specific problems that occurred on a recent project. The researcher can use questions about problems as a prompt for elucidating clues from which more fundamental theories can be induced.
- **Clients outsourcing for an original perspective reported worse satisfaction than those outsourcing for rapid product development, specific expertise, or additional development capacity (Section 5.5.2).** Consultant marketing and academic publications have touted design and innovation consultancies as "superstars of innovation" [9] who

use specialized techniques [9, 20-22] and knowledge brokering across diverse client industries [10] to deliver original solutions to old problems. While such projects are sometimes successful, the results suggested that on average clients outsourcing for originality had lower satisfaction than those outsourcing for all other reasons. It appears that the industry has been mischaracterized. It is particularly effective when the consultant brings a specific and unique expertise in an area in which the client is competent enough to specify, verify, and appreciate the results. Closely related to expertise is speed – the ability to perform tasks requiring moderate expertise, much faster than the client can do so, because of the absence of bureaucracy and other trappings of large organizations. Outsourcing for capacity can be effective but rarely produces delight.

- **Success factors suggested by the literature were often not the most predictive of client satisfaction, and many had an opposite effect than suggested (Section 5.5.2).** For example, product novelty and the inclusion of stakeholders on the project team had little association with client satisfaction. Increased manufacturing integration and involvement were negatively associated with satisfaction, as was corporate cultural similarity. Increased geographic distance was actually positively associated with client satisfaction. These surprising results suggest that design consulting is a unique beast, requiring different models from those used for conventional product development and systems engineering. In addition, the positive associations of geographic and corporate cultural distance on client satisfaction suggest that other factors might be responsible for hints of lower client satisfaction with international integrated design-and-manufacturing outsourcing than with domestic consulting [19].
- **Consultant estimates of client satisfaction are poor but can be improved substantially by considering just a few simple factors: the client's role and involvement in hiring the consultant, the consultant's own perception of project budget adequacy, and the consultant's perception of the extent of problems on the project (Section 5.5.2).** For the consultant, who must balance client satisfaction against the benefits of the project to her own business, an ability to accurately estimate client satisfaction offers significant competitive advantage. There is an inherent trade-off between the value of a project to the client firm and the profit generated by it for the consultant. Over-delivering client value can be as bad for business as under-delivering it.

The finding that client satisfaction can be reasonably well estimated implies that consultants might use the present model or develop their own to do so, helping them to tread the fine line between super-pleasing and disappointing their clients. The fact that the statistical model performed better than the estimates of individuals who had first hand experience with the projects under study confirms the significance of the finding.

6.3 Strengths of the Research Design

The validity of the above findings is supported by several aspects of the research design. These were cited in the concluding sections of each of the four studies as appropriate, and are briefly summarized here:

- **A precise research setting:** domestic design and innovation consultancies specializing in consumer, medical, and industrial product development [23].
- **Combination of qualitative and quantitative methods:** in-depth interviews and cross-case analysis were first used to establish conceptual understanding and generate testable hypotheses, followed by statistical analysis of survey data to confirm the hypotheses.
- **Multiple units of observation and analysis:** the interview phase considered the cumulative beliefs and values of individual consultants and clients, whereas the pilot and survey phases observed and analyzed the outcomes of specific projects. The use of both abstract and particular units of analysis allowed for semi-independent corroboration of the observed effects.
- **Use of standard, tested measurement items:** wherever possible, standard items were re-used from prior research, both for reliability and to allow approximate comparisons to published results.
- **Pre-testing of measurement instruments:** the questionnaire used in the Phase 3 survey had been pre-tested on thirty projects during the pilot study and revised to incorporate suggestions from the pilot respondents. The refined questionnaire was then reviewed by several members of the lead consultancy in the benchmarking study, who themselves were highly experienced in survey research. Their input was incorporated as well before full-scale deployment.

- **Collection of data from multiple perspectives:** interviews were conducted with both clients and consultants, at a range of experience levels, both currently and formerly employed in their respective industries. Survey data were collected from both client and consultant participants of the projects under study. Project demographic data were collected from consultancy records. The use of multiple perspectives provided rich data, allowing comparison of the perspectives, demonstration of the methodological effects of respondent role and type, and evidence of the misunderstandings that are often at the core of unsuccessful inter-firm development efforts.
- **Use of multiple samples to reach all corners of the population:** while each sample generated a wide range of satisfaction, the benchmarking sample in particular generated responses from highly satisfied respondents, while the patent sample generated responses from many who were only moderately satisfied.
- **Multiple respondents per project:** survey data were collected from up to five different individuals who had participated in the project. The use of multiple respondents improves reliability by reducing the influence of any one. It also enabled estimation of non-response bias, by calculating per-project response rates and comparing the results from high-response and low-response projects.

6.4 Additional Contributions

In addition to the findings discussed above, the dissertation makes several other contributions to scholarship and practice.

6.4.1 Academic Contributions

- Called attention to the distinction between two forms of outsourced product development – design consulting and integrated design-and-manufacturing outsourcing – that have been commingled in past research.
- Demonstrated the utility of design consulting as a research setting.
- Identified important outcome variables that have been overlooked to date, including perceived project value, rework, and client satisfaction.

- Documented previously unreported consultant perspectives on the meaning and sources of success in outsourced product development.
- Developed a novel method of using trace evidence in patent records and other public records to locate consulting projects participants.
- Devised a system of incentives and protections to encourage feedback from a broad range of satisfaction levels.
- Provided a much-needed public-domain source of empirical data on outsourced project outcomes (also a practical contribution, as developers can reference it as benchmark data).
- Developed and published survey instruments that can be used or adapted by future scholars (or practitioners, to measure their own performance).

6.4.2 Practical Contributions

- Developed several conceptual frameworks that can help to simplify the complex problem of planning and managing outsourced development projects.
- Mediated the collection of client satisfaction data for five participating consultancies. Analyzed the data and provided interpretive reports.
- Developed a statistical model to help consultants estimate client satisfaction with reasonably good accuracy.
- Demonstrated that client satisfaction can be partially predicted in advance of the project.

6.5 Limitations and Future work

6.5.1 Limitations

The chief limitation of the research is the modest sample size of the Phase 3 benchmarking/patent study. Although novel methods were devised to locate projects for study, consulting remains a small, somewhat secretive industry, and so only 104 projects were analyzed, too few to employ advanced statistical techniques such as structural equations modeling. In addition, the modest number of observations makes it difficult to test the effect of explanatory variables that can take many different nominal values (e.g., the department which sponsored the project, or the precise industry the client firm competes in). Nonetheless, the

sample size was large enough to identify many powerful effects, including some that have been overlooked by past research. Finally, the modest sample makes the descriptive results imprecise, though the benchmarking and patent samples likely provide high and low estimates, respectively.

A second limitation is that respondents' assessments of project return on investment appear to be somewhat unreliable. The answers provided by multiple client respondents on the same project often differed, and in some cases the answer to the ROI question appeared to be inconsistent with answers to other questions (e.g., a large-budget project that had already produced a positive return, just months after completion, without sending a product to market). In light of these issues, the descriptive and explanatory results for ROI should be interpreted with caution. It should also be noted that difficulty in assessing consulting project ROI does not appear to be unique to this study. While recruiting consultancies to participate in the benchmarking study, one consultancy owner noted that he was already running his own client satisfaction program but felt that what the industry really needs is a way to quantify the financial return on its output. Although quantitative ROI data could not be obtained, reliable data were gathered from consultancy records on such variables as project length, budget, start and completion date, extent of previous and repeat business with the client, and others.

A third limitation of the study design is that consultant participants on the patent sample projects were not surveyed out of respect for their employers' decisions not to participate in the benchmarking study. This precludes the possibility of comparing their perspectives to those of their clients, many of whom were moderately dissatisfied.

6.5.2 Future Work

This dissertation has generated many hypotheses and tested only a small fraction of them. In particular, detailed explanation models were only derived for client satisfaction. While satisfaction is one of the most important outcomes, additional understanding might be gained by explaining the origins of perceived value in greater detail, or working relationship quality, and so forth.

In addition, the limitations addressed previously naturally suggest avenues for improvement, including the collection of additional data and the use of more refined techniques such as path modeling and factor analysis. The understanding gained from the present results could be used in refining the novel measurement items used on the questionnaires and rigorously testing their validity and reliability.

After verifying the soundness of the methods, the study might be extended to other forms of outsourced product development, such as international consulting, or integrated design-and-manufacturing outsourcing. At least one prior study has hinted that such forms have lower satisfaction than consulting [19], which could account for the negativity surrounding design outsourcing in the trade press. On the other hand, prior results may simply be negatively biased because they collected data from low- to mid-seniority clients, while providing them with complete anonymity and a soap box upon which to vent their frustrations. Direct comparison of client satisfaction and other project outcomes, measured using identical methods, could help to resolve the question.

It would also be instructive to directly compare outsourced projects to non-outsourced projects, using both objective and subjective measures. The dissertation made comparisons to traditional product development wherever possible using published benchmarks from the literature, but a more rigorous test would be to directly measure the outcomes of comparable outsourced and non-outsourced projects from the same companies. It would also be interesting to apply some of the measures suggested by the study of outsourcing to traditional product development. How would client respondents rate their trust of their co-workers? How satisfied are product development directors with their own teams? What fraction of in-house product development projects experience problems? Are "pitfalls" [19] and "disasters" [2] unique to outsourcing, or merely an inevitable aspect of new product development?

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Appendices

Appendix A: Phase 1 Interview Template

Case Number: _____ Interview Date: _____

Title: _____ Company: _____

Experience: _____ Client Consultant

PART I: OPEN ENDED QUESTIONS ABOUT PROJECT SUCCESS AND FAILURE

1. People talk about successful projects, unsuccessful projects. What does "project success" mean to you?

    - [Consultants only] How important is repeat business to your business model?

    - Do you have a formal process for tracking project outcomes?

2. What kinds of projects are more likely to be successful?

    - [Additional prompt, if necessary] When negotiating a project, are there any red flags that raise concerns? Any green lights?

3. [Clients] How does your company decide whether to outsource a project or keep it internal? [Consultants] How do your clients decide whether to send a project out or keep it inside?

    - Who makes the decision?

    - What factors do they consider?

4. When projects are less successful, what are the typical causes?

5. [Clients only] I'd like you to think about the design and manufacturing vendors you've used recently. For each vendor, on a scale of 0 to 10, how likely is it that you would recommend them to a friend or colleague? Why did you give them that score? [Can be anonymous – respondent need not name the vendor, just provide a description]

Vendor	Vendor Description	Rating	Reason
1			
2			
3			
4			
5			
6			

PART II: IN-DEPTH DESCRIPTION OF A SPECIFIC PROJECT

6. Have you ever participated in a consulting project that struggled or failed? What happened?

PART III: FOCUSED QUESTIONS TO EXPLORE WORKING HYPOTHESES

7. How would you characterize the typical project handoff?

    - [How does the consultant transfer the knowledge it has developed during the project?]

8. What does the client do with the project after the handoff?

    - And after that?

    - [How does the client internalize the knowledge developed by the consultant?]

9. How frequently do you co-locate client and consultant personnel? Why or why not?

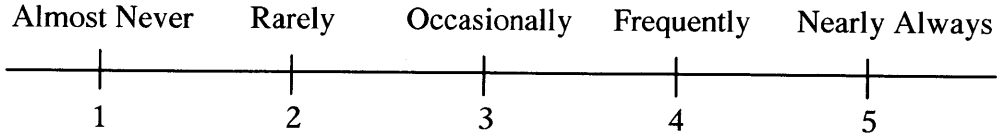
10. Do you see a difference between managing a design vendor vs. a production vendor?

11. In your experience, what percentage of consulting projects fail?

PART IV: FOCUSED QUESTIONS ON SUCCESS AND FAILURE

A. Causes of Poor Project Outcomes

In your experience with design consulting, how often do you encounter the following situations? Please estimate the frequency on a 5 point scale:



1. <u>During the negotiation or sales phase</u>:

	on the part of the **Consultant:**	on the part of the **Client:**
Client is not a knowledgeable buyer of design services	N/A	1 2 3 4 5
Poor design brief/statement of work/project proposal	1 2 3 4 5	1 2 3 4 5
A 'penny wise, pound foolish,' mentality	N/A	1 2 3 4 5
Consultant oversells their services	1 2 3 4 5	N/A
Difficult to price project accurately	1 2 3 4 5	

2. <u>During the project itself</u>:

	on the part of the **Consultant:**	on the part of the **Client:**
Poor or infrequent communication	1 2 3 4 5	1 2 3 4 5
Poor project management	1 2 3 4 5	1 2 3 4 5
Significant internal divisions (within the consultant or the client firm) over the project direction . . .	1 2 3 4 5	1 2 3 4 5
Inadequate capabilities to perform the work they were tasked with	1 2 3 4 5	1 2 3 4 5
Inadequate motivation, interest, or emotional investment . .	1 2 3 4 5	1 2 3 4 5
Inadequate time to perform the work they were tasked with	1 2 3 4 5	1 2 3 4 5
Personnel don't enjoy working collaboratively	1 2 3 4 5	1 2 3 4 5
Poor version control	1 2 3 4 5	1 2 3 4 5
Decisions not documented	1 2 3 4 5	1 2 3 4 5
Consultant ignores the brief, 'does their own thing'	1 2 3 4 5	N/A

2. During the project itself (continued):

	on the part of the **Consultant:**	on the part of the **Client:**
Consultant passes work on to inexperienced junior staff . . .	1 2 3 4 5	N/A
Consultant's work is poor or fails to satisfy the design brief	1 2 3 4 5	N/A
Consultant's ideas are impractical to manufacture	1 2 3 4 5	N/A
A 'penny wise, pound foolish,' mentality	1 2 3 4 5	N/A
Client has trouble specifying what they want	N/A	1 2 3 4 5
Client is overly aggressive on speed, compromises quality .	N/A	1 2 3 4 5
Misunderstandings about project objectives/expectations . .	1 2 3 4 5	
Design is not divided cleanly enough to enable multi-party development	1 2 3 4 5	
Organizational barriers between consultant and client	1 2 3 4 5	
Cultural barriers between consultant and client	1 2 3 4 5	
Geographic barriers between consultant and client	1 2 3 4 5	
Incompatible IT tools, software, and practices (including CAD)	1 2 3 4 5	
Unexpected changes of scope	1 2 3 4 5	
Unexpected changes in client's senior management direction or financial situation	1 2 3 4 5	
Outsourcing distracts, threatens, or de-motivates client personnel	1 2 3 4 5	
Persistent outsourcing degrades client's abilities	1 2 3 4 5	
Misalignment of objectives between consultant and client .	1 2 3 4 5	
Rivalries between vendors (design or other)	1 2 3 4 5	
Excessive use of modularity (to simplify multi-party development) limits holistic innovation	1 2 3 4 5	

3. During the project, or in between phases of a multi-phase project:

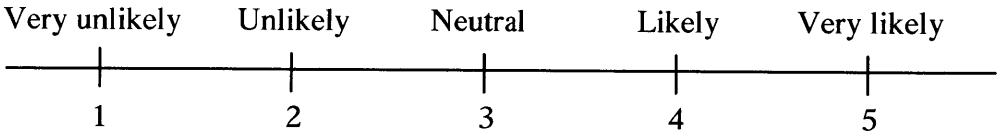
	on the part of the **Consultant:**	on the part of the **Client:**
Opportunistic behavior (e.g. opportunistic contract renegotiation, scope creep, etc.)	1 2 3 4 5	1 2 3 4 5
Discontinuity of service (different personnel used on subsequent phases of the project)	1 2 3 4 5	1 2 3 4 5

4. At the completion of the project:

	on the part of the **Consultant:**	on the part of the **Client:**
Poor project handoff	1 2 3 4 5	1 2 3 4 5
Not-Invented-Here syndrome limits acceptance of consultant's ideas	N/A	1 2 3 4 5
Client fails to perform necessary follow-on work	N/A	1 2 3 4 5
Difficult to document and transfer design intent	1 2 3 4 5	
Misunderstandings about degree of project completeness	1 2 3 4 5	
Architectural mismatch between the consultant's design and the client's organization (the interpersonal coordination required by the new product design doesn't match the interpersonal coordination that is encouraged within the client's existing organizational structure)	1 2 3 4 5	

B. Determinants of Project Success

In your experience with design consulting, are certain types of projects more likely to succeed than others? Please estimate the likelihood of the following types of projects to succeed.



1. Characteristics of the client:

Client is experienced with design consulting	1 2 3 4 5
Client is inexperienced with design consulting	1 2 3 4 5
Client is dependent on the consultant for specific knowledge or expertise	1 2 3 4 5
Client is dependent on the consultant for additional capacity (AKA "extra development bandwidth")	1 2 3 4 5
Client is dependent on the consultant for an original view (AKA "a fresh perspective")	1 2 3 4 5

2. Characteristics of the project structure:

	on the part of the **Consultant:**	on the part of the **Client:**
The project is strategically important to consultant or client	1 2 3 4 5	1 2 3 4 5
The project has low importance to consultant or client	1 2 3 4 5	1 2 3 4 5

Consultant is highly responsible for the design	1 2 3 4 5
Consultant is marginally responsible for the design	1 2 3 4 5
The project is about "blue-sky" innovation	1 2 3 4 5
The project is about "nuts and bolts" product development	1 2 3 4 5
Manufacturing is performed by the client	1 2 3 4 5
Manufacturing is performed by the consultant	1 2 3 4 5
Manufacturing is performed by a third party	1 2 3 4 5

3. Characteristics of the product or innovation:

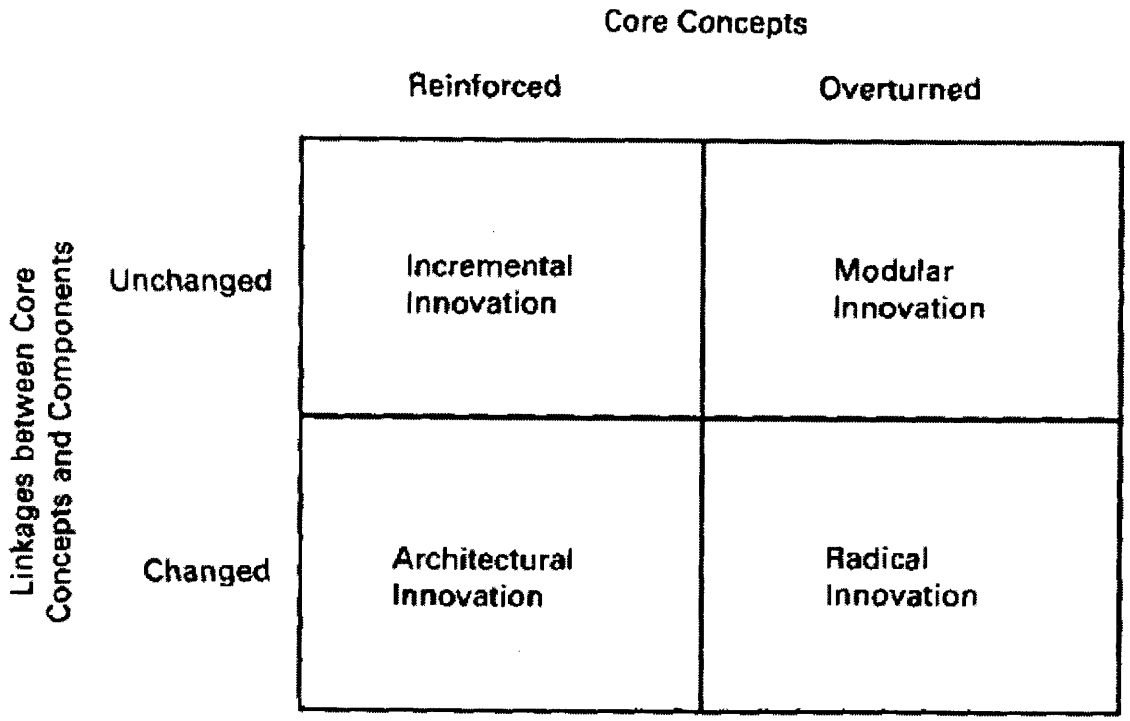
The product is highly complex	1 2 3 4 5
The product is fairly simple	1 2 3 4 5
The product architecture is highly modular	1 2 3 4 5
The product architecture is highly integral	1 2 3 4 5
The innovation poses technical challenges for the client	1 2 3 4 5
The innovation poses marketing challenges for the client	1 2 3 4 5
The innovation poses both technical and marketing challenges . .	1 2 3 4 5
The innovation poses neither technical nor marketing challenges	1 2 3 4 5

FOR THE NEXT FOUR ITEMS, REFER TO THE TEXT AND FIGURE BELOW

The innovation is incremental in nature	1	2	3	4	5
The innovation is modular in nature	1	2	3	4	5
The innovation is architectural in nature	1	2	3	4	5
The innovation is radical in nature	1	2	3	4	5

Product architecture refers to the way in which a product's *components* (subsystems, parts, etc) are arranged and how they interact with one another. For example, a personal computer system consists of several components (display, input devices, CPU, etc) interconnected via standard *interfaces* (USB, TCP/IP, etc). A *modular innovation* is one that is confined to one component, or *module*, such as an LCD screen replacing a CRT monitor on a desktop computer. An *architectural innovation* keeps the basic component technologies intact, but connects them in novel ways. For example, an upright vacuum is architecturally different from a canister vacuum, even though both use the same basic component technologies (vacuum generator, filter bag, etc).

Figure 1. A framework for defining innovation.



Source: R.M Henderson and K.B. Clark, "Architectural innovation . . .," *Administrative Science Quarterly*, v. 35, pp. 9-30, 1990.

PART V: MISCELLANEOUS

1. Is there anything else you'd like to tell me that we haven't discussed?

2. Do you know anyone else who might be interested in participating in this study?

Appendix B: Benchmarking Study Recruitment Letter and Prospectus

Massachusetts Institute of Technology

William J. Palm, PE
Doctoral Candidate

Department of Mechanical Engineering

77 Massachusetts Ave, Room 3-471
Cambridge, MA 02139-4307

Phone (617) 319-0105
Email wjpalm@mit.edu
http://web.mit.edu/wjpalm/www

[Date]

[Addressee's Name]
[Consultancy Name]
[Street Address]
[City, State Zip]

Dear [Addressee's Name],

I am writing to invite [Consultancy Name] to participate in a benchmarking study that Dr. Daniel Whitney and I are conducting on client satisfaction in design and innovation consulting. Our research to date suggests that client satisfaction varies widely between projects and consultants. The benchmarking study presents an opportunity for you to assess [Consultancy]'s own client satisfaction performance, while contributing to our effort to explain the causes of variation in consulting project outcomes. Questions we hope to answer with this study include: How is client satisfaction influenced by characteristics of the client firm, the consultancy, and the project? How might it be predicted before the project and managed during it? How does client satisfaction relate to other project outcomes such as repeat business, design awards, and product success in the market?

Benefits of participation: Participating in the study will enable you to receive candid feedback on [Consultancy Name]'s client satisfaction performance and a comparison of its performance to that of the consulting industry as a whole. Unlike commercial satisfaction surveys, the study has been tailored specifically for design and innovation consulting, based on our research as well as our professional experience in technical consulting. In addition, there is no cost to participate, as the study is funded by the Portuguese Foundation for Science and Technology.

What participation entails: If you choose to participate in the study, we will partner with you to conduct a client satisfaction survey of 15-30 recent projects. You will distribute the surveys and we will collect and analyze the responses. A coding system will be employed so that you need not disclose the identities of your clients to us, and the clients can provide anonymous, candid feedback to you.

Confidentiality: Any information that is obtained in connection with this study and that can be identified with [Consultancy Name] will remain confidential. At no time will the identities of study participants be revealed. If you desire, a non-disclosure agreement can be implemented to guarantee confidentiality.

The enclosed brochure contains additional detail about the study. Please feel free to share it with others within [Consultancy Name] as appropriate. If you would like to learn more or are interested in participating, please contact me at (617) 319-0105 or wjpalm@mit.edu. I look forward to hearing from you.

Sincerely,

William J. Palm
Doctoral Candidate, Mechanical Engineering

Massachusetts Institute of Technology

Study Prospectus

Client Satisfaction in Design & Innovation Consulting

William J. Palm, PE and Daniel E. Whitney, PhD

EXECUTIVE SUMMARY

Client satisfaction with design and innovation consulting varies widely between projects. This study seeks to explain the factors that influence client satisfaction and other project outcomes, as part of a larger effort to understand effective management of inter-firm product development.

A benchmarking approach will be used to provide participating consultancies with confidential feedback on their client satisfaction performance while simultaneously addressing the broader research questions. The study will survey both client and consultant employees on recently completed projects to describe levels of client satisfaction, relate them to other project outcomes such as repeat business and product success in the market, and explain how project outcomes might be predicted before the project and influenced during it.

All data, including the identities of study participants, will be anonymized to protect company confidentiality.

BENEFITS OF PARTICIPATION

Participating in this study will enable your company to:

- Obtain candid feedback from your clients, without revealing their identities
- Benchmark your client satisfaction against that of other study participants and the design and innovation consulting industry as a whole
- Contribute to the development of best practices to help clients make better use of design and innovation consultants
- Receive reports on research findings

Unlike commercial satisfaction surveys, there is no cost to participate in this study. In addition, the survey has been tailored specifically to design and innovation consulting by the investigators, who together have over twenty five years professional experience in technical consulting.

sponsored by: FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR
MIT Portugal

INTRODUCTION

Firms that develop, brand, and sell products increasingly contract design services from consultants and original design manufacturers. Academic research is limited but the trade and popular press have portrayed such "design outsourcing" as highly problematic. For example,

- A recent article in the *Harvard Business Review* states that two-thirds of outsourced design projects studied at *Fortune* 1,000 companies struggled or failed.[1]
- A survey of *EE Times* readers finds that one third of those at large companies view design outsourcing as a net liability to their companies.[2]

Is the situation really this bad? Do clients not know how to manage external product development or is past research not telling a complete story? Our own research suggests that prior studies contain several flaws that may cause them to overstate client dissatisfaction:

- Prior studies imprecisely define key concepts such as "success" and "failure."
- Prior studies do not distinguish between different types of inter-firm development, often including cost-driven offshoring with expertise-based consulting.
- Prior studies survey low- to mid-level client personnel exclusively; the perspectives of the project sponsor and the design provider are not represented.

Our research design improves upon these studies by carefully defining project outcome measures, distinguishing between collaboration types, and gathering balanced data from multiple perspectives within both the client firm and the consultancy. Initial results suggest that client satisfaction with design consulting is better than reported, but nevertheless highly variable (Figure 1). The present study seeks to explain the observed variation in project outcomes and develop recommendations to help optimize outcomes for both clients and consultants.

RESEARCH QUESTIONS

Specific questions addressed by this study include:

1. What factors influence client satisfaction in design and innovation consulting?
    - To what extent can satisfaction be predicted before the project begins, based on characteristics of the client, the consultant, the project, and the contract?
    - What events during the project most strongly impact satisfaction?
    - How can satisfaction be actively managed during the project?
2. How does client satisfaction relate to other project outcomes such as repeat business, design awards, and product success in the market?
3. How does client satisfaction vary between individual stakeholders within the client firm? How can the satisfaction of multiple stakeholders be balanced? Is satisfaction of the project sponsor sufficient to achieve repeat business?
4. How does the appraisal of project success vary between the client and the consultant? How accurate are consultants' estimates of client satisfaction?

---

[1] J. Amaral and G. Parker, "Prevent disasters in design outsourcing," *Harvard Business Review*, September 2008.
[2] B. Rayner, "Design outsourcing: Beware of pitfalls," *EE Times*, January 31, 2005.

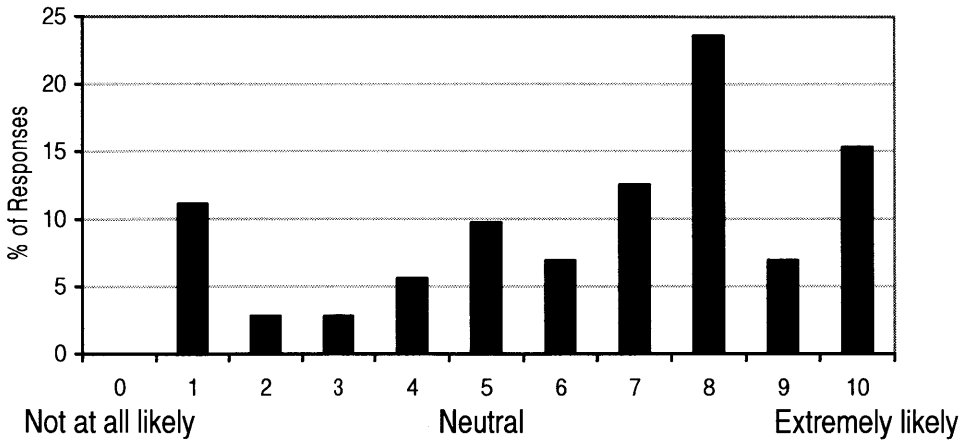


Figure 1: Client responses to the question, "How likely is it that you would recommend your design consultant to a friend or colleague?"

STUDY PROCEDURES

1. **Sampling:** If you choose to participate, we will first ask you to compile a list of projects completed in the last two years. You will assign each project an arbitrary code number so that you need not reveal the identities of your clients or the projects. Using the code numbers, we will draw a stratified random sample of approximately 20% (or fifteen, whichever is larger) of the projects for study.

2. **Data collection:** Next, a representative from your company will complete an Excel worksheet with basic factual information (e.g., contract type, work scope) about each project. This reduces the number of questions for the client respondents to answer, while providing important contextual information for interpreting their responses. For each project in the sample, we will provide you with a questionnaire and postage-paid return envelope to mail with an explanatory cover letter to the client project sponsor, project manager, and a project team member. The questionnaires will be labeled with the project code number so that we can associate the clients' responses with the project information you provided in the Excel worksheet. To preserve the respondents' anonymity, the questionnaire will not ask them for any other identifying information.

3. **Data analysis:** The client respondents will return their completed questionnaires directly to us for analysis. We will anonymize their responses, compile them, and report the results to you. In this way, client respondents can provide completely candid feedback. Among other results, our report to you will include your Net Promoter® Score,[3] your American Consumer Satisfaction Index performance, the issues clients identified with their projects, as well as their recommendations for improvements.

4. **Supplemental data collection:** To gain further insights, we can also anonymously survey consultant members of each project team. Comparison of client and consultant perspectives on the same project helps to shed light on the root-causes of any identified issues.

5. **Benchmarking analysis:** At the conclusion of the study we will provide an analysis of your performance relative to the entire study sample and other, anonymized, study participants.

[3] F. Reichheld, "The one number you need to grow," *Harvard Business Review*, December 2003.

ADDITIONAL INFORMATION REGARDING THIS STUDY

Your company was selected as a possible participant in this study because of its experience in design and innovation consulting for consumer, medical, and industrial products. You should read the information below, and ask questions about anything you do not understand, before deciding whether or not to participate.

- **Identification of investigators:** This study is being conducted by William J. Palm, PE, and Daniel E. Whitney, PhD, of the Department of Mechanical Engineering at the Massachusetts Institute of Technology (MIT).
- **Participation:** Your participation in the study is voluntary. If you choose to participate you may subsequently withdraw at any time without penalty or consequences.
- **Compensation:** There is no cost to participate, and no payment will be provided to you.
- **Confidentiality:** Any information that is obtained in connection with this study and that can be identified with your company, your clients, or your employees will be disclosed only with your permission or as required by law. In particular, your company's participation in the study and client satisfaction performance will be considered confidential. For benchmarking purposes, your overall performance may be disclosed anonymously, but at no time will your company's identity be revealed. If you desire, a non-disclosure agreement can be implemented to guarantee confidentiality. In addition, you have the right not to provide any requested information.

  Individual survey responses will be considered confidential and will not be disclosed by the investigators except as required by law. All respondent data will be anonymized and aggregated before being reported to you.
- **Publication of results:** Data from your company will be anonymized and combined with data from other study participants to describe the design and innovation consulting industry. Industry-level data may be included in Mr. Palm's doctoral dissertation and/or reported in academic, trade, and/or popular publications, but at no time will the identities of any participating companies or individuals be revealed.
- **Rights of research participants:** you are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a study participant, you may contact the Chairman on the Use of Humans as Experimental Subjects, MIT, Room E25-143B, 77 Massachusetts Ave, Cambridge, MA 02139, phone (617) 253-6787.

FOR MORE INFORMATION

If you would like to participate in the study or receive additional information about it, or if you have any questions or concerns about the research, please contact Bill Palm at (617) 319-0105 or wjpalm@mit.edu.

You may also visit the study website, where you may download papers on research to date, at:

http://web.mit.edu/ipd

Appendix C: Benchmarking Survey Respondent Cover Letter Template

[Consultancy letterhead]

[Date]

[Recipient Name]
[Company Name]
[Street Address]
[City, State, ZIP]

Dear [Recipient Name],

[Consultancy name] is participating in a study of client satisfaction with design and innovation consulting that is being conducted by William Palm and Daniel Whitney of the Massachusetts Institute of Technology (MIT). Because you recently took part in a project related to [project description] with [Consultancy name], I invite you to anonymously assess the project. Your feedback will help [Consultancy name] improve its service to you and will help Mr. Palm and Dr. Whitney advance scientific understanding of inter-firm product development.

Enclosed is a brief questionnaire about the project and its outcome. I ask you to look it over and, if you choose to do so, complete it and return it to Mr. Palm at MIT using the enclosed postage-paid envelope. I expect that this will take you no more than twenty minutes to complete. Your participation is completely voluntary and I will not find out if you participate or not, but I value your opinion and hope you will choose to take part.

Benefits of participation: Participating in the study will grant you exclusive access to research results and reports in the participant section of the study website, http://web.mit.edu/ipd. The results will help you to benchmark your own consulting experiences against those of other clients, and improve your company's use of design and innovation consultants in the future.

Confidentiality: the study has been carefully designed to protect your anonymity. The questionnaire does not ask for your name or any other identifying information, nor has [Consultancy name] given such information to anyone at MIT. Your anonymous responses will be pooled by Mr. Palm with data from other [Consultancy name] clients, and only the combined results will be reported back to [Consultancy name]. I hope that this will allow you to provide us with candid feedback on your project experience.

For more information: if you have questions or concerns about the study, you may reference the study website (http://web.mit.edu/ipd) or contact [Consultancy contact name] at [Consultancy name] ([phone number, email]), or William Palm at MIT (617-319-0105, wjpalm@mit.edu).

Thank you for helping us to serve you better. I look forward to working with you in the future.

Sincerely,

[Consultancy contact name]
[*Consultant contact title*]

Appendix D: Benchmarking Study Questionnaire – Client Version

Massachusetts Institute of Technology

Design & Innovation Consulting Survey 2010

77 Massachusetts Avenue, Room 3-471
Cambridge, Massachusetts
02139-4307

(617) 319-0105
wjpalm@mit.edu
http://web.mit.edu/ipd

FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR

MIT Portugal

CONSENT TO PARTICIPATE IN SURVEY RESEARCH

Explaining and Improving Project Outcomes in Design and Innovation Consulting

You have been asked to participate in a research study conducted by William J. Palm, PE, and Daniel E. Whitney, PhD, from the Department of Mechanical Engineering at the Massachusetts Institute of Technology (MIT). The purpose of this study is to explain the causes of variation in the outcomes of design and innovation consulting projects. The results of the study will be included in Mr. Palm's doctoral dissertation. You were selected as a possible participant in the study because of your involvement in the consulting project referenced in the enclosed cover letter. You should read the information below before deciding whether or not to participate.

Participation: this survey is voluntary. You have the right not to answer any question. We expect that it will take you about twenty minutes to complete the questionnaire.

Benefits: your participation in the study will help the consultancy to improve its service to you. You will also gain advance access to the study results at the study website, which will help you to benchmark your own project experience against those of other consulting clients, and help you to optimize your use of design and innovation consultants in the future.

Confidentiality: this questionnaire was sent to you by the consultancy referenced in the accompanying cover letter. To ensure your anonymity, the consultancy has not revealed and will not reveal your name, your employer's name, or any other identifying information to Mr. Palm, Dr. Whitney, or anyone else without your permission. Likewise, the questionnaire does not request any identifying information. Thus, your working history with the consultancy has not been and will not be disclosed to anyone outside the consultancy.

Your survey responses will be collected and analyzed only by Mr. Palm and Dr. Whitney at MIT. Your responses will remain confidential and will not be disclosed to the consultancy or anyone else without your permission, except as required by law. In analyzing the data, your responses will first be combined with those from others involved in your project, using the project identification number on the first page of your questionnaire. These responses will then be combined with those from other clients of the consultancy, and the overall results reported to the consultancy alone. Data from your consultancy will be combined with data from other consultancies to describe the consulting industry. Industry-level data may be disclosed publicly, but at no time will the identities of the consultancies or any other participating company or individual be revealed.

Identification of Investigators: if you have any questions or concerns about the research, please feel free to contact William Palm (617-319-0105, wjpalm@mit.edu) or Daniel Whitney (617-253-6045, dwhitney@mit.edu). You may also learn more at the study website, http://web.mit.edu/ipd

Rights of Research Participants: you are not waiving any legal claims, rights or remedies because of your participation in this research study. If you feel you have been treated unfairly, or you have questions regarding your rights as a research participant, you may contact the Chairman of the Committee on the Use of Humans as Experimental Subjects, MIT, Room E25-143B, 77 Massachusetts Ave, Cambridge, MA 02139, phone 617-253-6787.

Consent: by returning the questionnaire, you indicate that you understand the above information and voluntarily consent to participate in the study.

DESIGN AND INNOVATION CONSULTING SURVEY 2011

Instructions: All questions on this survey pertain to the consulting project referenced in the accompanying cover letter. Please answer each question to the best of your knowledge. If you would like to add additional information or qualify an answer, please feel free to write comments in the margins.

SECTION A – Your Company

Questions in this section refer to the company employing you at the time of the project.

1. **Approximately what was your company's annual revenue at the time of the consulting project?**
   - ☐ Less than $1 million
   - ☐ $1 million to $9.9 million
   - ☐ $10 million to $99 million
   - ☐ $100 million to $999 million
   - ☐ $1 billion to $9.9 billion
   - ☐ $10 billion or more

2. **At the time of the consulting project, how many new products had your company ever developed?**
   - ☐ This was our first new product
   - ☐ We had developed one or two
   - ☐ We had developed several
   - ☐ We had developed many new products

3. **How many products had your company developed that were similar in type to the one developed with the consultancy?**
   - ☐ This was our first product of this type
   - ☐ We had developed one or two
   - ☐ We had developed several
   - ☐ We had developed many products of this type

4. **How many times had your company utilized product development consultants?**
   - ☐ This was our first project with a consultant
   - ☐ We had done one or two projects with consultants
   - ☐ We had done several projects with consultants
   - ☐ We had done many projects with consultants

5. **How often did your company itself perform activities of the sort that the consultancy was hired to perform?**
   - ☐ We had never performed such activities ourselves
   - ☐ We infrequently performed such activities ourselves
   - ☐ We occasionally performed such activities ourselves
   - ☐ We frequently performed such activities ourselves

6. **Compared to other companies of similar size, how agile do you consider your company to be?**
   - ☐ Above average agility
   - ☐ Average agility
   - ☐ Below average agility

SECTION B – The Consulting Project

Questions in this section refer to the project the consultancy was hired to perform.

7. What department within your company sponsored the consulting project?

_____

8. What was the primary reason your company hired a consultant rather than doing this project internally?

_____

_____

_____

_____

9. Did your company usually outsource projects such as this one?

- ☐ Usually outsourced
- ☐ A mix of outsourced and in-house
- ☐ Usually performed in-house

Go to Questions 10 - 12 in right column

10. What project requirements were known by your company at the start of the project? *(check all that apply)*

- ☐ Few or none
- ☐ A strategic vision
- ☐ Marketing requirements
- ☐ Technical requirements
- ☐ Detailed technical specifications

11. How novel was the product?

- ☐ New to the world
- ☐ New for my company
- ☐ A new variant on an existing product made or sold by my company
- ☐ Incremental improvement or cost reduction of an existing product

12. What is the approximate sales price of the finished product?

_____

13. How familiar are you with the terms of the consulting contract?

☐ I read the contract ☐ I read our statement of work ☐ I didn't see either document

14. How challenging did you think it would be for the consultant to meet the project requirements?

Not very challenging	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very challenging

What particular aspects made it challenging or not? _____

_____

_____

15. How adequate was the schedule allotted by your company for the consulting project?

Not at all adequate	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	More than adequate

16. How adequate was the budget allotted by your company for the consulting project?

Not at all adequate	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	More than adequate	☐ Unfamiliar with budget

SECTION C – Your Company's Project Team

Questions in this section refer to the project team within your company.

17. What was your role on the consulting project?

- ☐ Project sponsor: negotiated contract, supervised project manager
- ☐ Project manager: responsible for day-to-day management of project
- ☐ Project team member: contributed technical expertise to the project
- ☐ Other: _____

18. Were you involved in the evaluation and selection of the consultancy for the project?

- ☐ I made the decision
- ☐ I was consulted in the decision
- ☐ I was not involved in the decision

19. Approximately how many employees of your company were on the core project team?

_____

20. What departments were represented on the core project team?

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

21. Were all necessary stakeholders included on the core project team?

☐ Yes ☐ No → **Who was missing?**

_____

_____

_____

_____

22. To what extent did the stakeholders agree on the project objectives?

- ☐ Substantial agreement
- ☐ Partial agreement
- ☐ Little agreement

23. How empowered was the project manager during the project?

- ☐ Substantial authority over project
- ☐ Some authority over project
- ☐ Little authority over project

24. How experienced was the project team with new product development?

- ☐ No prior experience
- ☐ Some prior experience
- ☐ Extensive prior experience

25. How experienced was the project team with the type of product you were developing?

- ☐ No prior experience
- ☐ Some prior experience
- ☐ Extensive prior experience

26. How experienced was the project team with utilizing product development consultants?

- ☐ No prior experience
- ☐ Some prior experience
- ☐ Extensive prior experience

27. How experienced was the project team with the activities that the consultancy was hired to perform?

- ☐ No prior experience
- ☐ Some prior experience
- ☐ Extensive prior experience

SECTION D – The Consultancy's Project Team

Questions in this section refer to the project team at the consultancy.

28. How satisfied were you with the consultancy project team's . . .

Technical competence?	Not very Satisfied	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Satisfied
Communication skills?	Not very Satisfied	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Satisfied
Project management?	Not very Satisfied	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Satisfied
Commitment?	Not very Satisfied	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Satisfied
Flexibility?	Not very Satisfied	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Satisfied
Consistency of team membership?	Not very Satisfied	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Satisfied

Comments: _____

_____

_____

_____

SECTION E – Relationship with the Consultancy

Questions in this section explore the familiarity of the consultancy and your company.

29. In your opinion, how similar or dissimilar were your company's and the consultancy's

Corporate cultures?	Very Dissimilar	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Similar
Objectives for the project?	Very Dissimilar	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Similar
Expectations for project deliverables?	Very Dissimilar	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Similar

30. How good was your working relationship with the consultancy on this project?

Not very good Relationship	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very good Relationship

31. How confident are you that the consultancy will always act in your best interest?

Not very Confident	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Confident

SECTION F – Evaluation of the Consulting Project Experience

These questions refer to your experience on the project before, during, and after the actual engagement with the consultancy.

32. To what extent did the consultancy's service on this project meet your expectations?

Fell short of your expectations	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	Exceeded your expectations

What aspects of the project went particularly well? _____

_____

_____

_____

What expectations did you have that were not met? _____

_____

_____

_____

33. How well did the consultancy's service compare with the ideal consulting service?

Not very close to the ideal	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	Very close to the ideal

34. Did you experience any problems related to the consulting project?

- ☐ No substantial problems *(skip to Question 37)*
- ☐ Some problems
- ☐ Serious problems

35. During which phase(s) of the consulting project did you experience problems?

- ☐ Specification of, and agreement upon, project requirements by my company
- ☐ Selection of the consultancy
- ☐ Negotiation of the project contract
- ☐ Briefing the consultancy on project requirements
- ☐ Development work by the consultancy
- ☐ Development work by my company
- ☐ Communication with the consultancy
- ☐ Coordination with the manufacturer
- ☐ Transfer (i.e., delivery) of the consultancy's work to my company
- ☐ Dissemination and acceptance of the consultancy's work within my company
- ☐ Refinement of the work by my company after the conclusion of the engagement

36. What problems did you experience? In what phase(s) did they occur?	**How severe was each problem? Was the problem resolved?**
•	Not Very Severe ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 Very Severe Resolved? ☐ Yes ☐ No
•	Not Very Severe ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 Very Severe Resolved? ☐ Yes ☐ No
•	Not Very Severe ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 Very Severe Resolved? ☐ Yes ☐ No

37. To what degree do you consider this project a success?

Not very Successful ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 Very successful

Why or why not? _____

SECTION G – Evaluation of Contractual Performance

Please assess the degree to which the consultant fulfilled the requirements of the project contract. If you are unfamiliar with the terms specified in the contract, check the box to the right of the question.

38. To what extent were the performance requirements specified in the contract fulfilled?

Failed to meet requirements ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 Exceeded requirements ☐ Unfamiliar w/ contract

39. When was the project completed relative to the schedule specified in the contract?

Behind schedule ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 Ahead of schedule ☐ Unfamiliar w/ contract

40. How much did the project cost relative to the budget specified in the contract?

Over budget ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 Under budget ☐ Unfamiliar w/ contract

41. Considering both the cost of the project and the benefits you obtained from it, how would you rate the value of the consulting project to your company?

Poor value ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 Excellent value ☐ Unfamiliar w/ contract

SECTION H – Project Outcomes

Questions in this section refer to outcomes related to the consultancy's work on the project. The outcomes may have occurred after the actual consulting engagement.

42. Did any patents result from the consultancy's work on the project?
(check all that apply)

- ☐ Utility patent(s) granted
- ☐ Utility patent application(s) pending
- ☐ Design patent(s) granted
- ☐ Design patent application(s) pending
- ☐ No
- ☐ I don't know

> A *utility patent* protects the way an article is used and works.
>
> A *design patent* protects the visual appearance of an article.

43. Did any awards result from the consultancy's work on the project?

☐ Yes ☐ No ☐ I don't know

44. Did the project continue at your company after the consultancy's involvement ended?

☐ Yes ☐ No → **Why not?** _____

45. Was the consultancy's work implemented in the project?

☐ Yes ☐ No → **Why not?** _____

↓

How much rework by your company was required relative to what was expected?

☐ None ☐ Minor changes ☐ Major changes

46. Considering the revenues and/or cost savings generated by the consultant's work, did the consulting project yield a positive return-on-investment for your company?

☐ Yes ☐ No ☐ Not yet ☐ Company doesn't track ☐ I don't have the data

↓

What was the payback period?

_____ ☐ Company doesn't track ☐ I don't have the data

47. Did product(s) resulting from the consultancy's work go to market?

- ☐ Yes
- ☐ Still in development
- ☐ No, but this was not a project objective
- ☐ No, project was cancelled or halted → **Why?** _____

48. If you answered *Yes* to Question 47, to what degree was the product a success?

Fell far short of objectives	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	Far exceeded objectives

SECTION I – Overall Evaluation of the Consulting Project

Please provide your overall evaluation of the project. If you have worked with the consultant on other projects, please try to answer the questions below based on your experience on this project alone.

49. What is your overall satisfaction with the consultancy's service on this project?

Very dissatisfied	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Very satisfied
	1	2	3	4	5	6	7	8	9	10	

50. If you have need for consulting services in the future, how likely is it that you would hire the consultancy again?

Not at all likely	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Very likely
	1	2	3	4	5	6	7	8	9	10	

51. Based on this project, how likely are you to recommend the consultancy to a friend or colleague?

						Neutral						
Not at all likely	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Extremely likely
	0	1	2	3	4	5	6	7	8	9	10	

52. What is your primary reason for your rating in Question 51?

_____

_____

_____

_____

What improvements would make you rate the consultancy closer to a ten?

_____

_____

_____

_____

53. Is there anything else you would like to add?

_____

_____

_____

_____

_____

Please create an account to anonymously access study results at http://web.mit.edu/ipd

User Name: _ _ _ _ _ _ _ _ _ Password: _ _ _ _ _ _ _ _ _

This concludes the survey. We appreciate the time and effort you have taken to answer our questions.

As a token of our appreciation, we would like to share our study results with you. They will be posted under password protection at the study website:

http://web.mit.edu/ipd

To access the results, please create an anonymous User Name and Password and write them at the bottom of the opposite page of the questionnaire. Your account will be activated when we receive the questionnaire in the mail. Please do not choose a User Name which compromises your anonymity to us.

You may wish to write the login information below, and remove and save this cover page for future reference.

User Name: _ _ _ _ _ _ _ _ _ (min. 6 characters, including one letter and one number)

Password: _ _ _ _ _ _ _ _ _ (min. 6 characters, including one letter and one number)

Please use the enclosed postage-paid envelope to mail your survey to:

William Palm
Massachusetts Institute of Technology
77 Massachusetts Ave., Room 3-471
Cambridge, MA 02139-4307

Surveys should be mailed by _____.

THANK YOU FOR YOUR PARTICIPATION

Appendix E: Benchmarking Study Questionnaire – Consultant Version

Massachusetts Institute of Technology

Design & Innovation Consulting Survey 2010

77 Massachusetts Avenue, Room 3-471
Cambridge, Massachusetts
02139-4307

(617) 319-0105
wjpalm@mit.edu
http://web.mit.edu/ipd

FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR

MIT Portugal

CONSENT TO PARTICIPATE IN SURVEY RESEARCH

Explaining and Improving Project Outcomes in Design and Innovation Consulting

You have been asked to participate in a research study conducted by William J. Palm, PE, and Daniel E. Whitney, PhD, from the Department of Mechanical Engineering at the Massachusetts Institute of Technology (MIT). The purpose of this study is to explain the causes of variation in the outcomes of design and innovation consulting projects. The results of the study will be included in Mr. Palm's doctoral dissertation. You were selected as a possible participant in the study because of your involvement in the consulting project referenced in the enclosed cover letter. You should read the information below before deciding whether or not to participate.

Participation: this survey is voluntary. You have the right not to answer any question. We expect that it will take you about fifteen minutes to complete the questionnaire.

Benefits: your participation in the study will help you and your employer to better understand and improve the outcomes of your projects, including client satisfaction, product success in the market, and profitability for your firm. You will gain advance access to study results at the study website, where you can learn how client employees perceive design and innovation consulting, and compare your own perceptions to those of other study participants.

Confidentiality: this survey is anonymous. Your employer has not revealed and will not reveal your name or any other identifying information to Mr. Palm, Dr. Whitney, or anyone else without your permission. Likewise, the questionnaire does not request any identifying information from you.

Your survey responses will be collected and analyzed only by Mr. Palm and Dr. Whitney at MIT. Your responses will remain confidential and will not be disclosed to your employer or anyone else without your permission, except as required by law. In analyzing the data, your responses will first be combined with those from others involved in your project, using the project identification number on the first page of your questionnaire. These responses will then be combined with those from other projects of your company, and the overall results reported to your employer alone. Data from your company will be combined with data from other consultancies to describe the consulting industry. Industry-level data may be disclosed publicly, but at no time will the identities of any participating company or individual be revealed.

Identification of Investigators: if you have any questions or concerns about the research, please feel free to contact William Palm (617-319-0105, wjpalm@mit.edu) or Daniel Whitney (617-253-6045, dwhitney@mit.edu). You may also learn more at the study website, http://web.mit.edu/ipd

Rights of Research Participants: you are not waiving any legal claims, rights or remedies because of your participation in this research study. If you feel you have been treated unfairly, or you have questions regarding your rights as a research participant, you may contact the Chairman of the Committee on the Use of Humans as Experimental Subjects, MIT, Room E25-143B, 77 Massachusetts Ave, Cambridge, MA 02139, phone 617-253-6787.

Consent: by returning the questionnaire, you indicate that you understand the above information and voluntarily consent to participate in the study.

DESIGN AND INNOVATION CONSULTING SURVEY 2011

Instructions: All questions on this survey pertain to the consulting project referenced in the accompanying cover letter. Please answer each question to the best of your knowledge. If you would like to add additional information or qualify an answer, please feel free to write comments in the margins.

SECTION A – Your Company

Questions in this section refer to the company employing you at the time of the project.

1. **At the time of the project, how many products had your company developed that were similar in type to the product being developed in this project?**
   - ☐ This was our first product of this type
   - ☐ We had developed one or two products of this type
   - ☐ We had developed several products of this type
   - ☐ We had developed many products of this type

2. **At the time of the project, how often did your company itself perform activities of the sort that it was hired to perform on this project?**
   - ☐ We had never performed such activities ourselves
   - ☐ We infrequently performed such activities ourselves
   - ☐ We occasionally performed such activities ourselves
   - ☐ We frequently performed such activities ourselves

SECTION B – The Client Company

Questions in this section refer to the company that hired your company for this project.

3. **Compared to other client companies, how experienced was this company with . . .**

New product development?	Not very Experienced	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Experienced
Using design consultants?	Not very Experienced	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Experienced

4. **Compared to other companies of similar size, how agile do you consider the client company to be?**
   - ☐ Above average agility
   - ☐ Average agility
   - ☐ Below average agility

> *Agility* can be thought of as the ability of an organization to rapidly adapt to market and environmental changes in productive ways.

SECTION C – The Consulting Project

Questions in this section refer to the project your company was hired to perform.

5. In your opinion, what was the primary reason the client hired a consultant rather than performing this project internally?

_____

_____

_____

_____

_____

_____

_____

_____

Go to Questions 6 - 7 in right column

6. What project requirements were known by your company at the start of the project? *(check all that apply)*

- ☐ Few or none
- ☐ A strategic vision
- ☐ Marketing requirements
- ☐ Technical requirements
- ☐ Detailed technical specifications

7. How novel was the product?

- ☐ New to the world
- ☐ New to the client company
- ☐ A new variant on an existing product made or sold by the client company
- ☐ Incremental improvement or cost reduction of an existing product

8. How familiar are you with the terms of the project contract?

☐ I read the contract ☐ I read the request for proposal ☐ I didn't see either document

9. How challenging did you think it would be to meet the project requirements?

Not very challenging	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very challenging

What particular aspects made it challenging or not? _____

_____

_____

10. How adequate was the schedule allotted for the consulting project?

Not at all adequate	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	More than adequate

11. How adequate was the budget allotted for the consulting project?

Not at all adequate	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	More than adequate	☐ Unfamiliar with budget

12. How adequate was the background information provided by the client in helping you understand the project objectives and constraints?

Not at all adequate	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	More than adequate	☐ Unfamiliar with briefing

SECTION D –Your Company's Project Team

Questions in this section refer to the project team within your company.

13. What was your role on the project?

- ☐ Program developer: negotiated the contract, supervised client relations
- ☐ Project manager: responsible for day-to-day management of project
- ☐ Project team member: contributed technical expertise to the project
- ☐ Other: _____

14. Were you involved in negotiating and planning the project?

- ☐ I led the negotiations/planning
- ☐ I was consulted
- ☐ I was not involved

15. Approximately how many employees of your company were on the core project team?

_____

16. Were all necessary contributors included on the core project team?

☐ Yes ☐ No → **Who was missing?**

_____

_____

_____

_____

17. To what extent did team members within your company agree on the project objectives?

- ☐ Substantial agreement
- ☐ Partial agreement
- ☐ Little agreement

18. How experienced was your project team with the type of product you were developing?

- ☐ No prior experience
- ☐ Some prior experience
- ☐ Extensive prior experience

19. How experienced was your project team with the activities you was hired to perform?

- ☐ No prior experience
- ☐ Some prior experience
- ☐ Extensive prior experience

20. Overall, how qualified do you feel your project team was for the work you were hired to perform?

Not very Qualified	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Qualified

Comments: _____

_____

_____

SECTION E – The Client's Project Team

Questions in this section refer to the project team at the client company.

21. Which of the following roles were represented on the client team? (*Check all that apply, and note that individual team members may have filled more than one role*)

- ☐ A leader
- ☐ A decision maker
- ☐ A project manager
- ☐ A diplomat to the rest of the client company
- ☐ A champion for the project
- ☐ A champion for your company
- ☐ A clear point-of-contact for your company
- ☐ I did not have sufficient visibility to answer this question accurately

22. How satisfied were you with the client project team's . . .

Technical competence?	Not very Satisfied	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Satisfied
Communication skills?	Not very Satisfied	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Satisfied
Project management?	Not very Satisfied	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Satisfied
Commitment?	Not very Satisfied	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Satisfied
Flexibility?	Not very Satisfied	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Satisfied
Consistency of team membership?	Not very Satisfied	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Satisfied
Unity of objectives?	Not very Satisfied	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Satisfied
Inclusion of all necessary stakeholders?	Not very Satisfied	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Satisfied

Comments: _____

_____

_____

_____

_____

_____

SECTION F – Relationship with the Client

This section explores the familiarity of your company and the client.

23. In your opinion, how similar or dissimilar were your company's and the client's . . .

Corporate cultures?	Very Dissimilar	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Similar
Objectives for the project?	Very Dissimilar	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Similar
Expectations for project deliverables?	Very Dissimilar	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Similar

24. How would you describe the client's treatment of your company?

More like a Supplier ☐ ☐ ☐ ☐ ☐ More like a Partner

SECTION G – Evaluation of the Consulting Project Experience

These questions refer to your experience during the consulting project itself.

25. How well did the consulting project compare with the ideal consulting project?

Not very close to the ideal	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	Very close to the ideal

26. Did you experience any problems related to the consulting project?

- ☐ No substantial problems *(skip to question 29)*
- ☐ Some problems
- ☐ Serious problems

27. During which phase(s) of the project did you experience problems?

- ☐ Specification of, and agreement upon, project requirements by the client
- ☐ Negotiation of the project contract
- ☐ Briefing of my company/project team on the project requirements
- ☐ Development work by my company
- ☐ Development work by the client
- ☐ Communication with the client
- ☐ Coordination with the manufacturer or other parties
- ☐ Transfer (i.e., delivery) of my company's work to the client
- ☐ Dissemination and acceptance of my company's work within the client
- ☐ Refinement of my company's work by the client after the conclusion of the project

28. What problems did you experience? In what phase(s) did they occur?	**How severe was each problem? Was the problem resolved?**
•	Not very Severe ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 Very Severe Resolved? ☐ Yes ☐ No
•	Not very Severe ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 Very Severe Resolved? ☐ Yes ☐ No
•	Not very Severe ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 Very Severe Resolved? ☐ Yes ☐ No

29. Compared to other projects you have worked on, how involved was the client in this project?

Not very Involved	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Involved

30. How consistent were the project requirements over the course of the project?

Not very Consistent	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Consistent

31. How good was your working relationship with the client on this project?

Not very good Relationship	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very good Relationship

32. How confident are you that the client will always act in your best interest?

Not very Confident	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Confident

33. To what degree do you consider this project a success?

Not very Successful	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	Very Successful

Why did you answer Question 33 the way you did? _____

_____

_____

_____

SECTION H – Evaluation of Contractual Performance

Please assess the degree to which the requirements of the project contract were met. If you are unfamiliar with the terms specified in the contract, check the box to the right of the question.

34. To what extent were the performance requirements specified in the contract fulfilled?

Failed to meet requirements	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Exceeded requirements	☐ Unfamiliar w/ contract

35. When was the project completed relative to the schedule specified in the contract?

Behind schedule	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Ahead of schedule	☐ Unfamiliar w/ contract

36. How much did the project cost the client relative to the budget specified in the contract?

Over budget	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Under budget	☐ Unfamiliar w/ contract

37. Considering both the cost of the project and the benefits the client obtained from it, how would you rate the value of the consulting project to the client?

Poor value	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Excellent value	☐ Unfamiliar w/ contract

SECTION I – Project Outcomes

Questions in this section refer to outcomes related to your company's work on the project. The outcomes may have occurred after the actual consulting engagement.

38. Did any awards result from your company's work on the project?

☐ Yes ☐ No ☐ I don't know

39. How satisfied do you think the client is with your company's work on this project?

Very dissatisfied	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	Very satisfied

SECTION J – Project Outcomes for Your Company

Please evaluate the impact of the consulting project on your company.

40. Compared to other projects with similar budgets, how financially profitable was this project for your company?

Not very Profitable	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Very Profitable

41. Compared to other projects with similar budgets, to what degree did this project . . .

Lead to additional business?

Well below Average	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Well above Average

Contribute to your company's sales and marketing efforts?

Well below Average	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Well above Average

Enhance your company's capabilities?

Well below Average	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Well above Average

Contribute to your staff's morale and personal development?

Well below Average	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	Well above Average

42. What is your overall satisfaction with this project?

Very dissatisfied	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10	Very satisfied

43. Is there anything else you would like to add?

_____

_____

_____

_____

_____

_____

_____

_____

Please create an account to anonymously access study results at http://web.mit.edu/ipd

User Name: _ _ _ _ _ _ _ _ _ Password: _ _ _ _ _ _ _ _ _

This concludes the survey. We appreciate the time and effort you have taken to answer our questions.

As a token of our appreciation, we would like to share our study results with you. They will be posted under password protection at the study website:

http://web.mit.edu/ipd

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You may wish to write the login information below, and remove and save this cover page for future reference.

User Name: _ _ _ _ _ _ _ _ _ (min. 6 characters, including one letter and one number)

Password: _ _ _ _ _ _ _ _ _ (min. 6 characters, including one letter and one number)

Please use the enclosed postage-paid envelope to mail your survey to:

William Palm
Massachusetts Institute of Technology
77 Massachusetts Ave., Room 3-471
Cambridge, MA 02139-4307

Surveys should be mailed by _____.

THANK YOU FOR YOUR PARTICIPATION