DISSERTATION

QUALITATIVE COMPARATIVE ANALYSIS OF SOFTWARE DEVELOPMENT PRACTICES TRANSLATED FROM SCENE TO SCREEN USING THE REAL-TO-REAL METHOD FOR INTER-INDUSTRY LEARNING

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ABSTRACT

QUALITATIVE COMPARATIVE ANALYSIS OF SOFTWARE DEVELOPMENT PRACTICES TRANSLATED FROM SCENE TO SCREEN USING THE REAL-TO-REAL METHOD FOR INTER-INDUSTRY LEARNING

Many projectized industries, in fields as diverse as healthcare, live theater, and construction, have developed sets of specific project management practices that are consistently associated with success. These practices – assignable activities, tasks, processes, and methods – have been acquired through decades of lessons painfully learned by project teams. Well-known, existing processes allow project teams to capture and disseminate these *best practices* and *lessons learned* between projects and across organizations, allowing new teams to benefit from previous efforts. Although overall progress may at times seem fitful, these knowledge-sharing processes have allowed each industry to improve their project management methodologies over time. Unfortunately, the specificity required to make a practice actionable, assignable, and beneficial within the domain of one industry also renders it difficult to apply in another. There is no formal method, or method in widespread use, for the translation of specific project management practices across the boundaries of industry and knowledge domains. As a result, most of the benefits of these learnings - each industry's collective knowledge of best practices – are restricted to their original domain, providing little guidance to project teams in other industries.

This research examines several previous attempts to apply project management practices across multiple domains and synthesizes a novel method for such inter-industry learning. The *Real-to-Real* method presented here begins by identifying potential barriers to project success

within a target industry. Next, an industry that has developed different approaches to similar challenges is chosen as a source of inspiration. After holistically examining project management practices within that source industry, a set of evident principles is synthesized through an iterative process of inductive reasoning which explain that industry's approach to project management and these shared challenges. Using these principles as a transformative intermediary, a set of specific practices suitable for the domain of the target industry can then be identified or developed, mirroring or paralleling practices used in the source industry. These practices may lead to improved project outcomes when used in target industry projects that have characteristics similar to those found in the source industry. This method may allow for the translation and practical application of hard-won project management expertise across many projectized industries, potentially improving project outcomes in multiple fields.

To provide an illustrative example of the Real-to-Real method in use, the software development industry is selected as an example target, and barriers to project success in that domain are examined. A review of the existing literature finds that the lack of simple, heuristic guidance on tailoring existing practices to better support hedonic requirements, which specify the intended emotional response of the user, may be a significant source of risk within the target industry, although the effect of hedonic requirements on project outcomes has not yet been empirically determined. With this potential source of risk in mind, the film industry is selected as a source of inspiration, as projects there share many similarities with software development projects and must routinely consider hedonic requirements. A holistic evaluation of film production project management practices suggests four evident, explanatory principles guiding that industry's approach to managing projects. This research then identifies and proposes a set of specific practices, suitable for software development projects, which also support or adhere to these same principles, thus mirroring practices used in film production projects.

To support these findings, the identified software development practices are situated within existing theory, and potential mechanisms by which they may consistently lead to improved project outcomes when used in projects with high levels of hedonic requirements are discussed. A series of semi-structured interviews with experienced practitioners in the film industry are then conducted to verify an accurate understanding of film production project management practices, the synthesized explanatory principles, and the pairing of each principle to a set of related practices through. Next, a second series of interviews with experienced practitioners in the software development industry is used to verify the selection of software development practices supporting these principles. To empirically validate these findings, and to determine the effect of hedonic requirements on project outcomes, a practitioner survey is then conducted, measuring project success, use of the identified practices, and the level of hedonic requirements in 307 software development project cases in five culturally similar countries.

First, the perceived criticality of hedonic requirements is compared to five measures of project success, to determine the impact of such requirements on project outcomes. Then, using Qualitative Comparative Analysis, causal recipes of the identified practices that consistently resulted in project success, across these same measures, are identified for projects with varying levels of hedonic requirements. These results validate the benefits of the identified principles and practices to projects with high levels of hedonic requirements, and provide simple, heuristic guidance to software development project teams on how to quickly and effectively tailor their management practices to better support individual projects based on the criticality of such requirements. This guidance may serve to significantly improve outcomes in software development projects with high levels of hedonic requirements. These results also help to validate the Real-to-Real method of translating management practices across industry and knowledge domains, potentially enabling additional opportunities for valuable inter-industry learning.

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Although all ideas presented are the author's own, and all content in this paper was produced by the author, ChatGPT, an artificial intelligence-based tool, was used to validate the grammar, spelling, and structure of all text in this manuscript.

AUTOBIOGRAPHY

My first exposure to *project management* was as an enlisted soldier in the US Army, although I didn't know it by that name at the time. I was lucky to serve during a rare period of peacetime, so much of my enlistment was spent participating in large-scale training exercises involving thousands of soldiers. I was alternately intrigued and frustrated. Some maneuvers proceeded like clockwork, with supplies and personnel arriving exactly when and where they were intended. Others descended into confusion, with seemingly no plans unfurling without snarl. I remember spending an afternoon standing in the Texas sun with hundreds of other soldiers, hungry because we hadn't managed to correctly rendezvous with our own supply trucks, while knowing there were fast-food restaurants a short walk away that we weren't allowed to visit for the duration of the simulated mission.

After completing my enlistment, I was able to continue my education at Portland State University with the benefits of the GI Bill. I wanted to learn how such large-scale, complicated efforts could be planned and managed effectively. One bachelor's degree in Supply Chain and Logistics Management and another in Financial Management provided my first toolbox of techniques for estimating, planning, and tracking complex sets of interrelated activities, but I felt neither gave enough insight into successfully leading teams. Thankfully, after completing my undergraduate degrees, I was awarded a scholarship to continue on to the university's Master of International Management program, which focused on cross-cultural communication and the challenging of leading geographically dispersed and culturally diverse teams.

After graduation, I began working on IT project teams and eventually earned my Project Management Professional and Agile Scrum Master certifications. During my career, I observed the software development industry continuously struggle to achieve success with the available management techniques.

Although it predated my own career, reading one post-mortem report detailing a particularly egregious example of project failure provided another impetus to understand why some projects fail disastrously while other, seemingly similar projects, achieve success. In 1998, DreamWorks Interactive released *Trespasser*, a PC-game based on the film *The Lost World*, the then-recent sequel to *Jurassic Park* (Grossman 2003, 183). Its release was intended to coincide with the premier of the much-anticipated film, but despite a short development window of only 36 months available before that immoveable deadline, the program team publicly announced plans for an entirely new type of physics engine, which was to be developed from scratch (Grossman 2003, 189). The game ultimately shipped a full year late, and then only after a reduction in scope so drastic the result was crowned "Worst Game of the Year" by reviewers (GameSpot.com 1998). The game is viewed from the player-character's first-person point of view, but the developers had so much difficulty in getting both of the character's arms to operate correctly that the left arm was eventually erased entirely. As a result, the single remaining arm was forced to bend in impossible ways to perform actions originally intended for a character with two arms, such as reloading (Grossman 2003, 193). One review began "Trespasser is the most frustrating game I have ever played. Of all the games I have ever reviewed, this one has been the most disappointing. Of all the games I have played, this is the one I am most adamant about never wanting to play again (Chin 1998)." Another stated "Of all the games released this year, none was as ill-received and terrible as Trespasser. No game was implemented as poorly, and no game squandered its potential as much […] Trespasser was undoubtedly the worst game of 1998 (GameSpot.com 1998)."

The project team's post-mortem report explained that "[Trespasser] suffered from being an innovative, technologically ambitious project produced by a team with little previous management experience at a company which had not yet gained institutional experience from publishing significant, less-ambitious projects (Grossman 2003, 193)." Comparing that reality with the team's original plans to produce revolutionary gameplay reveals the limitations of the estimation techniques in use, which did not forecast the effort required to any useful degree of accuracy. To a – thankfully - much lesser extent, my own projects often faced similar challenges in accurately estimating project work.

While my own career did not include the development of any games, I led teams on a wide variety of software-related projects, including the development of new-to-the-world software, software-as-a-service adoption, enterprise software configuration and deployment, data center migrations, go-to-market product launches, and the integration of newly acquired companies. I have led teams that were co-located and who enjoyed a long, shared history, and newly formed 'virtual' teams spread across the globe. I have managed programs with multiple teams spread across multiple companies, and have traveled across North America, Europe, and Asia while attempting to forge better teams and increase project success.

At the same time, I have remained a lifelong student. After earning my Project Management Professional (PMP) certification from the Project Management Institute, I moved on to newer methodologies such as Agile Scrum and Extreme Programming. I was able to incorporate their lessons into my work, but still felt that there was an underlying mismatch between the nature of the work being performed and the management techniques being brought to bear.

Another example of project failure which drove me to pursue this research occurred in my hometown of Portland, Oregon, early in my IT career, when the city attempted to implement common business software across all 16 city bureaus. Launched in 2006 with a 14-month timeline and a budget of $14.2 million, the program ultimately consumed over $47 million and took 40 months to complete, and only after drastically reducing scope. And while the program was originally promoted as a way of reducing maintenance costs, the delivered system was ultimately estimated to be more expensive to maintain than the original (Griffin-Valade, Kahn and Richards 2010, 20). Although I wasn't involved in the project, the news reports and eventual post-mortem furthered my interest in improving the industry's management practices – and in trying to avoid generating any similar headlines!

The disconnect I perceived between the available management practices and the types of project requirements that the industry most often struggled to manage led me to a second Master's degree, this one in Major Programme Management at the University of Oxford. There, I explored the research of project management and attempted to look outside of the software development industry for potentially applicable practices. Due to the similarities discussed elsewhere in this paper, the film production industry became my focus for inter-industry learning. After completing that program, I adapted my research into a book on my proposed project management techniques, published as *Hollywood Software Development* (Hawkey, Managing Major Projects: Hollywood Software Development 2016). This dissertation renders that book out-of-date, and I have now removed it from sale.

Near the end of my career in project management, I was asked to help improve and formalize project management processes at a large, multinational firm. During that effort, they shared with me the results of one of their recent projects, which had made the dangers of their existing processes clear. While negotiating to provide a bundle of legal services, their sales team had also been asked if their firm could build the client a website, with a brief discussion of that site's requirements. Without seeking input from anyone on the development team, the sales personnel concluded the development costs would be minimal, and quoted an additional fee of $5,000 to cover the work. The client accepted, and the requirements were passed to the development team, who then consumed approximately $80,000 in labor costs completing the website. During development, and without consulting with either the sales team or the client, the development team also added several additional features to the website which seemed eminently desirable to them, despite not having been requested by the client. This eventually drove development costs past the six-figure mark. Unfortunately, when the completed website was presented to the client, they naturally objected to the additional unasked-for features, and the additional rework necessary to remove them caused the project to ultimately cost the firm around $130,000, after billing the client just $5,000. Although the causes of failure may seem clear in this example, seeing repeated examples of similarly disastrous projects throughout my career eventually made me determined to complete this research.

In parallel with my education and my work as a practitioner, I also enjoyed a successful career as an educator. While working as an IT Project Manager during the day, I taught business courses at Portland Community College during evenings and weekends for twelve years. I taught Introduction to Business and Introduction to Marketing, and developed and taught the capstone course for the college's certificate on project management. Later, I served as the only practitioner and subject matter expert on the development team for an online course on Leading Strategic Projects at the University of Oxford. My teaching experience helped me to better communicate complex ideas and establish consensus on the project teams that I managed as a practitioner, and provided a forum to further refine the ideas that I'd developed as a student.

Balancing my continuing education, my work as an IT project manager, and my time as an instructor was a rewarding challenge, although I am glad those days are behind me. For years, however, I've felt the need to consolidate what I've learned and to complete the research needed to form more complete theories - and hopefully help to prevent disastrous projects like the examples that I've shared above. Although I am no longer an active practitioner, I hope the research detailed in this paper reduces some of the stress and uncertainty in other's projects.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

The following abbreviations are used in this dissertation:

fsQCA	Fuzzy-Set Qualitative Comparative Analysis
IATSE	International Alliance of Theatrical Stage Employees
IRB	Institutional Review Board
IT	Information Technology
NASA	National Aeronautics and Space Administration
PMI	Project Management Institute
PMP	Project Management Professional
QCA	Qualitative Comparative Analysis
ROI	Return on Investment
UI	User Interface
UX	User Experience

CHAPTER 1: THE REAL-TO-REAL METHOD OF INTER-INDUSTRY LEARNING

Introduction

Many industries are projectized, with temporary teams assembling to meet business needs only as they are needed. Industries as diverse as construction, emergency response, and live theater performance all rely on the work of project teams, and each industry has developed an independent body of knowledge detailing *what works* and *what doesn't* based on decades of hard-won experience. Practitioners within these projectized industries benefit from lessons learned by teams in prior projects, as each industry seeks to increase efficiency, reduce the risk of project failure, and improve project outcomes over time. Depending on context, effective management practices may be captured in project retrospectives, formal literature, apprenticeship programs, or after-action reports, each of which allows for the collection and sharing of knowledge within an industry. Unfortunately, despite the value of these learnings, the specificity required to make a practice actionable and assignable within the domain of one industry also makes it difficult to transfer between industries. As a result, the bulk of each industry's best known methods remain locked within their original domain, providing little benefit to practitioners in other industries.

In this introductory chapter, I examine four previous attempts translating project management *best practices* across industries. Using these examples, I then synthesize and propose a complete method for translating specific management practices – assignable activities, tasks, processes, and methods – between industries. This Real-to-Real method allows practitioners to examine project management practices within one industry and identify or develop specific practices suitable for another domain which mirror or parallel management those of the original industry. These translated practices may lead to improved outcomes when used in projects with characteristics similar to those in the original industry. This method enables new opportunities for the sharing and translation of knowledge between projectized industries and professional domains, potentially leading to improved project outcomes in multiple fields.

To validate the Real-to-Real method and provide a detailed example of its use, I then apply it in Chapter Two in an attempt to improve project outcomes in the software development industry. Drawing on an extensive literature review, I identify the lack of existing management practices addressing hedonic requirements, which detail the intended emotional response of the user, as a potential source of risk to software development projects. After examining that challenge and identifying the film industry as a potential source of relevant inspiration, I use the Real-to-Real method to identify a set of management practices suitable for software development which mirror film production practices. After situating the identified software management practices within existing theory, two series of interviews with experienced practitioners in both industries are conducted to verify their accurate reflection of film production practices. The benefits of these practices to software development projects with characteristics similar to film production projects – i.e. those with critical hedonic requirements – is then empirically validated through an analysis of 307 software development project cases. The results may lead to improved outcomes for software development projects by providing simple, heuristic guidance on how to quickly and effectively tailor existing management practices to support hedonic requirements, and also support the use of the Real-to-Real method in the translation of management practices between additional industry pairings.

The Value and Challenges of Inter-Industry Learning

Collaboration across industries can be challenging. Practitioners in separate industries acquire differences in vocabulary, management structures, beliefs in the relative importance of personal attributes, and many other factors, all of which contribute to incompatible mental models

(Edmondson and Harvey 2018). For example, in software development projects, mental models include each programmer's internal representation of how the software works (Vans 1996), while in live theater projects, they may be predicated on each character's *spine*, or underlying motivation (Lehner 2009). These differences form conceptual boundaries, hindering the flow of information between industry and knowledge domains (Edmondson and Harvey 2018). In addition, face to face interaction is often preferred when communicating complex procedures, which creates an additional barrier to inter-industry knowledge transfer (Spraggon and Bodolica 2012). As a result, process transfer across industries occurs more rarely than process elaboration within industries, and knowledge acquired through experience in one domain may remain localized within that context, never translated or generalized for use in others (Hawkey 2016).

In addition, while one might logically expect an organization's conceptual 'toolbox' of management practices to grow with experience, these barriers to inter-industry learning may also slowly reduce the set of practices used, as some become codified as *best known methods* (Eisenhardt and Martin 2000).' Teams can become deeply rooted in these familiar, inertial routines, engaging in only the slow and linear elaboration of existing knowledge, and discouraging more drastic changes and advances (Eisenhardt and Martin 2000).

Innovation, and the development of new management practices, requires the recombination of old ideas in new ways (Hargadon 2002). Learning is shaped by past knowledge, and to innovate, individuals, project teams, and organizations must decouple existing knowledge from the domain in which it was learned before it can be reframed to be valuable in another (Hargadon 2002). Unfortunately, even management practices proven to be successful in one domain can lead to failure when applied outside of their original context, without careful adaption through such reframing, which requires an understanding of both the source and target industries (Philipp, Tobisch and Matthes 2022, Wallace, Iyer and Chen 2022).

Conceptual boundaries between industries thus inhibit the translation of domain-specific knowledge, but without the cross-pollination of ideas, innovation within each industry is also reduced. As a result, the potential value of inter-industry learning increases over time, as the bodies of knowledge in each industry grow increasingly disparate. Research on collaboration has found that partnerships between firms separated by a large cognitive distance result in greater levels of innovation (Enkel and Heil 2014). Conversely, when partners share similar knowledge bases, the innovative results of collaboration may be reduced through cognitive lock-in on existing expertise, and new technologies and possibilities may be obscured (Enkel and Heil 2014).

Translating Project Management Practices Across Industries

Between project retrospectives, port-mortem reports, mentorships, and the work of Project Management Offices, opportunities for the sharing of best practices within an industry abound. Lessons learned in one project may need to be generalized for use in other projects within the same industry, but the level of abstraction required is relatively low, as experienced practitioners in the same industry often share similar knowledge bases and mental models (Edmondson and Harvey 2018). Project management practices have matured at varying rates across different projectized industries, resulting in diverse levels of process maturity in how projects are managed and suggesting the value of translating specific practices across industries (Cooke-Davies and Arzymanow 2003). Unfortunately, based on an extensive review of the existing literature and my own professional experience, there is no formal method, or method in widespread use, for the translation of specific management practices between industry and knowledge domains. The potential value of such inter-industry learning suggests that a generalized, repeatable method should be created.

There have been several notable, discrete attempts at such translation, from which it is possible to draw inspiration. The following four efforts have each used slightly different methods, but each has resulted in valuable insights. This set forms the exemplars upon which my method will be based.

From Live Theater to Product Development

Noting that the history of live theater is much longer than that of modern project management, and may therefore be a valuable source of inspiration, this research begins by establishing the similarities between product development projects and live theater productions (Lehner 2009). For example, in comparison to other types of projects, such as engineering, both product development and live theater productions have relatively low analyzability, high dynamism and uncertainty, and frequently have unclear and conflicting goals (Lehner 2009). After establishing that the inherent conflict between these characteristics and traditional project management methodologies may form a barrier to success for product development projects, traditional project management practices for product development projects are reviewed. Then, four principles, derived from live theater practices and the methods of classical theater directors, are proposed as a novel method for managing product development projects (Lehner 2009). Each principle is associated with specific practices in both industries. For example, in live theater projects, the director must interpret the text to refine the fit between the play and the lead actors. Similarly, "the project plan for product development projects is only a coarse description of…roles and responsibilities. It needs to be interpreted like a dramatic text (Lehner 2009)." These specific practices are therefore each a domain-specific application of the principle *Casting and Interpreting* *a Text*, with each generalized live theater principle forming a separate conceptual bridge for the translation of practices between industries.

From Software Development to Product Development

This research examines, as case studies, six firms in a variety of industries that have each adapted Agile Scrum practices to the development of physical products (Cooper and Sommer 2018). These Agile practices, such as time-boxed sprints of activity and short meetings to discuss each day's plan, have been used to develop hybrid management methodologies combining elements of Agile Scrum with traditional production management techniques.

Each firm studied had been using this hybrid model for at least two years, and each reported increased design flexibility, improved productivity, moral, and communication, among other benefits, although these benefits had not been objectively measured in most cases (Cooper and Sommer 2018). The interviewed firms also reported experiencing similar challenges, such as struggling to integrate inconsistent concepts between Agile Scrum and traditional product development methodologies, mitigating management skepticism, and difficulties in producing a concrete product within the standard two-week sprint recommended by Agile Scrum (Cooper and Sommer 2018).

To resolve these problems, teams adopting the hybrid methodologies turned to the core principles defined in the Agile Manifesto (Highsmith and Cockburn 2001) for inspiration (Cooper and Sommer 2018). These principles provided guidance in the development of new practices, suitable for product development, that mirrored Agile Scrum practices as closely as possible. For example, to support manufacturing departments' need for long-term plans while adhering to the Agile principle of "responding to change over following a plan (Highsmith and Cockburn 2001)," these new hybrid methodologies called for creating a schedule of tasks, tentative but similar to a traditional project plan, based on the best estimates available at the initiation of each stage (Cooper and Sommer 2018).

Adoptees found that the new hybrid methodologies were most valuable when used in product development projects with high levels of ambiguity and uncertainty (Cooper and Sommer 2018). Software development projects, where the Agile principles originated, have similar characteristics. If this parallel holds true in other attempts at translating management practices between industries, it suggests that practices translated between domains via explanatory principles may be most valuable when used in projects similar to those found in the industry providing inspiration.

From Oil and Gas to Construction

After management practices in the construction industry appeared to stagnate, research turned to the oil and gas industry for inspiration (Mejlænder-Larsen 2019). Beginning with an evaluation of the similarities between projects in the two industries and the relatively high recent proliferation of new practices within the oil and gas industry, interviews with oil and gas practitioners were then used to develop a set of case studies (Mejlænder-Larsen 2015).

Believing that the successful transfer of knowledge between these industries depended on separating key learnings from the culture and work principles in which they originated, this effort relied on codification and conceptual generalization, resulting in a set of easily communicated, identifiable rules (Mejlænder-Larsen 2015). These codified rules, organized in three overarching themes of people, process, and technology, were used to develop a Project Execution Model, a new hybrid methodology for managing construction projects incorporating specific practices adapted from oil and gas projects (Mejlænder-Larsen 2019). Although the benefits of this translation have not yet been measured in practice, the resulting domain-specific construction practices appear to accurately reflect practices used in oil and gas projects.

From Manufacturing to Construction

In perhaps the most successful of these examples, project management principles drawn from manufacturing influenced the development of a new methodology for construction projects, Lean Construction (Abdelhamid, El-Gafy and Salem 2008). Development of this methodology began with a thorough analysis of the three primary approaches to manufacturing: craft, mass, and lean (Koskela 1992). Consideration was given to the historical and scientific origins, governing characteristics and attributes, and associated advantages and disadvantages of each approach (Abdelhamid, El-Gafy and Salem 2008).

Traditional construction management practices viewed construction projects primarily as the process of converting raw materials to a finished product – a view similar to that in traditional manufacturing practices (Koskela 1992). Inspiration drawn from the newer principles of Lean Manufacturing allowed practitioners to reframe construction projects as three basic flows: the design process, the material process, and the work process (Koskela 1992). This conceptual change allowed for the application of process improvement techniques (Koskela 1992). Principles from Lean Manufacturing, such as the elimination of waste and the just-in-time delivery of materials, were then used to develop new practices for construction projects (Koskela 1992). Construction projects managed with the resulting Lean Construction methodology are easier to manage, safer, completed sooner, cost less, and are of better quality (Abdelhamid, El-Gafy and Salem 2008).

The Real-to-Real Method for Inter-Industry Learning

These exemplars share several notable characteristics which inform the construction of the Real-to-Real method. Each case began with an analysis of potential barriers to project success within an industry, such as the high dynamism and uncertainty in product development projects (Lehner 2009). A second industry, in which projects face the same set of challenges, was then identified as a source from which to draw inspiration – in that example, live theater projects, which face similar dynamism and uncertainty (Lehner 2009). Then, as was noted in the effort to adapt manufacturing practices to construction projects (Abdelhamid, El-Gafy and Salem 2008), an exhaustive analysis of project management practices in the second industry was conducted, often delving into the historical evolution and goals underlying each specific practice.

Through an iterative process of inductive reasoning, analysis of these managerial practices revealed the nature of these more fundamental goals shaping the second industry's approach to managing projects. Each specific practice was only one means by which to achieve these underlying goals, often referred to in these examples as principles, and it was these abstract principles that were often used as a conceptual bridge between industries. Teams that attempted to adopt specific practices from other domains directly, as when product development projects attempted to apply Agile software development practices, were less successful than those who attempted to develop new, domain-specific practices that also supported or adhered to the identified principles (Cooper and Sommer 2018).

These abstract principles allowed for the codification and conceptual generalization of key learnings in one industry (Mejlænder-Larsen 2015) and the development of new practices, suitable for a second domain, which conceptually mirror the original. Lastly, it is noteworthy that the resulting translated practices were found to be of most value when used in projects with characteristics similar to those found in the second industry and the domain in which their reflective counterparts originated (Cooper and Sommer 2018).

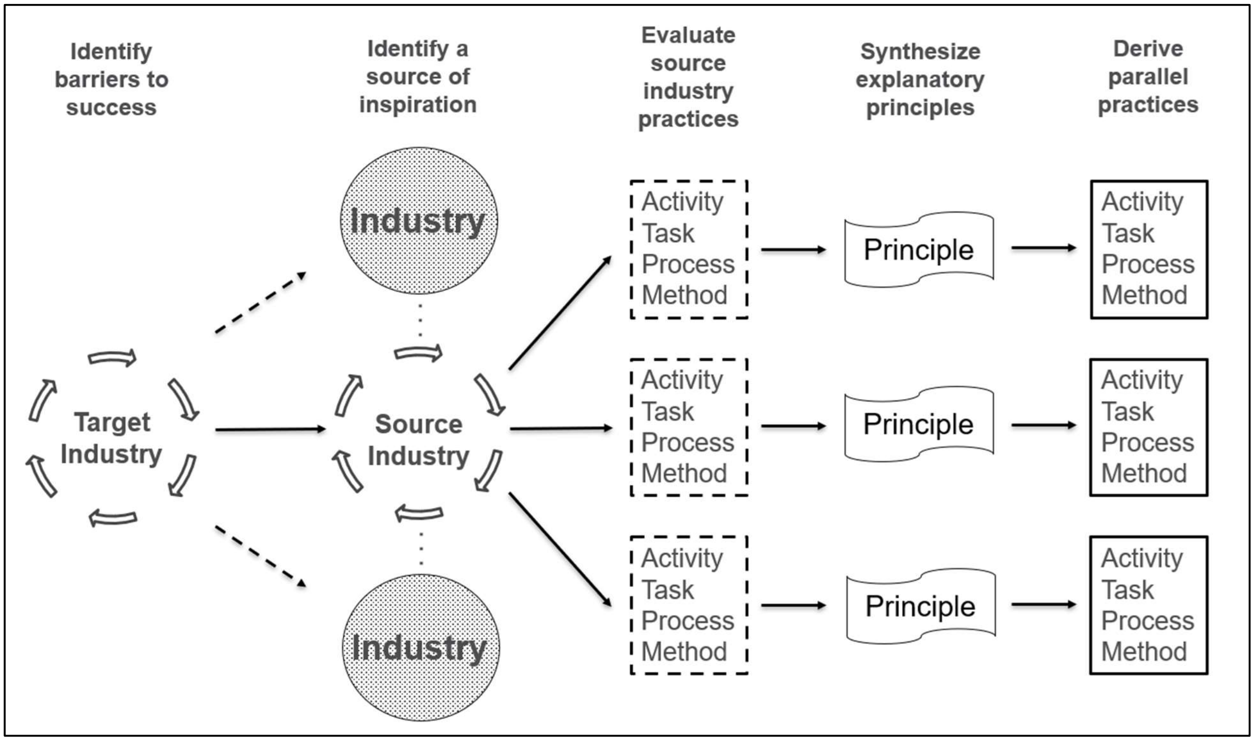

***Figure 1**: Illustration of the Real-to-Real Method of Inter-Industry Learning*

The full process, illustrated in **Figure 1** above and detailed in **Table 1** below, is therefore composed of five steps. The method begins, as evidenced in the exemplars discussed above, with an assessment of potential barriers to project success within an industry (Step 1). As this first industry is the intended recipient of the effort, it is designated as the *target*. Next, a second industry, sharing those same project challenges, is selected for study (Step 2). This second industry is designated in this method as the *source* of inspiration, and may have developed different approaches to managing these shared difficulties. Project management practices within that source industry are then evaluated, again as seen in the selected exemplars (Step 3).

To enable the translation of these practices to another domain, it is now possible to draw on this analysis to synthesize a set of explanatory principles (Step 4). The specific practices found in the source industry are each a means to actualize these guiding principles, or methods to achieve each underlying goal. The resulting principles should be both more abstract and more generalized than the assignable activities, tasks, processes, and methods that form the set of examined practices. Accurate construction of each principle relies on a thorough understanding of the source industry, including the mental models informing that domain, and verification with previous research or experienced source industry practitioners may add important context.

It is now possible to derive a set of specific, assignable practices, suitable for the target industry, which also support or adhere to these same principles [Step 5]. This may include the identification of and increased focus on existing practices found within that industry. Alternatively, it may be necessary to develop novel practices to more fully support each principle. This work again relies on a comprehensive understanding of project management within the target industry, and verification of these practices and their relationship to each principle with expert target industry practitioners and the existing literature may provide valuable insights. It is now possible to investigate whether the identified practices lead to improved project outcomes when used in target industry projects with characteristics similar to those found in the source industry.

The complete method therefore starts with concrete, assignable practices in one industry, elevates to the level of abstract principles, then drives back down to real-world, tangible practices in another, thus leading from 'Real-to-Real.'

To continuously drive the advancement of project management theory, it is necessary to generalize abstract guidance, suitable for any industry, from practitioner experience. The direct translation of managerial practices using the Real-to-Real method involves a lower level of abstraction, however, in which valuable practical information on the implementation of each principle in the source industry is retained to shape parallel applications within the target industry.

The preservation of this domain-specific information on the assignable tasks and duties that have been used to successfully reify each principle is critical for the accurate translation of management practices between industries. The Real-to-Real method does not replace or lessen the importance of the industry-agnostic guidance necessary to continually mature the discipline as a whole. Instead, it provides a method for the sharing of *best practices* between industries, and allows practitioners in one industry to benefit from the experience and body of knowledge developed within another.

Table 1: *The Real-to-Real Method of Inter-Industry Learning*

1	Assess potential barriers to project success within a **target** industry
2	Identify, as a **source** of inspiration, another industry that has developed different approaches to similar challenges
3	Holistically evaluate project management practices used in that source industry
4	Synthesize a set of explanatory principles those practices evidently support
5	Identify or develop practices suitable for the target industry which also support or adhere to these principles

Significance of the Method

The opportunities for adapting project management lessons learned within one industry to another seen in the four example efforts discussed above may represent only a small fraction of the available possibilities. Many other potential industry pairings may also be feasible, including simply reversing the flow of ideas between each of these first four examples. The Real-to-Real method presented here allows for a shared vocabulary and conceptual model between such efforts, and a standardized process suitable for use in any projectized industry. The method is offered in hopes of increasing the sharing of best practices and painful experience between industries, and of enabling the creation of specific, assignable activities, tasks, processes, and methods that mirror beneficial practices originally developed in other domains.

Summary

This introductory chapter discussed the barriers preventing the application of lessons learned in project management across industries, and examined the potential value that may be found by enabling opportunities for such inter-industry learning. After analyzing four noteworthy efforts at translating specific project management practices across industry and knowledge domain barriers, a complete method was proposed, incorporating process steps drawn from these examples.

Chapter Two provides a detailed example of the Real-to-Real method in practice, proceeding stepwise in the translation of management practices from the film production industry to software development projects. Four principles are found to inform the film industry's approach to project management and are used to identify sets of parallel existing practices within the software development industry. The resulting practices, mirroring those found in film production, are then situated within existing theory, and potential mechanisms by which they may lead to improved project outcomes when used in software development projects with characteristics similar to those found in film production projects are discussed.

In Chapter Three, methods for first verifying, then empirically validating these findings are outlined. The results of this example use of the Real-to-Real method were first verified through two series of structured interviews with experienced practitioners in both the film production and software development industries, confirming an accurate reflection of practices across each intermediating principle. Then, a survey of experienced practitioners in the software development industry, measuring project outcomes, the criticality of hedonic requirements, and practices used, was conducted to construct 307 project cases. These cases were first used to examine the relationship between hedonic requirements and project outcomes, across five measures of success.

Then, an iterative process of Qualitative Comparative Analysis (QCA) was used to validate the effect of the identified practices on project outcomes in projects with varying levels of hedonic requirements – i.e., in software development projects with characteristics more and less similar to film production projects.

The results of these confirmatory steps are presented in Chapter Four, along with combinations of the identified practices which consistently led to improved project outcomes in software development projects with varying levels of hedonic requirements from the set of project cases. The value and implications of these findings are then synthesized and discussed in Chapter Five. In the final chapter, the illustrative use of the Real-to-Real method is concluded, key implications for both researchers and practitioners are highlighted, and opportunities for future research are presented.

CHAPTER 2: TRANSLATING MANAGEMENT PRACTICES FROM SCENE TO SCREEN

This chapter provides a detailed example of the Real-to-Real method presented in Chapter One. Here, best known practices and lessons learned within one industry are translated into specific, assignable tasks and duties suitable for use in another. Each step in the method is detailed in **Table 1** and illustrated in **Figure 1**. Although this effort represents only one possible use of the method, the results are of potential value to the target industry selected below and provide validation of the Real-to-Real method in general.

Step One: Assess Potential Barriers to Success Within a Target Industry

The Real-to-Real method begins by identifying potential barriers to project success in a *target* industry. While there are many industries that could potentially benefit by adopting or adapting practices developed in other domains, the software development industry, where project outcomes have remained problematic for decades (Flyvbjerg, Budzier and Lee, et al. 2022) is a particularly relevant example. This industry has been chosen as the target for this example of the Real-to-Real method, in part as extensive experience managing projects within this field may help to shape this research. Many other potential targets for inter-industry learning exist, but this practitioner experience may provide additional insight and help to inform this illustrative effort. To complete this step of the method, it is now necessary to examine potential barriers to project success within this example target industry, and to choose one that may benefit from the application of lessons learned in other industries.

History and Evolution of IT Project Management Practices

IT project management began with *predictive* methodologies, commonly known as 'waterfall' or 'big-bang,' which were originally adapted from methods developed to manage earlier large-scale engineering projects, and which attempt to foresee and estimate all work in advance (Bennington 1983, Project Management Institute 2021, Wysocki 2019). These proved to be a poor fit for many software projects, and *adaptive* methodologies such as Agile Scrum were developed in response (Highsmith and Cockburn 2001, Cohn 2004), which rely on shorter planning horizons and the incremental delivery of completed features (Project Management Institute 2021). Adaptive methodologies have grown in popularity over time, although predictive methodologies remain in widespread use (Butler, Vijayasarathy and Roberts 2020, Reed and Angolia 2023).

Software Project Outcomes

Software projects, whether tasked with developing new-to-the-world software or configuring and implementing off-the-shelf solutions, face significant risks of going over budget, over schedule, and of failing to deliver expected value. One study of 5,600 IT projects by McKinsey & Company, a global management consulting firm, and the University of Oxford found that software projects were, on average 66% over budget, 33% over schedule, and delivered 17% less value than expected (Bloch, Blumberg and Laartz 2012). Other studies have found these risks are both stable and persistent over time. A larger analysis of 5,392 IT projects, completed between 2002 and 2014, across 66 countries on six continents by a mix of public and private enterprises, with a total budget of $74 billion in 2024 dollars, found that the risk of cost overruns did not vary significantly between public and private enterprises, by project size, project type, or project year (Flyvbjerg, Budzier and Lee, et al. 2022, adjusted for inflation). A later analysis of 617 software projects found that only 28% were implemented successfully, and that success rates have remained similarly low for at least ten years (Khoza and Marnewick 2020). The risks of failure are significant, and their endurance over time suggests the need to thoroughly evaluate the management practices currently being used.

While small overages may be survivable for many organizations, software development projects also risk catastrophic project overruns. An analysis of 1,355 public-sector IT projects found that more than one out of four software implementation projects and 18% of custom software development projects finished at least 130% over budget and 40% over schedule (Budzier and Flyvbjerg 2012). Another analysis of 1,471 IT projects found that while the average project cost overrun was a still-significant 27%, one out of six projects finished at least 200% over budget and 70% over schedule – results so damaging they risked bankrupting their sponsors (Flyvbjerg and Budzier 2011). A further analysis of 4,227 IT projects found that these cost and schedule outliers are non-random and stable over time (Budzier and Flyvbjerg 2013b), further suggesting that existing management practices may be insufficient.

It is noteworthy that these risks have remained stable despite the industry's methodological changes over time. Adaptive methodologies have slowly grown in popularity, although that trend may soon be eclipsed by hybrid models incorporating both adaptive and predictive elements (Reed and Angolia 2023). This shift has led to improved project outcomes in some areas; a study of over 1,000 IT projects found that the use of adaptive methodologies increased project efficiency and stakeholder satisfaction (Serrador and Pinto 2015). Unfortunately, a larger study of 4,227 projects found that, while the use of adaptive methodologies appears to reduce the risk of schedule overruns, the risks of exceeding the estimated budget and of failing to deliver expected value remain unchanged (Budzier and Flyvbjerg 2013b). Supporting this, a study of 5,392 IT projects conducted during the twelve years following the publication of the first adaptive methodologies found that cost overruns did not vary significantly during that time (Flyvbjerg, Budzier and Lee, et al. 2022) The use of adaptive methodologies, such as Agile Scrum, may improve outcomes for some software projects (Khoza and Marnewick 2020), but empirical evidence is inconclusive (Dybå and Dingsøyr 2008). Agile, and related adaptive methodologies, should not be considered a panacea, and project risks in the industry remain unacceptably high.

Methodological Limitations

Although there are significant differences between adaptive and predictive methodologies for software development, they share some underlying similarities. For example, as shown in **Figure 2**, every software development project management methodology in popular use calls for the selection of project goals prior to the formation of the full development team. In traditional, predictive methodologies such as waterfall, V-Model, or B-Model, requirements are defined before most of the project team is assigned during the design phase (Ruparelia 2010, Wysocki 2019). In adaptive methodologies, such as Agile Scrum, the development team defines the scope of each Sprint by selecting requirements, in the form of User Stories, from a Product Backlog, but that backlog is created and prioritized before the full development team is assembled (Cohn 2004).

Although all common software development methodologies sequence these two activities similarly, selecting project goals before forming the project team may worsen project outcomes. In projects where plans must respond to frequent changes, the value of planning arises primarily from the team's collaborative identification of goals, challenges, and responses, not from reliance on the resulting plan itself (Bryson and Bromiley 1993). Allowing project team members to participate in selecting both project goals and strategy also stimulates the exchange of information within the team and leads to greater self-efficacy and higher commitment (Locke and Latham

2002). Conversely, the imposition of mandated project goals can reduce enthusiasm (Bryson and Bromiley 1993).

The impact on project outcomes may be significant; higher levels of team member commitment are consistently associated with increased performance and project success (Neininger, et al. 2010, Ehrhardt, et al. 2014, Buvik and Tvedt 2017). Reversing the sequence of these activities, and allowing teams to participate in the selection of project goals, may lead to increased *affective* commitment, the acceptance of project goals and willingness to engage with the project (Barczak and McDonough 2003, Buvik and Tvedt 2017).

In addition, all popular software development project management methodologies share an inherent assumption that requirements can be successfully defined in advance. In predictive methodologies, project requirements are thoroughly detailed in the Work Breakdown Structure and related documents (Wysocki 2019). Traditional approaches often call for these documents to be *frozen* prior to the start of development, after which new requirements may be added to project scope only after passing through a formal change approval process (Wysocki 2019). Adaptive methodologies, such as Agile Scrum, ease the addition of requirements to project scope by freezing only the scope of each Sprint, a relatively short development cycle of approximately two weeks (Cohn 2004, Wysocki 2019). Even in this approach, however, requirements are not approved for development until they are defined, including a *definition of done* or other acceptance criteria, then prioritized against other requirements and accepted for inclusion in a Sprint (Cohn 2004, Wysocki 2019)

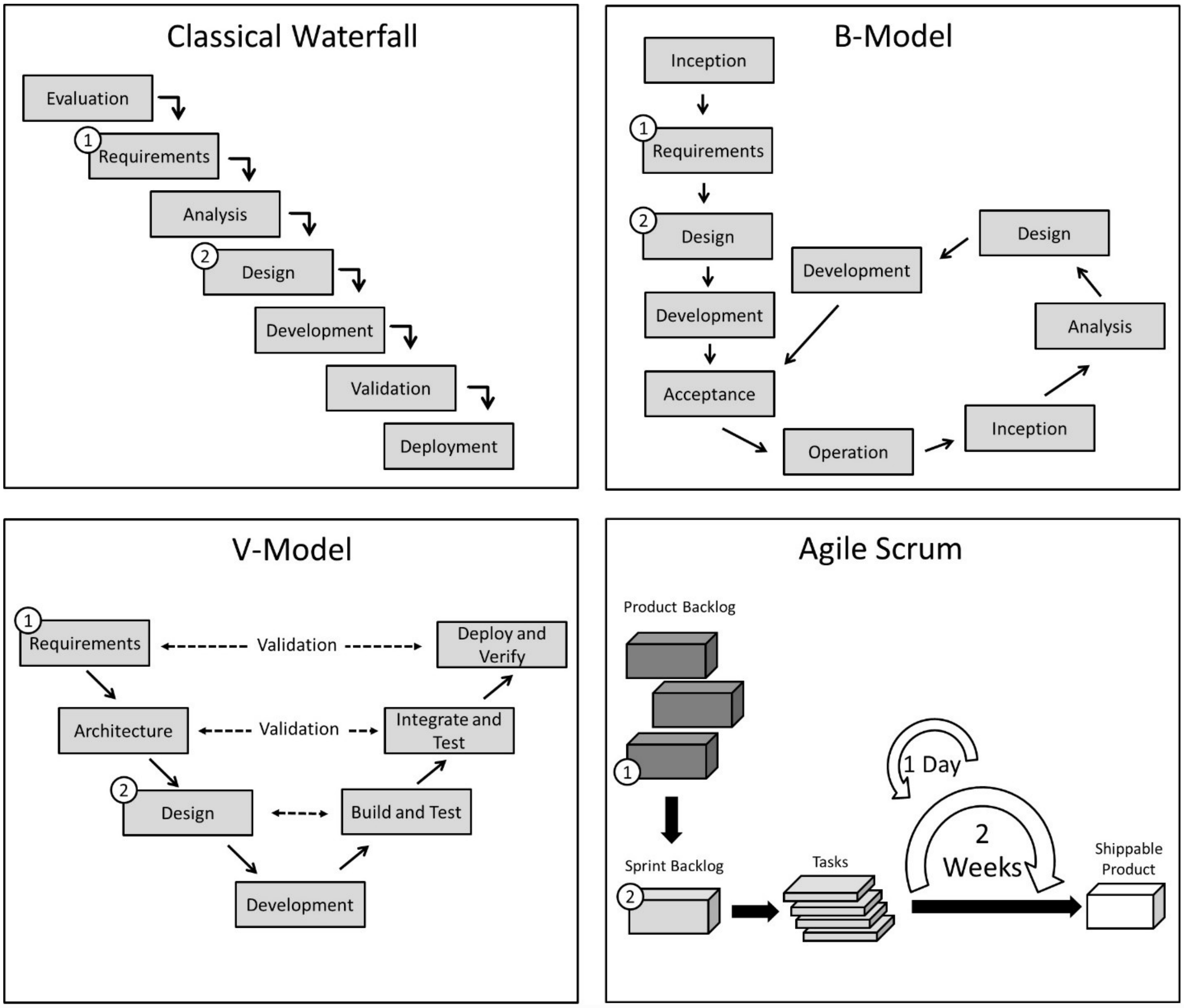

***Figure 2**: Four popular software development methodologies, marked to indicate (1) goal selection and (2) team formation (adapted from Cohn 2004, Ruparelia 2010, and Wysocki, 2019).*

This assumption that requirements are 'knowable' in advance may not accurately reflect the reality faced by many software development projects. For example, user workflow or reporting requirements may not be predictable before a working prototype is provided for experimentation; users may need to grow familiar with a new system before they are able conceptualize their needs. A meta-analysis of more than a decade of research found that project management in the software development industry is often grounded in this normative-positivist conceptual approach, implicitly assuming that the path forward is both knowable and measurable (Fortune and White

2006, Budzier and Flyvbjerg 2013a). When developing an intangible product that cannot be held, touched, or felt, and for which preliminary collaborative planning discussions must be necessarily abstract, this approach may provide only the illusion of control (Budzier and Flyvbjerg 2013a).

Hedonic Requirements

Hedonic requirements in particular may be a poor fit for the software development industry's normative-positivist approach to project management. These are a type of non-functional requirement seeking to increase usage and enjoyment of the system through, for example, graphics, music, or color (Hassenzahl, Beu and Burmester, Engineering Joy 2001). Part of the broader concept of User Experience (UX), which includes usability and user satisfaction (Quiñones and Rusu 2019), hedonic requirements specify the intended emotional response of the user, the means by which to achieve it, and the artistic context in which the experience is to occur (Callele, Neufeld and Schneider 2008, Callele, Neufeld and Schneider 2009a). Such aesthetic considerations may be critical to the success of the product while remaining challenging to define in detail prior to development.

User-facing software is an experiential product (Persse 2008), and development teams must often consider aesthetic and hedonic requirements alongside more straightforward, utilitarian requirements. While some software provides only a limited user interface (UI), or none at all, many software products attempt to curate specific emotional reactions in users. While a video game may be an obvious example of software with hedonic requirements that are critical to success (Callele, Neufeld and Schneider 2009b), even something as ubiquitous as an online payment screen may have similarly critical hedonic requirements. Depending on the context, such a screen may need to convey to the user a sense of security, encouraging potential customers to trust the company and website with their payment information. In other contexts, the sellers may wish to instill a sense of urgency, such as when concert tickets or an online auction may only be available for a limited time and interested buyers are therefore encouraged to buy without undue consideration of price or potential alternatives. Other examples include the user interface for autonomous driver assistance systems, which when activated by the user may take partial control of the vehicle to avoid crashes or assist in parking, and which therefore must seek to engender an appropriate level of trust (E. E. Miller 2018). Even software products that may seem entirely divorced from the considerations of user emotions, for example software for controlling military hardware such as infantry-fired guided missiles, may have hedonic requirements that are entirely critical to success, such as those mandating ease-of-use or minimizing the emotional impact of taking human life in wartime.

Existing software development practices may not be well-suited to managing either non-functional requirements in general or hedonic requirements specifically. Methods for translating pragmatic customer needs into detailed, prioritized, and traceable functional requirements are well established (Rodgers 1991), but despite the prevalence of hedonic requirements in software products and their frequent criticality to success, there are few similarly established techniques for eliciting emotional requirements from users or product designers.

Existing elicitation techniques may overstate the importance of pragmatic qualities to a product's appeal, as customers unconsciously focus on elements that feel justifiable (Diefenbach and Hassenzahl 2011). For example, users tend to describe their preferred UX by referring only to pragmatic requirements, often believing they are describing hedonic qualities when they are actually describing pragmatic qualities (Maier and Berry 2018). Storytelling and the development of personas and narratives may help the project team to discuss the intended experience and emotions with expected users or customers (Ciancarini, et al. 2023), but many projects never capture hedonic requirements in any official manner (Callele, Neufeld and Schneider 2005).

Interviews with software architects found that validation processes for these types of requirements were universally informal and that architects did not share a common vocabulary to describe them. Most of those interviewed did not document non-functional requirements at all, and no participants considered hedonic requirements specifically when non-functional requirements were elicited (Ameller, et al. 2012). The subjective nature and apparent irrationality of hedonic requirements makes identifying, specifying, and representing them inherently difficult (Callele, Neufeld and Schneider 2006, Diefenbach and Hassenzahl 2011).

Notable attempts have been made to address these challenges by proposing methods for eliciting and defining hedonic requirements (Callele, Neufeld and Schneider 2009a) and for classifying the hedonic outcomes intended to arise through interaction with a software system (P. Zhang 2013). However, despite the potential utility of these methods, they have seen limited adoption within the field. Consequently, the issue of effectively managing hedonic requirements remains largely unresolved in practice. Moreover, while research has consistently highlighted the challenges posed by hedonic requirements, there has been no direct measurement of their impact on project success or relationship to project outcomes.

Tailoring Management Practices to the Needs of Individual Projects

Although research has suggested that current software development methodologies may be a poor fit for hedonic requirements, it may be possible to tailor existing project management practices to better support these needs. While adaptive methodologies have increased in popularity (Serrador and Pinto 2015), there is a growing consensus that there is no one-size-fits-all methodology suitable for every project (Shenhar 2001, Simon 2006, Proba and Jung 2019). The

Project Management Institute (PMI) now recommends that teams adapt their templates, governance, and methods to fit the needs of the organization and the project (Project Management Institute 2021). These *hybrid* methodologies adapt or combine elements of both predictive and adaptive approaches as necessary. Unfortunately, while many emerging hybrid methodologies are industry-specific (Reed and Angolia 2023), existing guidance from the PMI on the process of tailoring is industry-agnostic (Project Management Institute 2021). The available literature on tailoring also lacks specific advice on what factors to consider, how to match existing practices to project and organizational characteristics, and how to ensure the result provides a complete management solution without introducing redundancies or inefficiencies (Project Management Institute 2021).

Several attempts to provide additional specificity have been made. For example, Situational Method Engineering is a tailoring method that involves building a library of method fragments drawn from multiple methodologies, then assembling a bespoke management solution from these fragments, chosen to match the characteristics of a specific project and the surrounding organization (Gupta and Dwivedi 2012). The authors have given detailed guidance on what constitutes a method fragment as well as multiple potential processes for combining these fragments into a complete method, but the result is time-consuming and perhaps impractical for use in a fast-paced business environment. This method of tailoring has also been applied to agile project management specifically, with Situational Agile Method Engineering. In this approach, the library of method fragments is drawn only from adaptive methodologies, and complete management solutions should be assembled from this library in response to five key project characteristics (Proba and Jung 2019). Unfortunately, despite the additional industry specificity, Situational Agile Method Engineering shares many of the same limitations as Situational Method Engineering.

Existing advice on tailoring provides either too little information or requires analysis far more detailed than could be easily completed during project initiation. As a result, practitioners are unable to efficiently tailor existing practices to each project, encouraging attempts at force-fitting projects into standardized practices. In order to more quickly tailor their management practices to fit the needs of the project, teams need simple, heuristic guidelines pairing specific practices with specific project needs. For example, advice could be structured as straightforward conditional statements: if the team is inexperienced, they should implement practice *X*; if project requirements cannot be clearly stated, they should adopt practice *Y*. This approach would enable teams to quickly identify and apply the most relevant management practices based on the specific characteristics and needs of their projects.

Summary of Step One

In this first step, the software development industry was selected as the target of this example inter-industry learning effort. Although an exhaustive list of risks faced by software development projects is beyond the scope of this paper, a review of existing software development management practices has suggested several potential barriers to success, including the challenge of managing hedonic requirements and a lack of guidance on tailoring existing practices to better fit the needs of individual projects. These examples were drawn from a broad array of potential challenges, and it is important to note that the impact of hedonic requirements on project outcomes has not yet been empirically examined in the existing literature. Nevertheless, these examples appear suitable for this illustrative use of the Real-to-Real method. It is now possible to clearly formulate a goal for this effort, based on these potential barriers to project success: using the Real-to-Real method, this effort will attempt to identify management practices developed in another industry that, when translated for use in software development, may significantly improve project outcomes by providing simple, heuristic guidance to project teams on adapting their existing practices to better support hedonic requirements.

Step Two: Identify a Source of Inspiration

Next, identify a second industry that may have developed different approaches to similar challenges, as a source of inspiration. Projects in this *source* industry should face barriers to success that are conceptually similar to those faced by the target industry. These shared challenges will form the fulcrum around which the translation of management practices will pivot, and the identification of a suitably complementary pair of target and source industries is therefore important to the of success the process. The selection of a source industry should be made with care, as the translation of management practices between industries that are too similar may offer fewer insights and therefore spur less innovation than the analysis of industries separated by a larger cognitive distance (Enkel and Heil 2014).

In Step One, the software development industry was selected as an example target industry, and the challenge of tailoring that industry's management practices to better support hedonic requirements was selected as an example potential barrier to project success. Now, from among many possible candidates, a projectized industry that routinely encounters hedonic requirements must be identified as a source of inspiration for this illustrative use of the Real-to-Real method. By accurately matching the selected source industry to the challenge identified in Step One, this effort aims to explore whether it is possible to develop or adapt target industry management practices using source industry experience.

Categorizing Projects

To aid in the search for a suitable source industry, it can be useful to categorize projects according to type. There are many project characteristics that could be used to develop categorization models, such as team size, duration, level of investment, level of innovation required, and more, but as this model is intended to highlight potential candidate source industries for this inter-industry learning effort, the selection should be based on the challenges identified in Step One. This effort focuses on the management of hedonic requirements, so any model useful for this effort should help to identify other industries that frequently face subjective, emotional requirements.

With this in mind, a method for categorizing potential source industries using a simple 2x2 matrix is shown in **Figure 3**. Although many alternative models for framing project complexity have been proposed (Vidal, Marle and Bocquet 2011, Mikkelsen 2018), this matrix is organized using only two measures, adapted from previous project categorization efforts (Turner and Cochrane 1993, Obeng 1996). Vertically, by how clearly project goals can be stated at project inception, and horizontally by how clearly the tools and processes that will be used to achieve those goals are understood at the same point in time. The level of available detail at the beginning of the project is an important consideration for each axis. This model groups candidate source industries into four basic types, detailed in **Table 2**.

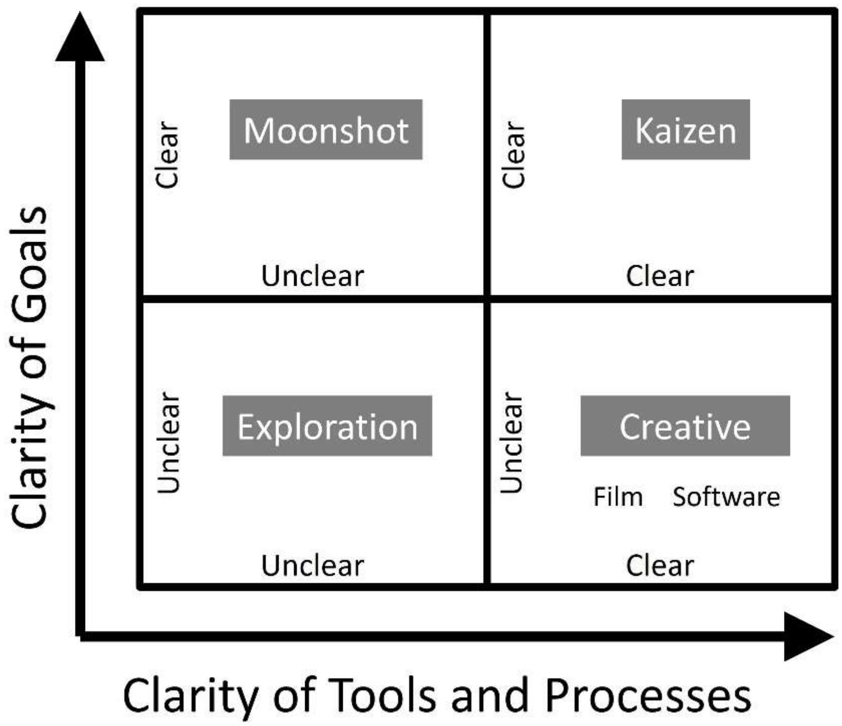

Figure 3*: A model for categorizing projects by type (adapted from Turner and Cochrane 1993, Obeng 1996)*

Kaizen Projects

The upper right-hand quadrant of **Figure 3** contains projects that enjoy clear goals and a clear understanding of the methods that will be used to achieve them. A simple example of a project in this category might be that of an experienced team tasked with building a residential house in a planned subdivision consisting of hundreds of similar homes. In these types of projects, which are sometimes referred to as *production* or *paint-by-numbers* projects (Obeng 1996), requirements are detailed clearly in advance, the level of change to requirements during production is low, the effort required to achieve these requirements is highly predictable, and the quality of project deliverables can be objectively measured. As a result, the project team does not need to further refine the set of starting requirements, and the tools and processes in place at the start of the project are already suitable for purpose. Projects in this category may benefit from the use of predictive methodologies, such as Waterfall or the V-Model (Wysocki 2019, Project Management

Institute 2021), as teams may be able to accurately forecast many activities relatively far in advance.

With both goals and the methods to achieve them already clear, management of projects in this quadrant can focus on *kaizen* activities, a Japanese compound word combining *kai*, meaning "change," and *zen,* or "for the better (Singh and Harwinder 2009)." First developed as the Toyota Production System in 1950, kaizen is a strategy for constant, conscious, and committed efforts to develop and implement small, iterative process improvements: to "do it better each time (Singh and Harwinder 2009)." Kaizen has since grown to include concepts such as *kanban*, or the use of visual process flow indicators; the just-in-time delivery of inventory and materials known as JIT; *lean*, or the elimination of waste; and *six sigma*, a process improvement technique (Zhang, et al. 2012). It is now widespread in industries as diverse as healthcare, manufacturing, and the military (Zhang, et al. 2012), and IT projects have successfully integrated kaizen processes with existing project management practices (Tenara and Pinto 2014). In projects that enjoy initial clarity on both project goals and the methods and processes to be used, kaizen practices can be used to iteratively and incrementally improve efficiency.

This categorization effort is intended to identify candidate source industries that have developed extensive experience in managing hedonic requirements. The nature of projects within this category, which possess clarity on both project goals and the methods by which to achieve them, seems to preclude a pervasive struggle with aesthetic considerations and these types of requirements. Thus, this quadrant may not contain an example source industry useful for this illustrative example of the Real-to-Real method.

Moonshot Projects

The upper left-hand quadrant of **Figure 3** contains projects that begin with clearly defined goals, but lack knowledge of the methods and processes necessary to achieve them. This quadrant is named after the American *moonshot* missions, e.g. Atlas, Polaris, and Apollo (Turner and Cochrane 1993), in which the National Aeronautics and Space Administration (NASA) was given the challenge "…before this decade is out, of landing a man on the moon and returning him safely to the Earth (Space.com Staff 2011)." While the ultimate goal was clear, the process of traveling to the moon – and safely back again – was not yet known. The teams involved, like those of other projects in this category, thus had to focus on efficiently developing the methods and processes necessary to meet the goals of the project. This category logically also includes projects where the tools and processes required may exist, but are unfamiliar to the project team; such projects would share a similar management focus and engage in similar practices (Turner and Cochrane 1993, Obeng 1996)

In the software development industry, Waterfall and other predictive methodologies such as the V-Model were originally adapted from management practices first developed during NASA's moonshot missions (Wysocki 2019). These techniques may have been effective in managing early software development projects in this category, i.e. those inventing new-to-the-world software tools and processes, but the increased rationality these methodologies brought to software development projects simultaneously reduced the freedom necessary for creativity (Blankevoort 1983). Many later software development projects were tasked with creatively combining preexisting methods and processes in new and innovative ways, moving them out of this quadrant to the lower-right of **Figure 3**, and found adherence to predictive methodologies restrictive (Cohn 2004).

For example, predictive methodologies assume that both objectives and methods can be clearly defined in advance, and therefore call for *freezing* the project's design as early as possible. Projects that are unable to freeze their activity plan at an early stage may therefore appear to be failing, when the work of exploring, evaluating, and selecting potential methods is simply an essential part of such a project's scope (Turner and Cochrane 1993). Adaptive methodologies, such as Agile Scrum and Extreme Programming, were developed in response to this increasingly poor fit between project and methodology (Beck 2000, Cohn 2004, Virag, Bernroider and Remus 2022), but have not entirely resolved the apparent gaps between management practices and project needs (Budzier and Flyvbjerg 2013b, Khoza and Marnewick 2020). Although many early software development projects may have been Moonshot projects, most modern efforts no longer fit this quadrant of the model, and alternative project management methodologies may prove to be more effective for current needs.

Moonshot projects often require a high level of innovation and creativity when developing the tools and methods necessary for achieving their goals. In some types of engineering projects, such as consumer product development, aesthetic factors may also be a crucial consideration. This suggests that consumer product development may be a potentially valuable candidate for this example of the Real-to-Real method. However, the existing literature does not clearly indicate that this industry has developed significant expertise in managing hedonic requirements specifically. While a focus on balancing time-to-market pressures with product quality is well documented (Cohen, Eliashberg and Teck-Hua 1996, Bayus 1997, Bajaj, Kekre and Srinivasan 2004), there is limited discussion on the explicit management of hedonic factors. Although some methods for gathering customer requirements do tangentially address these types of requirements - for example when allowing customers to virtually design proposed products (Dahan and Hauser

2002) - there is no evidence of a comprehensive framework encompassing the challenge selected for this effort. Therefore, it may be worthwhile to review the remaining quadrants to identify other potential source industries with more robust and relevant expertise.

Exploration Projects

Continuing counterclockwise within the categorization model shown in **Figure 3**, the lower-left quadrant contains projects that begin with poorly defined goals and a matching lack of clarity on the most effective tools and processes to be used. Although it could be argued that efforts in this category are mere concepts rather than actual projects, in practice many teams must operate within this quadrant. For example, project teams may be tasked with changing a corporate culture, revitalizing a neighborhood, or increasing the level of innovation within an organization. In each of these examples, the measures used to determine progress, and the definition of success may need to be defined and redefined iteratively through engagement with stakeholders, who may also need to first be identified.

Projects in this category, which may alternatively be named *blue sky* projects. (Turner and Cochrane 1993), often require project managers to navigate significant uncertainty. The means by which to effectively and efficiently make progress must be determined during the project, once consensus on a direction of travel has been achieved. Management of projects in this category must therefore focus on the identification of both goals and methods by iterating through increasing levels of clarity (Turner and Cochrane 1993). Without additional clarity, it will not be possible to make further progress, or for an actual project to coalesce around the initiating concept (Turner and Cochrane 1993).

Given the inherent uncertainty and conceptual nature of projects in this quadrant, it is perhaps unsurprising that the management of such projects is not well represented in the literature.

Additionally, the lack of clear goals and methods suggests these projects are less likely to have developed clear experience in resolving the challenge of hedonic requirements. As a result, this category does not appear to offer an obviously useful source industry for this illustrative application of the Real-to-Real method.

Creative Projects

The final, lower-right quadrant of **Figure 3** contains projects that may begin with a clear understanding of the tools and methods that will be used, but with project goals that are initially unclear. Example types of projects in this quadrant include this effort's target industry of software development (Turner and Cochrane 1993, Obeng 1996, Farina, Fedorovskaya, et al. 2022, Hawkey and Roberts 2023) as well as film production (Obeng 1996, Persse 2008, Hawkey 2016, Hawkey and Roberts 2023, Farina, Fedorovskaya, et al. 2022) and research and development (Jain, Triandis and Weick 2010). Other potential source industries in this quadrant include music (Farina, Ivanova, et al. 2021), television (Brook 2005, Gould 2006, Lundin and Norbäck 2009), video games (Callele, Neufeld and Schneider 2005), and even circuses (Simon 2006). Despite beginning with initial uncertainty surrounding their final product, projects in each of these industries launch with clear knowledge of the methods and tools that will be used, making them potentially valuable sources of inspiration.

To illustrate the characteristics of projects in this quadrant, consider that a software development or film production team may each hold significant professional experience. For example, depending on the industry, a team may include a senior architect, lighting guru, master prop maker, or database expert. Despite this expertise, however, these teams often must elicit specific requirements and manage changes to those requirements during development. They must compare multiple methods of combining existing tools and methods to achieve a suitable result.

Additionally, they must constantly review and evaluate incremental progress towards overall aesthetic or hedonic goals, such as determining whether the latest shot or user interface are good enough, or should be redone before continuing.

These *Creative* projects must recombine existing tools and methods in novel ways to produce innovative results. Management of these projects therefore focuses on the identification and refinement of suitable goals and the evaluation of alternative proposed solutions; as a result, project requirements may change throughout the project at a rate higher than that experienced by Moonshot or Kaizen projects. Significant changes to requirements may also occur later in development during these projects than in other project types (Highsmith and Cockburn 2001, Cohn 2004). Predictive management methodologies, which may be beneficial when used in Kaizen or Moonshot projects, may therefore be a poor fit for Creative projects. Although some authors suggest that Creative projects may be managed as Kaizen projects once goals have been selected (Turner and Cochrane 1993), continued frequent changes to requirements render predictive management methodologies a poor fit. Projects in all four quadrants each face some level of inherent risk, but the type of uncertainty faced by Creative projects may lead to a wider disparity between project outcomes; vague goals increase the variability of performance by increasing the ambiguity about what is to be attained (Locke and Latham 2002).

Creative projects experience a high degree of change to project requirements, and therefore may often need to incorporate frequent changes to team resources or skills. To enable this, it is often necessary to form cross-organizational teams composed of team members employed by different firms or freelancers (Lorenzen and Frederiksen 2005). Successful management of the resulting teams thus requires successfully managing those cross-organizational relationships (Lorenzen and Frederiksen 2005), as organizational boundaries often form the most critical barrier to effective innovation (Tushman 1978). This cross-organizational network is also beneficial when the motivation of skills holders and the nature of the work make both planning and governance difficult (Lorenzen and Frederiksen 2005). Successful Creative projects thus rely extensively on verbal communication and the reinforcement of relationships across these boundaries, rather than on documents and artifacts (Tushman 1978).

Although team members in Creative projects may begin with deep technical knowledge in their individual domains, the management of such teams can be problematic. While more complex projects require additional management activity, additional uncertainty requires increased managerial flexibility (Shenhar 2001). Leading creative projects involves fostering innovation, developing and achieving a shared vision through the direction of others' work, and the integration of multiple workstreams (Mainemelis, Kark and Epitropaki 2015). Management oversight should be reduced when teams are tasked with developing new products by combining existing elements in novel configurations (Bajaj, Kekre and Srinivasan 2004). Organizations that attempt to control their creative professionals too closely, allowing for little flexibility in the execution of tasks, are often less likely to produce products that are innovative (Lampel and Germain 2015).

In dynamic projects, the value of personal relationships greatly increases (Joyce and McGee 1997), although a balance of flexibility and hierarchy is required (Introna, Cushman and Moore 2000), and as the complexity of the work and the knowledge of the workers increase, management should shift from a bureaucratic to an egalitarian approach (Jain, Triandis and Weick 2010). Establishing an egalitarian culture of success requires steady, predictable decision making (O'Connell 1999), the empowerment of subordinates to make decisions (Wysocki 2019), and a problem-solving approach that views project difficulties as a network of interrelated challenges (Isenberg 1984). Egalitarian practices may be more effective when leading Creative projects because they decrease the fear of failure, increase innovation and flexibility, and increase participation in setting project strategy (Jain, Triandis and Weick 2010).

Team member participation in the selection of strategy and goals has also been found to significantly improve performance (Locke and Latham 2002). Conversely, mandated goals can result in reduced enthusiasm on the project team (Bryson and Bromiley 1993), leading to lower levels of commitment and worsened project outcomes (Ehrhardt, et al. 2014, Buvik and Tvedt 2017).

Creative industries are often hubs of managerial innovation and experimentation (Lampel and Germain 2015), and successful creative project teams may develop certain strengths. Because they already have expertise in the methods and tools to be used, Creative project teams can learn to rapidly reconfigure their routines and resources in response to changes in requirements, allowing them to change their approach to solving problems as necessary to better fit each new problem as it arises (Zahra, Sapienza and Davidsson 2006). The ability to rapidly restructure the team's problem-solving abilities can minimize redundancies, ensure strategic alignment, and allow for the effective deployment of resources (Zahra, Sapienza and Davidsson 2006). Also, because Creative project teams must constantly collaborate to develop new methods of addressing normally routine tasks in response to changing circumstances (Gould 2006), the creation of cooperative and collaborative relationships within the team is often more necessary and more rewarding in the dynamic environments of Creative projects than it is in more predictable projects (Miller and Shamsie 1996). As a result, teams working in dynamic environments, subject to frequent changes, are more innovative and likely to experiment than those in stable environments (Zahra, Sapienza and Davidsson 2006).

In total, projects in this quadrant, although situated in multiple industries, face many similar challenges, and it is within this set that a suitable source of inspiration for this effort will be found.

Table 2: *Types of Projects (adapted from Obeng, 1996 and Shenhar, 2001)*

Project Type	Goals	Methods	Management Focus
Kaizen	Clear	Clear	Efficiency and incremental improvements
Moonshot	Clear	Unclear	Efficient development of necessary tools and processes
Exploration	Unclear	Unclear	Increasing the clarity of the project scope and plan
Creative	Unclear	Clear	Innovative discovery of suitable goals

Similarities Between Software Development and Film Production

Of the potential source industries located within this quadrant, the film production industry seems noteworthy, as film projects must routinely manage hedonic requirements, the challenge facing software development projects identified in Step One. Although there are obvious differences in management practices between the two industries, film production and software development projects share many characteristics. For example, projects in both industries often face fixed and immoveable deadlines for delivery, require significant levels of investment, and experience a high degree of changes to requirements, even after development begins (Persse 2008). Fundamentally, project management practices in both industries seek to manage creativity (Rhyne 2008).

Film and software both deliver intangible, experiential products (Persse 2008), and the end-user experience is often critical to success in both industries (Hassenzahl, Beu and Burmester, Engineering Joy 2001, Hassenzahl 2001, Patz 2010, Honthaner 2013). To plan and manage the user experience (UX), successful film production and software development require extensive knowledge of the intended user or target market (Calvo 2013). Designers of both film and software must manage pragmatic, utilitarian requirements alongside aesthetic and hedonic requirements (Hawkey and Vans 2024). Management of film projects must consider requirements related to aesthetics such as the color grade, shot composition, and narrative structure (Calvo 2013), in addition to more pragmatic requirements related to location selection, catering, and resource scheduling (Clevé 2018). Software development projects must similarly consider functional requirements such as the maximum allowable downtime, latency, compatibility, and the number of concurrent users, in addition to color choice, iconography, layout, sound, and other important elements of the user interface (Hassenzahl, Beu and Burmester 2001).

While each industry has developed distinct and independent project management practices, interesting parallels are immediately apparent. Time-to-market is an essential component for project success in both industries, and both have therefore identified rapid resource allocation as a key risk mitigation strategy (Eisenhardt and Tabrizi 1995, Lampel and Shamsie 2003, Persse 2008, Brown 2014). Reshoots and test screenings in film production are similar to refactoring and User Acceptance Testing in software development, for example (Calvo 2013). Both film and software products can be original and new-to-the-world, derived from earlier efforts, or intentionally similar remakes of existing products (Antelman 2020). The concepts of *code freeze* or *release ready* in software development are similar to the concept of *picture lock* in film production, the point at which a film is finalized and ready for exhibition (Calvo 2013). And of course, projects in both industries are beholden to the so-called 'iron triangle' of budget, schedule, and scope (Antelman 2020).

Perhaps the most striking similarity is that both film production and software development projects require collaboration and cross-organizational creativity between multiple specialized experts and sub-teams, each of which may have extensive technical knowledge within their own technical domain (Persse 2008). In both industries, the output of these multiple workstreams must be consolidated into a single integrated product, which then must be validated against both pragmatic and hedonic requirements and delivered to the end user in a carefully planned and managed release (Persse 2008, Antelman 2020).

Summary of Step Two

In Step One of the Real-to-Real method, the lack of simple, heuristic guidelines on how to tailor existing management practices to better support hedonic requirements was identified as a potential barrier to success within the software development industry. Although the effect of hedonic requirements on software project outcomes has not yet been explicitly measured in the existing literature, this challenge will form a suitable example for this illustrative use of the method. Step Two, here, sought to identify a projectized industry that has developed different approaches to the same challenge. By categorizing projects by type, according to the initial clarity of project goals and the initial clarity of the methods and tools to be used in fulfilling them, this method isolated a set of potential source industries that each face challenges similar to those experienced by software development projects.

The category of Creative projects includes many potentially valuable source industries. The music, circus, and video game industries, for example, have each likely developed significant experience in managing hedonic requirements that may be beneficial if adapted for use in software development. In the Moonshot category, consumer product development projects often involve consideration of aesthetic qualities, and may therefore also hold beneficial insights worth exploring. The film industry has emerged as the most intriguing candidate for this illustrative use of the Real-to-Real method, however, due to its focus on hedonic requirements and wealth of similarities with software development.

There is another intriguing reason to select the film production industry for this effort: while modern software development management is based on methods first developed in the 1950s

(Wysocki 2019), management practices for film production projects have evolved from live theater production, one of the oldest industries focused on the projectized production of experiential products (Lindgren and Packendorff 2007, Lehner 2009). Although several other industries may also hold valuable guidance for software development, the film production industry will serve as the source industry for this example use of the Real-to-Real method.

Step Three: Evaluate Project Management Practices Used in the Source Industry

The next step of the Real-to-Real method calls for the holistic analysis of project management practices used in the source industry selected in Step Two. The goal of this step is to develop a thorough understanding of source industry practices, in the form of assignable tasks and duties. While these practices may not be directly applicable to the target industry, Step Four and Step Five of the method will enable their translation across industry and knowledge domain barriers and the identification of specific practices suitable for the target industry that mirror or parallel the activities identified in this step.

It is beyond the scope of this paper to offer a complete guidebook on managing film production projects. As this research was conducted by an experienced practitioner from the software development industry, this analysis of film production practices is also necessarily viewed from an outsider's perspective. Despite these limitations, a holistic understanding of source industry practices is necessary to provide sufficient detail for the next steps of the Real-to-Real method. This step began by researching the source industry literature. To further verify and enrich the descriptions of film production practices presented here, a series of interviews with experienced film producers was then conducted. These interviews provided valuable insights and are detailed in Chapter Three, although selected quotes are used throughout the following sections.

Review of Existing Literature

This step necessitated a review of source industry literature, intended to identify challenges facing film projects and to develop a theoretical and conceptual framework of film industry project management by assessing prior research (Rowe 2014). Although many valuable sources were found, it appears that the film industry rarely relies on the generalized project management concepts and terminology used in other projectized industries, and that generalized guides to project management rarely reference the film industry. Neither the word *film* nor the phrase *motion picture* appear once in the PMI's Guide to the Project Management Body of Knowledge (Project Management Institute 2021), and neither appear in a wide variety of other well-known general texts on project management (Rhyne 2008). As a result, this research was extended to include so-called 'grey' literature, including four noteworthy textbooks on managing film production projects, each written by experienced film industry practitioners (Patz 2010, Honthaner 2013, Ryan 2017, Clevé 2018).

In total, this review identified 237 relevant sources, including a broad span of topics necessary to situate film production practices within the wider literature, such as project team commitment, new product development, and strategies for leading creative teams. Of these, 93 sources detailed film production project management practices specifically. Exhibition strategies for completed films are clearly a subject of interest to the film production industry, as 17 separate sources dealt solely with this topic. Only the challenge of successfully predicting box office results was better represented, with 22 total sources. Eleven sources covered film production project management in general, 11 more focused on film project planning, 8 examined the approval process for film project proposals, and 6 considered risk management in film production projects.

Previous research has suggested that an understanding of film industry practices may prove beneficial when managing projects with similar characteristics in other industries. Limited attempts at such inter-industry learning have been made, however (Eliashberg, Elberse and Leenders 2006). A recent literature review identified only 13 sources directly comparing film production to software development, noting that the existing literature has not yet attempted the adaptation of film production practices to software development or measured the potential benefits of doing so (Farina, Fedorovskaya, et al. 2022).

The Project Manager Role in Film Production Projects

An important initial step when analyzing film production project management practices is considering the industry's equivalent to the Project Manager role in software development. *Project Manager* is not a standard or common job title in the industry, nor is any formal project management certification in widespread use (Cheklitch 2002, Persse 2008, Rhyne 2008). Previous research has identified many standard film industry roles as potential best-fit equivalents to the Project Manager, including several non-obvious choices such as Script Supervisor, Tech Scout, and Traffic Coordinator (Rhyne 2008).

Many standard film production roles include some project management functions; for example, the Director is responsible for achieving the aesthetic and emotive goals of the film within the constraints of time and budget (Rhyne 2008). The Director leads the creative vision of film production projects, but the closest equivalent to Director within software development projects may be that of the Architect, not Project Manager (Rhyne 2008).

It is within a film's Production Office that the scope, schedule, and budget are determined, and from there that the project's resources, in the form of locations, sets, props, equipment, and team, are marshalled (Honthaner 2013, Clevé 2018). While small film projects may boast only a single Producer, or even a single Producer/Director, in larger projects the role of Producer is divided into many finely-graded variations, such as Executive Producer, Line Producer, and Production Manager (Persse 2008, Rhyne 2008, Patz 2010, Ryan 2017). This proliferation results in the dispersal of project management responsibilities across many separate and interrelated roles, with any specific allocation determined by the number of team members within a particular film's Production Office and the skills and availability of each. Thus, at least for large film projects, there may be no direct 1:1 equivalent of the Project Manager role in software developer projects.

In smaller film projects, however, the Producer is the one person who steers the film's project from beginning to end, and who is ultimately response for its success (Persse 2008, Rhyne 2008). The Director is primarily responsible for managing the actual filming of the script, but even during filming, the Producer is responsible for the flow of information throughout the project team, and coordinates and supervises the various units (Clevé 2018). The Producer initiates the project, oversees it through development, and continues managing it through both distribution and exhibition (Rhyne 2008). The Producer controls all creative, financial, technological, and administrative aspects of the project (Patz 2010), is involved in all phases of the project, and must supervise and coordinate the efforts of every other team member (Rhyne 2008, Patz 2010). As the size of the Production Office and the number of Producer-adjacent roles increases, the bulk of these duties may move to the Production Manager (Katsiris 2007, Patz 2010, Clevé 2018), Line Producer, or other roles (Rhyne 2008), but for this effort, *Producer* will suffice as a catch-all term for the Project Manager role in film production projects.

A related and noteworthy role is that of the Assistant Director. The Assistant Director is often one of the first team members to join the project, initially as a member of the Production Office, reporting to the film's Producer. There, the Assistant Director is responsible for completing the first detailed budget and shooting schedule for the film. After the project receives approval to begin production, however, the Assistant Director moves out of the Production Office and shifts to report directly to the Director. As the job title would suggest, they then assist the Director through the production phase, helping to track, manage, and report progress against the schedule and budget (Clevé 2018). After crafting the project budget and schedule, the role moves to sit 'in the middle of the action' as the project begins moving through those plans. This organizational move, which has no direct correlation in software development, ensures a single owner for the budget and schedule throughout the project, even as the work surrounding the budget and schedule transition from forecasting and estimation to measuring and reporting.

Film Production Project Organizational Structures

Early entrants to the nascent film industry were innovative and explored new methods and strategies for producing films. Competition was fierce, however, and by the 1920s, film making in Hollywood was controlled by just 8 major firms. The hierarchical and vertically integrated production studios (Lampel and Shamsie 2003) in this oligopoly often signed actors to exclusive, long-term contracts (Miller and Shamsie 1996), and performed all film production functions in-house, including financing marketing, distribution, and exhibition (Robins 1993, Lampel and Shamsie 2003). Each firm directly owned or leased theaters for the exhibition of completed films; together, the major film studios controlled 75% of box office sales in the United States (Miller and Shamsie 1996).

In the 1950s and 1960s, new anti-trust regulations (Rhyne 2008) forced production studios to cease ownership and direct control over theaters (Lampel and Shamsie 2003). At the same time, rising costs caused production studios to shift away from long-term contracts, the storage and maintenance of specialized equipment, and the full-time employment of highly specialized staff

(Rhyne 2008). As a result, the film industry transitioned from monolithic production studios to a loose network of smaller firms, each specializing in a particular function (Robins 1993). Today, film projects require the marshalling of resources from many different firms and temporary collaboration on short-term projects (Introna, Cushman and Moore 2000).

Modern film production teams therefore use a matrix organizational model (Belsen 1996), which can include large production, distribution, and financing organizations alongside an array of smaller firms offering specialized services (Desai, Loeb and Veblen 2002). During production, the crew assembles into various dynamically changing organizational structures as needed (Introna, Cushman and Moore 2000). These temporary organizations must enable creativity and collaboration while balancing the needs for hierarchical control and flexibility (Introna, Cushman and Moore 2000).

Film Production Project Methodologies

The software development industry's approach to managing projects has slowly shifted over time from predictive methodologies that attempt to plan the entire project in advance and deliver a completed product in a single release to adaptive methodologies that rely on shorter planning horizons and incremental delivery of value (Wysocki 2019, Project Management Institute 2021). Although primarily predictive, the film production industry's approach to managing projects has characteristics of both predictive and adaptive methodologies, and does not fit wholly into either category.

Software development projects are now encouraged to tailor their methodology to better fit each individual project, selecting practices from both predictive and adaptive methodologies as needed (Shenhar 2001, Project Management Institute 2021). The film industry has apparently reached the same conclusion via a different route, and has settled on a partially hybrid methodology combining elements of both approaches. One producer explained that while "filmmaking has been the same for one hundred years…in terms of how you move through the process of delivering a product," these standardized practices "do get more bespoke, the smaller the project and the further away from [Hollywood] you get." Just as in software development, practitioners in the film production industry have also argued that there may be no one-size-fits all approach to managing projects (Lundin and Norbäck 2009).

Adaptive Characteristics of Film Production

Some authors have claimed that the process of filmmaking is Agile because a production team films only one scene at a time and further plans can change repeatedly during a project (Agrawal 2016). Others believe they have used principles from Agile software development to manage film production projects because the production schedule for two films, *The Midnight Game* and *House of Dust*, partially overlapped; one script was being finalized while the previous movie was still being edited (Calvo 2013). These arguments may not accurately reflect the full spectrum of Agile principles or adaptive methodologies used in software development, but it is still possible to draw parallels between film production and adaptive software development at both the project and the activity level.

For example, some commonly used film project artifacts may mirror those used in Agile software development. For every scene in the script, an associated Call Sheet lists specific task assignments, a system partially echoed by Story Cards in Agile software development. Both systems are intended to aid in team member commitment and in tracking progress (Persse 2008). In addition, the process of filming the script is inherently iterative, with the same set of phases repeated for each scene: rehearsal, blocking, lighting, final rehearsals, then shooting (Patz 2010, Clevé 2018). The cycle repeats until a shot is considered suitable for inclusion in the finished product before moving on to the next (Persse 2008). This cycle is similar to the iterative development and testing of Agile User Stories (Cohn 2004). Film production teams may also experiment with short planning horizons, at least on the level of individual scenes: when filming on public streets in Tangiers, the production team for *Bourne Ultimatum* started with a relatively simple plan that would be easy to change during shooting, then ensured high levels of communication on site and used an iterative plan for execution (Collyer and Warren 2008).

At a higher level, practitioners sometimes advise that the script should be seen only as a starting point, and that successful 'movie magic' is generated through continuous improvisation, compromise, and sometimes drastic departures from the intended scene (Antelman 2020). "My philosophy is that it's a creative process. As an executive, as a studio, you need to give that space for talent to create. It's not an exact science. Magic happens in that bubble," shared one extremely experienced producer. The film industry has a long tradition, drawn from the precursor industry of live theater, that 'the show must go on.' One experienced producer mentioned that initial benefit analysis and cost details, although instrumental during the project approval process, sometimes can't be maintained after filming begins. Even significant challenges, like an impending hurricane, only force to the team to adapt, possibly by shooting indoors. "Or in a hurricane," they added after a pause.

Predictive Characteristics of Film Production

Despite these scattered reflections of Agile principles, the modern film production process primarily follows a predictive methodology, shown in **Figure 4**. Film production projects proceed through clearly defined phases that do not normally repeat (Patz 2010). Film production project teams have been described as "rigidly hierarchal" (Introna, Cushman and Moore 2000), and projects are planned in detail before they are approved for production, with it not being uncommon for estimated budgets to reach 100 pages (Persse 2008). The decision to approve a project proposal for full production is a formal stage-gate decision, calling for a finalized script, shooting schedule, budget, distribution and release plan, and many other details (Ciancarini, et al. 2023).

At the conclusion of filming, the production team assembles the *answer print*, a list of shots matching the original script. Later, the editing team assembles a *continuity script*, listing every shot to be used in the final print of the film. These provide traceability between the final product and the original requirements (Persse 2008), similar to the requirement validation steps in the predictive V-Model of software development (Ruparelia 2010). Before release, feedback from test screenings may lead to reshoots, but although the act of filming an individual scene may be iterative, each finished film is released as a single, complete product, in what clearly resembles a ‘big bang’ event. As a result, the overall structure of film production project management is essentially predictive, with islands of iterative or Agile development activities embedded throughout.

The Film Production Project Life Cycle

While a full overview of the process of producing a film is beyond the scope of this paper, a brief synopsis of each phase, including key activities, methods, and deliverables, is essential to this effort. The Film Production Project Life Cycle, illustrated in **Figure 4**, is used almost universally throughout the industry, regardless of project size, genre, or union affiliation (Persse 2008). Each stage is intended to proceed in sequence, with very little overlap. Although some previous attempts at modeling this process have included only the three central phases of Preproduction, Production, and Postproduction (Cheklitch 2002, Katsiris 2007), these works still acknowledge the existence of important Development and Distribution & Exhibition activities within their texts. Other sources combine all production activities into a single phase while unnecessarily separating Distribution from Exhibition (Litman, 1989). These attempts do not comprehensively cover the complete film production process from initiation to closure, shown in **Figure 4**. The key *greenlighting* decision, which formally approves a project proposal for full production, has been highlighted, and the key deliverables of each phase are identified.

While there are multiple attempts within the existing literature to map each film production phase to a corresponding generalized phase, process group, and knowledge area in the Project Management Institute's *Guide to the Project Management Body of Knowledge* (Project Management Institute 2021), there has been little consensus (Katsiris 2007, Rhyne 2008). For this effort, it may therefore be sufficient, and perhaps more helpful, to consider the Film Production Project Management Life Cycle as distinct, developed separately, and tailored to the specific needs of the industry. Each phase has distinct characteristics, and should be reviewed separately.

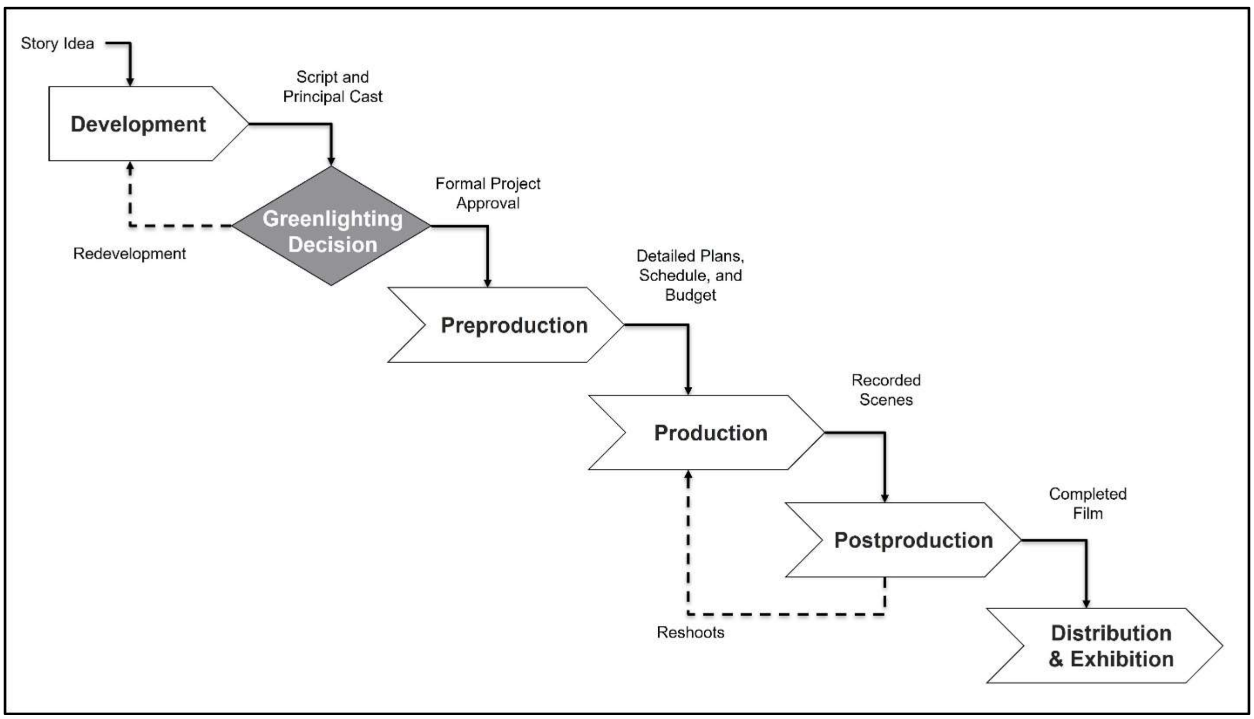

Figure 4: *The Film Production Project Life Cycle (Adapted from Belsen 1996 and Persse 2008)*

Development

Film Production projects are Creative projects, and begin with the germ of an idea. The initiating "Story Idea" shown in **Figure 4** can originate from a script, a desire to work with specific individuals, or any other trigger. In this initiating phase, the scope of the project proposal first begins to take shape. Key activities during Development include writing and revising the script and acquiring any necessary intellectual property rights. After an early proposal presentation or *pitch deck* is created, financing and distribution plans are drafted (Ryan 2017). Projects in the film production industry have a unique focus on culture, communication, and stakeholder engagement (Hartman, Ashrafi and Jergeas 1998). During the Development phase, the relationships so necessary for success in a loosely networked industry are established or reaffirmed.

During this phase, the three primary project leadership roles each commit to the proposal. The Producer, as discussed above, may be the closest analogue within the industry to the Project Manager role in software development projects, while the Director role may be closer in scope to that of a Software Architect (Persse 2008, Rhyne 2008). The Financer role, which in film production commits to funding the proposal, may be filled by a single investor, an investment group, a film production studio, or a combination of these and other entities, and parallels the role of the Project Sponsor in software development. Even at this early stage, when the Financer, Producer, and Director join the project, they do so in writing, with their key responsibilities and schedule clearly defined (Ryan 2017, Clevé 2018). These agreements are more than brief summaries; as one producer noted, they are "not a hundred pages, but it's substantial. Easily between 20 or 40 pages."

The alignment of these key elements - script, Financer, Producer, Director, and distribution - is possibly the most difficult part of the Development process. Each of these crucial resources is only temporarily available, and until the formal greenlighting decision approves a project proposal for the additional expense of preproduction, each may withdraw their interest in the project at any time. A script may suddenly appear to lose marketability, a key release window may become unavailable, the Producer or Director may commit to another project, or the Financer may elect to fund other investments (Hofmann 2002, as cited in Lampel and Shamsie 2003). There may be therefore be intense pressure at this stage to proceed with any resources available, but film projects benefit from a good match between director and script (Wei and Yang 2022) and projects with ill-fitting resource bundles face increased risks of failure at the box office (Lampel and Shamsie 2003). The pairing of project proposals with resources is a multi-dimensional decision; Producers often select Directors suitable for the script, but Directors select scripts based on multiple factors (Wei and Yang 2022). Producers are more likely to work with Directors they have collaborated with before, but larger project budgets allow producers to hire Directors with a history of successful projects, higher professional status and prestige, and larger professional networks (Wei and Yang 2022).

The Producer assembles the first project budget estimates during the Development phase (Clevé 2018). Here, the script serves a function similar to a Work Breakdown Structure (Katsiris 2007). In addition to the dialogue, the script includes a wealth of detail helpful for estimating the cost of each scene, including locations, types of props, number of actors, interior vs. exterior filming, and time of day (Lehner 2009). “The script is the number one thing. That’s the standardized document that we’re all working off of, during practice, during filming, during everything,” explained one seasoned producer.

Another industry veteran shared that “breaking down the script, at least in a general way, prior to greenlighting is important. For example, if you are going to shoot on location in Fargo, you'll need exposure insurance for the crew, and will need to plan on whether to assemble a crew in Fargo or ship them in from Chicago." They described the process of *lining* a script, or identifying key elements, as "Super fun! I get out my colored pencils, and highlight props, characters, locations, and develop raw numbers for each, which we can now plan against."

Even these early estimates may reshape the intended script, as budget constraints are incorporated into the developing proposal (Brook 2005). Another producer reported that "The first version of the schedule is really a call out to each department, asking 'Could you do this?' Could you build this up in time? Could you have these costumes ready? Could we film this at night even though the scene is set during the day?" The ability to efficiently and accurately plan budgets and schedule is seen as a core competency within the film production industry (Hartman, Ashrafi and Jergeas 1998).

Greenlighting

Once the proposed film project's concept has been fully developed, the formal decision to approve the additional expense of Preproduction and eventual Production is known as *greenlighting* (Eliashberg, Hui and Zhang 2007). This key decision, highlighted in **Figure 4**, commits the financing to complete the film and confirms the planned schedule for all later phases (Honthaner 2013). "Greenlight means you can start spending money. That's what it boils down to," summarized one veteran producer. Another explained that greenlighting "is based on when the studio fully commits to the movie. There are certain financial responsibilities that they have to commit to at that time, both with the various signatory companies, and with the banks, in terms of putting money into escrow accounts for the DGA (Directors Guild of America), Screen Actors Guild, Writers Guild, etc. Up until then, they can operate as if they're still in development…but once they give it the green light, it's all hands on deck in terms of moving the concept to the camera."

The greenlighting decision relies on detailed cost and benefit analysis, including consideration of return on investment (ROI), both from initial theater ticket sales and so-called *after-market* returns from international distribution, DVD or Blu-ray sales, online streaming, merchandise, and more. The income from these sources often exceeds box office returns, and may factor heavily in the analysis (Persse 2008). The project budget must accurately reflect the scope of the intended work (Honthaner 2013), and it is not uncommon for project budgets at this stage to reach 100 pages of detail (Persse 2008). A distribution agreement is also normally required for a film to successfully achieve a green light (Lampel and Shamsie 2003). Once the green light has been given, the project moves into Preproduction and begins preparing the final budget, shooting schedule, and production dates (Clevé 2018).

Very few individuals in each organization have the authority to greenlight a proposed project. As a result, "greenlighting is one of the rarest jobs in Hollywood (Persse 2008)." According to the Writers Guild of America West, the world's leading screenplay registration service representing over 25,000 professional writers (Influence Watch n.d., Writers Guild of America West n.d.), over 50,000 pieces of creative material are registered annually (WGAW representative, personal communication, October 17, 2024). These materials include screenplays, treatments, outlines, stage plays, novels, and other media works. In stark contrast, an average of only 611 films were released annually in the United States between 2004 and 2023 (Box Office Mojo by IMDB Pro 2024). Although precise statistics on the number of film production projects that begin development are not available, this suggests that a very small percentage - perhaps as little as 1–2% - successfully pass the critical greenlighting decision. Experienced producers accumulate deep archives of film proposals that were never approved for production, with major film production studios possessing entire "floors' full (Persse 2008)."

The level of allowable risk when greenlighting can vary between projects and film production studios. For example, although Miramax, a large film production studio, had already funded the initial $12 million in development costs for director Peter Jackson's *Lord of the Rings* film, the estimated cost to complete the film caused them to decide against any further investment. In order to pitch the proposal to other studios, Jackson then flew to New Zealand and produced a 35-minute self-funded documentary detailing the work that had been completed and his directorial fit for the project, which led to the project's eventual acquisition by New Line Cinemas (Hofmann, Pete and Ken's Excellent Adventure 2002b). In what may be a counter example, James Cameron's film *Avatar* was greenlit before the technology required to produce the desired computer-generated imagery had been invented, based on estimates of when the necessary technical advances might be achievable (Persse 2008).

The term greenlighting is also often used casually to describe multiple smaller decisions in the film production process. For example, intended filming locations are sometimes said to be greenlighted through the official county or city permitting process (Clevé 2018). Project teams in the industry nevertheless always enjoy clarity on whether their proposal as a whole has received a greenlight, and with it the firm authorization to begin work on a specific date (Honthaner 2013). Projects that do not receive a greenlighting decision are either canceled outright or undergo redevelopment. In **Figure 4**, dashes are used to indicate that this potential flow line is not the intended path, but as very few project proposals receive approval to continue on to Preproduction, it may actually be more accurate to show that this is the primary path, and the route to Preproduction an anomaly.

Preproduction

Preproduction is often the longest and most important phase in the film production project life cycle (Ryan 2017). Here, the production phase is planned in detail, and all necessary resources are secured and aligned. In comparison to the amount and variety of planning activities in this phase, the actual process of filming may seem relatively straightforward (Hawkey 2016). A full discussion of key deliverables created during this phase is out of scope for this paper, but can include (Ryan 2017):

- Creating the shooting schedule, which establishes the time, duration, and order in which every scene will be shot,
- Drafting Call Sheets, which detail the resources and personnel needed for each scene
- Building storyboards and shot lists for every scene
- Scouting, negotiating with, and leasing filming locations and other facilities
- Revising, finalizing, and locking the script
- Purchasing domain names, creating websites, and establishing social media accounts
- Obtaining insurance and any permits needed for the project
- Interviewing, hiring, and completing union and guild paperwork and bonds for all crew members and department heads
- Auditioning and hiring all cast members
- Planning, building, and testing the media workflow, which will securely transfer camera footage to storage both on and off set, and to editing workstations
- Planning and acquiring all necessary props and wardrobe

- Negotiating and contracting with vendors for equipment and facility rental, catering, transportation, security, health and safety, etc.

During the Preproduction phase, detailed estimates are created for the project budget, schedule, and eventual box office returns, as well as the anticipated return on investment (Patz 2010, Ryan 2017). The estimated budget grows to include a detailed list of assumptions, and while the estimated budget may be flexible during Preproduction, it must be finalized and locked before Production begins (Patz 2010). While this work may not seem well suited to creative professionals, it is integral to the filmmaking process: the professional success of director Steven Spielberg has been at least partly attributed to the meticulous planning of production budgets that he routinely undertakes during Preproduction, for example (Farina, Fedorovskaya, et al. 2022).

The Producer, or the Production Manager in larger project teams, also manages the *script breakdown* process during this phase (Clevé 2018). In this detailed analysis of the script, each page is first broken down into individual scenes. For every scene, key requirements, such as locations, cast, props, wardrobe, shots, filming techniques, and special effects, are then identified (Cheklitch 2002). These requirements are then transferred to a linked set of planning documents, including the Shooting Schedule, Call Sheets, Wardrobe List, Prop List, Stunt List, Location List, and others, described as "a series of documents that are standardized, and shared with the studio, with finance, with [everyone] working on the project," by an experienced film producer. The results of the script breakdown form the basis for the entire filmmaking process (Patz 2010); one veteran producer explained "It's something that's used every single day. Certainly, by the Assistant Director, but it's also useful for the rest of the shooting crews."

The Wardrobe List, for example, details the wardrobe items necessary to film each scene in the script. And although within the fiction of the films, Indiana Jones or James Bond may wear only one jacket throughout their adventure, in reality, the wardrobe department must sometimes provide one that is dirty, one that is clean, or one with hidden slits for a wire harness used in a stunt scene, in a sequence that depends on the order in which scenes are filmed rather than on the narrative of the film. The Wardrobe List specifies exactly which versions of these jackets are needed for each scene. In conjunction with the Shooting Schedule, which details the order, date, time, and duration planned for the filming of each scene and the Location List, which details the intended physical location at which each scene will be filmed, the Wardrobe List allows the wardrobe team to plan their activities in detail and to collaborate effectively with team members from other departments, who may each have different informational needs, technical backgrounds, or domain knowledge. Each department head, including the Assistant Director, Art Director, Stunt Coordinator, Prop Master, Wardrobe Designer, and others, creates key documents for their work through the script breakdown process. Every resulting document is linked to the script through references to specific scene numbers, but is intended to fulfill the specific needs of individual departments. Modern film projects often use script breakdown software to automatically generate these documents (Honthaner 2013). Each resulting breakdown is then sent back to the Producer for use in preparing the overall project schedule and budget (Clevé 2018).

The level of standardization in the script breakdown process and set of resulting documents is noteworthy. One producer described these as "standardized documents. Pretty universal." Film production projects across the industry, regardless of project size, budget, genre, or union affiliation, use this process to generate the same set of documents; even the formatting is standardized (Hawkey and Vans 2024). Scripts all use the same font, font size, and number of lines per page, for example (Patz 2010). Formatting within the script for dramatic instructions, scene shifts, margins, and the use of capitalization are all codified across the industry (Persse

2008). One producer explained that "the structure and formatting in the script hasn't changed in the last 100 years." Production Boards, which provide a visual overview of the shooting schedule, also follow a standard template, and use standardized colors to indicate whether each scene is set during the day or night, and in an interior or exterior location. Black lines on the Production Board are always used to demarcate shooting days, with grey lines separating weekends or other non-working days (Clevé 2018).

Formal change control is used to manage changes approved to the script. For example, scene numbers are never changed; if a scene is added between Scene 4 and Scene 5, the new scene is numbered 4A, A4, or something similar, rather than renumbering all existing later scenes. If a scene is deleted from the script, the existing scene number is retained, but all associated text is changed to "omitted (Honthaner 2013)."

In addition, although the script and all the associated documents generated through the breakdown process are initially printed on a white paper, whenever an approved change is made, the script is reprinted on a new color of paper. Then, when that change is propagated through the network of associated planning documents, each is then also reprinted on the same new color paper. Described as a "universal" practice by one experienced producer interviewed for this effort, the set and sequence of paper colors used to indicate changes is known as the *color wheel*, and is fixed for each project but can vary between them (Patz 2010). "Each studio has their own order they want you to go in, but in most studios…at least [the first] five or six colors tend to be in the same order," explained one experienced film producer. They continued: "During the preproduction phase, at some point we will lock the script, and then once it's locked any subsequent changes go into the colored pages," adding that these color-coded changes "help the entire team to make sure we're all on the same page." Another clarified that "It's just a way to standardize what version we're all looking at."

In one project, the color wheel sequence began with the traditional white paper, followed by, in order, blue, pink, yellow, green, goldenrod, buff, salmon, cherry, tan, gray, and ivory, before repeating (Honthaner 2013). In another project, the production team prided themselves on never repeating a color, and resorted to hand-drawn plaids and stripes after exhausting all other available options (Brook 2005). By the conclusion of some projects, the final script is printed on "a rainbow of different colors (Cheklitch 2002)."

As more film projects transition to digital documentation, this tradition is being kept alive through version names that refer to color, according to several experienced film producers interviewed as part of the verification process detailed in Chapter Three. Although one participant noted that "those days are almost gone," and explained that, on modern film projects, physical documents are often only printed for a few extremely senior cast members or producers, another explained they "consistently see" electronic documents distributed on colored backgrounds, continuing the use of the color wheel. Some film projects still rely extensively on printed documentation; one producer explained that "the smaller the budget, the more paper I see. In indie films, you see some of these systems revert back to their former processes, because the analog version was reliable." Lamenting the industry's slow transition away from the use of hard-copy, printed documentation in favor of digital media, a veteran of the field advised that "You know, some of the old ways are the best ways," before leaning back in their chair and taking a dramatic pull from an imaginary cigar.

Although the Producer, Director, and Financer join the project during the Development phase (Hawkey and Vans 2024), the full project team is assembled during Preproduction (Ryan

2017) and clear lines of managerial authority are established (Brook 2005). Apart from unexpected changes, cast and crew expectations, requirements, and schedule are clearly defined before each team member formally joins the project. Depending on the role, this can include the shooting schedule, filming locations, the script itself, the project budget, and team-specific breakdowns such as the amount allocated to wardrobe (Introna, Cushman and Moore 2000, Hawkey and Vans 2024). Information about the project leadership team's prior projects is also readily available on the internet (IMDb n.d.).

Many professionals in the film industry are represented by unions and guilds, such as the Screen Actors Guild – American Federation of Television and Radio Artists (SAG-AFTRA), which represents over 160,000 creative practitioners (SAG-AFTRA n.d.). Each union and guild publishes an array of standardized job titles and detailed supporting descriptions of expected responsibilities (Persse 2008). For example, IATSE 705, a union representing motion picture costumers, has established 34 unique roles related only to tailoring and costume design for film production, and provides film projects with detailed limits of the responsibilities expected of each role (IATSE 705 n.d.).

Job titles are standardized throughout the industry; even independent films not employing union- or guild-represented crew often use official union and guild job titles (Honthaner 2013). "They don't have to have job titles because there's no union involved, but it just makes it easier," shared one experienced film producer interviewed for this research, adding "It helps [team members] to know what they're signing up for," and "For small budget films, it makes them seem more organized. They don't have to reinvent the wheel." Another believed that using union and guild job titles on a non-union project is "probably a mark of a well-run project. If I'm applying to be on a crew for an independent film project, and they don't know what my job title is or can't be clear on what the duties are going to be…that's probably a red flag, right?"

The detailed information provided by industry unions and guilds about the requirements of each role is not limited to expected duties. An experienced film producer explained that film projects must book all members of the Screen Actors Guild in business class when flying. Members of IATSE, as well as those represented by local unions and guilds, must be flown in business class when traveling abroad, but may be flown in economy on shorter domestic flights. Each guild also specifies differing requirements for turnaround, with a minimum of 11 ½ hours on the ground between trips mandated for some roles, they added.

It is interesting that, in contrast to the standardization of roles and responsibilities throughout the industry, the role of Producer remains somewhat nebulous. The Producer is the closest analogy to Project Manager in the film industry, and is responsible for managing a project from start to finish. Yet even the Producers Guild of America, representing 8,400 producers, confirms that the definition of *Producer* can vary depending on the unique requirements of each project (Producers Guild of America 2024). An interview participant suggested that, while "9/10" roles may be standardized in the film industry, "the most vague one is the title of producer. If somebody says, 'I'm a producer,' I don't trust anything until I see their experience, because anybody can be [called] a producer, but that doesn't mean they can budget a movie." Another laughed that "If you ask a producer what they do, they'll all give you a different answer."

The responsibilities of the role may also vary with the size of the project team. While small film projects may boast only a single Producer, or even a combined Producer/Director role, larger budgets and larger scope both allow and necessitate a proliferation of supporting roles. "When you have a producer title on an indie film, you're doing 10 more things than you would be on a studio film," explained one experienced producer.

While few film projects may include every role listed below, the Producers Guild recognizes each of these positions as part of the production team and eligible for full membership – and are also willing to consider additional titles not listed here (Producers Guild of America n.d.):

- Producer
- Executive Producer
- Co-Producer
- Co-Executive Producer
- Line Producer
- Supervising Producer
- Producer Supervisor
- Production Manager
- Production Coordinator
- Supervising Field Producer
- Segment Producer
- Field Producer
- Supervising Story Producer
- Senior Story Producer
- Story Producer
- Post-Production Producer
- Post-Production Supervisor
- Post-Production Manager
- Post-Production Coordinator
- Visual Effects Producer
- Visual Effects Co-Producer
- Visual Effects Production Supervisor
- Visual Effects Coordinator
- Animation Producer

Despite the abundance of related titles and the inherent ambiguity of the role, the Producers Guild of America attempts to maintain the integrity of the Producer title. For example, the Guild will not extend official recognition to film projects that award a Producer credit to financial backers as a benefit or perk, and will not consider such projects for industry awards (Producers Guild of America 2024).

The film production industry draws on an unusual labor pool; both employment and unemployment can rise simultaneously, and the prospect of low wages and uncertain employment does not seem to deter new applicants (Lampel and Germain 2015). Nevertheless, experienced practitioners advise diligence when selecting projects, and suggest only committing to projects and roles that are a good fit and appear likely to succeed. Key questions to consider include "Am I the right person for this film?" and "Do I trust my key collaborators? (Ryan 2017)."

Project stakeholders in the film industry must repeatedly make risky decisions, and rely on trust and reputation to mitigate these risks (von Rimscha 2009). The film production industry relies heavily on personal and professional networks, and the importance of working with known, trustworthy people is often heavily emphasized (Honthaner 2013). Personality and team fit may be even more valuable to project success than talent or experience (Ryan 2017). For example, when selecting both cast and crew, director Steven Spielberg is known to prioritize those with a friendly management style, strong social skills, and seeks to achieve the maximum degree of cooperation possible (Farina, Fedorovskaya, et al. 2022).

Formal project cost reporting is usually done weekly during Preproduction (Patz 2010). Project financing can be complicated, with as many as 33% of films co-financed by multiple studios, as a risk mitigation strategy due to the difficulty in predicting box office returns (Goettler and Leslie 2005). Other elements of the project financial plan may include the sale and leaseback of physical property, equipment, or intellectual property rights or the presale of distribution rights to specific markets. One production studio said that, of the 90 films they had worked on, no two had relied on the same financing scheme (Hofmann, Ladies Who Launch 2002a).

One often essential element of obtaining project financing is the purchase of a *completion bond* (Hofmann 2002a, Clevé 2018). A completion bond essentially provides against failed production; if the management team is unable to deliver the promised film, the company issuing the bond steps in to complete the work (Ryan 2017). Most investors require projects to acquire a completion bond during the Preproduction phase; as a result, film projects that begin Production almost always deliver a finished product (Ryan 2017).

Production

During the Production phase, often referred to as *principal photography* (Clevé 2018), the detailed plans created during Preproduction are put into the motion. Here, the actual filming of the script takes place, scene by scene. Filming is an iterative process, beginning with rehearsal, then *blocking*, or directorial decisions on lighting and the placement of cameras and actors for each scene (Honthaner 2013). Once these decisions are made, lighting is adjusted, final rehearsals are held, and the scene is shot (Patz 2010, Clevé 2018). Although the intent may often be to capture exciting events or palpable emotion, the reality of filming can sometimes feel repetitive. When one researcher visited a film studio to observe on-set communication and collaboration, the project's publicity director questioned why she needed to observe production for more than one week, asking "Doesn't everyone just do the same thing every day (Gould 2006)?"

During Production, ongoing expenses and progress are measured and reported in detail. The Assistant Director, who originally reported to the Producer and in many projects would have completed the first detailed budget and schedule for the film, now reports to the Director and compiles the Daily Production Report. This records the team's progress against the planned schedule: which scenes have been shot, how much film stock has been used, and any delays or cost overruns (Clevé 2018). Call Sheets, which list the cast and crew needed on set for each day of the shooting schedule and scene in the script, are used to track each actor's arrival and departure times, as well as their time spent in makeup and on breaks. They are used to compute salaries, overtime, night-shift premiums, and fines, and are forwarded to guild and unions as required (Clevé 2018). Even minor expenses, such as meals, staplers, and other incidentals are captured as "hot costs (Persse 2008)", including expenses paid for with petty cash (Patz 2010). With these tools, the project team begins documenting actual progress and expenses.

Cost reporting is usually done weekly during Production (Patz 2010). Although the *estimated budget* was approved and locked during Preproduction, the *working budget* changes constantly to reflect reality during the Production phase. The final, *actualized budget* is created only after final invoices are received and complete expenses are known (Ryan 2017).

Exceeding the estimated budget or schedule, even by relatively small amounts, results in immediate discussion and changes to the plan. Financial investors in the project often expect weekly detailed updates, and provide immediate feedback on project progress (DeFillippi and Arthur 1998). The President of Legendary Pictures, a large film production studio, stated that exceeding the estimated budget by only two or three percent would "require a lot of explaining," and that the financial agreements made prior to greenlighting would never allow their projects to reach 10 percent over budget (Persse 2008). A seasoned film producer interviewed for this effort related that overages "can very dramatically affect the process for execution. You might fire a producer in the middle of [production], or a line producer, or you might bring in a bond producer to hold everybody accountable." Another explained that, in the case of budget or schedule overages, the studio bankrolling the project would step in, have a conversation with the producers, and insist that the project either "make up the time or cut something out" from the planned film.

Although there are famous examples of film projects drastically exceeding their estimated budgets, such as *Waterworld*, which was estimated to cost $60 million but eventually consumed $175 million before completion, it appears that the large majority of film production projects finish on time, on schedule, and with the full script having been shot as intended. Interviews with over a dozen film studio executives aligned on a shared estimate of about 10% in total annual budget overages (Persse 2008).

Postproduction

During the Postproduction phase, the final film is edited and prepared for distribution. While the project as a whole does not formally enter the Postproduction phase until principal photography is complete, the work of editing filmed scenes may begin as soon as the first shot is successfully captured. The Postproduction phase can therefore overlap with Production in some projects (Patz 2010, Calvo 2013). At the conclusion of filming, the production team assembles the *answer print*, listing all shots to be included in the final product and matching each to the original script. During Postproduction, the editing team assembles a *continuity script*, listing every shot to be used in the final print of the film. These provide traceability between the final product and the original requirements, as captured in the script (Persse 2008).

Project costs are normally reported monthly during Postproduction (Patz 2010). In addition to the editing of the final film, this phase also often includes a financial audit of the entire project, conducted by a third party. One producer explained that “Typically, 100% of the time, we have someone come in towards the end of physical production…and sit down with Accounting.” The detailed progress and financial reports compiled during earlier phases are designed to facilitate these audits, which are routinely required by financial investors seeking an accounting of their funds (Patz 2010). Although most interview participants confirmed these final audits are conducted for almost all film projects, exceptions do occur: "It's not every project. We prepare for it, but sometimes nobody checks," explained one producer, adding that "Before I wrap, I make sure all my documents are in for an audit, even if there isn't one."

Distribution & Exhibition

The final phase of the film production project life cycle includes the release of the film and the tracking and reporting of financial returns and industry awards, which are both widely reported in the international press (Variety Media, LLC n.d.). Although the logistics for distribution and delivery of the physical film can be complex, and can include concerns about speed, security and secrecy, they are not in themselves sufficient to form a distinct project phase, so have been combined here with the activities related to exhibition.

Release planning is an essential part of the overall project plan, and can directly influence project success. The largest film projects often seek to release in the summer and around large national holidays, when demand is highest, and low-season demand is often not well supported (Einav 2007). Release dates can therefore be fiercely contested, but audiences tend to be selective, and films that may be less competitive in the market should postpone their release rather than directly battle with stronger films for viewers (Krider and Weinberg 1998). The value of professional networks within the projectized industry of film production is again evident; distributors who have an existing relationship with the film's director, producer, or financer are likely to offer better terms, release dates, marketing, and time in theaters (Sorenson and Waguespack 2005).

Because each showing of the completed film carries a financial cost, release planning is a heavily researched topic in the film production industry. Decisions on the optimal number of screens to commit to the exhibition of a new film are often analyzed with specialized software, such as *SilverScreener* (Swami, Eliashberg and Weinberg 1999, Eliashberg, Jonker, et al. 2000, Eliashberg, Swami, et al. 2001, Eliashberg, Hegie, et al. 2009). Due to the difficulty of accurately forecasting film revenue, film exhibition contracts can include several features that have been developed to share the risks between production studios and theaters. The profits of exhibition are shared between both parties, with defined upper and lower limits based on the film's percentage of the theater's total revenue and the film's most profitable week of exhibition (Filson, Switzer and Besocke 2007). The industry is also unusual in relying on a uniform pricing model; while ticket prices may be discounted based on the time of day, e.g. matinee showings, ticket prices for all other showings, and for competing films, are normally identical (Orbach 2004, Orbach and Einav 2007).

The number of theater screens has reduced over time relative to market demand (Davis February 2002); increasing the number of screens serving each market results in moderately lower ticket prices, but reducing the number of theaters does not result in higher prices (Davis 2005). The decision on when to remove a film from theaters is often based on its relative performance to other films currently being shown (Chisholm and Norman 2006). When a film performs well in the domestic market, releasing it internationally or in a second market relatively quickly can enable a wave of additional sales (Lehmann and Weinberg 2020). If domestic performance is poor, however, a secondary release in additional markets may be more successful after a delay (Frank 1994, Elberse and Eliashberg 2003). When syndicating a film for television broadcast, the popularity of the network has a larger influence on the number of viewers than the film's performance in the theater (Gambaro 2004). In total, the planning, analysis, and decision making necessary for the successful large-scale exhibition of a completed film may rival the work performed during the Preproduction phase and thoroughly eclipse the effort of filming during the Production phase.

Film Production Project Outcomes

Due to the complex nature of financial accounting in the film production industry, project financial results can be difficult to determine (Daniels, Leedy and Sills 1999, Vogel 2020). However, despite the success of the overall industry, it is clear that films are among the riskiest of all products, and most films are unprofitable (De Vany and Walls 1999).

It appears impossible to accurately predict the eventual box office results for a proposed film (De Vany and Walls 1999). "We never know how well it will do until it's happening," remarked one veteran of the industry. Noteworthy attempts have been made using virtual stock exchange simulations (Spann and Skiera 2003, Elberse and Anand 2007), virtual futures markets simulations (Gruca 2000), custom software applications (Eliashberg, Jonker, et al. 2000), through comparison to content ratings (Leenders and Eliashberg 2004), the word-of-mouth transmission of consumer information (Moul 2007), consumer psychological variables (Neelamegham and Jain 1999), and others (Shugan 2000). Despite these attempts, film projects still face very high risks (Shugan 2000).

Only the top 22% of highest-earning films are believed to break even during their theatrical run (De Vany and Walls 1999). In the United Kingdom, the top 20% highest-earning films capture 80% of all revenue in the industry (Collins, Hand and Snell 2002). In the United States, just 6.3% of films earned 80% of the industry's total profit over a ten-year period (De Vany and Walls 2004). Even experienced practitioners are unable to predict the box office returns for a proposed film project, and a statistical analysis of 2,000 films in the United States and United Kingdom found that success cannot be attributed to any specific set of factors (De Vany and Walls 1999), although several apparent trends may offer partial insights, such as the observation that sequels with numbers in their titles perform worse than those without (Sood and Drèze 2006).

Risk Management in Film Production Projects

Film projects face several clear risks, and the industry has developed equally clear responses to each (Desai, Loeb and Veblen 2002). For example, completion bonds help to mitigate the risk of failing to film the script as originally intended. Detailed estimation, frequent cost reporting, final financial auditing, and the severity and immediacy of corrective actions taken in response to overages all serve to mitigate the risk of exceeding the planned budget. The final risk category, concerning box office results and the financial success of the film, may be the most intractable. In one strategy, some film production studios have elected to simplify their product lines, choosing to develop core competencies in specific genres or projects of a certain size (Miller and Shamsie 1999).

Perhaps surprisingly, the addition of a well-known 'star' actor to the project team is not an effective indicator of financial success, and most famous actors do not have a statistically significant association with the probability that a movie will perform well at the box office (De Vany and Walls 1999). Films starring even very well-known actors are still unprofitable on average, although such 'star power' does appears to reduce the chances of extreme outcomes, both positive and negative (De Vany and Walls 2004). Why, then, do star actors command such high salaries? The answer, perhaps also surprisingly, is in their value in mitigating the largest source of risk to film projects: the greenlighting decision.

Although almost all film projects that successfully pass the greenlighting decision eventually deliver a completed product (Ryan 2017), roughly 95% of films that begin the Development phase are never approved to begin Preproduction (Eliashberg, Hui and Zhang 2007).

The primary benefit of including well-known “star” actors on the project team is to help ensure the project is one of the few allowed to proceed, and the high salaries commanded by popular actors are justified only by the increase they bring to the project’s ability to secure other necessary resources, not by any direct correlation to overall project success (De Vany and Walls 1999, De Vany and Walls 2004, Brewer, Kelley and Jozefowicz 2009, Skilton 2009). Although films with award-winning stars receive only marginally better reviews than those without (Ravid 1999), a well-known actor can greatly ease the challenge of securing funding for the project (Ryan 2017, Vogel 2020). No star can guarantee a successful film, but stars help get films into Production (Albert 1998).

Time-to-market is an important component of financial success in many projectized industries, and delivering even a superior product late can significantly reduce potential returns (Eisenhardt and Tabrizi 1995, Brown 2014). The risk of moving too slowly is compounded in the film industry, as the key resources needed to form a project – producer, director, script, financing, and distribution – may each be only temporarily available, potentially causing project proposals to languish in Development (Hofmann 2002, as cited in Lampel and Shamsie 2003). In response, film industry processes have evolved to focus on the rapid bundling of the resources necessary to pass the greenlighting decision (Lampel and Shamsie 2003). Moving too quickly also carries risks, and there is a trade-off between time-to-market and the quality of the product under development, but most project resources should be allocated to the most important phases (Cohen, Eliashberg and Teck-Hua 1996). The film industry attempts to balance these risks by postponing most investment until after the greenlighting decision.

One way in which film projects speed the process of resource acquisition in a loosely networked, projectized industry is through repeated collaboration. The apparent diversity of projects in the film industry conceals enduring patterns of collaboration among practitioners, and film project teams are more successful if they have worked together before (Narayan and Kadiyali 2016). Production studios often retain core members of successful projects to serve on successor efforts (DeFillippi and Arthur 1998), and these repeated pairings more easily allow for the retention of lessons learned through experience (Ferriani, Corrado and Boschetti 2005).

For example, a set of 20 actors were cast and recast in a total of 47 roles in the films *Shaun of the Dead*, *Hot Fuzz*, and *The World's End*. Although the plot and setting of each film is unrelated, they are commonly referred to as a trilogy due to the extent of recasting. Judd Apatow, a particularly prolific director, cast the same 63 actors a total of 240 times across 24 separate films and television series, although only one was an official narrative sequel (Hawkey 2016). The famed Japanese film director Akira Kurosawa also chose to repeatedly work with the same group of technicians, crew members, and actors (Farina 2022), and even the Greek tragedies of Aristophanes, Sophokles, and Euripides were written for specific actors and directors familiar to each playwright (Lehner 2009).

Existing teams may reform more rapidly than new teams can be assembled *ex nihilo*, giving them an important competitive edge in securing the other elements necessary to achieve a greenlight. This may also help to explain the industry's growing reliance on sequel films (Bohnenkamp, et al. 2015). Film sequels are, in general, less financially successful (Basuroy and Chatterjee 2008) and reviewed more critically than their parent films (Prag and Casavant 1994). As films are an experiential product, this may indicate an inherent audience preference for original works. Success rates are higher for sequels that begin immediately after the previous film, however, possibly due to the retention of original team members (Basuroy and Chatterjee 2008).

Although long-term contracts and direct ownership of the physical assets necessary for film production were effective mitigants of financial risk during the industry's early years, the coordinative skills necessary to rapidly assemble large groups of temporary employees are more valuable in the modern, networked and projectized industry. Technical, creative, and collaborative skills are most valuable in the uncertain and unpredictable environment of Creative projects (Miller and Shamsie 1996), and film producers have responded to the project risks posed by the important greenlighting decision by seeking to retain talented teams across multiple projects (DeFillippi and Arthur 1998).

Step Four: Synthesize Explanatory Principles Evident in the Source Industry

In Step One, this example of the Real-to-Real process began by selecting a target industry and identifying potential barriers to project success within that domain. Then, in Step Two, another industry that may have developed different approaches in response to similar challenges was identified, as a source of inspiration. Step Three involved a holistic overview of project management practices used in that source industry.

As many of the specific practices – assignable tasks and duties – used in the source industry are not directly applicable within the context of the target industry, Step Four will now synthesize a set of guiding principles, evidenced by project management practices in the source industry, which explain that industry's approach to managing projects. The conceptual shape of each principle, as outlined by the specific practices used to fulfill or support it, is revealed through an iterative process of inductive reasoning. These principles will serve as a conceptual bridge between the source and target industries, much like a central language in translation software is used as an intermediary between multiple language pairs (Simske and Vans 2021). Each principle will facilitate the accurate transfer and application of its associated practices across domains. Each acts as a transformative intermediary, and will enable, in Step Five, the selection of target industry practices which mirror or parallel those used in the source industry.

The analysis of management practices used in film production, in Step Three, reveals at least four recurring patterns that may help to explain that industry's approach to managing projects. Each forms a high-level, aspirational directive that seems to shape or inform project management in the film industry. Other evident patterns may reveal additional film industry principles not directly relevant to this effort, such as the bundle of film industry practices relating to the successful exhibition of completed films; these will be disregarded in favor of principles which may help to manage hedonic requirements. While the principles identified here are not directly assignable as tasks themselves, each encapsulates sets of more specific activities in both the target and source industries. The full mapping of practices to principles across both industries is shown in Appendix A.

Expectation Clarity

The first noteworthy pattern to emerge from the analysis of film production management practices is the high level of information available to potential team members prior to joining the project. Labor unions and professional guilds serve the industry by publishing lists of official job titles and extensive detail about the responsibilities expected of each role (Persse 2008, Honthaner 2013, IATSE 705 n.d.). These job titles and associated responsibilities are used throughout the industry, on projects of every size, in productions of every genre, and even on independent film productions not using union-affiliated team members (Honthaner 2013). In the projectized and dynamic film production industry, these standardized roles and responsibilities are essential for quickly building relationships (Introna, Cushman and Moore 2000). The set of roles currently in use has been stable over time, and, in conjunction with information related to the script and shooting schedule, enable practitioners to understand their potential duties, expectations, requirements, deliverables, budget, and schedule before deciding whether to join the team (Introna, Cushman and Moore 2000, Brook 2005, Ryan 2017). Even early in the Development phase, at project initiation, when the Financer, Producer, and Director commit to a project concept, their individual contributions and schedule are clearly defined and documented (Clevé 2018, Ryan 2017).

Careers in the film industry involve moving from project to project and collaborating with diversly skilled specialists in temporary teams on complex, non-routine tasks (DeFillippi and Arthur 1998). The use of an industry-wide hierarchy of clearly defined roles and responsibilities allows producers to build accountability into every phase of production (Introna, Cushman and Moore 2000, Persse 2008). The system also enables the passion and commitment essential for success in Creative projects; every member of the team enjoys clarity on their role, budget, and expected contributions, as well as those of the rest of the team (Katsiris 2007, Persse 2008). In addition to minimizing the time needed for integration and orientation when forming each new project team, the level of information available enables potential team members to select projects they believe provide a foundation for success, and roles in which they expect to excel. Experienced producers caution diligence when committing to a project: all provided details should be examined carefully, and only projects that are a good fit should be chosen (Ryan 2017).

Table 3 details some of the specific management practices identified in the analysis above that support this principle, titled *Expectation Clarity*. Each of these practices is evidence that the film industry seeks to enable team members to understand their own and other's responsibilities, select suitable projects, and commit to roles in which they will excel (Hawkey and Vans 2024). While the specific practices noted in **Table 3** may not be directly applicable to this effort's target industry, the underlying principle of Expectation Clarity driving their use will allow the identification of practices suitable for the domain of software development.

Table 3*: Film Production Practices Supporting the Principle of Expectation Clarity (Hawkey and Vans 2024)*

<table>
<tr><th>Film Project Management Practices</th><th>Principle</th></tr>
<tr><td>Independent film projects often use the same job titles and assigned duties as union film projects.</td><td rowspan="4"><u>Expectation Clarity</u>
Enable team members to understand their own and other’s responsibilities, select suitable projects, and commit to roles in which they will excel.</td></tr>
<tr><td>The Financer, Producer, and Director formally commit to a film project in writing, with their responsibilities and schedule clearly defined.</td></tr>
<tr><td>Apart from unexpected changes, cast duties, expectations, requirements, and schedule are clearly spelled out before they formally join the project.</td></tr>
<tr><td>Unions and guilds, such as SAG-AFTRA, provide detailed descriptions of job roles and duties.</td></tr>
</table>

Rigorous Project Approval

The second noteworthy pattern visible in the analysis of film production practices revolves around the rigor of the greenlighting decision, which approves a proposed project to advance from the Development phase to Preproduction and eventual Production (Eliashberg, Hui and Zhang 2007, Honthaner 2013). Many projectized industries struggle to arrest the inertial escalation of commitment which can lead to investment in underperforming efforts that should be canceled in favor of more competitive projects. While the pain of sunk costs partially drives such escalation, the sharing of decision-making authority much more strongly reduces an organization’s ability to definitively cancel poor project proposals (Sleesman, et al. 2012). In comparison, in the film industry, the authority to approve project proposals is heavily restricted. Even in large film organizations, very few people are allowed to formally approve projects (Eliashberg, Hui and Zhang 2007, Persse 2008). And although other industries make use of similar stage-gate decisions, the level of analysis incorporated here is unusual.

Greenlighting decisions rely on detailed estimates of cost, schedule, and benefits (Persse 2008, Honthaner 2013), require the identification and formal commitment of the project leadership team (Clevé 2018, Ryan 2017), distribution plans (Lampel and Shamsie 2003, Ciancarini, et al. 2023), and risk mitigation strategies (Hofmann 2002a, Clevé 2018), among other details. A successful greenlighting decision triggers the hiring of the full project team and allows access to the committed budget for the first time; as a result, teams in the industry enjoy clear knowledge as to whether any particular proposal has been approved (Honthaner 2013), limiting the risk of investment in projects that do not receive approval to proceed.

Perhaps most striking is the severity of filtering performed by the greenlighting decision: as discussed in Step Three, only approximately 1–2% of film project proposals are greenlit for production, and experienced producers eventually accumulate vast stores of proposals that never receive further investment (Persse 2008). Films are among the riskiest of all products, and the rigor of the greenlighting decision may be a response to the impossibility of predicting box office results for any given film (De Vany and Walls 1999, Shugan 2000). The film industry partly addresses project financial risks by using the greenlighting decision as a competitive filter, and by attempting to ensure that only the most viable projects are selected.

Table 4*: Film Production Practices Supporting the Principle of Rigorous Project Approval (Hawkey and Vans 2024)*

<table>
<tr><th>Film Project Management Practices</th><th>Principle</th></tr>
<tr><td>The greenlighting decision approves a film project for production.</td><td rowspan="4"><u>Rigorous Project Approval</u>
Ensure the use of formal project approval decisions, based on detailed analysis, to authorize project proposals for full development.</td></tr>
<tr><td>Greenlighting calls for detailed cost and benefit analysis.</td></tr>
<tr><td>Many proposed films are never greenlit for production.</td></tr>
<tr><td>Very few individuals in each organization have the authority to greenlight a proposed project.</td></tr>
</table>

Table 4 includes a list of specific practices related to project approval in the film industry. The existence of an underlying guiding principle of *Rigorous Project Approval* leading to these

specific practices seems clear. The film production industry ensures the use of formal project approval decisions, based on detailed analysis, to authorize projects for full production (Hawkey and Vans 2024).

Benefits Management

In addition to the detailed estimation activities discussed above, a third observable emphasis within film production management practices is the dedication to tracking and reporting actual costs, progress, and outcomes (Hawkey and Vans 2024). During production, actual incurred expenses and project progress, in terms of the number of scenes and pages of script filmed, are captured daily and reported at least weekly to all project stakeholders, including those nominally in other organizations, such as project financers (DeFillippi and Arthur 1998, Patz 2010). Exceeding the estimated budget or schedule by as little as 2% can trigger immediate discussion and replanning activities (Persse 2008). Almost all film projects close with a detailed financial audit by a third party (Patz 2010), and, after release, achieved benefits, in the form of ticket sales and industry awards, are reported not only to the project team but in the international media (Variety Media, LLC n.d.).

This system promotes regular and thorough measurement of project outcomes (Persse 2008). Combined with the detailed estimation activities which inform the greenlighting decision, these practices reveal the film industry's adherence to a principle of *Benefits Management*, or the planning, measuring, and reporting of the project's actual achieved progress, spending, and outcomes (Zwikael 2016, Hawkey and Vans 2024). **Table 5** lists several practices that the film industry uses to reify this principle.

Although there is no single, widely adopted definition or process for benefits management (Project Management Institute 2017), the concept is not unique to film production (Chih and

Zwikael 2015). The terms *value creation*, *business value*, and *benefits realization* all have overlapping definitions and have been used interchangeably in the literature (Laursen and Svejvig 2016). It is the level of the film industry's dedication to this principle that is noteworthy: the scope of detail captured and reported, the recency and frequency of reports, the organizational distance across which reports are travel, and the severity and immediacy of actions taken in response.

***Table 5**: Film Production Practices Supporting the Principle of Benefits Management (Hawkey and Vans 2024)*

Film Project Management Practices	Principle
During production, progress and expenses are reported daily or weekly.	**Benefits Management** Estimate, track, and report actual progress, spending, and outcomes.
Box office results and industry awards are widely reported in the media.	
Going over budget or over schedule is noticed quickly, and causes discussion and changes to the plan.	
Projects end with a financial audit by a third party.	

Linked Boundary Objects

The final evident pattern informing film production management practices involves the set of documents derived through the script breakdown process. Here, film industry projects generate a standardized set of documents used to plan each aspect of the project in detail, all linked through references to scene numbers (Cheklitch 2002). For example, for every scene in the script, Call Sheets denote which team members are needed on set, the Shooting Schedule explains the planned start time and duration of filming, and the Prop List and Wardrobe List each specify which items those respective sub-teams will need to furnish (Patz 2010, Clevé 2018). The set of documents generated by the script breakdown process is standardized across the industry and familiar to all experienced practitioners (Patz 2010, Hawkey and Vans 2024). Even the formatting of each document is uniform in all projects, regardless of size, scope, or genre (Persse 2008, Patz 2010, Honthaner 2013). When approved changes are made to the script, it is reprinted on a new color of paper; when that change is then propagated through the set of linked documents, each is then also reprinted on the same new color paper, providing an immediate and obvious visual indication of the revision (Brook 2005, Honthaner 2013).

Each document generated through the script breakdown process is a *boundary object*, a flexible artifact that supports and satisfies the information requirements of multiple knowledge domains (Star and Griesemer 1989, Bechky 2003). Boundary objects can be an effective tool for enabling and encouraging collaboration and learning across organizational or knowledge domain boundaries (Bechky 2003, Hargadon and Bechky 2006). Innovating across such boundaries requires disentangling knowledge from the context of one domain in order to identify its relevance and value in another (Hargadon 2002). For creative professionals attempting to collaborate, boundary objects can also be a source of guidance to team members who come from different fields and are responsible for different aspects of the project (Lampel and Germain 2015). Standardized templates and processes also allow the cross-industry development of core competencies despite the ephemeral nature of projectized teams (DeFillippi and Arthur 1998).

Film projects require the collective creativity of multiple specialized experts and sub-teams, each of whom needs context-specific information. The project team is only temporarily assembled, and may at times be widely dispersed (Introna, Cushman and Moore 2000). As a result of the script breakdown process, in a projectized industry relying on the temporary collaboration of loosely networked resources, experienced team members join each new project already understanding what project planning artifacts to expect, how they will be used, and already able to decode these documents at a glance (Clevé 2018). As detailed in **Table 6**, film production projects improve communication and collaboration across organizational and knowledge domain barriers, and reduce the time needed for orientation and integration when initiating new projects, through the use of these standardized documents and by tracking revisions to them (Hawkey and Vans 2024).

***Table 6**: Film Production Practices Supporting the Principle of Linked Boundary Objects (Hawkey and Vans 2024)*

Film Project Management Practices	Principle
The *script breakdown* turns the script into Call Sheets, Shooting Schedules, Location Lists, and others.	**Linked Boundary Objects** Improve communication and collaboration by using a set of standardized documents and by tracking revisions.
Changes to the script are printed on new colors of paper.	
Scripts all use the same formatting.	
All film projects use a set of documents that are familiar to the cast and crew, such as Call Sheets, Shooting Schedules, Production Reports, etc.	

These four principles, summarized in **Table 7**, shape the film production industry's approach to managing projects. None are explicitly stated in the existing literature, and the names and definitions used here were unfamiliar to the experienced film producers interviewed as part of the verification process detailed in Chapter Three. Nevertheless, their existence and the extent of their influence can be inferred from the industry's consistent use of the associated practices.

***Table 7**: Four Evident Project Management Principles in the Film Production Industry*

Principle	Definition
Expectation Clarity	Enable team members to understand their own and other's responsibilities, select suitable projects, and commit to roles in which they will excel.
Rigorous Project Approval	Ensure the use of formal project approval decisions, based on detailed analysis, to authorize project proposals for full development.
Benefits Management	Estimate, track, and report actual progress, spending, and outcomes.
Linked Boundary Objects	Improve communication and collaboration by using a set of standardized documents and by tracking revisions.

Each of the practices discussed here is well documented and used both consistently and systematically within the industry, but are essentially followed by rote, without discussion of underlying goals or reference to guiding principles driving the selection of these specific practices. Each principle is therefore a reflective construct, inspiring the set of specific tasks, methods and duties meant to reify them, if only imperfectly (MacKenzie, Podsakoff and Podsakoff 2011).

These four principles now provide a framework for the identification of software development practices that may be beneficial when used in projects with characteristics similar to those in the film industry.

Step Five: Identify Parallel Practices Suitable for the Target Industry

The Real-to-Real process, illustrated in **Figure 1** and detailed in **Table 1**, may help to identify beneficial project management practices by examining practices in another industry that has developed different approaches to similar challenges. The example use detailed in this chapter looks to the film production industry for inspiration on managing hedonic requirements in software development projects. Now, after having identified four principles that evidently shape or guide project management within the film industry, it is possible to identify existing software development management practices which will also adhere to or support the same principles. It is also possible to develop entirely new software development practices, which could potentially more closely mirror the identified film production practices. Testing novel practices in new software development projects is beyond the scope of this example, however, and the validation of results will necessarily be limited to an examination of existing project records. This example use of the method will therefore seek only to identify existing software development practices which support each of the film production principles.

A set of existing software development practices relevant to each principle is detailed in this step. After the identification of an initial set of practices believed to support these principles, a series of interviews with experienced software development project managers was conducted to verify each pairing. These interviews are presented in full in Chapter Three, with selected quotes included below.

This final step of the Real-to-Real process uses the principles identified in Step Four as a conceptual bridge between domains, and results in a set of assignable tasks and duties suitable for the target industry which mirror or parallel management practices in the source industry. In target industry projects with characteristics similar to those in the source industry, these practices may lead to improved project outcomes by allowing target industry practitioners to tap into hard-won source industry experience.

Expectation Clarity

The first principle shaping the film industry's approach to project management is *Expectation Clarity*. In the film industry, projects enable team members to understand their own and other's responsibilities, select suitable projects, and commit to roles in which they will excel (Hawkey and Vans 2024). Specific film industry practices supporting this principle are listed in in **Table 3**. Software development practices which would also support this principle and thus mirror film industry practices are detailed in **Table 8**, while the full mapping of principles to practices in both industries is shown in **Appendix A** (Hawkey and Vans 2024).

To support *Expectation Clarity*, software development projects could also, as the film industry does, rely on standardized roles and responsibilities. As discussed in Step Three, film production job titles are standardized across the industry, regardless of project scope, size, or genre (Persse 2008, Honthaner 2013, IATSE 705 n.d.). The software development industry could develop a similarly detailed library of standardized roles and responsibilities suitable for all projects. While some professional organizations, such as the Agile Alliance, already provide generalized information on a relatively small set of roles (Agile Alliance n.d.), these lack the gradations in seniority seen in film industry job titles, such as the progression from Costumer Entry Level to Costumer Journeyperson to Costume Department Keyperson and beyond (IATSE 705 n.d.). Existing generalized role and responsibility information available within the software development industry also does not fully cover the breadth of roles in common use on large projects, such as User Experience Analyst (Maier and Berry 2018).

With or without referencing an industry-wide set of job titles, software development projects could also define and document their project roles and associated responsibilities during project initiation, and provide these details, along with the project scope, schedule, budget, and leadership team, prior to hiring or assigning team members, as is routinely done in the film production industry. A Program Director interviewed during this research remarked "I think that's very helpful," adding that "Personally, that's been very helpful in Scrum, with the 'separation of state' clearly delimited in the set of standard roles."

By offering such comprehensive information prior to onboarding, the film industry encourages participants to select only projects they believe will be successful and roles in which they will excel (Ryan 2017). This approach essentially enables team members to participate in the selection of project goals and strategy, which has been found to significantly improve performance (Locke and Latham 2002). In contrast, as shown in **Figure 2**, in most popular software development methodologies, project goals are selected before the team is formed. Mandated goals are detrimental to both enthusiasm and team commitment, leading to worsened project outcomes (Bryson and Bromiley 1993).

In Creative projects, clear roles and responsibilities are essential for success, and can help to engender passion and commitment from the team (Katsiris 2007). Clear expectations can lead to greater affective commitment, the acceptance of and belief in project goals (Buvik and Tvedt 2017). This clarity is particularly important in dynamic, creative teams, where mutual trust is a key factor driving overall commitment (Barczak and McDonough 2003). Higher levels of team commitment, supported by clear roles and mutual trust, are consistently associated with project success (Hoegl, Weinkauf and Gemuenden 2004, Ehrhardt, et al. 2014, Buvik and Tvedt 2017).

When projects are formed from a temporarily assembled network of independent specialists, mutual trust, repeated collaboration, and a clear understanding of interdependencies accelerate the adoption of innovative processes (Taylor and Levitt 2004). Agreeing with the value of re-using familiar roles, one Program Director opined "You can imagine scaring the life out of most people, if we made it up ourselves."

Additionally, team clarity on task interdependencies and the integration of work is strongly related to both team and organizational commitment (Bishop and Scott 2000). When project teams enjoy clarity on how each member's individual work contributes to the whole, the team is also more likely to set realistic and relevant goals, further increasing the likelihood of success (Chih and Zwikael 2015). In the film industry, this is reflected in the use of detailed and standardized roles and in the emphasis placed on trust by experienced practitioners (Honthaner 2013, Ryan 2017).

In film production, project goals are often as clearly defined as the familiar, standardized roles used in almost every project. The script and shooting schedule delimit the project as a whole, while other standardized artifacts, such as the Prop List, apportion the overall scope to sub teams and individual contributors (Patz 2010). Even during project initiation, when the Financer, Producer, and Director join the project, they do so in writing, with their key responsibilities and schedule clearly defined (Ryan 2017, Clevé 2018). This mirrors existing research, which has found that contracts detailing the project cost, intended benefits, and scope of work for the project manager, project funder, and benefits owner are critical for realizing expected outcomes (Badewi

2016). Clear goals, explicitly stated, have also been found to enhance team performance (Locke and Latham 2002, Chih and Zwikael 2015).

***Table 8**: Software Development Practices Supporting the Principle of Expectation Clarity (Hawkey and Vans 2024)*

Principle	Software Development Management Practices
Expectation Clarity Enable team members to understand their own and other's responsibilities, select suitable projects, and commit to roles in which they will excel.	Use standardized roles, titles, and responsibilities.
	Define and document roles and responsibilities.
	Provide access to role and project details before hiring or assigning team members.

In total, the film industry's adherence to the principle of *Expectation Clarity* provides clearly defined roles and objectives for every member of the team, allows for the close monitoring of progress, and enables a form of participative leadership by encouraging team members to select only the most suitable potential projects, all of which have been identified as best practices for leading creative teams (Mainemelis, Kark and Epitropaki 2015). This principle, and the practices supporting it, may be equally beneficial in software development projects attempting similarly creative collaboration.

Rigorous Project Approval

Projects in the film production industry generally follow a predictive methodology, as shown in **Figure 4**, regardless of size, scope, or genre (adapted from Turner and Cochrane 1993, Persse 2008). The greenlighting decision serves as a formal stage-gate decision between the exploration of project concepts still in Development and the detailed planning activities of the Preproduction phase. The vast majority of proposed film projects are never greenlit for further investment (Eliashberg, Hui and Zhang 2007). The film industry practices shown in **Table 4** each support a principle of *Rigorous Project Approval*: ensure the use of formal project approval decisions, based on detailed analysis, to authorize project proposals for full development (Hawkey and Vans 2024). Specific practices suitable for software development projects which also support this principle are shown in **Table 9**.

Software development projects could rely on a formal project approval process before authorizing the full investment and resourcing of project proposals. One software development project manager responded to this proposed practice with "I think this approach is essential, frankly. Any company that hasn't got some form of project life cycle, with various stage gates that you're aiming to hit, is at a disadvantage." Reflecting on past experience, one participant shared "Sadly, as a Program Director, I would regularly see a million ideas – a million good ideas! It was something we called NAGI, or *not another good idea*. We'd come in [for a project], and before you knew it, they'd ask 'could we also do this?'"

As is done in the film industry, initial staffing and investment could be restricted prior to this decision. "Up to 25% of your project spend could be in those early phases, and you don't want to be staffed too early," warned one extremely experienced Program Director, cautioning that while "you want to make people happy by stretching [resources,] but you do your people no favors by stretching, so there is a bit of personal integrity in saying 'no' sometimes, but that's really difficult."

The decision to approve project proposals could also be formally restricted to a handful of key decision makers. One IT Project Manager interviewed for this effort believed that centralizing approval authority would help "Try to make sure that [business stakeholders] feel empowered to share their voice, but would also put them on the hook. Before we really move forward, let's make sure we understand, from an IT, from a business, from a potential partner perspective, who's making the decisions on what it is we're going to do, and who's going to pay for it." They added

“Part of having a good, rigorous project approval is making sure people’s expectations are clear in advance.”

Project approval decisions could also require consideration of a detailed ROI analysis predicated on estimated expenses and benefits. “With any organization, you’ve got far more potential projects than you’ve got resources, and ensuring that your resources are applied to the most important projects – it’s fundamental,” explained one Program Director.

Mirroring the film industry’s greenlighting decision, software projects could frame the project approval decision as a competitive and highly selective filter, through which only the most promising project concepts are allowed to pass (Hawkey and Vans 2024). Agreeing with the potential value of this practice, but reflecting on contrasting experience, one Program Director shared that “I’ve worked in relatively small organizations of up to 1,000 people, and often times [project approval decisions are] not clearly defined. It is down to the CEO who says ‘yes, I feel it in the waters that we should do this.’”

The inherent rigor of the greenlighting decision is a form of risk management, as less certain or potentially lucrative projects are filtered out (Hawkey and Vans 2024). A formal and competitive project approval process may also be helpful in establishing a software development team as a true partner in its relationship with customers or the wider organization, rather than as a mere service provider. Adding clearly defined structure to the project approval process may also help to reduce managerial pressure to support every requested project proposal (Persse 2008). Software development teams could help to reduce the risk of investment in less competitive efforts by restricting investment in project proposals prior to a formal approval decision. This approval should be framed as a key decision gate, based on detail sufficient to accurately weigh the risks, expected costs, and potential rewards against other proposed efforts. In addition, as in the film industry, the risk of individual team members investing development time in proposals which never receive approval could also be reduced by ensuring clarity on the approval status for all projects.

***Table 9**: Software Development Practices Supporting the Principle of Rigorous Project Approval (Hawkey and Vans 2024)*

Principle	Software Development Management Practices
<u>Rigorous Project Approval</u> Ensure the use of formal project approval decisions, based on detailed analysis, to authorize project proposals for full development.	Project approval (Go/No-Go Decision) is a competitive and highly selective filter.
	Limit funding and staffing before project approval (Go/No-Go Decision).
	Use a formal project approval (Go/No-Go Decision) process.
	Centralize project approval (Go / No-Go) decision authority in a few key decision makers.
	Conduct a detailed ROI analysis before project approval (Go/No-Go Decision).

Benefits Management

Film production projects estimate, track, and report actual progress, spending, and outcomes in detail (Hawkey and Vans 2024). The specific film industry practices shown in **Table 5** reveal an adherence to a principle titled here as *Benefits Management*, though a variety of similar names have been used interchangeably in the literature (Laursen and Svejvig 2016). **Table 10** lists several ways by which software development projects could also support this principle.

Software development projects could, like those in the film industry, establish specific overage thresholds which would trigger corrective action if the project exceeded its budget or schedule by a predetermined amount. Such thresholds would, according to one Technical Program Manager, "help provide a collective understanding, across everyone, that when the project goes over schedule, we all know." Another agreed, stating that "I like the idea of some kind of formal review [after hitting a threshold] – a conscious decision to continue, or to stop, together."

Teams could measure and report actual progress and expenses daily or weekly during development, as film projects do during the Production phase (Patz 2010), and similarly ensure such reports reach all project stakeholders. At the conclusion of the project, a final audit of both expenses and delivered scope could help to ensure accountability and compare project outcomes to original estimates. Lastly, after release, the measurement of actual achieved benefits would provide the final information necessary to judge the overall success of the project, and would mirror the film industry's wide reporting of box office returns and industry awards (Hawkey and Vans 2024). Regarding this final audit, an experienced Program Director believed "We should be doing that as part of the handover and close-down in the final project phase. That should be a PM saying, look, I committed that this is what I was going to deliver, and this is what I've done," before concluding "I would believe that's absolutely key."

The benefits management process is not unique to the film production industry, and is highly recommended for use in software development projects. The process of estimating, measuring, and reporting both expenses and actual achieved benefits is related with overall project success (Serra and Kunc 2015), most significantly when combined with other project management processes (Badewi 2016). IT projects using Benefits Management are also less likely to experience cost and schedule overruns (Budzier and Flyvbjerg 2012). Previous research has also identified the value of consistently defining cost overruns and measuring project expenses in detail; both are key practices for reducing the risk of budget overages (Flyvbjerg, Ansar, et al. 2018). The prevalence of benefits management in the film industry highlights its influence on project outcomes, and suggests that it should be more widely adopted in software development.

Although already used in some software development projects, the process of benefits management may not be fully standardized. "When I was a Program Director, I couldn't point to a benefits management process that we used," related one interview participant, sharing that while each project was expected to measure achieved benefits, the details of measuring and reporting those benefits were developed from scratch for each project.

In addition, the wide reporting of film industry project outcomes, in the form of box office results and industry awards, ensures that every team begins each project understanding that the results of their efforts will be known or easily discoverable by potential future teammates and employers (Hawkey and Vans 2024). As discussed previously, the principle of Expectation Clarity may improve team member's affective commitment, or the acceptance of project goals, emotional attachment, and inherent desire to contribute. The wide reporting of project outcomes in the film industry may drive two other forms of project commitment: *normative* and *continuance*. Normative commitment is the felt obligation to contribute, while continuance commitment is shaped by the risk of potential losses and the desire to avoid potential negative outcomes (Buvik and Tvedt 2017). While these forms of commitment may seem less palatable to some managers than affective commitment, they are each significant determinants of overall commitment, which is consistently associated with project success (Neininger, et al. 2010, Ehrhardt, et al. 2014, Buvik and Tvedt 2017).

***Table 10**: Software Development Practices Supporting the Principle of Benefits Management (Hawkey and Vans 2024)*

Principle	Software Development Management Practices
Benefits Management Estimate, track, and report actual progress, spending, and outcomes.	Define overage thresholds that trigger corrective action when a project goes over budget or schedule.
	Report progress and expenses frequently.
	Conduct and publish a final accounting of expenses and delivered scope.
	Measure and report actual delivered benefits.

Linked Boundary Objects

The final identified principle underpinning the film production industry's approach to managing projects is their reliance on *Linked Boundary Objects*. Film production teams improve communication and collaboration across organizational, temporal, geographic, and knowledge domain boundaries by using a set of standardized documents generated by the script breakdown process and by tracking revisions to them using the color wheel (Patz 2010, Hawkey and Vans 2024), as discussed in Step Three and shown in **Table 6**. A set of specific practices suitable for software development which would also support this principle is shown in **Table 11**.

To mirror the film industry's script breakdown process, software development teams could also derive a set of supporting artifacts, such as architecture diagrams or UI mockups, from a detailed scope statement. The set of documents generated for each project, and the formatting of each document, could be standardized across all projects in the organization or all projects in the industry, as the set of documents generated through the script breakdown is standardized across the film production industry.

Software development projects could also mandate formal change for these key project artifacts, and use a defined process to propagate changes made to one document to other effected artifacts, similar to the film production industry's traditional color wheel process (Hawkey and Vans 2024). While this type of formal change control was common in predictive methodologies, with one interview participant noting "This is fundamental," it may not occur as often in newer, predictive methodologies. One experienced Program Director reflected that "Agile was, to my mind, born of a crisis, because people initially assumed that they knew what the user wanted, and that they could specify that, and write massive amounts of documentation. I said no, that's a waste of time, because in the time that you spent specifying that documentation, the human systems this information system is seeking to support – we've changed! Now all your documents and artifacts will need to change as well, and you run this sort of ever-evolving business of trying to [update] the artifacts. And to a certain extent, I think we've thrown the baby out with the bathwater."

Software development, like other Creative projects, requires the creative collaboration of multiple individuals and sub-teams, each of which may have domain-specific expertise. Effective processes enabling collaboration within these subteams and across the resulting project network drive overall performance and can predict successful adherence to delivering expected scope on time and within budget (Hoegl, Weinkauf and Gemuenden 2004). The collective creativity necessary for successful innovation is fostered in part by encouraging team members to seek out help, to give help when asked, and enabling them to quickly reframe relevant information (Hargadon and Bechky 2006). Unfortunately, in many organizations, there can be a perceived social cost to asking for help (Hargadon and Bechky 2006), and creative professionals often resist overly-formal coordination mechanisms (Endrissat, Islam and Noppeney 2016). Boundary objects, such as the project artifacts derived from the film industry's script breakdown process, support the information requirements of multiple knowledge domains (Star and Griesemer 1989, Bechky 2003), and, in dymanic, fast-changing project environments, these repositories, specifications, and standards support communication and learning across boundaries (Kellog, Orlikowski and Yates 2006, Bechky 2003, Hargadon and Bechky 2006). For creative professionals of differing backgrounds, boundary objects can both enable and guide collaboration (Lampel and Germain 2015).

In addition, the standardization of such documents across a wider organization, or more preferably across the software development industry as a whole, could help to enable the wider retention and adoption of best practices despite the inherently temporary nature of project work

(DeFillippi and Arthur 1998). This level of standardization may be rare in the software development industry; a Principle Software Solutions Engineer shared that projects in their firm followed a "Solutions Delivery Life Cycle – essentially, a checklist of things that you need to have completed before you go to production. But there is no standardized template; it depends on the experience of the PM and what they've used before to be successful." Standardization of project artifacts may also reduce the time needed for team orientation and integration during the initial launch of each new project, as key artifacts will already be familiar from past efforts (Hawkey and Vans 2024).

Table 11*: Software Development Practices Supporting the Principle of Linked Boundary Objects (Hawkey and Vans 2024)*

<table>
<tr><th>Principle</th><th>Software Development Management Practices</th></tr>
<tr><td rowspan="4"><u>Linked Boundary Objects</u>
Improve communication and collaboration by using a set of standardized documents and by tracking revisions.</td><td>Use formal change control for project artifacts.</td></tr>
<tr><td>Use standardized project templates.</td></tr>
<tr><td>Follow a defined process to propagate changes approved to one artifact to other artifacts.</td></tr>
<tr><td>Facilitate collaboration by deriving supporting artifacts, such as mockups, from a detailed scope statement.</td></tr>
</table>

Summary of the Illustrative Example

This chapter provided a detailed, step-by-step example use of the Real-to-Real process for inter-industry learning presented in Chapter One. The process began by selecting the software development industry as the target of this effort, and identified the challenge of managing hedonic requirements as a potential barrier to project success for software development teams. Although any relationship between project outcomes and hedonic requirements has not yet been explicitly measured, multiple previous studies have suggested a link to increased project risk (Callele, Neufeld and Schneider 2005, Diefenbach and Hassenzahl 2011, Ameller, et al. 2012). As other industries may have developed different approaches to managing these types of requirements, this forms a suitable choice for this example use of the method.

After a thorough consideration of possible candidates, the film production industry, which routinely deals with hedonic requirements, was then selected as a source of inspiration, in Step Two. A holistic overview of film production project management practices was conducted in Step Three, after which four evident guiding principles were synthesized explaining that industry's approach to managing projects in Step Four. Lastly, in Step Five, software development practices which would also support these principles were identified, allowing software teams to mirror or parallel film production practices by utilizing assignable tasks and duties suitable for their own domain. The full Real-to-Real process is illustrated in **Figure 1** and detailed in **Table 1**, and the full mapping of film production practices to principles and parallel practices is shown in **Appendix A**.

The practices identified through this example use of the Real-to-Real process may be beneficial when used in software development projects with characteristics similar to those found in film production projects. If these practices prove to be useful in managing hedonic requirements, however, it is noteworthy that they would appear to be non-obvious solutions to that challenge, as none seem to address hedonic or emotional requirements directly. In fact, many of the film industry practices reviewed in Step Three seem to contradict existing research into the management of Creative projects, which often advise increasing process flexibility (Shenhar 2001, Lampel and Germain 2015).

The film industry's approach to managing projects, shown in **Figure 4**, is rigorously predictive and standardized, and film industry teams have been described as "rigidly hierarchical (Introna, Cushman and Moore 2000)." One experienced software development project manager, after a short review of film industry practices, described film production as "contracts intermixed with a big, huge, Waterfall." This appears to conflict with previous research, which has suggested that, in dynamic and creative projects, management should shift to more egalitarian practices (Joyce and McGee 1997, Jain, Triandis and Weick 2010). This incongruity must be examined further to understand whether such a structured approach actually leads to consistent success in similarly creative software development projects.

It is also striking that, while each of the software development practices identified through this process have already been recommended by various sources (Wysocki 2019, Project Management Institute 2021), none are currently paired specifically with hedonic requirements in the existing literature. Any attempted listing of all generally recommended project management practices would, of course, be prohibitively broad (Fortune and White 2006, Mainemelis, Kark and Epitropaki 2015), and as the goal of this example effort, established in Step One of this chapter, was to provide software development teams with simple, heuristic guidelines on how to tailor their management practices to better support hedonic requirements, this work may help to close an important gap.

Before the practices identified in this example of the Real-to-Real process can be fully recommended to software development teams wrestling with hedonic requirements, it will therefore first be necessary to verify these findings with experienced practitioners in both industries, and then to empirically validate any effect on project outcomes when they are used in software development projects with varying levels of hedonic requirements.

CHAPTER 3: METHODOLOGY

Chapter One identified the potential value of translating specific management practices developed through hard-won experience in one industry to other industries facing similar challenges. The Real-to-Real method shown in **Figure 1**, which involves developing generalized principles to serve as a conceptual bridge between domains, was then proposed as a repeatable process for such inter-industry learning. Chapter Two presented a detailed, step-by-step example use of the Real-to-Real method. The software development industry was selected as the effort's target, and a review of existing literature found that the management of hedonic requirements may be a barrier to project success in that industry (Callele, Neufeld and Schneider 2005, Ameller, et al. 2012). The film production industry, which shares several characteristics with the software development industry and has deep experience in managing hedonic requirements, was then selected as a possible source of inspiration. A holistic overview of film production management practices revealed four guiding principles which evidently shape that industry's approach to managing projects. These four principles, defined in **Table 7**, then allowed for the identification of existing software development practices which also support each principle and thus mirror or parallel film industry practices. The complete mapping of principles to practices in both industries is shown in **Appendix A** (Hawkey and Vans 2024).

Research Design

Next, it was necessary to critically examine these findings. Although existing research has identified hedonic requirements as a potential source of risk to software development projects, there appears to be little existing empirical evidence of their effect on project outcomes. Accurately measuring this effect, if any, formed the initial question facing this research. In addition, if the software development practices identified through this example of the Real-to-Real method are beneficial when used in projects with high levels of hedonic requirements, they are non-obvious solutions to that challenge, as none appear to directly reference the intended emotional response of the user. The second question shaping this research, therefore, was to identify whether any combination of the identified software development practices consistently lead to improved project outcomes. Determining whether the most beneficial combination of practices differs for projects with varying levels of hedonic requirements comprised the third key point to explore, as that answer would help establish whether software development projects managers should tailor their selection of practices to their project's level of hedonic requirements. Ultimately, it was necessary to establish whether the Real-to-Real method successfully enabled the identification of beneficial software development practices that mirror or parallel film production practices

Research Questions

R1. How do software development project outcomes differ as the criticality of hedonic requirements increases?

R2. What combination of the project management practices identified from the film industry are associated with improved project outcomes when used in software development projects?

R3. Do software development projects with differing levels of hedonic requirements benefit from different combinations of the identified practices?

R4. Has the Real-to-Real process identified beneficial software development practices that mirror film production practices?

Three separate research efforts were conducted to address these questions. First, a series of semi-structured interviews with experienced film producers was held to verify the understanding of film production management practices outlined in Chapter Two, the four principles synthesized in this example use of the Real-to-Real method, and the mapping of principles to supporting film industry practices. Then, a second series of semi-structured interviews with experienced software development project managers was conducted to verify the identified set of software development practices and the principle that each best supports. Lastly, to empirically validate the effect, if any, of hedonic requirements on project outcomes, a survey was used to query software development project managers on the project outcomes, level of hedonic requirements, and practices used during a recent project. Through an iterative process of Qualitative Comparative Analysis, data from this survey was also used to determine the effect, if any, of the identified practices on project outcomes and the most effective combination of the identified practices, for projects with varying levels of hedonic requirements.

This effort defines project success using the three classic measures of on-time completion, adherence to an estimated budget, and the delivery of promised scope. In addition, a measure of stakeholder satisfaction is used to indirectly gauge achieved benefits, as any more precise quantification of realized value may have been problematic to conduct at scale. Alternative measures of success have been proposed (Khoza and Marnewick 2020), but were considered potentially difficult for participants to assess objectively and without the need to refer to project records that might not have been readily accessible. Increasing the duration or the number of questions in the survey was also believed likely to decrease participation, and was therefore avoided. Lastly, an aggregate score averaging these four individual measures was used to determine the overall success for the project case detailed in each response.

When beginning these research efforts, it was first hypothesized that one or more sets of the identified software development practices would consistently result in project success, across each of these five measures of success. It was also expected that, in software development projects not using that combination of practices, an inverse relationship exists between project success and the level of hedonic requirements. A small set of preliminary survey results were collected primarily to confirm the mechanics of the survey, data export process, and analysis software. These results also suggested that, in order to achieve similar levels of success, software development projects with high levels of hedonic requirements would need to use more of the identified practices than projects with low levels of hedonic requirements. Lastly, corresponding to the final research question, it was hypothesized that the Real-to-Real method, in this example use, identified software development practices which accurately reflect film industry practices and lead to success when used in software projects with characteristics similar to film projects (Hawkey and Vans 2024).

Research Hypotheses

H1. A combination or combinations of the identified management principles and practices lead software development projects to meet or exceed predefined criteria for success across the measures of adherence to budget, adherence to schedule, delivery of expected scope, stakeholder satisfaction, and an aggregated score of overall project success.

H2. As the criticality of hedonic requirements increases, there is a corresponding decrease in the success of software development projects which do not adhere to that combination of principles and practices, across the measures of adherence to budget, adherence to schedule, delivery of expected scope, stakeholder satisfaction, and an aggregated score of overall project success.

H3. To consistently achieve a predefined level of success, projects that rate the criticality of hedonic requirements above a predetermined level must adhere to more of the identified principles and practices than projects with rates below this threshold.

H4. The Real-to-Real method enables the translation of domain-specific management practices between industries, leading to improved project outcomes in the target industry when the translated practices are applied to projects with characteristics similar to those in the source industry.

Verification

This research began by conducting interviews with experienced practitioners in both industries to verify the management practices used in both domains and the relationships of principles to practices shown in **Appendix A**.

First Phase: Film Producer Interviews

The first phase of verification involved a series of semi-structured interviews with experienced film producers. These interviews were intended to confirm the understanding of film production management practices developed through this research, corroborate the synthesis of principles describing the film industry's approach to managing projects, and ensure accurate mapping of these principles to film industry practices (Hawkey and Vans 2024).

Goals

This first interview series began with four primary goals. The unstructured portion of each interview aimed first to confirm the description of each specific film industry practice given in Chapter Two, and then to verify the near-universal use of each practice throughout the film industry. Perhaps most importantly, the structured portion of each interview was used to confirm the relationship between each practice and the principle that it best supports. Lastly, these interviews hoped to determine whether the principles, as defined in **Table 7**, accurately describe a portion of the film industry's general approach to managing projects (Hawkey and Vans 2024).

Recruitment and Participants

An initial set of interview participants were drawn through existing personal connections. Participation was limited to experienced film producers, defined for this effort as professional working film producers (and related roles, such as Production Manager or Line Producer) with a history of completed film projects. Potential participants were excluded if their reported experience could not be independently verified, and one completed interview was not included in subsequent analysis for this reason. At the conclusion of each interview, these initial participants were then asked to provide referrals to other experienced film producers (Hawkey and Vans 2024).

Table 12*: Film Producer Interviews*

No.	Title	Years of Experience	Duration (h:mm)
1	Production Supervisor	15	0:53
2	Producer	15	1:45
3	Production Supervisor	15	0:46
4	Producer; Production Manager	23	1:20
5	Production Supervisor; Production Coordinator	13	0:40
	TOTALS:	**81**	**5:24**

Five interviews, shown in **Table 12**, were retained for analysis. The participants had an average of 16 years of experience, with a minimum of 13 years. To ensure anonymity, specific film titles cannot be referenced here. However, it is noteworthy that three of the five interviewees have held production roles on one or more Oscar-winning films. At the time of the interviews, one participant was producing a film at a *major* Hollywood studio, an industry term referring to a small set of large and well-known production companies. Another participant's career has included production roles on films that have earned more than $10 billion in total box office returns (Hawkey and Vans 2024). Although the number of interviews is limited, the breadth of participants' experience and the relative rarity of the professional role suggest that the information gained is both valuable and sufficient for the purposes of this study.

Data Collection Methods

Before proceeding, this study and all supporting research protocols were reviewed and approved by the Colorado State University Institutional Review Board (IRB). For this series of interviews, the IRB evaluated and approved the recruitment messaging, inclusion criteria, data management plan, and potential risks to participants. This approval ensured that all data collection efforts were conducted in accordance with ethical standards and that the rights and well-being of participants were safeguarded throughout the research process.

Interviews were held separately over a period of 5 weeks, and were conducted remotely using standard video conferencing software. Permission to record each session was received from each participant at the beginning of each interview. Summary details of each interview were recorded in a research log, including the interview number, duration, and time. No identifying information was stored in the interview log.

An initial, unstructured discussion was used early in each interview to outline the researcher's professional background and the research goal of translating film production practices for use in software development projects. The value of each participant's professional experience to that effort was highlighted. The Real-to-Real method was presented in detail, and the current status of the research was explained: a review of the existing literature had generated a list of specific management practices which seemed to reveal the existence of four underlying principles shaping the film industry's approach to managing projects.

The four evident principles shown in **Table 7** were then presented to each participant. The definition of each principle was discussed at length, with informal questions and answers encouraged. The structured portion of each interview began only after each participant indicated an understanding of all four principles.

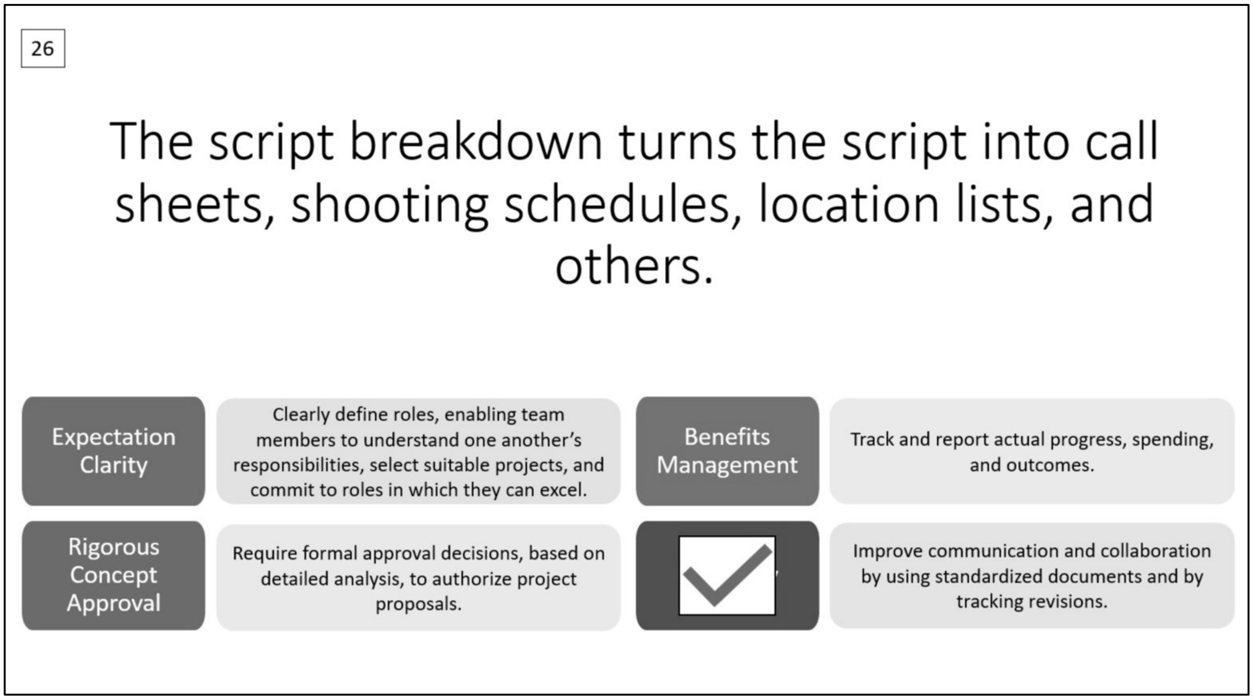

Figure 5: *Example Card-Sorting Slide*

Each film producer then participated in a virtual card-sorting procedure used to map each principle to a set of supporting practices, a process exemplified by Moore and Benbasat (1991) and Thatcher, et al. (2018). Standard presentation software was used to display each specific film industry management practice listed in **Table 18** – **Table 21**, with one practice shown per slide. The practice under consideration was discussed, and each participant was asked to confirm both the description of the practice, developed from the literature, and the practice's near-universal use on projects in the film industry. Lastly, each producer was asked to identify which of the four principles each practice best supported. Questions were allowed, although care was taken not to indicate any preferred response. Participants were allowed to change previous answers, to conclude that the practice under discussion supported none of the evident principles, or to determine that it supported more than one simultaneously. Responses were captured directly on the presentation slide, providing for an immediate visual and audio confirmation of each selection before proceeding (Hawkey and Vans 2024). An example slide is shown in **Figure 5**, showing a single practice paired to a selected principle.

The teleconferencing software used for these interviews generated audio and video recordings, as well as a text transcript of each interview. To help ensure participant anonymity, only the text transcript was retained. Immediately following each interview, the text transcript was manually reviewed for accuracy, and edited to remove any identifying information (Hawkey and Vans 2024).

At the conclusion of the interview, each participant was also asked whether each of the four principles, which had now been discussed at length, accurately represented an important part of the film industry's general approach to managing projects.

Data Analysis Methods

Analysis began with the de-identification of all interview records. Participant consensus was then used to measure the accurate description of each specific practice and its ubiquity within the film industry. The expected pairing of each practice to the principle it bests supports is shown in **Appendix A**. The percentage of matching responses was calculated for each practice, and the average percentage agreement for the set of practices believed to support each principle was used to measure overall participant consensus on these relationships. Any explanations given for nonmatching answers were noted for further analysis. Lastly, participant consensus on the definition and accuracy of the four synthesized principles was used to determine their effective encapsulation of film industry project management values, and their suitability for use as a conceptual bridge between the film and software development industries.

Second Phase: IT Project Manager Interviews

In the second verification phase, a series of semi-structured interviews was held with experienced software development project managers. These interviews followed a format similar to the first phase, and were intended to confirm the mapping of principles to software development practices shown in **Appendix A** and to substantiate the potential value of these practices to software development projects in general (Hawkey and Vans 2024).

Goals

This second series of interviews had two explicit goals. First, to verify the relationship between each practice and the principle that it best supports. Second, to affirm the applicability and potential value of each identified practice to software development, based on the professional experience of each participant (Hawkey and Vans 2024). While these values may seem evident given this example's reliance on existing practices, these interviews were essential in confirming their practical relevance and effectiveness within the domain.

Recruitment and Participants

As in the first series of interviews, a set of participants was drawn from existing personal and professional connections. Inclusion was restricted to experienced professional project managers, defined as working professionals with any of a variety of related roles, such as Scrum Master, with experience managing software development projects (Hawkey and Vans 2024). As the initial population of this set was believed sufficient for this research, participants in this series were not asked to provide referrals to other experienced software development project managers. Each participant in this series thus had a preexisting personal or professional relationship with the researcher. However, the topics and proposed methods underlying the study had not been previously discussed, and these relationships are not believed to have affected the quality of data collected.

Six interviews were conducted, detailed in **Table 13**. Participants had an average of 19 years of professional working experience, with a shared total of more than a century spent managing software development. While the specifics of each participant's professional experience are again withheld to preserve anonymity, the set included employees of multiple firms, serving multiple industries. Of particular note is the variety of formal project management certifications held by these participants, covering five of the most popular certifications in the United States and United Kingdom. In addition, one participant held 24 years of working experience, but no formal certification, providing confirmation of these findings from another direction (Hawkey and Vans 2024).

In one interview, five practices were inadvertently skipped. These practices were subsequently sent via email, and the participant's responses collected in the same manner. This deviation from the planned procedure was noted in the interview log, and these responses were included in all later analysis. The inclusion of these email responses did not affect the overall results or integrity of the data collected.

Table 13: *Software Development Project Manager Interviews*

No.	Title – Certification	Years of Experience	Duration (h:mm)
6	IT Project Manager – Certified Scrum Master	25	0:34
7	Technical Program Manager – Scaled Agile Framework	17	0:20
8	Principle Software Solutions Engineer – Lean Six Sigma	18	0:39
9	Program Director – Member, Assoc. of Project Management	27	1:00
10	IT Project Manager – Project Management Professional	5	0:42
11	Technical Program Manager – None	24	0:41
	TOTALS:	**116**	**3:56**

Data Collection Methods

Protocols for this second series of interviews also underwent review and received approval from the Colorado State University IRB. As with the first series, the IRB assessed and authorized the recruitment messaging, inclusion criteria, data management plan, and potential risks to participants. This approval confirmed that the study was designed with ethical considerations in mind, ensuring that participants were protected from any foreseeable harm.

The second series of interviews was also held remotely using widely available teleconferencing software. Automatically generated text transcripts were again retained for each interview; each was also immediately manually reviewed for accuracy, and any identifiable information was removed at the conclusion of each interview. As in the first series of interviews, details were noted in an interview log, including the years of experience of each participant, any project management certifications held, and the time, date, and duration of the interview. This series of interviews was conducted separately over a period of nine days.

Each interview began with an unstructured review of the research effort. The goal of translating film production practices to the domain of software development was discussed, and the Real-to-Real method was examined in detail. Mirroring the interviews with film producers, each of the four principles in **Table 7** was presented and discussed prior to beginning the structured portion of the interview. In the structured portion, each of the software development practices listed in **Table 23** through **Table 26** was presented and discussed, in random order. As each practice was evaluated, participants were asked to identify the principle that it best supports, and again were allowed to change previous responses, select more than one principle, or select no principle at all. Lastly, in an unstructured discussion, participants were asked their opinion on the potential value of each practice to software development, based on their professional expertise (Hawkey and Vans 2024).

Data Analysis Methods

Analysis of this second series of interviews also began with the de-identification of all interview records. Using the expected pairing of principles to practices shown in **Appendix A,** the percentage of matching responses was calculated for each practice, and an average percentage agreement for the set of practices believed to support each principle was used to measure overall participant consensus on these relationships (Hawkey and Vans 2024). Any explanations given for nonmatching answers were again noted for further analysis. Lastly, participant consensus on the potential value and suitability of the practices listed in **Table 23** through **Table 26** to software development was used to partially evaluate the effectiveness of the Real-to-Real method in translating film production practices to software development.

Verification Summary

Together, these two series of interviews with experienced practitioners were intended to help verify whether the translation of practices from the film industry to software development shown in **Appendix A** is accurate. The identified principles listed in **Table 7** are each intended to serve as a conceptual bridge spanning the boundary between industries. Just as a physical bridge must be supported by robust earthworks, the theoretical span of these principles is supported through linkages to specific practices in each industry. Confirming the link between each principle and its associated practices separately, on either side of the boundary, allows for an overall evaluation of the bridge's sturdiness.

Validation

To fully address this effort's research questions, it was also necessary to investigate the effect, if any, of hedonic requirements of software development project outcomes. Additionally, the effect, if any, of the identified software development practices needed to be empirically validated in projects with varying levels of hedonic requirements. This phase of research attempted such validation by conducting a survey of experienced project managers in the software development industry, intended to gather data on project outcomes, the practices used, and the level of hedonic requirements.

Survey of Practitioners

In this survey, each participant was asked to consider a recent software development project that they had managed to completion. Each response therefore summarized a single case study from the point of view of the project manager, allowing for a detailed comparison of project characteristics and outcomes across a wide array of projects.

Goals

The primary goal of the survey was to empirically validate the results of the Real-to-Real method detailed in Chapter Two. While the specific research questions and corresponding hypotheses have been detailed earlier in this paper, the survey intended to address three overall objectives:

1. **Assessment of Hedonic Requirements**: To evaluate the effect of hedonic requirements on the success of software development projects, and in relation to the use of the identified practices.

2. **Validation of Identified Practices**: To determine whether the software development practices translated from the film industry have a significant impact on project outcomes.
3. **Generalization of Findings**: To support the broader applicability of the Real-to-Real method by validating the benefits of this example use of the method, demonstrating the potential for the translation of practices between other industry pairings.

Recruitment and Participants

Participants for the survey were recruited through a popular online professional social networking platform. No incentive was offered for participation, as the chosen platform prohibits such offers. Recruitment messages were sent to qualified potential respondents; criteria included having a profile page set to English and at least 5 years of professional working experience in one of a set of specific job titles. An extensive list of eligible titles was compiled to fully cover the wide variety used in the industry (Hawkey and Vans 2024). The responsibilities assumed of each role below are ambiguous, and many have overlapping definitions, but it is interesting that the diversity of this list partially mirrors the wide array of Producer-related job titles and contrasts with the more explicitly defined roles used in the film industry:

- Lead Information Technology Project Manager
- Agile Coach
- Information Technology Program Project Manager
- Director of Information Technology
- Senior Technical Program Manager
- Technical Program Director
- Program Manager
- Scrum Master
- Global Information Technology Project Manager

- Technical Project Program Manager
- Technical Project Lead
- Information Technology Project Manager
- Program Manager
- Senior Information Technology Project Manager
- Senior Program Manager
- Project Manager
- Technical Program Manager
- Senior Technical Project Manager
- Technical Project Manager
- Principal Program Manager
- Scrum Master
- Senior Project Manager
- Information Communication Technology Project Manager
- Digital Project Manager
- Information Technology Service Delivery Manager

To allow for the accurate measurement of the effects that specific management practices may have on project outcomes, it seemed prudent to attempt to minimize cultural differences in the resulting set of cases. Recruitment messages were therefore restricted to the United States, Canada, United Kingdom, Australia, and New Zealand. These five countries are situated very similarly on the axes of *collectivism – individualism* and *monumentalism – flexibility* which can be used to evaluate national cultures (Minkov and Kaasa 2022). Although several member states of the European Union have similar characteristics, data privacy limitations imposed on the selected recruitment platform disallowed their inclusion.

The subject line of each message, which invites recipients to open the full message, was restricted to only 60 characters, and as noted previously, the chosen platform disallowed the use of any incentives for participation. Adhering to these guidelines, the recruitment message for this survey was thus a simple "Can you take our short survey for IT PMs?" Although the sending of recruitment messages was automated, each appeared to originate from the researcher's own personal profile, and were sponsored by the Colorado State University Systems Engineering Department. The messaging format allowed for an interactive, conversational sharing of information about the survey and this research, with a series of pre-written questions and answers for the recipient to select as desired.

All research protocols for this practitioner survey were also reviewed and approved by the Colorado State University IRB prior to the launch of the recruitment campaign. As in the similar review conducted prior to the series of practitioner interviews, the IRB assessed and approved the proposed recruitment messaging, inclusion criteria, data management plan, and potential risks to participants. This review ensured that this phase of research was also conducted ethically, and that participants were treated with care and respect.

Before proceeding with the full recruitment campaign, a small set of preliminary data was collected from participants with professional experience managing software development projects enrolled in two sections of a graduate-level course on technical project management at a university located in the United States. This preliminary survey was intended to validate the functional operation of the survey, data export process, analysis software, and the full data workflow, all of which were ultimately deemed suitable for use. Thirteen complete responses and two partial responses were collected. Although the number of preliminary responses was not sufficient to address the research questions of this effort, a completion rate of 85% and a median time to completion of 4.2 minutes both suggested that the survey, as designed, could be successfully presented to a larger audience.

The full survey was then conducted over a period of 108 days. During this time, 30,462 recruitment messages were sent, resulting in 320 survey responses. Thirteen of these responses repeated only one or two answers to all 21 prompts, suggesting that these practitioners did not read or focus on the survey with sufficient diligence. These responses were therefore excluded from consideration for data quality reasons, resulting in a dataset of 307 project cases. Although the ratio of *messages sent* to *surveys completed* was low, the cost per completed survey was acceptable. The results were deemed sufficient for the purpose of this research, and provide valuable insight into the management of a wide array of software development projects.

Survey Design

The survey was delivered in an online, accessible format, suitable for both desktop and mobile devices. After an initial page providing information about the research project, contact information, and data privacy, users were given a single set of instructions that then applied to every section of the survey:

> Please recall a recent project that you managed from start to finish, which involved developing or configuring software. You may select a project with any final outcome, whether it was successful, faced challenges, or did not meet its goals. How well do each of the following statements describe management of the project?

Seven possible responses were then available for each following statement, ranging from “Not at all accurate” to “Extremely accurate.” This scale was used to enable a more detailed analysis of responses than binary options would allow. The list of all 21 subsequent statements in the survey is included in **Appendix B**.

The bulk of the survey focused on the use of the 16 software development practices identified through the Real-to-Real process (Hawkey and Vans 2024). While some practices are one-time events, others are iterative or used throughout the project. The phrasing of these instructions therefore contains more nuance than simply asking “Which of the following practices did you use?" By asking participants to rate the accuracy of these statements, this survey attempted to measure how rigorously each practice was used, and how thoroughly. Phrasing each practice as a benchmark against which respondents could self-assess, using clear, everyday language, encouraged reflection on how each practice was integrated and executed during the project. The *accuracy* of each statement, here, measured the fidelity of implementation of each practice, both in quality and consistency.

The first four statements referred to the project outcomes of scope, schedule, budget, and stakeholder satisfaction, e.g., "The project was completed on schedule." The phrasing of the fifth statement was critical for this research, as it attempted to measure the level of hedonic requirements in each project. Respondents may not have previously encountered the phrase *hedonic requirements*, and providing a definition and/or example within the survey would have raised both the complexity and the amount of reading required for each respondent, increasing the risk of capturing incorrect responses. Instead, technical terminology was avoided by using a straightforward definition within the statement itself. Before closing with specific examples, the statement also noted that these types of requirements may sometimes call for the avoidance of specific emotions: "It was critical to project success that the end user experienced or avoided specific emotional reactions while using the software, such as satisfaction, frustration, or fear."

It was unfortunately not possible to directly measure the level of hedonic requirements in each project case. Doing so would require a review of project documentation, detailed discussions with team members, and the development of a method to objectively quantify these types of requirements. Instead, as a proxy, this statement attempts to measure the project manager's perception of the criticality of hedonic requirements to project success. Although this may have been the best available approach, it should be noted that the project manager's perception, at the time of the survey, enjoyed the benefit of hindsight, and may not accurately reflect the actual level of hedonic requirements in the project being evaluated.

The remaining 16 statements in the survey were each intended to measure the project's use of one of the software development practices identified through the Real-to-Real method in Chapter Two. As verified during the earlier practitioner interviews, these 16 software development practices each support one of the four principles shaping project management in the film industry, and are reflections of specific film industry practices. The available responses for these statements followed the same scaled format as earlier statements in the survey.

Data Analysis Methods

The results of this survey were analyzed in two sequential stages. The first stage attempted to determine the relationship, if any, between hedonic requirements and project outcomes, using the collected responses to the first five survey statements. The second stage considered the effects of various combinations of the software development principles and practices identified through the Real-to-Real method on project outcomes, in project cases with differing levels of hedonic requirements, and included analysis of the remaining 16 survey statements.

A total of 320 survey responses were received. Thirteen responses, which repeated only one or two answers for all 21 survey statements, were removed for data quality reasons. The remaining 307 responses were included in the first stage of the analysis. Of these, 45 were incomplete and did not contain responses to every survey statement. Only the set of 262 complete responses was used during the second stage of analysis, which included consideration of the identified practices.

Data Preparation

Analysis began by exporting all survey responses from the online survey tool to a desktop spreadsheet program. Here, each column corresponded to a survey statement, each row represented a unique case, and all responses were converted to numerical form ranging from 1 to 7. Each survey response was anonymized during this process; no identifying information was retained. The full set of survey statements is shown in **Appendix B**. Every project case included four measured project outcomes: on-time completion, adherence to an estimated budget, the delivery of promised scope, and stakeholder satisfaction. Before proceeding, a fifth measure of project outcomes was added to each project case, Overall Project Success, which was calculated as the average of each of the other four measures.

Comparison of Hedonic Requirements to Project Outcomes

Using responses to statement #5, the perceived criticality of hedonic requirements was then compared relative to project outcomes, across all five measures of project success, for the full set of project cases. Next, project cases were separated into two groups: *High Hedonic* cases, where the perceived criticality of hedonic requirements was rated as 6 or 7 on the survey's 1-7 scale, and *Low Hedonic* cases, where the perceived criticality of hedonic requirements was reported as 1 or 2. This categorization resulted in 129 *High Hedonic* projects and 34 *Low Hedonic* projects. All five project outcomes were then compared between these two groups.

Fuzzy-Set Qualitative Comparative Analysis (fsQCA)

The second stage of analysis attempted to consider whether any combination of the identified practices consistently led to improved project outcomes, separately for all five measures of success, and whether these beneficial combinations varied with the perceived criticality of hedonic requirements. The analysis of such causal recipes for success can be complex; the association of any one practice with success does not necessarily mean that its absence will to lead to failure, and determining which practices contribute to success does not necessarily illuminate which practices contribute to failure (Bacon, Williams and Davies 2020). As there are many ways for a project to fail, and many combinations of practices that allow for the possibility of success, this analysis also assumed that multiple combinations of the identified practices could prove beneficial, adding another layer of complexity. Multiple combinations of practices may lead to identical outcomes, and each individual practice contributes both independently and in combination with others towards that result (Pappas and Woodside 2021).

Classic linear regression was considered unsuitable for this analysis, as neither standard nor multivariate regression considers the possibility of multiple, mutually exclusive paths to the same outcome, or *equifinality* (Fiss 2007, Fiss 2011). Linear regression treats variables as competing to cause variation in the measured outcome, and attempts to identify the effect of each variable by holding the value of all other variables constant (Fiss 2007). Instead, this analysis sought to identify how these management practices combine to form outcomes. The resulting analytical gap could be partially addressed by considering interaction effects, but evaluating the interaction of more than three variables using linear regression becomes problematic (Fiss 2007). This phase of analysis attempted to consider combinations of 16 separate management practices, rendering the accurate determination of interaction effects using multivariate regression improbable.

Cluster analysis was also considered and rejected for similar reasons. This research sought to distinguish combinations of the identified practices that consistently led to improved project outcomes, and cluster analysis has significant limitations for examining how elements combine to create a result. Cluster analysis does not consider the contribution of individual elements in a combination, or help to understand how that contribution may change as the combination of elements changes. While deviation scores measure the distance between a given combination and an ideal combination, these scores do not help to explain which aspect of the mismatch affects the outcome or the how the individual elements within a combination work together – the causal relationships within a combination (Fiss 2007).

In contrast, Qualitative Comparative Analysis (QCA) inherently assumes equifinality, and can be used to identify combinations of causal conditions that lead to an outcome (Ragin and Sonnett 2005, Lo, Rey-Marti and Botella-Carrubi 2020). QCA is a set-theoretic approach that attempts to determine how the individual underlying elements, used in various combinations within a set of cases, contribute to a specified result (Bacon, Williams and Davies 2020). QCA directly addresses the complex nature of this analysis, and assumes that although the presence of one practice may lead to success, its absence may not necessarily lead to failure (Bacon, Williams and Davies 2020). QCA treats each of the identified management practices as a *causal condition*, and the set of project cases collected by this survey as a set of configurations of these conditions, allowing for the examination of complex causality and nonlinear relationships (Fiss 2007, Bacon, Williams and Davies 2020). This approach encompassed the diversity of managerial approaches used across the set of project cases, and preserved potentially relevant causal relationships (Bacon, Williams and Davies 2020).

The management of each project case under consideration was essentially a networked set of interconnected practices, and these cases should therefore not be analyzed as discrete entities whose components can be individually evaluated (Fiss 2007). QCA reflects this by viewing each case as a one-time combination of interrelated components (Ordanini, Parasuraman and Rubera 2014, Bacon, Williams and Davies 2020). Although QCA requires a working knowledge of the causal elements, outcomes under consideration, relevant underlying theory, and context (Pappas and Woodside 2021), it was more suitable for both this analysis and the construction of resulting theories than other options (Lo, Rey-Marti and Botella-Carrubi 2020). As a result, this effort relied on a process of qualitative comparative analysis exemplified by Ordanini, Parasuraman and Rubera (2014), Bacon, Williams, and Davies (2020) and Drăgan, Valisache and Schin (2020). QCA should be similarly considered whenever causal recipes are complex, the elements in question must combine to cause an outcome, and when there may be multiple equifinal solutions (Kent 2008).

Two approaches to QCA are available: *crisp set* and *fuzzy set*. In both versions, each case under consideration is categorized into sets according to a degree of membership in that set. For example, drawing from the cases resulting from this survey, a project delivered perfectly on schedule would be categorized as 'fully in the set of cases that delivered on schedule.' A project that used no standardized roles and responsibilities would be categorized as 'fully out' of the set of projects which adhered to that practice. In crisp set QCA, membership is defined using binary values – full membership or full nonmembership. In fuzzy set QCA, or fsQCA, membership is not restricted to these binary values, and uses inflection points in a membership score between 0 and 1 to demark the additional categories of partially in, partially out, and fully ambiguous (Fiss 2011, Bacon, Williams and Davies 2020). The project outcomes and the level of adherence to specific practices evaluated here are not binary constructs; fsQCA was therefore chosen for this effort, as it better reflected the causal elements under consideration. Enabling the use of fsQCA, this survey required participants to respond to each statement using a 7-point scale, rather than providing binary answers (Bacon, Williams and Davies 2020), which could have limited analysis to crisp set QCA.

In preparation for fsQCA, responses from the 262 complete surveys were converted to a comma-separated text file using standard desktop spreadsheet software. In the first row, variable names were assigned to each project outcome and management practice, with no punctuation, spacing, or case-sensitivity, and with lengths between two and 15 characters (Ragin 2018). Then, four additional aggregate measures were manually added to every project case, each representing that project's overall adherence to one of the four principles in **Table 7**. For each principle, these aggregate measures were computed by averaging each case's reported adherence to the practices supporting that principle. Lastly, the aggregate measure of Overall Project Success was also added manually to each case, calculated by averaging the scores for all four directly measured project outcomes.

Next, using specialized QCA software developed by Ragin and Davey (2022), this data was *calibrated* by computing membership scores indicating each case's degree of membership in categories for each variable, corresponding to each project's five measures of success, adherence to each practice, or aggregate adherence to each principle. Survey participants initially rated the accuracy of each statement using seven available responses; these responses were converted to numerical scores ranging from 1 to 7 when exported from the online survey tool. To calibrate answers within this scale, 6 was used as the minimum threshold for full membership, 2 as the maximum threshold for full non-membership, and 4 as the crossover point of maximum ambiguity when calculating each membership score, as is generally recommended (Park and Fiss 2020).

The resulting calibrated data was then exported from the QCA software. The process of calibration results in membership scores between 0 and 1, in this case representing each case's degree of membership in the sets of projects adhering to each principle and practice, and in the sets of projects achieving each measure of success. As currently designed, however, the available

QCA software does not include any cases with a membership score of exactly 0.5 in further analysis, as it is unable to determine whether to treat such cases as in or out of each membership set. This can result in the inefficient use of valuable collected data, and multiple authors suggest manually adding a constant value of 0.001 to all membership scores less than 1.0 before proceeding (Fiss 2011, Pappas and Woodside 2021). This change shifts membership scores of 0.5 to 0.501, essentially forcing the program to consider these cases as 'very partially in' the set of cases for which the variable was present, rather than disregarding them entirely. This modification was made using a standard desktop spreadsheet program.

Next, project cases were again separated into two groups: *High Hedonic* cases, where respondents rated statement #5, which asserted that hedonic requirements were critical to project success, as either *Very* or *Extremely accurate*, and *Low Hedonic* cases, in which the same statement was rated as either *Slightly* or *Not at all accurate*. Survey responses which indicated that statement #5 was *Somewhat*, *Moderately*, or *Fairly* accurate were not included in further analysis. As before, this separation resulted in 129 *High Hedonic* and 34 *Low Hedonic* cases. While this decision superficially resembles the software limitation discussed above, and may also seem to result in valuable survey data going unused, it was essential for this research to analyze projects where hedonic requirements were perceived as highly critical to success separately from those where their criticality was perceived as low. This approach was necessary for determining whether the most beneficial combination of management principles and practices varied with the level of hedonic requirements.

The resulting two sets of project cases, *High Hedonic* and *Low Hedonic*, were then prepared for an iterative process of fuzzy-set Qualitative Comparative Analysis. Each file contained calibrated membership scores related to the reported use of the 16 identified management practices, to the aggregate scores of the overall adherence to each of the four evident principles, and to the five project outcomes for each case. This allowed for the analysis of beneficial causal recipes to be conducted separately for each measure of success. The full data analysis process is illustrated in **Figure 6**. By analyzing each group separately, this process also enabled the comparison of the resulting beneficial combinations of management principles and practices between the 129 *High Hedonic* project cases and the 34 *Low Hedonic* project cases, helping to determine whether management practices should vary with the level of hedonic requirements. In addition, analysis was conducted to determine combinations of the identified principles and practices that consistently lead to failure, separately for each measure of success and for each group of project cases.

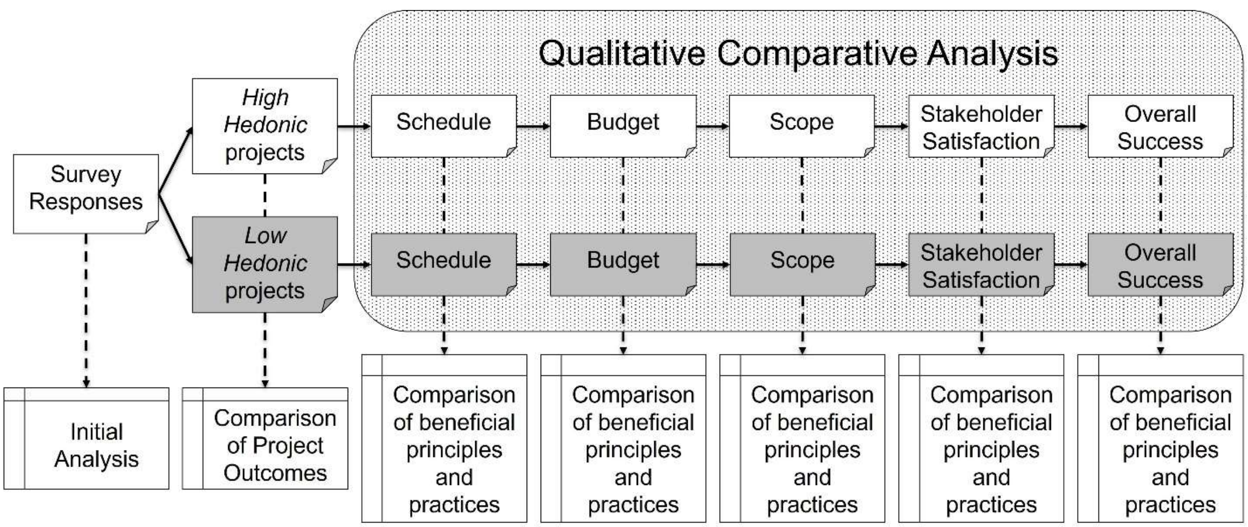

Figure 6*: Data Analysis Process*

During each iteration, the QCA software was used to generate a *truth table* for each file. A truth table lists all possible configurations of causal elements and outcomes; in this case every possible combination of project management principles and practices and all potential corresponding project outcomes (Fiss 2007). Two cases which experienced different outcomes despite relying on the same configuration of causal elements are called *contradictions*. If a theoretically possible combination of elements did not occur in any observed cases, it is called a *remainder*; in fuzzy-set QCA, this includes combinations for which there are no cases with a membership score greater than 0.5 (Ragin and Sonnett 2005, Kent 2008).

Each truth table generated by the QCA software also includes the *coverage*, *frequency*, and *consistency* for each possible combination. Coverage, which can be used similarly to variance in regression analysis (Kent 2008), measures the portion of cases explained by a given combination, and thus indicates the potential relevance and effectiveness of a given recipe (Ragin 2018, Park and Fiss 2020). Frequency is simply the number of times each potential combination of causal conditions appeared within the set of empirically observed cases (Bacon, Williams and Davies 2020). The minimum useful frequency for large studies, such as this one, is two (Park and Fiss 2020); combinations with less were removed from all ten truth tables at this point. Lastly, consistency is a measure of how reliably a given combination of causal conditions resulted in the same outcome within the set of cases. In fsQCA, this is presented using two separate calculations: *Raw Consistency*, which gives credit for 'near misses' and awards penalties to largely inconsistent combinations, and *Proportional Reduction in Consistency*, which does not include contradictory cases (Park and Fiss 2020). Values below 0.75 indicate substantial inconsistency (Ragin 2018). For this effort, combinations with consistency values less than 0.8 were also discarded from all ten truth tables. The resulting truth tables are presented in **Appendix C**.

Now, the QCA software employed Boolean algebra to determine commonalities among the combinations of causal elements resulting in each project outcome, allowing for the logical reduction of the remaining combinations. This analysis of the relationships between variables through the consideration of set membership is the crux of qualitative comparative analysis (Fiss 2007).

When analyzing possible combinations of causal conditions, it is helpful to compare cases containing very similar combinations. In an ideal study, pairs of directly observed cases would vary on only a single causal condition, allowing for the unambiguous determination of effect. In practice, such exactitude is rarely possible, leading to the need for *counterfactual analysis*, or the consideration of theoretical combinations not directly observed in the set of empirical cases. So-called *easy* counterfactual analysis assumes that the addition of a redundant causal condition to a configuration already known to produce an outcome will still lead to the same result. *Difficult* counterfactual analysis attempts to remove a causal condition from a configuration known to produce the outcome by assuming the cause is redundant (Ragin and Sonnett 2005).

To better illustrate counterfactual analysis, a theoretical example not drawn from the set of project cases developed in this research may be helpful. In this example, consider that the available data might include many examples of project success resulting from the presence of the first three principles and the absence of the fourth, as shown in **Table 14** as combination #1. However, this hypothetical dataset has no additional examples in which projects adhered to all four principles, as shown as combination #2. Without knowing the results of this unobserved combination, it would be impossible to determine if the absence of Linked Boundary Objects was truly necessary for success (Ragin 2018).

Table 14: *Theoretical Example of Counterfactual Analysis (1)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Outcome
1	Presence	Presence	Presence	Absence	Success
2	Presence	Presence	Presence	Presence	Not Observed

Now, to continue this example of counterfactual analysis, recall that the four film industry principles developed in Chapter Two are each believed to be generally beneficial project management methods. All should contribute towards success, even if it is determined that the strength of each contribution varies with the criticality of hedonic requirements. Armed with this theory, a researcher may now propose that the inclusion of Linked Boundary Objects to combination #1 – it's addition to an observed combination already seen to consistently result in success – would also result in success, as shown as the new, highlighted counterfactual combination #3 in **Table 15**.

This theoretical counterfactual case, although not directly observed in the data, allows for the determination that the absence of Linked Boundary Objects seen in combination #1 is generally irrelevant. In the terminology of QCA, this allows for an intermediate solution, shown as the reduced combination #4, which involves only the presence of the first three principles. In this example, while adherence to Linked Boundary Objects may not contribute to success, projects do not necessarily need to avoid it. This is an example of easy counterfactual analysis, or the addition of a redundant cause to a combination already linked to an outcome (Ragin 2018).

Table 15: *Theoretical Example of Counterfactual Analysis (2)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Outcome
1	Presence	Presence	Presence	Absence	Success
3	Presence	Presence	Presence	Presence	Success
4	**Presence**	**Presence**	**Presence**		**Success**

In contrast, difficult counterfactual analysis allows for the inclusion of any theoretical possible combination. Here, this abandons the existing theory that each film industry principle is believed to be generally beneficial. To continue the example above, this would necessarily include the additional theoretical combinations #5 and #6, shown in **Table 16**. Together with the directly observed combination #1, these counterfactuals would allow for a reduction to the minimized solution shown as combination #7, in which only the first element is necessary for success, and the presence or absence of all others is irrelevant. In QCA, this is termed the parsimonious solution. Difficult counterfactual analysis allows for the removal of elements from a combination observed to result in success by theorizing that they are redundant (Ragin 2018).

Table 16: *Theoretical Example of Counterfactual Analysis (3)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Outcome
1	Presence	Presence	Presence	Absence	Success
5	Presence	Presence	Absence	Absence	Success
6	Presence	Absence	Absence	Absence	Success
7	**Presence**				**Success**

Conceptually, difficult counterfactual analysis would be a poor fit for this study, as the managerial benefits of the principles and practices examined here are believed to arise primarily when they are used in combination. None are recommended as sufficient, alone, for the management of a complex project. This analysis will therefore rely on intermediate solutions resulting from easy counterfactual analysis wherever possible.

After using Boolean algebra and counterfactual analysis to reduce all ten truth tables, the QCA software generated three sets of possible solutions for each. The set of *complex* solutions relied only on configurations directly observed within the data, with no counterfactual analysis. The *parsimonious* solutions used difficult counterfactual analysis including all theoretically possible logical remainders – configurations not appearing within the observed cases – in order to derive the simplest possible set of solutions. The set of *intermediate* solutions considered only easy counterfactuals (Park and Fiss 2020), and in this analysis therefore relied on the belief that each practice and principle under consideration should be beneficial to some degree, and should help lead projects towards success rather than failure. Causal conditions present in both the parsimonious and intermediate solutions are considered essential, *core* conditions, while those present solely in the intermediate solutions are *peripheral* and of lesser importance (Fiss 2011, Bacon, Williams and Davies 2020).

This analysis relied on intermediate solutions with a consistency above 0.70, where available, as the set of project management principles and practices under examination are each believed to contribute towards success, and should be most effective when used in combination. The distinction between core and peripheral elements was then used to identify the most essential causal ingredients in combinations of practices and principles that consistently led to improved project outcomes, across all five measures of success, and allowed for the comparison of these causal recipes between projects with high and low levels of hedonic requirements. This analysis was then repeated, seeking combinations of elements which consistently lead to failure, separately for all five measures and for the sets of *High Hedonic* and *Low Hedonic* cases.

Combinations of principles and practices consistently resulting in success are termed *beneficial* combinations in this study, while combinations consistently resulting failure are designated *critical*. This process provided a clear framework for understanding the relative importance of each practice and principle, and facilitated the identification of the most impactful combinations for projects with varying levels of hedonic requirements.

Analytical Limitations

The number of theoretically possible combinations in a truth table is 2^k, where K is the number of causal conditions (Ragin and Sonnett 2005). In this effort, analysis of possible combinations of only the four aggregate measures of overall adherence to each of the principles in **Table 7** therefore resulted in 16 possible truth table combinations. A deeper level of analysis, involving possible combinations of all 16 management practices supporting those principles, required consideration of 65,536 possible combinations. Due to scale of such increases, limitations in the currently available software generally restrict truth table analysis to a maximum of 10 causal conditions (Ragin 2018), which in this research disallowed the full consideration of all specific practices. The qualitative comparative analysis of all 16 management practices was abandoned after an initial attempt to generate a truth table involving the full set ran for more than 24 hours without producing a result.

To keep the number of causal conditions under consideration low, existing guidance suggests relying on higher-order concepts that each incorporate several variables (Kent 2008). Analysis therefore began using only combinations of the four aggregate measures of overall adherence to each principle, rather than directly considering all practices supporting those principles.

Each of the four principles synthesized in Chapter Two are supported by only 3-5 identified practices, however. The existing software limitation of 10 causal conditions thus at least partially allowed for a deeper level of analysis, and the evaluation of combinations of specific practices rather than evident principles. In cases where combinations of less than three principles were found to consistently result in success or failure for any of the five measures of project success, the analysis was repeated using all of the identified practices supporting those principles.

In cases where the most effective combination included three or more principles, no more detailed analysis of the relative value of the individual practices supporting those principles was possible. In addition, in some cases, no combination of principles was found meeting the desired thresholds for coverage and consistency. In combination with the partial barrier formed by the software's limit of 10 causal conditions, this allowed for 28 iterations of fuzzy-set qualitative comparative analysis, which are detailed in Chapter Four.

By analyzing the asymmetric relationships between the desired outcome and the causal conditions in each combination, QCA can also, in theory, identify causal elements that are *necessary* and/or *sufficient* for the desired result (Pappas and Woodside 2021). Caution is advised, however, as any such distinction must be grounded in theory: "No cause is necessary, for example, independent of a theory that specifies it as a relevant cause. Neither necessity nor sufficiency exists independently of theories that propose causes (Ragin 2018)." Each of the principles and practices under consideration here are believed to contribute to project success, and none are expected to increase the risk of project failure. This research focused only on identifying the relative importance of each element, and the most effective combination, for projects with varying levels of hedonic requirements.

Therefore, this analysis relied solely on detecting core and peripheral causal conditions within the identified causal recipes, and no attempt was made to categorize necessary or sufficient causal conditions. Any such attempt would conflict with existing theory, which suggests that none of the identified principles and practices would be sufficient, alone and without the use of any other management activities, to manage a complex project to success. Theory also suggests that success should not be impossible due to the avoidance of any single principle or practice. None are alone sufficient, and none are absolutely necessary, so the concepts of necessary and sufficient should not apply.

Summary

This chapter reviewed the methods used to first verify and then empirically validate the potential benefits of the project management practices translated from the film production industry to software development in Chapter Two using the Real-to-Real method. First, the accuracy of the translation was evaluated through two series of semi-structured interviews with experienced practitioners in both domains, using a virtual card-sorting process to pair each practice with the principle that it best supports. Then, after preliminary validation with a small set of participants, a survey of experienced software development project managers on the outcomes, level of hedonic requirements, and practices used in a recent project was conducted. The methods discussed here were used in an attempt to determine the effect, if any, of hedonic requirements on software project outcomes. Then, an iterative process of fuzzy-set Qualitative Comparative Analysis was used to identify significant combinations of core and peripherally important management principles and practices in projects with varying levels of hedonic requirements. This analysis was repeated to identify beneficial combinations consistently resulting in success, and critical combinations consistently leading to failure, for all measures of success.

The findings are intended not only to provide software development project managers with simple, heuristic guidelines on how to quickly and effectively tailor their management practices to better support hedonic requirements, but also to support the use of the Real-to-Real method in general, potentially enabling the translation of industry practices across multiple additional industry pairings. The next chapter presents and discusses the results of these analysis methods.

CHAPTER 4: RESULTS

Introduction

The previous chapter detailed the methods used to gather and analyze data to address the research questions of this effort. The results of the example use of the Real-to-Real method covered in Chapter Two may provide simple, heuristic guidelines to software development project managers on how to tailor their management practices to better support hedonic requirements, and validation of this example may also provide support for the use of the method in translating practices between other industry pairings. This chapter presents the results of the data collection and analysis methods discussed in Chapter Four.

Verification Results

In Chapter Two, an example use of the Real-to-Real method attempted to translate assignable tasks and duties used in the film production industry to similarly detailed activities suitable for use in software development projects. A set of four guiding principles, which evidently shape the film production industry's approach to managing projects, was synthesized from a holistic evaluation of management practices used throughout that industry (Hawkey and Vans 2024). These four principles are intended to serve as a conceptual bridge between the domains of film production and software development, allowing for the identification of parallel practices on either side. The full mapping of practices to principles is shown in **Appendix A**. As a first step, this research attempted to verify the accuracy of this mapping through two series of semi-structured interviews with experienced practitioners in both industries (Hawkey and Vans 2024).

In the structured segment of each interview, participants were asked to match each film industry practice to the principle that it best supports. Each practice was discussed in turn, with questions and answers encouraged, although care was taken not to indicate a preference for any specific response. Discussion was facilitated using standard presentation software; an example card-sorting slide is shown in **Figure 5**. Participants were allowed to change previous answers as desired, to respond that a given practice supports none of the proposed principles, or to answer that a single practice supports multiple principles simultaneously. Responses were captured directly in the presentation used for each interview, allowing for an immediate visual and audio confirmation (Hawkey and Vans 2024).

The results of each series of interviews are presented below. During the structured, card-sorting portion of each interview, specific film industry practices were discussed in random order. In the following sections, the results for the set of practices supporting each principle are presented separately. As shown in **Table 17**, the results of these interviews will be indicated using a series of symbols. In each of the following tables, ● will indicate a matching, expected pairing of practice to principle, while ⊗ will denote unexpected pairings. In cases where a participant indicated that a practice provides support to more than one principle, with one of those matching the expected principle, Ⓟ is used to indicate a partial match. In comparison to expected pairings, these responses are scored as 50% agreement, in calculations of overall agreement. Additionally, Ⓝ would denote responses that a practice supported none of the proposed principles.

Table 17: *Indicators Used for Practitioner Interview Results*

Symbol	Meaning
●	The selected principle matches expectations.
⊗	The selected principle does not match expectations.
Ⓟ	More than one principle was selected. One selection matches expectations.
Ⓝ	No principle was selected.

First Phase: Results of Film Producer Interviews

The first series of five interviews, with experienced film producers, began with four goals. Each participant was asked to confirm the understanding, built from a review of relevant literature, of each film industry practice. The ubiquity of each practice in the industry, across projects of varying scope and budget, was also discussed. Then, using a structured, card-sorting process exemplified by Moore and Benbasat (1991) and Thatcher, et al. (2018), participants were asked to match each practice to the principle that it best supports. Lastly, after a thorough discussion of each of the four principles listed in **Table 7**, each producer was asked to confirm that each principle accurately describes a portion of the film industry's approach to managing projects. A summary of the practitioners who participated in this interview series can be found in **Table 12** (Hawkey and Vans 2024).

During these discussions, participants unanimously confirmed the description of each management practice provided in Chapter Two. This series of interviews confirmed that the breadth and accuracy of sources included in the literature review successfully enabled a working understanding of these practices. In addition, participants also corroborated the use of each practice almost universally in all film industry projects, regardles of scale, genre, or union affiliation.

Lastly, in the final unstructured portion of each interview, participants also generally affirmed that the four principles described in **Table 7** accurately reflect their approach to managing projects, although the naming, definitions, and conceptual framework were novel (Hawkey and Vans 2024). While agreeing on the overall descriptive accuracy of the principle of Rigrous Concept Approval, some participants expressed limited reservations. For example, one participant expressed hestiation with the given definition, explaining that they believed decision makers on their past projects had not always been elevated to that role rigorously. They also noted that, although organizations may strive for rigor when approving projects, any process that must consider aesthetics might never be completley consistent. Another added the caveat that, while

"They try to make these decisions with a lot of data, there's always a bit of guesswork. It's an artistic endeavor, so there's a bit of a gut reaction, too."

Expectation Clarity

All participants matched each of the specific practices listed in **Table 18** with the principle of Expectation Clarity, fully aligning with expected pairings (Hawkey and Vans 2024).

***Table 18**: Results of Film Producer Interviews on the Principle of Expectation Clarity (see Table 17 for definitions of indicators)*

	Interview					
Statement	**#1**	**#2**	**#3**	**#4**	**#5**	**% Agreement**
Independent film projects often use the same job titles and assigned duties as union film projects.	●	●	●	●	●	100%
The financer, producer, and director formally commit to a film project in writing, with their key responsibilities and schedule clearly defined.	●	●	●	●	●	100%
Apart from unexpected changes, cast duties, expectations, requirements, and schedule are clearly spelled out before they formally join the project.	●	●	●	●	●	100%
Unions and guilds, such as SAG-AFTRA, provide detailed descriptions of job roles and duties.	●	●	●	●	●	100%
	AVERAGE					**100%**

Rigorous Project Approval

Table 19 lists each of the practices expected to support the principle of Rigorous Project Approval. Interview responses fully matched three expected pairings of practice to principle. When discussing the fourth practice listed here, regarding the restriction of project approval authority to a small set of key decisions makers, four participants selected Rigorous Project Approval, as expected. One experienced producer explained that this practice instead supports the principle of Expectation Clarity by explicitly assigning approval authority to specific roles, a nonmatching response. Overall, the set of practices believed to support the principle of Rigorous Project Approval received 95% agreement (Hawkey and Vans 2024).

***Table 19**: Results of Film Producer Interviews on the Principle of Rigorous Project Approval (see Table 17 for definitions of indicators)*

	Interview					
Statement	**#1**	**#2**	**#3**	**#4**	**#5**	**% Agreement**
The *greenlighting* decision approves a proposed film project for production.	●	●	●	●	●	100%
Greenlighting calls for detailed cost and benefit analysis.	●	●	●	●	●	100%
Many proposed films are never greenlit for production.	●	●	●	●	●	100%
Very few individuals in each organization have the authority to greenlight a proposed project.	●	⊗	●	●	●	80%
	AVERAGE					**95%**

Benefits Management

Each participant also matched the four specific practices listed in **Table 20** with the principle of Benefits Management, again fully aligning with expected pairings (Hawkey and Vans 2024).

***Table 20**: Results of Film Producer Interviews on the Principle of Benefits Management (see Table 17 for definitions of indicators)*

	Interview					
Statement	**#1**	**#2**	**#3**	**#4**	**#5**	**% Agreement**
During production, progress and expenses are reported daily or weekly.	●	●	●	●	●	100%
Box office results and industry awards are widely reported in the media.	●	●	●	●	●	100%
Going over budget or over schedule is noticed quickly, and causes discussion and changes to the plan.	●	●	●	●	●	100%
Projects end with a financial audit by a third party.	●	●	●	●	●	100%
	AVERAGE					**100%**

Linked Boundary Objects

Four practices expected to adhere to the principle of Linked Boundary Objects are listed in **Table 21**. Participants fully agreed with the expected pairing of three of these practices, as shown. When asked about the remaining practice, which encapsulates the script breakdown process detailed in Chapter Two, one participant gave a partially matching response. They explained that while this practice does support the principle of Linked Boundary Objects, as expected, the results of the script breakdown process, in early draft form, are also an essential method of enabling the principle of Rigorous Project Approval (Hawkey and Vans 2024).

Table 21: *Results of Film Producer Interviews on the Principle of Linked Boundary Objects (see Table 17 for definitions of indicators)*

	Interview					
Statement	**#1**	**#2**	**#3**	**#4**	**#5**	**% Agreement**
The script breakdown turns the script into call sheets, shooting schedules, location lists, and more.	●	●	●	●	Ⓟ	92%
Changes to the script are printed on new colors of paper.	●	●	●	●	●	100%
Scripts all use the same formatting.	●	●	●	●	●	100%
All film projects use a set of documents that are familiar to the cast and crew, such as call sheets, shooting schedules, production reports, etc.	●	●	●	●	●	100%
	AVERAGE					**98%**

Summary of Findings

Results from this first set of interviews are summarized in **Table 22**. The sets of practices expected to support the principles of Expectation Clarity and Benefits Management reach received full agreement from all participants. The set of practices believed to support the principle of Linked Boundary Objects was similarly verified, receiving only one partially matching response. The set of practices predicted to adhere to the principle of Rigorous Project Approval also found near-unanimous consensus, with a single nonmatching response (Hawkey and Vans 2024).

In addition, participants also confirmed the description of each practice as detailed in Chapter Two and affirmed the nearly universal use of each practice throughout projects in the film industry. Lastly, this set of experienced film producers also generally affirmed that each of the principles listed in **Table 7** accurately describe project management in the film industry (Hawkey and Vans 2024).

***Table 22**: Summary of Film Producer Interviews*

Principle	% Agreement
Expectation Clarity	100%
Rigorous Project Approval	95%
Benefits Management	100%
Linked Boundary Objects	98%
AVERAGE:	**98%**

Second Phase: Results of IT Project Manager Interviews

The example use of the Real-to-Real process detailed in Chapter Two attempted to translate film production practices to software development by synthesizing a set of four guiding principles, detailed in **Table 7**, as a conceptual intermediary. The first series of interviews attempted to verify the first half of that translation, linking film industry practices to evident principles, and the accurate encapsulation of film production project management by those principles. The second series of interviews attempted to verify the second half of the translation, and the accurate mapping of those principles to software industry practices, using a virtual card-sorting procedure identical to the process used in the first series.

In addition, in unstructured discussions, these interviews also confirmed the potential value and applicability of the identified practices to software development, based on the professional expertise of the practitioners involved. Although the scope of this example effort was restricted to the identification of existing practices and no attempt was made to develop novel software development tasks and duties, this confirmation was important to verify the applicability and effectiveness of each practice to projects across the industry. This series included interviews with six experienced software development project managers; participant details are summarized in **Table 13** (Hawkey and Vans 2024).

Expectation Clarity

In these interviews, all participants matched the three specific practices listed in **Table 23** with the principle of Expectation Clarity, fully aligning with expected pairings (Hawkey and Vans 2024).

***Table 23**: Results of Software Development Project Manager Interviews on the Principle of Expectation Clarity (see Table 17 for definitions of indicators)*

	Interview						
Statement	**#6**	**#7**	**#8**	**#9**	**#10**	**#11**	**% Agreement**
Use standardized roles, titles, and responsibilities.	●	●	●	●	●	●	100%
Define and document roles and responsibilities.	●	●	●	●	●	●	100%
Provide access to role and project details before hiring or assigning team members.	●	●	●	●	●	●	100%
	AVERAGE						**100%**

Rigorous Project Approval

Five software development practices believed to support the principle of Rigorous Project Approval are shown in **Table 24**. Of these five, only one, specifying formality when approving project proposals, was paired as expected with Rigorous Project Approval by all six project managers. The remaining four practices each received one nonmatching response (Hawkey and Vans 2024).

The first practice listed here, calling for the project approval decision to be a competitive and highly selective filter, was matched to the principle of Rigorous Project Approval by five software development project managers. The sixth participant selected Expectation Clarity, and explained that the project approval decision is a tool for establishing clear responsibilities. The second practice listed in **Table 24**, which suggests that both funding and staffing be restricted to project proposals prior to their formal approval, also received the expected pairing to Rigorous Project Approval by five respondents. Another participant believed this practice best supported the principle of Benefits Management, stating that both funding and staffing concerns are related to tracking expenses. Next, the practice of centralizing approval authority in a small number of decision makers was paired to the principle of Expectation Clarity by only one project manager, who described the identification of key decision makers as another tool for setting clear expectation. All other participants paired this practice with Rigorous Project Approval, as expected. Lastly, the practice of conducting a detailed ROI analysis prior to project approval was matched to Rigorous Project Approval by five respondents, and to the principal of Benefits Management by another. That respondent stated that the budget and schedule estimates in an ROI analysis are essential when tracking and reporting progress. In total, the practices believed to support Rigorous Project Approval received 87% agreement with the interviewed practitioners (Hawkey and Vans 2024).

Table 24*: Results of Software Development Project Manager Interviews on the Principle of Rigorous Project Approval (see Table 17 for definitions of indicators)*

	Interview						
Statement	**#6**	**#7**	**#8**	**#9**	**#10**	**#11**	**% Agreement**
Project approval (Go / No-Go) decision is a competitive and highly selective filter.	⊗	●	●	●	●	●	83%
Limit funding and staffing before project approval (Go / No-Go) decision.	●	●	●	●	⊗	●	83%
Use a formal project approval (Go / No-Go) decision.	●	●	●	●	●	●	100%
Centralize project approval (Go / No-Go) decision authority in a few key decision makers.	⊗	●	●	●	●	●	83%
Conduct a detailed ROI analysis before project approval (Go / No-Go) decision.	●	●	⊗	●	●	●	83%%
	AVERAGE						**87%**

Benefits Management

As shown in **Table 25**, two of the practices believed to support the principle of Benefits Management received matching responses from the full set of practitioners. The remaining two practices each received one nonmatching response. One project manager paired the practice of reporting progress and expenses frequently to the principle of Linked Boundary Objects, with no further comments. Another stated that the practice of defining overage thresholds that would serve to trigger corrective actions supported the principle of Rigorous Project Approval, explaining that their organization already requires projects to revisit approval after exceeding similar overage thresholds. All other interviewees agreed with the expected pairing for both practices, resulting in an overall 92% agreement for this set of practices (Hawkey and Vans 2024).

***Table 25**: Results of Software Development Project Manager Interviews on the Principle of Benefits Management (see Table 17 for definitions of indicators)*

	Interview						
Statement	**#6**	**#7**	**#8**	**#9**	**#10**	**#11**	**% Agreement**
Define overage thresholds that trigger corrective action when a project goes over budget or schedule.	●	●	●	●	●	⊗	83%
Report progress and expenses frequently.	⊗	●	●	●	●	●	83%
Conduct and publish a final accounting of expenses and delivered scope.	●	●	●	●	●	●	100%
Measure and report actual delivered benefits.	●	●	●	●	●	●	100%
	AVERAGE						**92%**

Linked Boundary Objects

Similarly, the set of practices expected to support the principle of Linked Boundary Objects, shown in **Table 26**, also received 92% agreement with the interviewed practitioners, overall. Three of the four practices were matched to the expected principle by all participants, while the fourth received two nonmatching responses. This proposed practice mirrors the film industry's script breakdown process by calling for the translation of a detailed scope statement into a set of supporting artifacts, such as UI mockups. One participant believed that this practice would best support the principle of Expectation Clarity, reasoning that some potential artifacts help to establish clear responsibilities, such as RACI charts which indicate which team members are considered *responsible*, *accountable*, *consulted*, or *informed* for a set of key tasks. Another project manager paired this practice with Benefits Management, explaining that mockups and other such artifacts are helpful in tracking progress. Of the 16 practices discussed in these interviews, this practice received the lowest agreement. While two practitioners believe it provided the most support to other principles, they did not agree on which principle, and neither believed the practice lacked merit. With this in mind, and noting the overall consensus, this practice has been retained in the set for further analysis, although the relatively low level of agreement may be noteworthy (Hawkey and Vans 2024).

Table 26*: Results of Software Development Project Manager Interviews on the Principle of Linked Boundary Objects (see Table 17 for definitions of indicators)*

	Interview						
Statement	**#6**	**#7**	**#8**	**#9**	**#10**	**#11**	**% Agreement**
Use formal change control for key project artifacts.	●	●	●	●	●	●	100%
Use standardized project templates.	●	●	●	●	●	●	100%
Follow a defined process to propagate changes approved to one artifact to other artifacts.	●	●	●	●	●	●	100%
Facilitate collaboration by deriving supporting artifacts, such as mockups, from a detailed scope statement.	●	●	⊗	●	⊗	●	67%
	AVERAGE						**92%**

Summary of Findings

The results of this second series of interviews are summarized in **Table 27**. Practitioners again strongly agreed with the expected pairings of principles to practices, with a 93% overall alignment. The set of practices believed to support the principle of Expectation Clarity received matching responses from all practitioners, while the sets of practices supporting the principles of Benefits Management and Linked Boundary Objects each received two nonmatching responses. The set of practices intended to support the principle of Rigorous Project Approval received the lowest level of agreement, at 87%, although this is still believed to represent strongly encouraging support (Hawkey and Vans 2024).

***Table 27**: Summary of Software Development Project Manager Interviews*

Principle	% Agreement
Expectation Clarity	100%
Rigorous Project Approval	87%
Benefits Management	92%
Linked Boundary Objects	92%
AVERAGE:	**93%**

Discussion

With these two sets of interviews, the translation of film production practices to software development was evaluated. By first confirming the accurate synthesis of film production principles from specific practices, and the pairing of specific practices to each principle, this research attempted to verify these principles for use as a conceptual bridge between domains. Then, by evaluating the identification of practices suitable for the target domain which also adhere to these principles, this work sought to measure the accuracy of translation. While these interviews provide an initial verification of the conceptual framework, further validation is necessary to determine the potential benefits of these practices when used in software development projects with characteristics similar to film production. The next section will provide the results of the validation process described in Chapter Three, examining the data collected through a survey of software development practitioners.

Validation Results

Next, to fully address the research questions detailed in Chapter Three, it was necessary to determine the relationship, if any, between hedonic requirements and project outcomes, for all five measures of project success. Further, it was also necessary to attempt to isolate the most beneficial combinations of the identified principles and practices, for each measure of success, and to determine whether these combinations vary with the level of hedonic requirements. To enable this analysis, a survey of experienced software development practitioners was conducted.

Results of Practitioners Survey

Participants in this survey were asked to consider a recent project they had managed to completion which involved developing or configuring software. Instructions presented at the beginning of each survey noted that projects with any final outcome were equally suitable, regardless of the level of success. Each responded was asked to rate the accuracy of 21 statements describing this project, listed in **Appendix B**. Responses to these statements were used to measure the outcomes, perceived criticality of hedonic requirements, and practices used in each project case. The full survey design is discussed in Chapter Three.

Demographic Overview of Participants

Using the online professional networking platform selected for recruitment, a total of 30,462 messages were sent over 105 days, of which 16,167 were opened. Final responses were then collected over a further three days. A total of 320 survey responses were received, although 13 were excluded from analysis for data quality reasons. Of the remaining 307 cases, 262 included responses to all 21 statements. The remaining 45 responses were incomplete, but usefully included responses to all four measures of project outcomes and the perceived criticality of hedonic requirements, allowing for their inclusion as project cases in that portion of the analysis.

Recruitment messages were sent only to platform users meeting the inclusion criteria discussed earlier, including a profile page set to English and at least 5 years of professional experience as an Information Technology Project Manager or in any of 24 related roles. Participation was also restricted to residents of the United States, United Kingdom, Canada, Australia, and New Zealand, in an attempt to minimize the effect of culture on the beneficial combinations of principles and practices this effort sought to identify. Specific users meeting these criteria were chosen automatically by the platform, although only generalized demographic data on the set of recipients is available, as per the platform's policy.

The survey was hosted separately on an enterprise-level online survey and data collection platform, accessible by a URL included in each recruitment message. Responses to the survey included no identifiable user data, helping to ensure anonymity. It is therefore not possible to provide demographic data on the set of project managers who completed the survey. However, each response was necessarily triggered by a recruitment message, so a demographic overview of recruitment message recipients provides a partial confirmation that survey responses were generated from a suitably diverse population meeting the inclusion criteria.

As shown in **Table 28**, recruitment messages were distributed across each targeted country in approximate alignment with their population sizes, ensuring broad representation. It is notable that the percentage of messages opened appears to be lower in countries with larger populations. The final column, which shows the relative portion of total messages opened by recipients in each country, provides the clearest available insight into the likely percentage of surveys completed by each country. The percentages given here, and in all following tables, do not total 100%, due to minor variations in the data provided by the platform.

Table 28: *Survey Recruitment by Country*

Country	Messages Sent	% of Total Sent	Messages Opened	% Open Rate	% of Total Opened
United States	12,293	40.36 %	6,087	49.52 %	**38.09 %**
United Kingdom	10,994	36.09 %	6,043	54.97 %	**37.82 %**
Australia	3,094	10.16 %	1,585	51.23 %	**9.92 %**
Canada	2,795	9.18 %	1,537	54.99 %	**9.62 %**
New Zealand	500	1.64 %	295	59.00 %	**1.85 %**

Recipients in the London area opened a relatively large portion of total opened messages, as shown in **Table 29**, which lists the metropolitan areas that received the highest number of recruitment messages. While no other city opened more than 3% of the total, it is notable that some cities in the targeted countries had a level of engagement disproportionate to their size, potentially reflecting regional differences in networking activity or platform usage.

Table 29: *Survey Recruitment by Metropolitan Area*

Metropolitan Area	Messages Sent	% of Total Sent	Messages Opened	% Open Rate	% of Total Opened
London	3,233	10.61 %	1,872	57.90 %	**11.72 %**
New York City	862	2.83 %	418	48.49 %	**2.62 %**
Sydney	848	2.78 %	455	53.66 %	**2.85 %**
Melbourne	785	2.58 %	417	53.12 %	**2.61 %**
Toronto	578	1.90 %	328	56.75 %	**2.05 %**
Bristol	500	1.64 %	273	54.60 %	**1.71 %**
Washington, D.C.	479	1.57 %	250	52.19 %	**1.56 %**
Manchester	410	1.35 %	230	56.10 %	**1.44 %**

Recruitment messages were sent to software development project managers embedded in a broad range of industries, as shown in **Table 30**. The final column shows the relative portion of total messages opened by recipients in each industry, and provides the best available data on the percentage of surveys completed by industry. Please note that the *Construction* industry shown in this table combines data on the *Construction* and *Building Construction* industries reported separately by the recruiting platform. The *IT Services and IT Consulting* industry opened the highest proportion of total messages, at 9.98%. Although a similar demographic breakdown of completed surveys is unavailable, this implies that no single industry contributed more than 10% of the collected responses, helping to ensure a broad range of perspectives across different sectors.

Although the names of specific companies are withheld for privacy, the size of companies employing the recipients of recruitment messages is shown in **Table 31**. It is interesting that there is no apparent correlation between company size and the proportion of *messages sent* and *messages opened*. For example, firms employing between 5,001 and 10,000 people account for less than 6% of opened messages, while smaller organizations employing up to 200 people account for over a third. Notably, no single company accounted for more than 0.23% of all opened messages, suggesting that the survey successfully sampled a diverse range of perspectives.

Table 30: *Survey Recruitment by Industry*

Industry	Messages Sent	% of Total Sent	Messages Opened	% Open Rate	% of Total Opened
Construction	3,760	12.35 %	1,888	49.68 %	**11.67 %**
IT Services and IT Consulting	2,754	9.04 %	1,595	57.92 %	**9.98 %**
Technology, Information, and Internet	2,265	7.55 %	1,224	54.04 %	**7.66 %**
Business Consulting and Services	2,228	7.31 %	1,212	54.04 %	**7.58 %**
Non-profit Organizations	1,412	4.64 %	711	50.35 %	**4.45 %**
Media and Telecommunications	1,243	4.08 %	678	54.55 %	**4.24 %**
Higher Education	1,181	3.88 %	621	52.58 %	**3.89 %**
Civil Engineering	1,118	3.67 %	575	51.43 %	**3.50 %**
Transportation Equipment Manufacturing	1,102	3.62 %	499	45.28 %	**3.12 %**

Table 31: *Survey Recruitment by Company Size*

Company Size	Messages Sent	% of Total Sent	Messages Opened	% Open Rate	% of Total Opened
10,001+	6,702	22.02 %	3,389	50.51 %	**21.21 %**
5,001 – 10,000	1,843	6.05 %	920	49.92 %	**5.76 %**
1,001 - 5000	4,576	15.02 %	2,358	51.53%	**14.76 %**
501 – 1,000	2,117	6.95 %	1,116	52.72 %	**6.98 %**
201 – 500	2,634	8.65 %	1,359	51.59 %	**8.5 %**
51 – 200	4,559	14.97 %	2,425	53.19 %	**15.18 %**
11 – 50	4,281	14.05 %	2,320	54.19 %	**14.52 %**
2 - 10	2,291	7.52 %	1,303	56.87 %	**8.15 %**

The instructions for this survey of practitioners began by asking participants to "Please recall a recent project that you managed from start to finish, which involved developing or configuring software." In an attempt to fully cover the various titles used by software development project managers, 25 titles were selected within the platform. Eligible recipients were required to have at least five years of experience in at least one of these titles, although no restriction was made based on their current title. The most common current job titles held by recipients are shown in **Table 32**.

It was initially expected that most eligible recipients would hold the title of Information Technology Project Manager, or a related variation, and it is therefore noteworthy that no similar title appears in this list of results. Holders of the more general title of Project Manager account for the largest single proportion of opened messages, at almost 45%, with only holders of the similarly general title of Program Manager exceeding 10%. It is also interesting that the title of Scrum Master is comparatively less well represented, accounting for only 1.36% of opened messages. Several other titles appearing on this list, such as Construction Manager and Engagement Manager, were not anticipated, and may therefore provide useful suggestions for future research efforts in this area.

Table 32: *Survey Recruitment by Job Title*

Job Title	Messages Sent	% of Total Sent	Messages Opened	% Open Rate	% of Total Opened
Project Manager	13,537	44.44 %	7,097	52.43 %	**44.41 %**
Program Manager	3,844	12.62 %	1,880	48.91 %	**11.77 %**
Senior Project Manager	2,690	8.83 %	1,442	53.61 %	**9.02 %**
Program Coordinator	909	2.98 %	461	50.72 %	**2.88 %**
Construction Manager	620	2.04 %	307	49.52 %	**1.92 %**
Engagement Manager	525	1.72 %	288	54.86 %	**1.80 %**
Senior Program Manager	453	1.49 %	239	52.76 %	**1.50 %**
Delivery Manager	424	1.39 %	202	47.64 %	**1.26 %**
Scrum Master	381	1.25 %	218	57.22 %	**1.36 %**
Service Project Manager	347	1.14 %	172	49.57 %	**1.08 %**
Program Specialist	273	0.90 %	147	53.85 %	**0.09 %**

Although no demographic information is available on the set of recipients who ultimately chose to complete the survey, this review of the overall population who received recruitment messages appears promising. Recruitment messages were opened by a diverse range of participants, across various industries, company sizes, and geographic locations, and by experienced practitioners holding a wide range of job titles. The breadth of included perspectives lends support to the findings resulting from the following analysis.

Initial Analysis

Analysis of the results from the practitioner survey began by examining project outcomes, the perceived criticality of hedonic requirements, and overall adherence to each of the four film industry principles across the full set software development project cases. This initial analysis included partial survey responses where possible, allowing evaluation across the widest possible set of project cases at each stage. As a result, the population size differs in the following figures and tables; the relevant population size is noted in each.

All Projects: On-Time Completion

The survey's first statement attempted to measure the success of each project in meeting its expected release date. Respondents were asked to rate the accuracy of the statement, "The project was completed on schedule," by selecting one of seven possible responses. When converted to numerical values, with *Not at all accurate* corresponding to 1 and *Extremely accurate* corresponding to 7, the full set of 307 cases yielded an average score of 4.15, suggesting that many projects struggled to meet their expected schedule. Specifically, 21.9% of projects rated this statement as either *Not at all* or *Slightly accurate*, indicating a substantial failure to deliver on time. Conversely, 28.7% of projects rated this statement either *Very* or *Extremely accurate*, signifying a high degree of success. The distribution of responses is shown in **Figure 7**, while all project outcomes are summarized in **Table 33**.

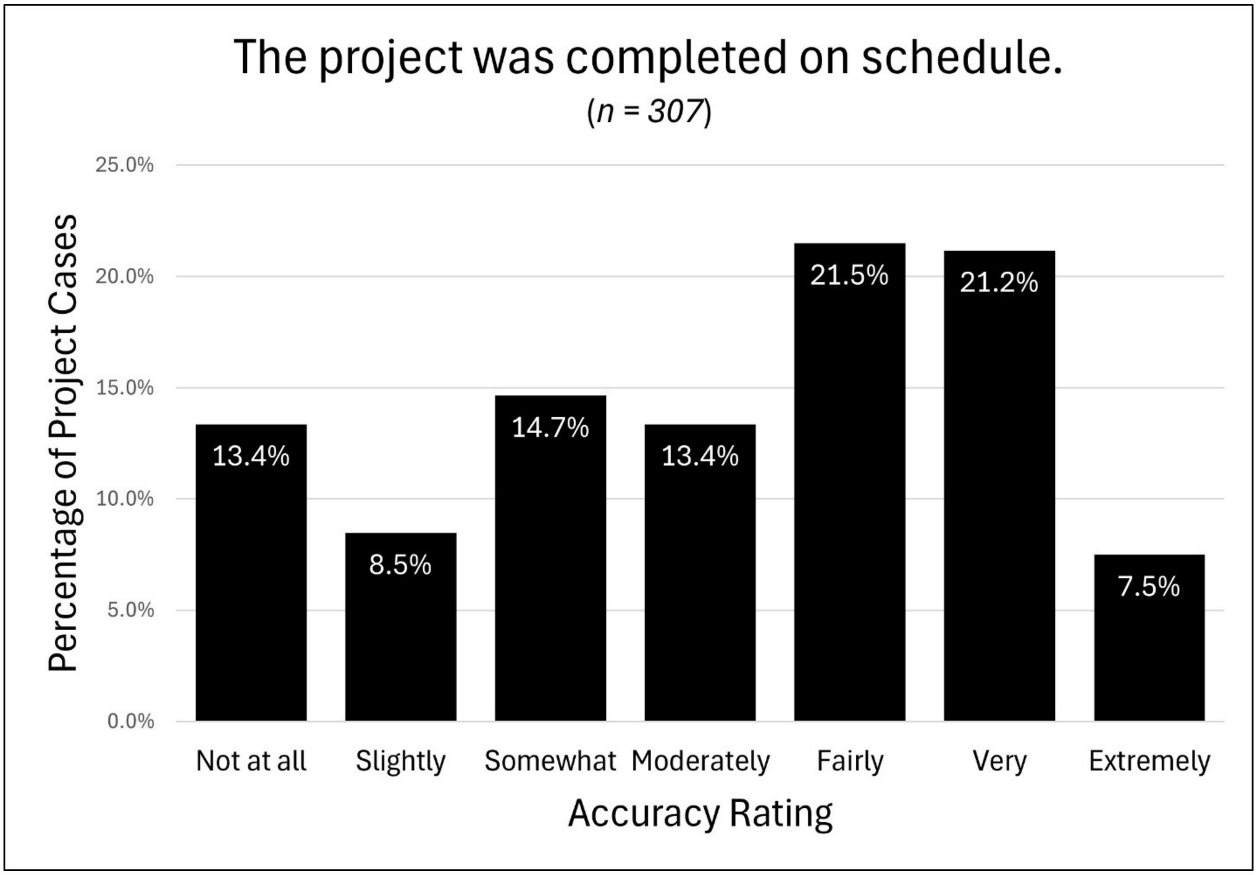

***Figure** 7: All Projects: On-Time Completion*

All Projects: Adherence to Estimated Budget

The next statement assessed how closely each project's expenses matched expectations. Across the full set of 307 projects, respondents rated the accuracy of the statement, "The project was completed within or below budget," at an average of 4.44 out of 7. This suggests that many projects also experienced difficulties in estimating or controlling costs. In contrast to the measure of on-time completion, however, a slightly larger proportion of projects reported success on this measure, at 37.5%. In contrast, only 19.3% of project cases reported significant failure to deliver within or below budget. The distribution of responses is shown in **Figure 8**.

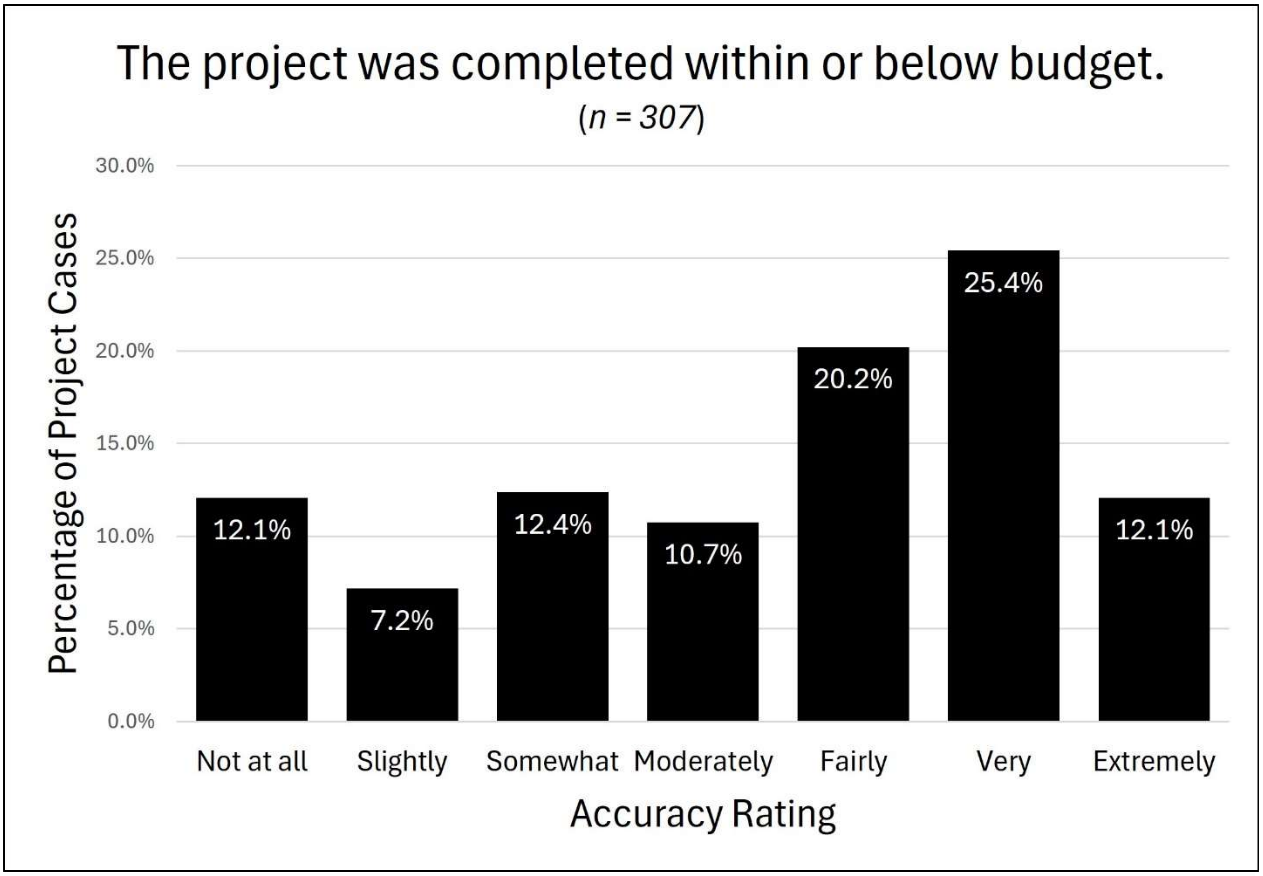

Figure 8*: All Projects: Adherence to Estimated Budget*

All Projects: Delivery of Promised Scope

Participants were next asked to rate the accuracy of the statement "The project delivered promised features and scope." On average, this measure of success was rated at 5.52 out of 7, which is appreciably higher than both previous measures. Only 4.9% of projects reported challenges in providing all expected features, while 64.5% indicated a substantial level of success. The distribution of responses is shown in **Figure 9**.

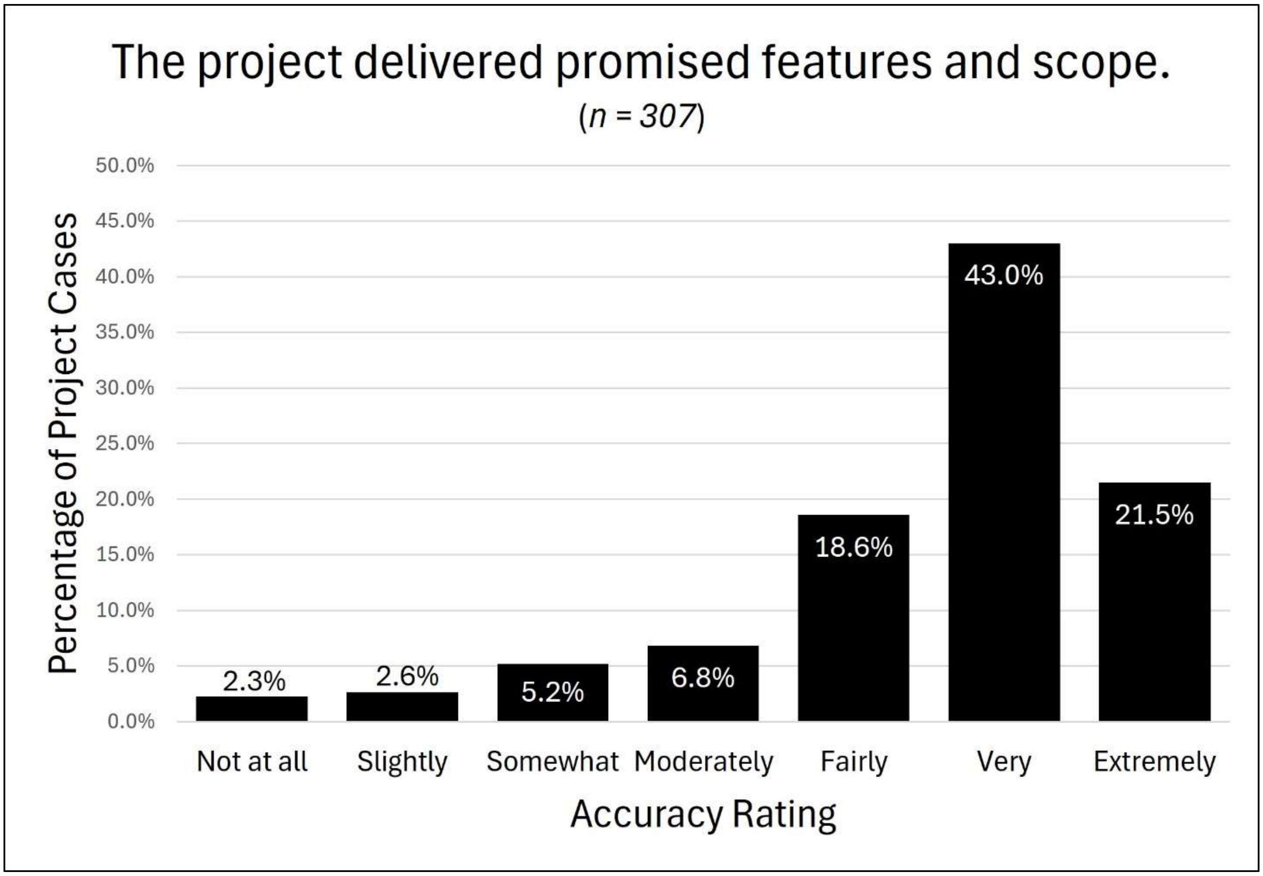

***Figure 9**: All Projects: Delivery of Promised Scope*

All Projects: Stakeholder Satisfaction

The final directly measured project outcome required participants to rate the accuracy of the statement, "Project stakeholders were satisfied with the results of the project." As discussed in Chapter Three, this measure of stakeholder satisfaction was chosen over a more explicit examination of each project's achieved benefits, which may have been more challenging for participants to evaluate. Responses to this statement indicated relatively high levels of success on this measure, with an average accuracy rating of 5.51 out of 7, and 61.5% of projects indicating a substantial degree of stakeholder satisfaction. Only 4.2% of projects reported that project stakeholders were *Slightly* or *Not at all* satisfied with the results of the project. The distribution of results in shown in **Figure 10**.

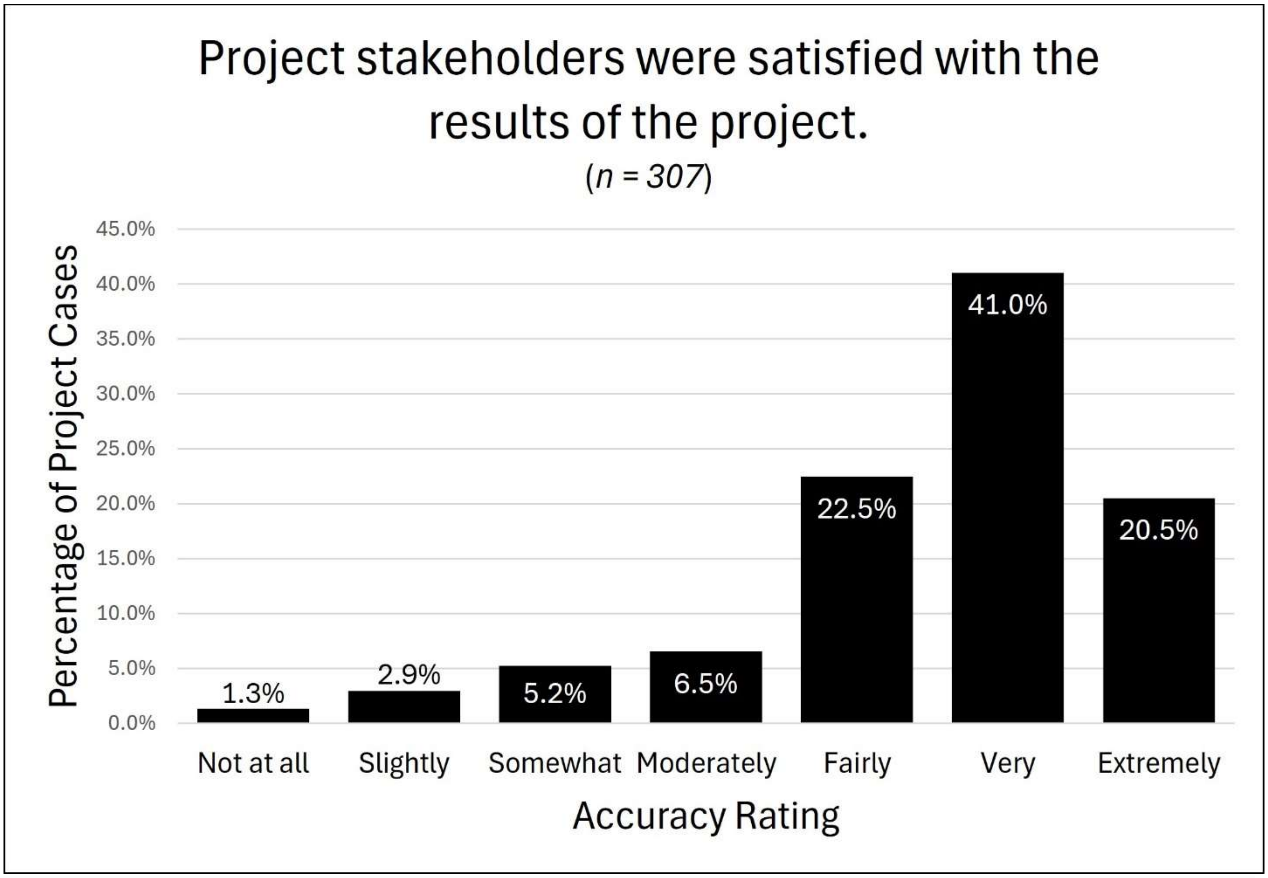

Figure 10: *All Projects: Stakeholder Satisfaction*

All Projects: Overall Project Success

To derive an overall measure of the success, the ratings for each of the four direct measures were then averaged for each project case. The distribution of these results, with possible scores falling between 1.0 and 7.0, is shown in **Figure 11**. In order to maintain consistency with the definitions used for the individual measures of success discussed above, matching thresholds were applied here. Specifically, projects with an average score of 6.0 or higher were categorized as successful overall, while those with average scores of 2.0 or lower were categorized as overall failures.

While this approach enables a clear and logical comparison to other metrics, it also results in unequal ranges for the remaining average scores, which now cannot be divided evenly. Instead, the remaining scores are grouped into two additional categories: *Moderate Failure* (2.1 – 4.0) and

Moderate Success (4.1 – 5.9). Although these categories have unequal ranges, they nevertheless provide a meaningful distinction between varying levels of overall project outcomes.

On average, the 307 projects in this set scored 4.90, implying a moderate level of success and suggesting that many projects experienced difficulty in meeting all four measured goals. Only 2.3% of projects reported a high degree of overall failure, while a still relatively low 26.7% of responses indicated a substantial degree of overall success.

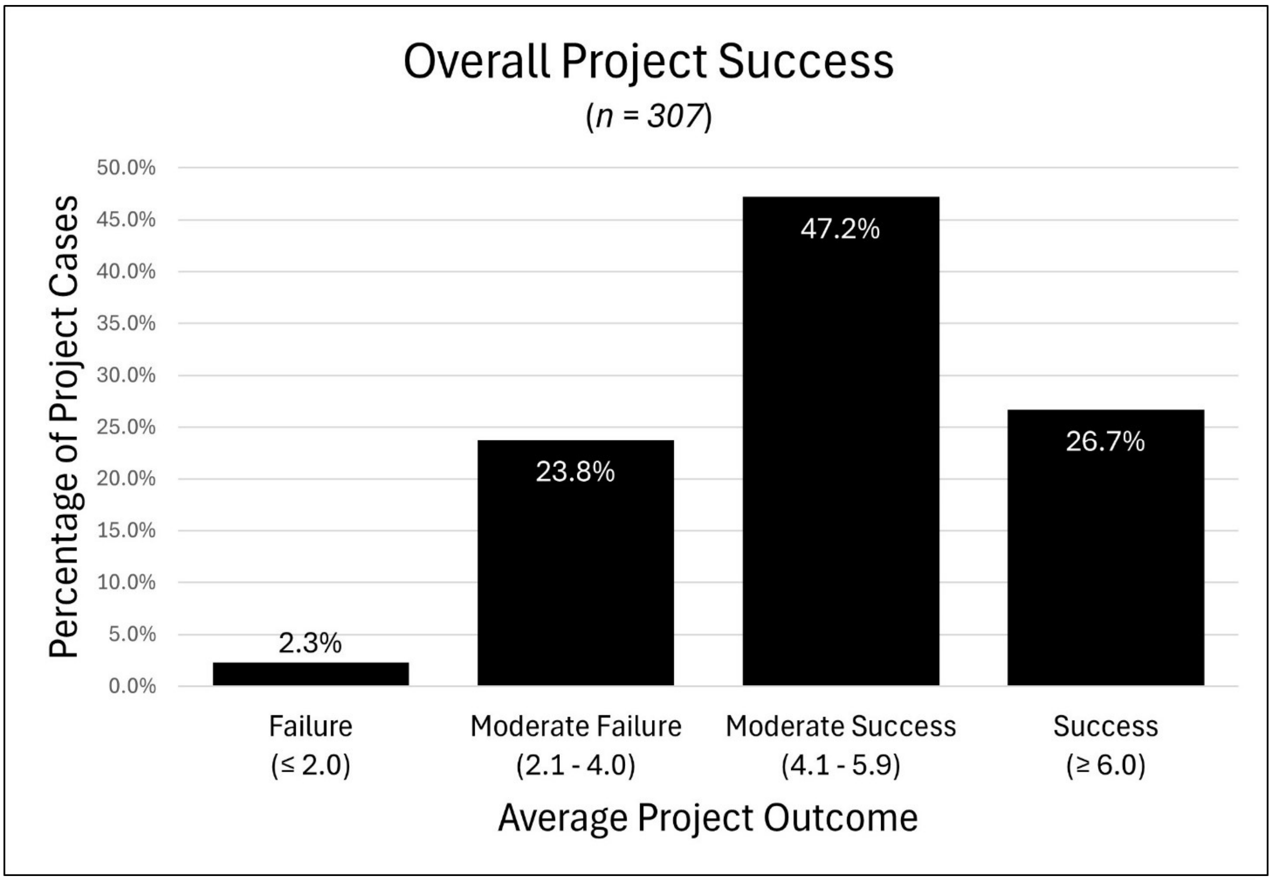

Figure 11: *All Projects: Overall Project Success*

Based on this second figure, it appears that 73.3% of projects within this set of cases were less than completely successful. As an alternative definition of failure, 94 cases, or 30.6% of projects, rated at least one of the four statements describing a successful project outcome as either *Slightly* or *Not at all* accurate, indicating substantial failure on at least one measure of success.

The inclusion of *Somewhat* accurate responses in the same analysis, corresponding to a rating of 3 out of 7, raises this number to 150 cases, or 48.9%.

All Projects: Summary of Project Outcomes

All five measures of project success are summarized in **Table 33**. Adherence to an estimated schedule had the lowest average rating at 4.15, and the highest portion of failed projects at 21.9%. In contrast, the delivery of expected scope and stakeholder satisfaction received similarly high average ratings, at 5.52 and 5.51, respectively, with the delivery of expected scope showing a slightly higher proportion of successes, at 64.5%.

***Table 33**: All Projects: Summary of Project Outcomes*

	Average	Failures (≤ 2)	Successes (≥ 6)
Schedule	4.15	21.9 %	28.7 %
Budget	4.44	19.3 %	37.5 %
Scope	5.52	4.9 %	64.5 %
Satisfaction	5.51	4.2 %	61.5 %
Overall	4.90	2.3 %	26.7 %
Number	*307*		

All Projects: Perceived Criticality of Hedonic Requirements

The fifth survey statement assessed the level of hedonic requirements in each project. It was, unfortunately, not possible to directly and objectively measure the relative quantity of these types of requirements. Instead, this statement instead relied on the project manager's perception of their criticality to success, necessarily in hindsight. The full statement read "It was critical to project success that the end user experienced or avoided specific emotional reactions while using the software, such as satisfaction, security, frustration, or fear."

The distribution of responses is shown in **Figure 12**. The average of all responses was 4.87, near to the range's midpoint. 13.7% of participants rated this statement as *Slightly* or *Not at all* accurate, while nearly half, at 48.2%, rated it as *Very* or *Extremely accurate*.

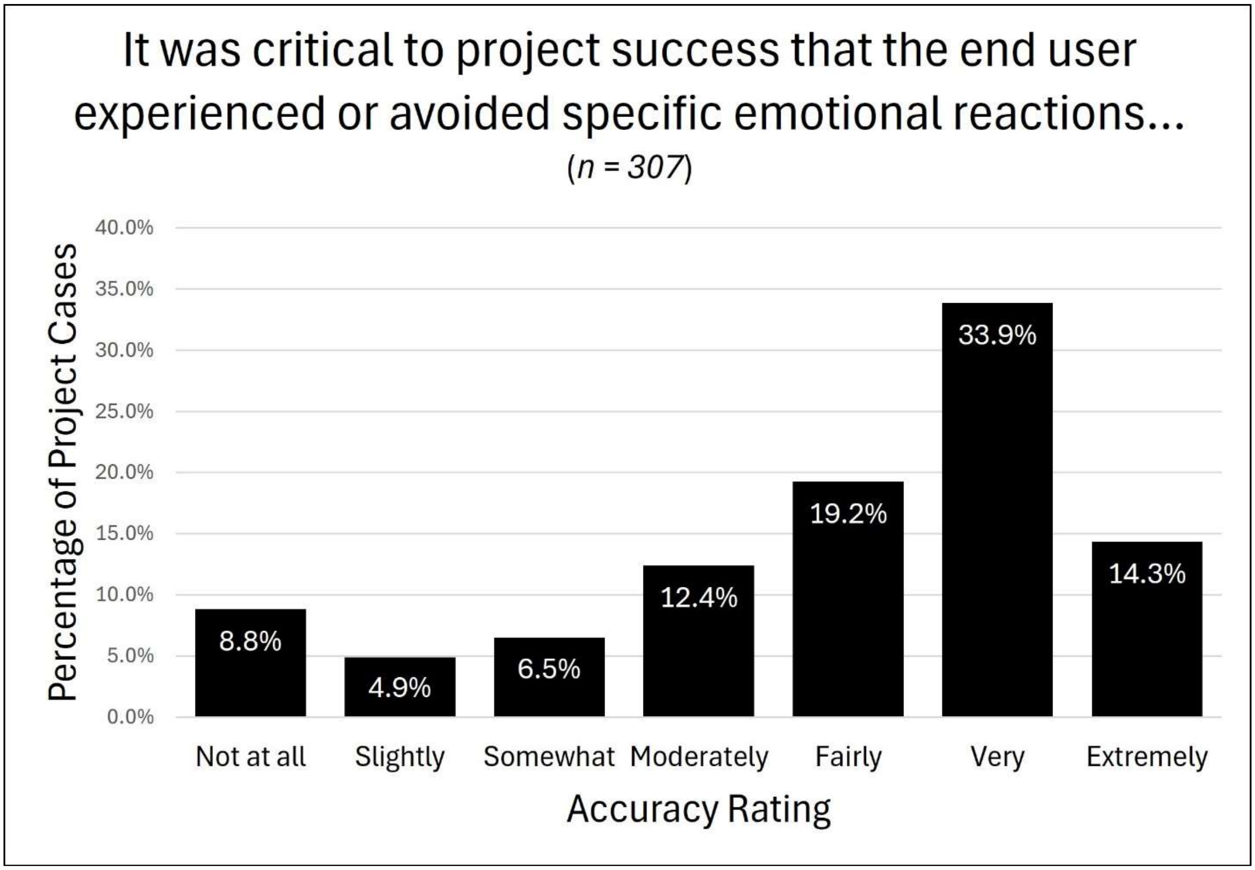

***Figure 12**: All Projects: Perceived Criticality of Hedonic Requirements*

All Projects: Overall Adherence to Expectation Clarity

The example use of the Real-to-Real method presented in Chapter Two synthesized four principles that appear to shape the film industry's approach to project management, shown in **Table 7**. Sixteen existing software development practices were then identified, each of which also supports or adheres to one of these principles. The full mapping of principles to practices in both industries is shown in **Appendix A** (Hawkey and Vans 2024). This survey measured the use of each of these practices within the collected set of software development projects, using the same rating scale as previous questions. By averaging each project's responses on the use of practices associated with each principle, it was therefore possible to determine each project's overall adherence to that principle. Results for all four principles are shown in **Table 34**.

The distribution of overall adherence to the principle of Expectation Clarity is shown in **Figure 13**. Projects following this principle seek to enable team members to understand their own and other's responsibilities, select suitable projects, and commit to roles in which they will excel (Hawkey and Vans 2024). Here, thresholds were defined using the same criteria established earlier, with average responses of 6.0 representing *Strong* adherence and average responses of 2.0 or lower indicating *Weak* adherence.

Within the set of 288 projects for which complete data on these practices was available, 4.2% reported substantially weak adherence to this principle. Strong use of the set of three supporting practices, on average, was found in 30.2% of projects. On average, the software development projects included in this survey rated the accuracy of statements describing use of the three supporting practices as 4.91 out of 7, or 70.1%

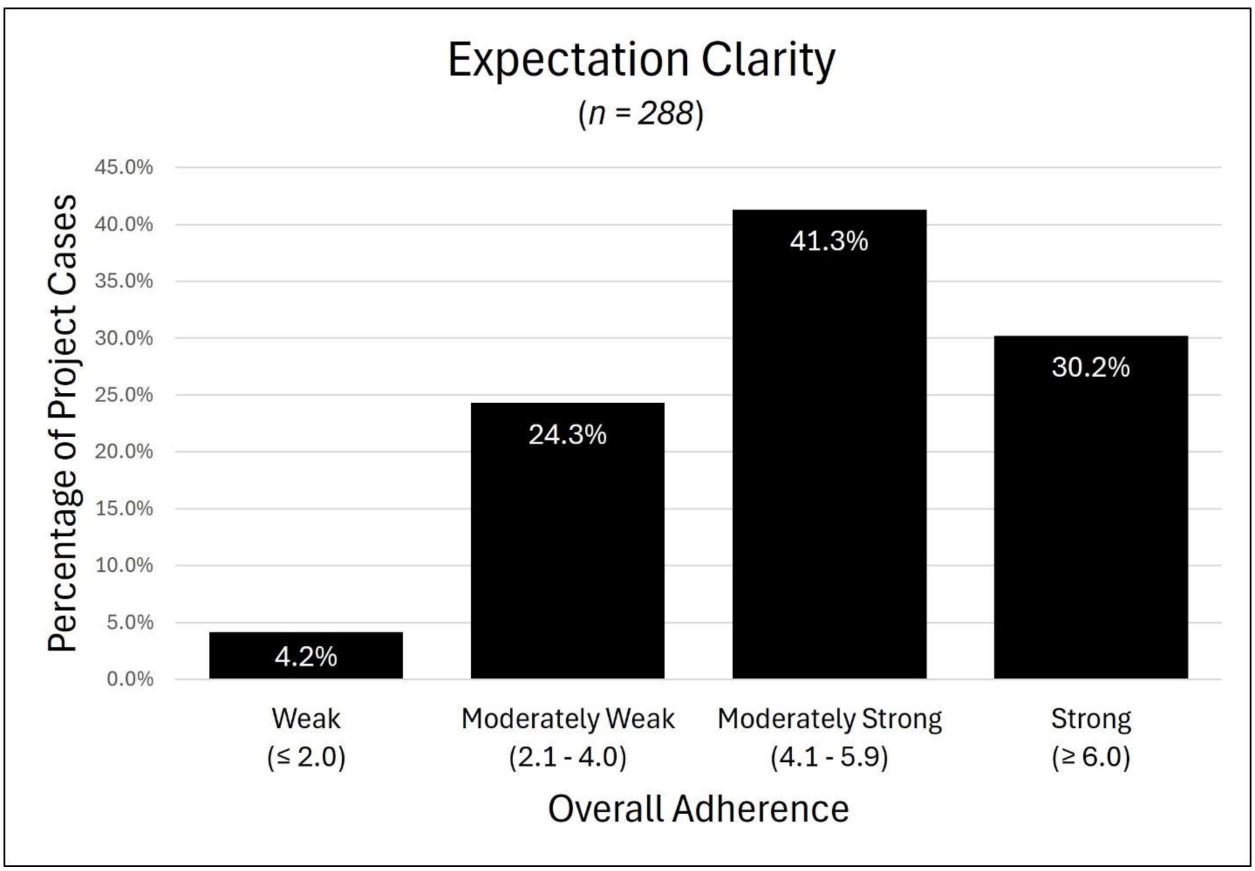

***Figure 13**: All Projects: Overall Adherence to Expectation Clarity*

All Projects: Overall Adherence to Rigorous Project Approval

Using the average response to the five practices supporting the principle of Rigorous Project Approval, the distribution of overall adherence is shown in **Figure 14**. This principle calls for projects to ensure the use of formal project approval decisions, based on detailed analysis, to authorize project proposals for full development (Hawkey and Vans 2024). On average, for the 272 cases in which full data on these practices was available, projects reported 4.94 out of 7.0, indicating a moderately strong adherence to this principle. One quarter of all projects showed strong support to this principle, while only 2.6% indicated weak overall adherence.

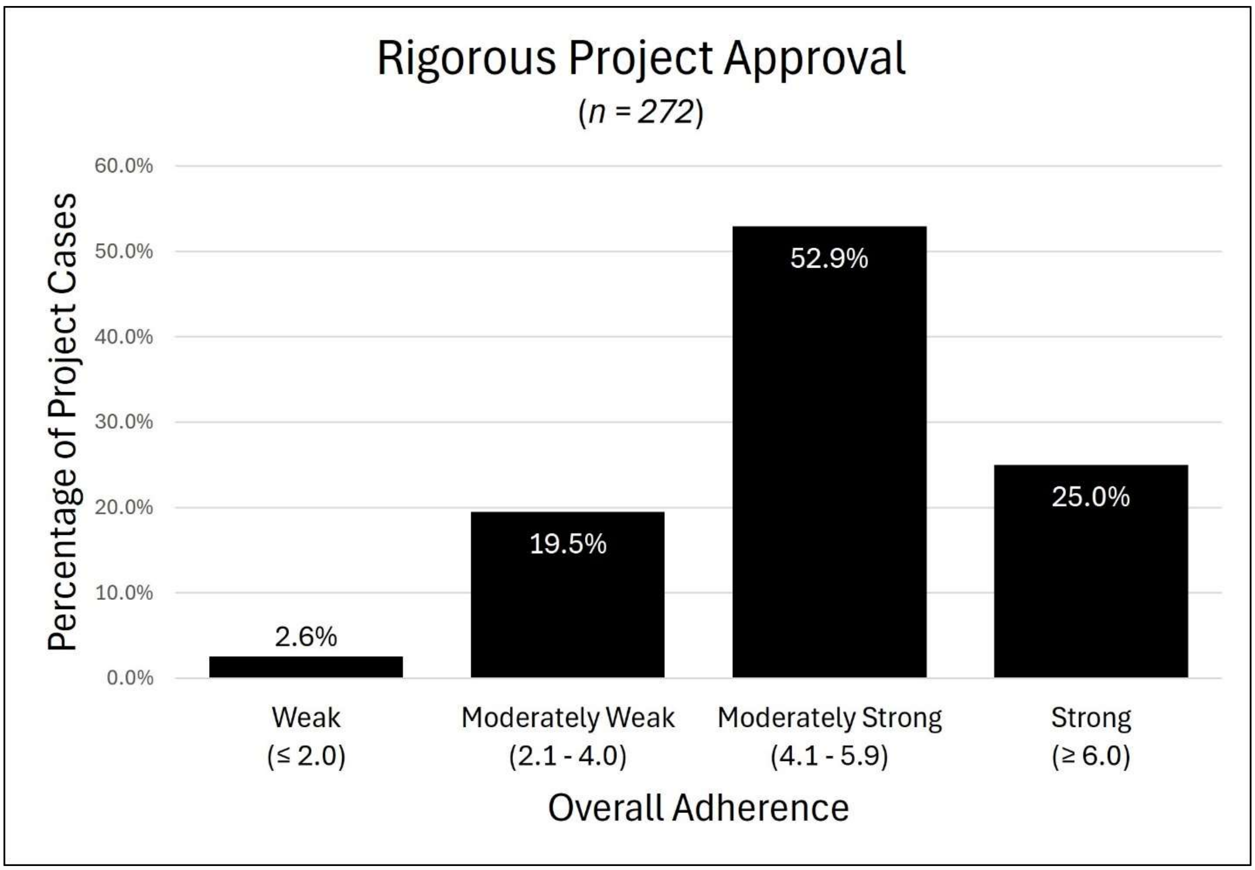

Figure 14: *All Projects: Overall Adherence to Rigorous Project Approval*

All Projects: Overall Adherence to Benefits Management

Use of the four practices supporting the principle of Benefits Management appeared slightly more popular, as shown in **Figure 15**. Projects following this principle estimate, track, and report actual progress, spending, and outcomes (Hawkey and Vans 2024). On average, projects in the set of 265 cases fully reporting on the use of the practices supporting this principle reported 5.19 out of 7 in overall adherence, suggesting moderately strong adherence. 35.1% of projects reported strong adherence, while only 1.5% of projects indicated weak overall use of the associated practices.

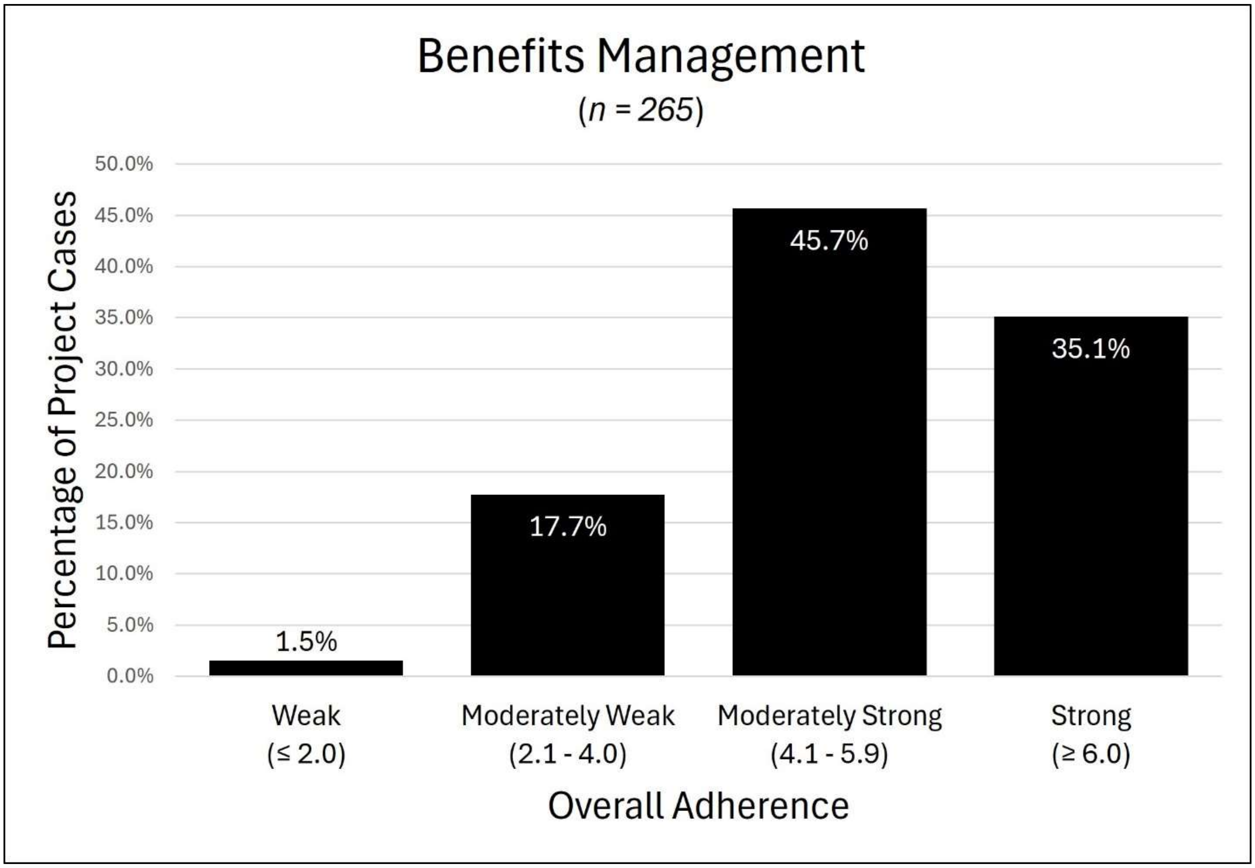

Figure 15: *All Projects: Overall Adherence to Benefits Management*

All Projects: Overall Adherence to Linked Boundary Objects

The distribution of overall adherence to the fourth film industry principle, Linked Boundary Objects, is shown in **Figure 16**. Projects following this principle seek to improve communication and collaboration by using a set of standardized documents and by tracking revisions to them (Hawkey and Vans 2024). Survey data on the use of the four identified software development practices supporting this principle is available for 262 project cases, who reported an average adherence of 5.08 out of 7. 30.5% of all projects reported strong adherence to this principle, while 3.8% indicated a weak application of the associated practices.

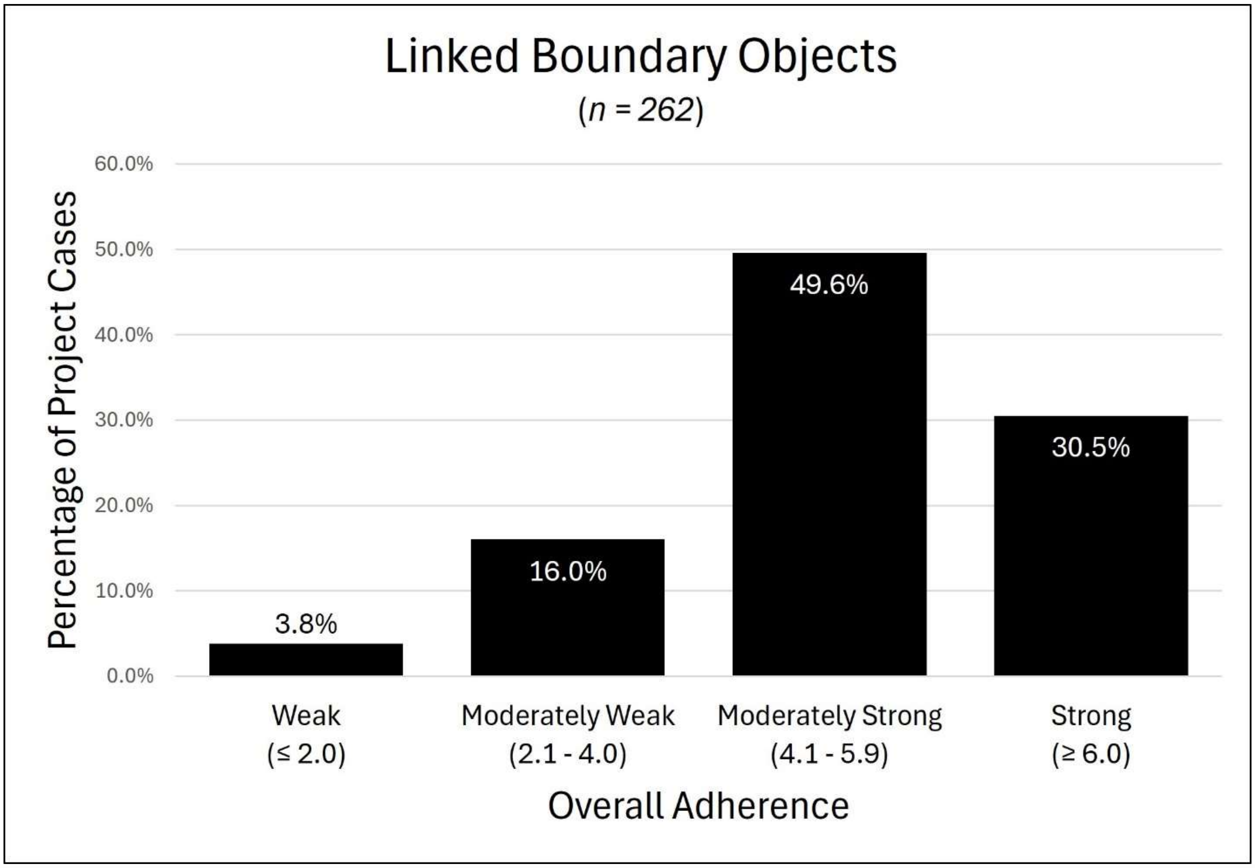

Figure 16: *All Projects: Overall Adherence to Linked Boundary Objects*

All Projects: Adherence to Film Industry Principles

Adherence to all four film industry principles within the set of software development project cases generated by the practitioner survey is summarized in **Table 34**. The principle of Benefits Management had both the highest average adherence, at 5.19 out of 7, and the largest portion of projects exhibiting high adherence, at 35.1%. The principle of Expectation Clarity, in contrast, saw only 4.91 average adherence, with 4.2% of projects reporting low adherence. Notably, the range of average adherence across all four principles was relatively narrow.

Table 34: All Projects: Adherence to Film Industry Principles

	Number	Average	Low (≤ 2)	High (≥ 6)
Expectation Clarity	*288*	4.91	4.2 %	30.2 %
Rigorous Project Approval	*272*	4.94	2.6 %	25.0 %
Benefits Management	*265*	5.19	1.5 %	35.1 %
Linked Boundary Objects	*262*	5.08	3.8 %	30.5 %

All Projects: Most Prevalent Practices

The three software development practices which received the highest average accuracy rating, across the set of 262 full survey responses, are shown in **Table 35**. Two practices supporting the principle of Benefits Management are included, involving measuring and reporting actual delivered benefits and reporting regular and frequent updates on the project's progress and expenses, with average ratings of 5.31 and 6.06 out of 7, respectively. The third practice here supports the principle of Rigorous Project Approval, and involves restricting project approval authority to a select group of key decision-makers, which received an average accuracy rating of 5.56.

Table 35: *All Projects: Most Prevalent Practices*

Average Accuracy Rating	Number of Cases	Associated Principle	Software Development Practice
6.05		Benefits Management	We reported regular and frequent updates on the project's progress and expenses.
5.56	*262*	Rigorous Project Approval	The authority to approve our project for production was restricted to a select group of designated decision makers.
5.31		Benefits Management	We measured and reported actual delivered benefits.

All Projects: Least Prevalent Practices

Table 36 details the three software development practices which received the lowest average rating in the set of 262 complete survey responses. In seeming contrast to the set of most prevalent practices detailed in **Table 35**, a practice supporting the principle of Benefits Management received the lowest average rating, at 4.27 out of 7. This practice involves identifying thresholds that trigger corrective action if the project exceeds its budget or schedule after development begins. Practices supporting the principles of Rigorous Project Approval and Expectation Clarity were rated as the second and third least accurate, respectively. Although the range of average adherence to each principle is narrow, as shown in **Table 34**, the range of average adherence to the set of 16 supporting practices is slightly broader, with the most prevalent practice being 41.6% more widely implemented than the least prevalent.

Table 36: *All Projects: Least Prevalent Practices*

Average Accuracy Rating	Number of Cases	Associated Principle	Software Development Practice
4.52	*262*	Expectation Clarity	We provided access to role and project details before hiring or assigning team members to the project.
4.49		Rigorous Project Approval	Our project approval process was competitive, ensuring that only the most promising proposals were approved for production."
4.27		Benefits Management	Before starting development, we defined specific overage thresholds that would trigger corrective actions, such as a replanning session, if the project went over budget or schedule.

Summary of Initial Analysis

This initial analysis provides an overview of the software development project cases constructed from the practitioner survey, highlighting both areas of success and goals that are frequently challenging. While the average overall adherence to film industry principles is relatively consistent across the set, notable differences emerged in the distribution of projects with strong versus weak adherence to each principle, as well as in the prevalence of associated specific practices. These findings lay the groundwork for further exploration of the relationship between hedonic requirements and project outcomes.

The Impact of Hedonic Requirements on Project Outcomes

Next, for the full set of 307 project cases, each participant's response to survey statement #5, which measured the perceived criticality of hedonic requirements to project success, was compared separately to each of the four measures of project outcomes. The same measure of hedonic requirements was then compared to the derived metric of Overall Project Success, which was calculated by averaging each project's reported outcome across all four measures of success. Each of the resulting figures below illustrates the association between the perceived criticality of hedonic requirements and a single measure of project success. The size of each bubble corresponds to the frequency with which each combination appears within the dataset. The displayed trendline, while helpful in visually assessing the apparent relationship, is not calculated with reference to these frequencies. Instead, linear regression analysis is used to empirically determine the effect of the perceived criticality of hedonic requirements on each project outcome. These results are detailed in **Table 37**.

All Projects: Hedonic Requirements vs. On-Time Completion

Respondents to the practitioner survey were asked to rate the accuracy of the statements "The project was completed on schedule" and "It was critical to project success that the end user experienced or avoided specific emotional reactions, such as satisfaction, security, frustration, or fear." Seven response options were provided for each statement, ranging from *Extremely accurate* to *Not at all accurate*. In **Figure 17**, responses from the full set of 307 project cases have been converted to numerical form and averaged, allowing for an analysis of the effect of the perceived criticality of hedonic requirements on on-time completion.

This analysis revealed a weak but statistically significant positive relationship, at a confidence level exceeding 99.99% ($p = 1.16E-06$). Respondents who more fully agreed that hedonic requirements were critical to success also reported on-time completion more frequently. Specifically, for every one-unit increase to the perceived criticality of hedonic requirements, there was a corresponding 0.285 increase in the project's adherence to schedule. Linear analysis statistics are presented in **Table 37**.

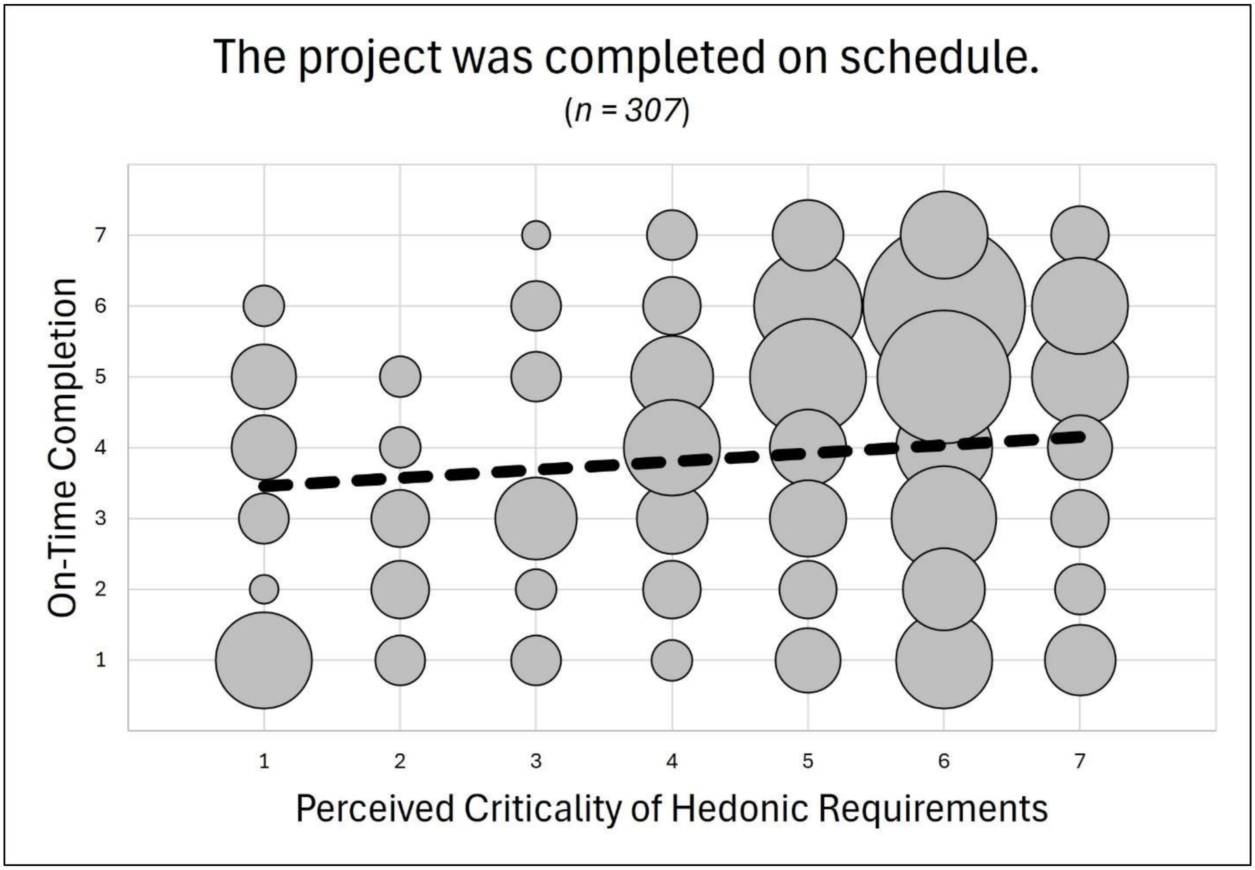

Figure 17: *All Projects: Hedonic Requirements vs. On-Time Completion*

Hedonic Requirements vs. Adherence to Estimated Budget

When practitioner agreement on the criticality of hedonic requirements to success is compared to each project's completion within or below budget, a slightly weaker relationship is evident. As shown in **Figure 18**, this relationship is also positive, and statistically significant at a 99.5% confidence level ($p = 0.005$). Every one-unit increase to the perceived criticality of hedonic requirements is matched by a 0.171 increase in the project's adherence to budget. Linear analysis statistics are again presented in **Table 37**.

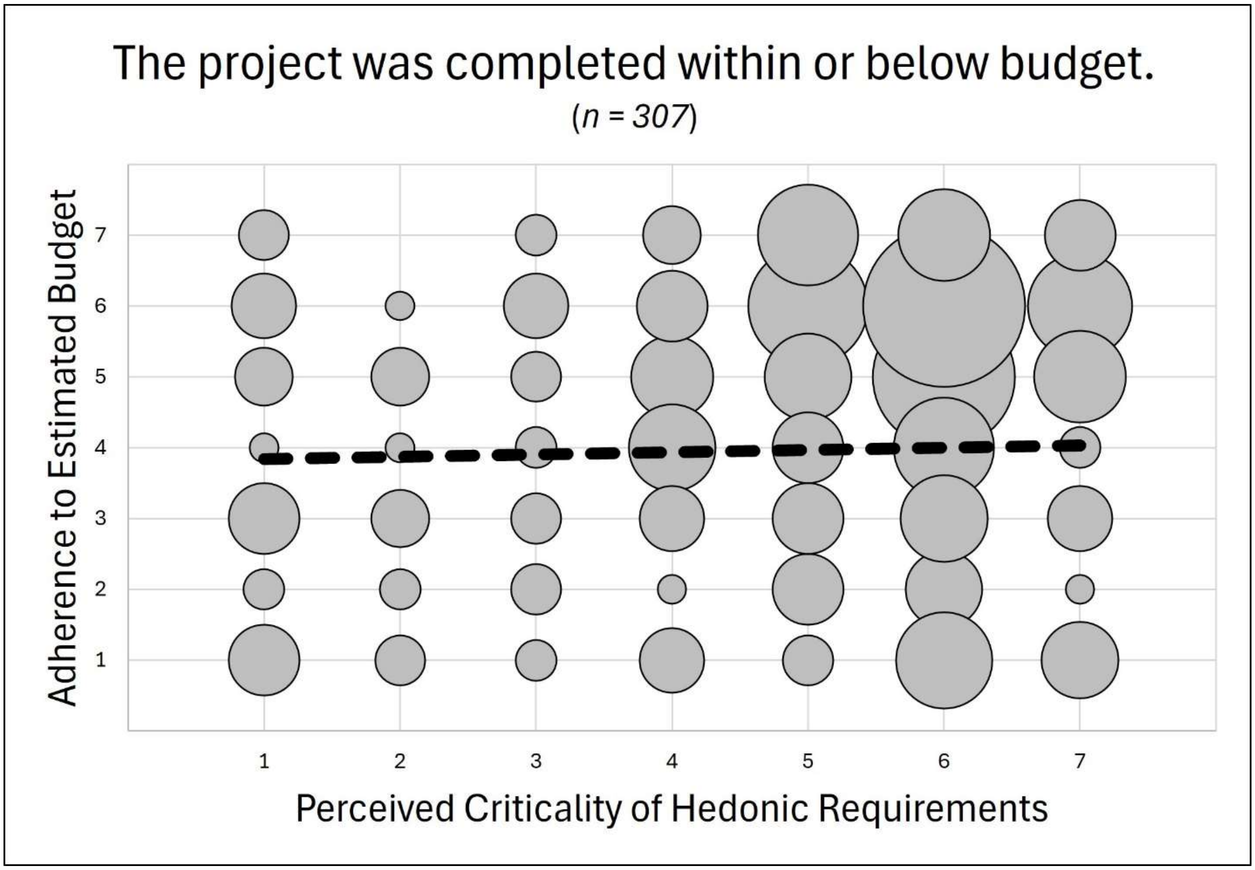

Figure 18: *All Projects: Hedonic Requirements vs. Adherence to Estimated Budget*

Hedonic Requirements vs. Delivery of Promised Scope

Next, practitioner responses to the criticality of hedonic requirements were compared to each project's delivery of promised features and scope. Here, a similar relationship is found. This relationship is also positive, and statistically significant to a 99.9% confidence level ($p = 0.001$). As illustrated in **Figure 19** and detailed in **Table 37**, a one-unit increase in the perceived criticality of hedonic requirements results in a 0.14 increase in the projects successful delivery of promised scope.

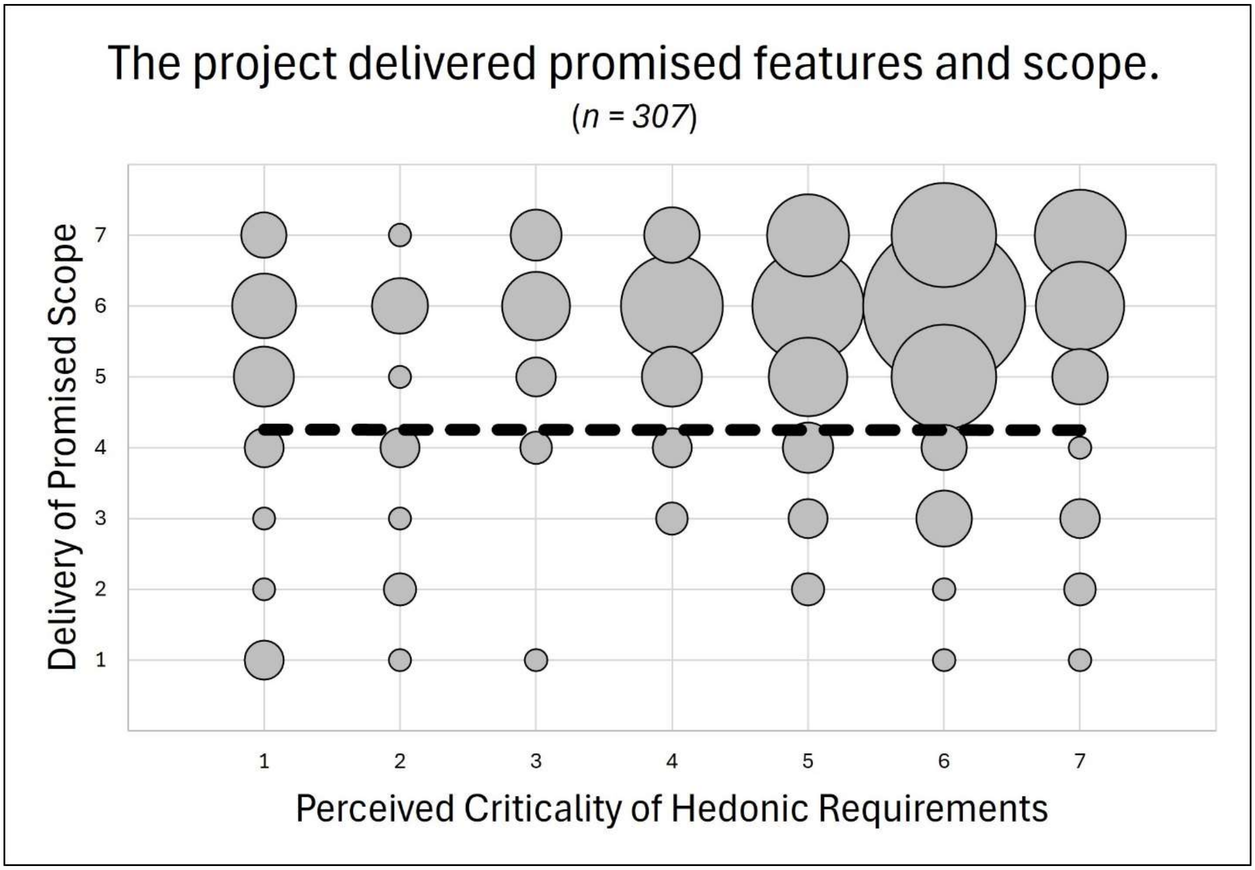

Figure 19*: All Projects; Hedonic Requirements vs. Delivery of Promised Scope*

Hedonic Requirements vs. Stakeholder Satisfaction

In the final direct measure of project outcomes, practitioners were asked to rate the accuracy of the statement "Project stakeholders were satisfied with the results of the project." When these responses are compared to the degree of each respondent's agreement with the criticality of hedonic requirements, a weak and slightly positive relationship is revealed, as shown in **Figure 20**. The correlation is statistically significant at the 97.5% confidence level (p = .025), as detailed in **Table 37**. The reported satisfaction of project stakeholders increases 0.094, for each one-unit increase in the perceived criticality of hedonic requirements.

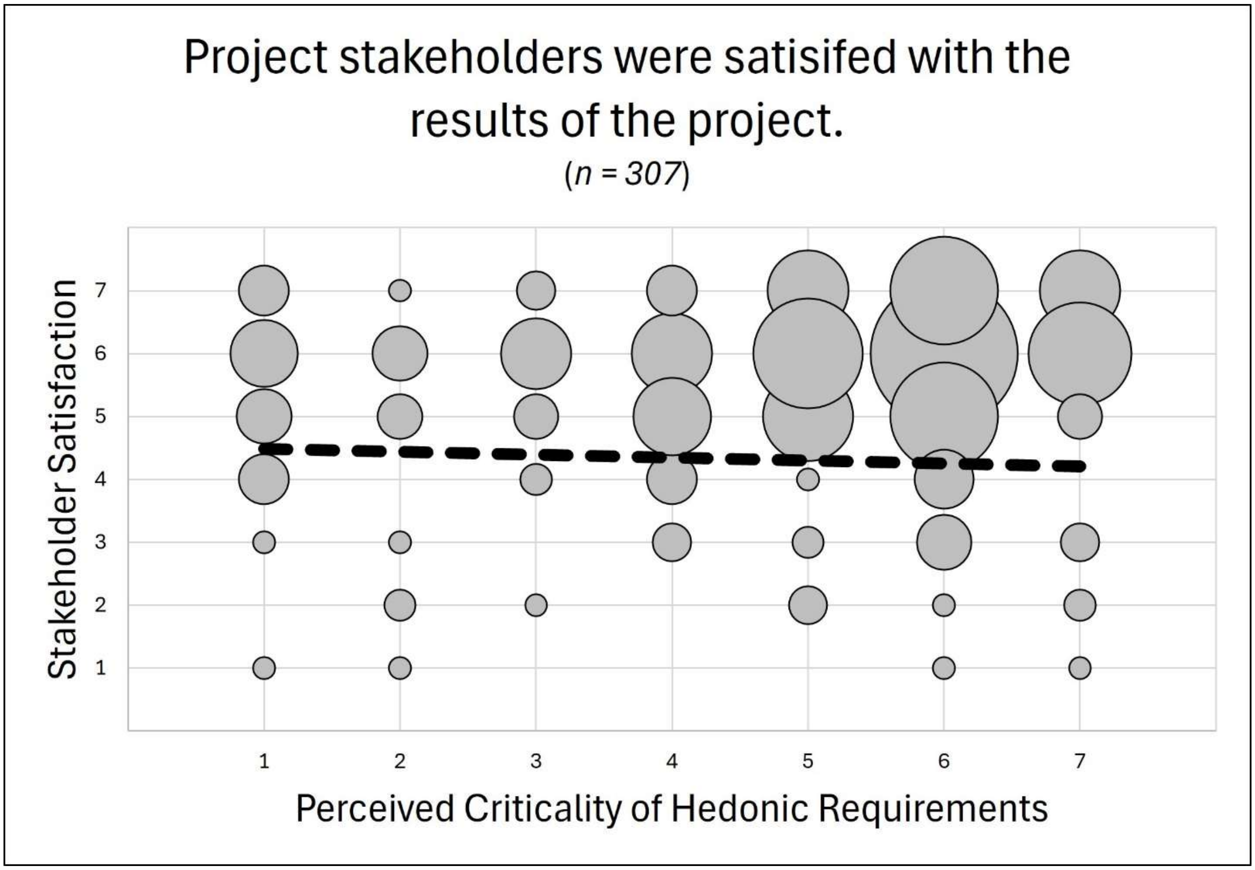

Figure 20*: All Projects: Hedonic Requirements vs. Stakeholder Satisfaction*

Hedonic Requirements vs. Overall Project Success

By averaging responses to the four direct measures of project outcomes, it is also possible to calculate a measure of overall success for each project, also on a scale from 1 to 7. In **Figure 21**, a clear relationship is illustrated. While the correlation is weak, it is statistically significant at a confidence level above 99.9% (p = 7.9E-06), as detailed in **Table 37**. The relationship between the perceived criticality of hedonic requirements and overall project success is positive, with each one-unit increase in the former corresponding to a 0.172 increase in the latter.

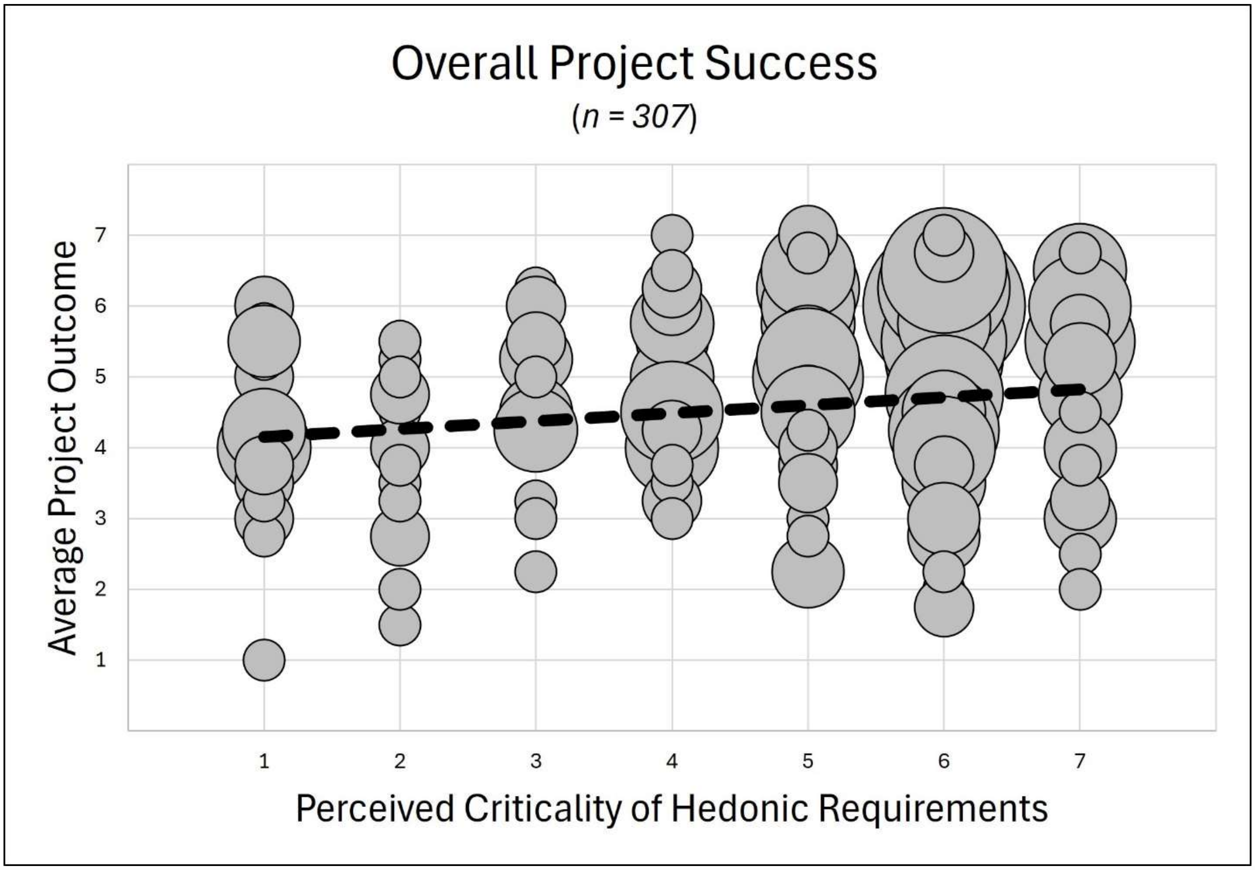

Figure 21: *All Projects: Hedonic Requirements vs. Overall Project Success*

Summary of Results: Hedonic Requirements vs. Project Outcomes

Although the relationships shown in **Figure 17** through **Figure 21** are weak, each is statistically significant to a very high level of confidence, as detailed in **Table 37**. The consistency of the relationship across all five measures of project success is also noteworthy. In the set of 307 cases developed through this practitioner survey, software development project managers who agree that hedonic requirement are critical to project success consistently report better project outcomes, by every definition of success considered in this survey.

Comparing Project Cases: *Low* vs *High Hedonic* Projects

Next, to further examine the relationship between hedonic requirements and project outcomes, survey responses were first grouped according to the perceived criticality of hedonic requirements. A total of 34 project cases in which statement #5, as listed in **Appendix B**, was rated as either *Slightly* or *Not at All* accurate were grouped together as *Low Hedonic* projects. Another 129 cases, including only projects for which that statement was rated as *Very* or *Extremely* accurate, were classified as *High Hedonic* cases. This categorization allowed for a comparison of project outcomes between each group.

Table 37: *All Projects: Hedonic Requirements vs. Project Outcomes*

Project Outcome	Schedule	Budget	Scope	Satisfaction	Overall
Multiple R	0.273	0.159	0.180	0.127	**0.251**
Strength	Weak	Weak	Weak	Weak	**Weak**
R Square	0.074	0.025	0.032	0.016	**0.063**
t Stat	4.962	2.82	3.20	2.25	**4.54**
P-Value	1.16E-06	0.005	0.001	0.025	**7.9E-06**
Significant	Yes	Yes	Yes	Yes	**Yes**
Coefficient	0.285	0.171	0.140	0.094	**0.172**

In the practitioner survey, four project outcomes were rated by survey participants using seven available responses, which were converted to numerical form for this analysis. An aggregate measure of Overall Project Success was also calculated, as the average of the four individual success measures for each project case, maintain the 1-7 scale. The percentage of projects scoring 6 or higher, indicating a high degree of success, and those scoring 2 or lower, indicating a high degree of failure, was then calculated for all five measures of success, separately for the sets of *High Hedonic* and *Low Hedonic* projects. These results are presented in **Figure 22** and **Figure 23**, and detailed in **Table 38**.

Project Success Rates: **Low *vs* High Hedonic *Projects***

The set of *High Hedonic* projects included a higher percentage of successful projects, across all measures of success, as shown in **Figure 22**. Although the average success rates for each measure were similar between the two groups, as detailed in **Table 38**, it is noteworthy that over 34% of projects in which the assertion that hedonic requirements were critical to success was rated as *Very* or *Extremely* accurate were highly successful overall. In contrast, less than 6% of *Low Hedonic* projects achieved a similar level of overall success.

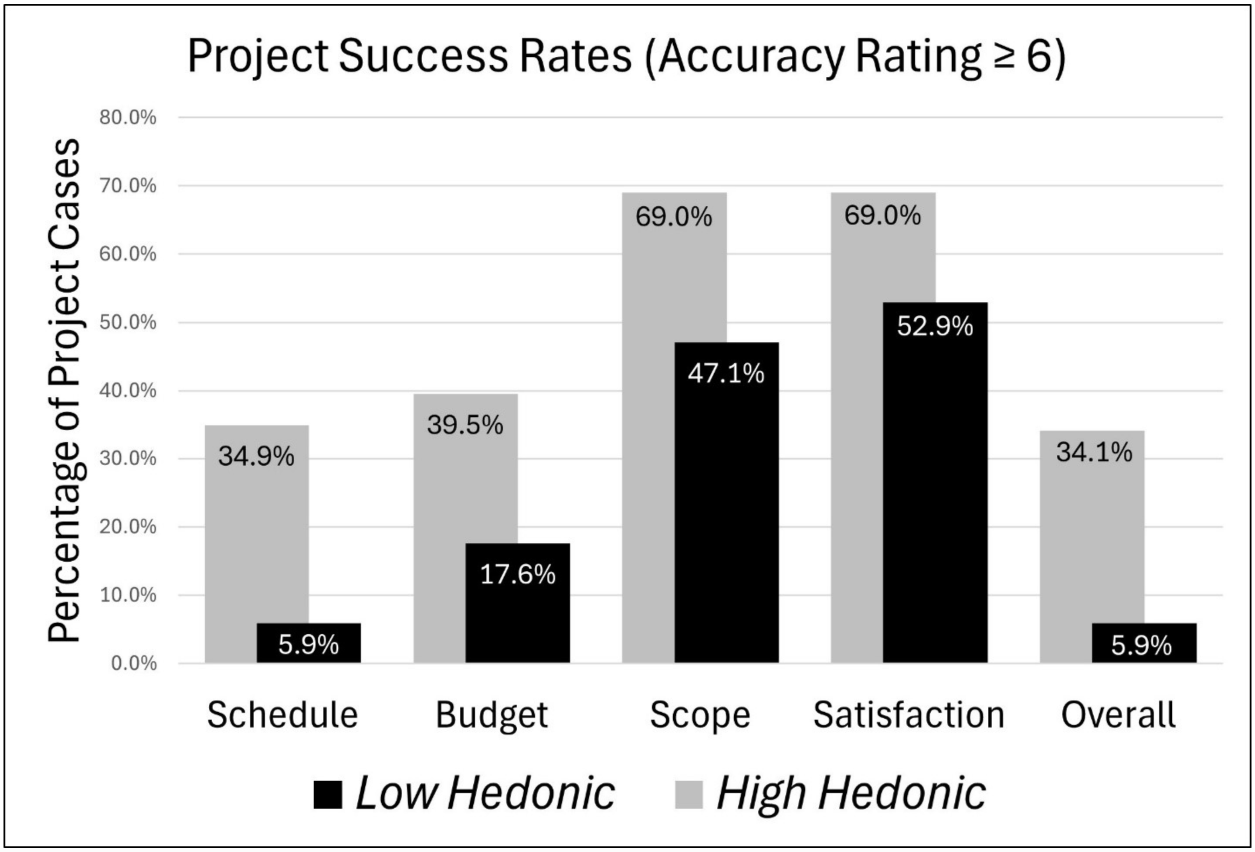

Figure 22: *Project Success Rates:* Low *vs.* High Hedonic *Projects*

Project Failure Rates:* Low *vs* High Hedonic *Projects

The set of *Low Hedonic* projects also included a higher percentage of failed projects, across all measures of success, as shown in **Figure 23**. It is particularly striking that while over 41% of projects in which the criticality of hedonic requirements to project success was rated as *Slightly* or *Not at All* accurate failed to deliver on time, only approximately 17% of *High Hedonic* projects reported similar difficulties. *Low Hedonic* projects also experienced overall failure at roughly double the rate of *High Hedonic* projects, although the number of such failures in each set was low.

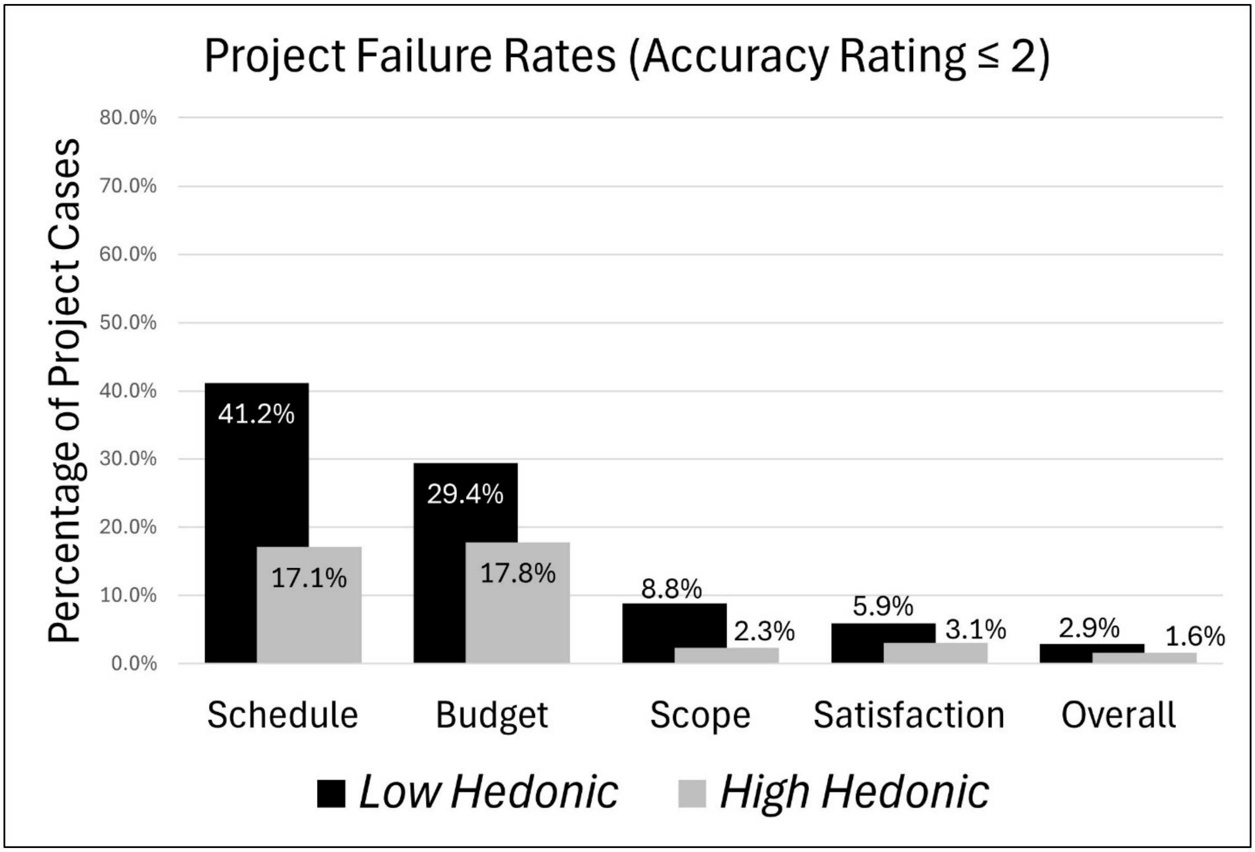

Figure 23: *Project Failure Rates:* Low *vs.* High Hedonic *Projects*

Project Outcomes: **Low *vs.* High Hedonic *Projects***

The average outcome for each project set is detailed in **Table 38**, for all measures of success. It is noteworthy that, while each average outcome is similar between groups, the relative proportion of successful and failed projects is starkly different, across every project outcome.

Table 38: *Project Outcomes:* Low *vs.* High Hedonic *Projects*

	Average		**Successes (≥ 6)**		**Failures (≤ 2)**	
	High Hedonic	***Low Hedonic***	***High Hedonic***	***Low Hedonic***	***High Hedonic***	***Low Hedonic***
Schedule	4.46	4.49	34.9 %	5.9 %	17.1 %	41.2 %
Budget	4.57	4.58	39.5 %	17.6 %	17.8 %	29.4 %
Scope	5.73	5.87	69.0 %	47.1 5	2.3 %	8.8 %
Satisfaction	5.69	5.84	69.0 %	52.9 %	3.1 %	5.9 %
Overall	5.11	5.14	34.1 %	5.9 %	1.6 %	2.9 %

Average Adherence to Principles: **Low *vs* High Hedonic *Projects***

The review of film industry practices presented in Chapter Two identified four project management principles guiding that industry's managerial approach, detailed in **Table 7**. For each principle, a set of 3 to 5 specific practices suitable for software development were then identified, allowing project teams within that domain to mirror film industry methods. The full mapping of principals to practices in both industries is shown in **Appendix A**. The practitioner survey measured the use of these 16 practices within each project case, using the statements presented in **Appendix B**. By averaging responses for each supporting set of practices, it is possible to calculate each project's overall adherence to each guiding principle. The average overall adherence to principle is shown in **Table 39**, separately for the *High* and *Low Hedonic* projects groups.

While the average adherence to each principle is relatively similar within each set of projects, it is noteworthy that project managers who agreed that hedonic requirements are critical to project success reported higher adherence to each principle than project managers who disagreed. This suggests that projects in the set of *High Hedonic* cases were managed more actively, and with greater rigor.

Principle	***High Hedonic***	***Low Hedonic***
Expectation Clarity	5.14	4.50
Rigorous Project Approval	5.25	4.35
Benefits Management	5.46	4.62
Linked Boundary Objects	5.28	4.46
Count	*129*	*34*

***Table 39**: Average Adherence to Principles:* Low *vs.* High Hedonic *Projects*

Most Prevalent Practices: **Low *vs* High Hedonic *Projects***

Practices receiving the highest average rating in the set of *High Hedonic* projects are detailed in **Table 40**. Those receiving the highest average rating in the set of *Low Hedonic* projects are similarly presented in **Table 41**.

Both sets of projects reported the highest average adherence to the practice of reporting regular and frequent updates on the project's progress and expenses, although *High Hedonic* projects rated the accuracy of the associated survey statement slightly higher on average. Similarly, the restriction of project proposal approval authority to a select group received the second-highest average rating in both groups; this was again rated slightly higher on average within the *High Hedonic* set. Actual delivered benefits were measured and reported more frequently in projects where hedonic requirements were rated as critical to success. Although reliance on standardized roles, titles and responsibilities received the third-highest average rating in projects in which hedonic requirements were not rated as critical, this practice again saw a higher average rating in *High Hedonic* cases, where adherence to all practices was generally stronger.

***Table 40:** Most Prevalent Practices in* High Hedonic *Projects*

Average Accuracy Rating	**Number of Cases**	**Associated Principle**	**Software Development Practice**
6.24	*129*	Benefits Management	We reported regular and frequent updates on the project's progress and expenses.
5.69		Rigorous Project Approval	The authority to approve our project for production was restricted to a select group of designated decision makers.
5.67		Benefits Management	We measured and reported actual delivered benefits.

***Table 41:** Most Prevalent Practices in* Low Hedonic *Projects*

Average Accuracy Rating	**Number of Cases**	**Associated Principle**	**Software Development Practice**
5.70	*34*	Benefits Management	We reported regular and frequent updates on the project's progress and expenses.
5.17		Rigorous Project Approval	The authority to approve our project for production was restricted to a select group of designated decision makers.
5.05		Expectation Clarity	We used standardized roles, titles, and responsibilities.

Least Prevalent Practices: Low vs High Hedonic Projects

Practices receiving the lowest average ratings in the set of *High Hedonic* projects are presented in **Table 42**. Those receiving the lowest average ratings in the set of *Low Hedonic* projects are similarly detailed in **Table 43**.

It is noteworthy that projects within each set of cases reported the lowest utilization of the same three practices. Again, average adherence to each practice is appreciably higher within *High Hedonic* projects – approximately 33% higher on average than in *Low Hedonic* cases.

Table 42: *Least Prevalent Practices in* High Hedonic *Projects*

Average Accuracy Rating	Number of Cases	Associated Principle	Software Development Practice
4.91	*129*	Rigorous Project Approval	Our project approval process was competitive, ensuring that only the most promising proposals were approved for production.
4.82		Expectation Clarity	We provided access to role and project details before hiring or assigning team members to the project.
4.57		Benefits Management	Before starting development, we defined specific overage thresholds that would trigger corrective action, such as a replanning session, if the project went over budget or schedule.

Table 43: *Least Prevalent Practices in* Low Hedonic *Projects*

Average Accuracy Rating	Number of Cases	Associated Principle	Software Development Practice
3.73	*34*	Rigorous Project Approval	Our project approval process was competitive, ensuring that only the most promising proposals were approved for production.
3.58		Expectation Clarity	We provided access to role and project details before hiring or assigning team members to the project.
3.41		Benefits Management	Before starting development, we defined specific overage thresholds that would trigger corrective action, such as a replanning session, if the project went over budget or schedule.

Comparison of **Low** *vs* **High Hedonic** *Projects*

A clear pattern emerges from this comparison of *High Hedonic* and *Low Hedonic* projects. Those in the set of *High Hedonic* projects, where hedonic requirements were believed to be critical to project success, adhered more closely to the film industry principles and parallel software development practices than projects in the set of *Low Hedonic* cases. These *High Hedonic* cases also reported markedly better project outcomes, across all measures of success. In particular, these *High Hedonic* projects included a much larger proportion of highly successful projects than the *Low Hedonic* set – over 34% and below 6%, respectively – while those in the *Low Hedonic* set experienced nearly double the rate of overall failure.

This suggests that the principles and practices identified in the illustrative use of the Real-to-Real method in Chapter Two are beneficial when used in software development project with characteristics similar to those in the film industry – i.e., those where consideration of the user's emotional reactions to the system are critical to success. It is not possible to definitely determine from this comparison, however, whether these principles and practices are equally beneficial in software development projects with fewer similarities to film production, as the reduced outcomes within *Low Hedonic* cases may be related to that set's lower average utilization. To conclusively establish the effectiveness of these principles and practices in managing hedonic requirements specifically, it is therefore necessary to identify and compare the most beneficial combinations of each for both sets of projects.

Qualitative Comparative Analysis

In order to identify the most beneficial combination of the principles and practices identified through the Real-to-Real method in Chapter Two, an iterative process of fuzzy-set qualitative comparative analysis (fsQCA) was used, as described in Chapter Three. Beginning with combinations of the four evident principles listed in **Table 7**, analysis was conducted to identify beneficial combinations consistently leading to success and critical combinations consistently leading to failure, for each measure of success, and separately for the sets of *High* and *Low hedonic* projects. Then, in instances where the most effective identified combination included less than three principles, a second round of fsQCA was conducted, evaluating combinations of specific practices supporting those core principles. Where three or more principles were identified as core causal elements, limitations in the currently available software precluded further analysis (Ragin 2018, Ragin and Davey 2022). In some cases, no combination of principles was found with sufficient consistency or coverage to warrant further examination. This analysis relies primarily on the identification of intermediate solutions, which includes consideration of so-called easy counterfactuals, or theoretical combinations of elements not found within the set of project cases (Park and Fiss 2020). Here, counterfactual analysis is predicated on the belief that each identified project management principle and practice should contribute towards success, rather than failure. When no intermediate solutions meeting the thresholds for frequency and consistency were found, parsimonious solutions, which include analysis of all theoretically possible combinations, regardless of the positive or negative effect of each element, are presented and discussed.

In total, this process allowed for 28 iterations of fuzzy-set Qualitative Comparative Analysis. The scope of this work is shown in **Table 44**, in which ● is used to indicate completed analysis, black fill indicates that no effective precursor combination of principles was found, and grey fill indicates that no further analysis was possible because the precursor combination of principles contained too many elements to allow a more detailed examination of supporting practices. Results are presented below, and discussed in Chapter Five.

Table 44: *Scope of Iterative Fuzzy-Set Qualitative Comparative Analysis*

		***Low Hedonic* Cases**		***High Hedonic* Cases**	
		Principles	Practices	Principles	Practices
On-Time Completion	Success	●		●	●
	Failure	●	●	●	●
Adherence to Budget	Success	●		●	
	Failure	●	●	●	
Delivery of Promised Scope	Success	●		●	●
	Failure	●		●	
Stakeholder Satisfaction	Success	●		●	
	Failure	●		●	
Overall	Success	●	●	●	●
	Failure	●	●	●	

Combinations of elements found to consistently lead to success are detailed in **Table 46** through **Table 73**. As shown in **Table 45**, these combinations will be presented using a series of marks. In each table, ● is used to denote the presence of an element, while ⊗ is used to indicate absence. Combinations appearing in both the intermediate solutions and parsimonious solutions are considered of core causal essentiality, while those appearing only in intermediate solutions are of peripheral essentiality (Fiss 2011, Bacon, Williams and Davies 2020). Core elements and peripherally important elements in each combination are distinguished by the relative size of each mark. To facilitate discussion, combinations will be enumerated in each table, as indicated in the # column.

Table 45: *Indicators Used for fsQCA Results*

Symbol	Meaning	Causal Essentiality
● (small)	Presence	Peripheral
● (large)	Presence	Core
⊗ (small)	Absence	Peripheral
⨂ (large)	Absence	Core
	Irrelevant	

For each combination, two measures of coverage are also presented: *Raw Coverage*, or the percent of cases with the selected outcome in which the combination is present, and *Unique Coverage*, or the percentage of cases with the selected outcome is fully explained by the combination. In addition, the *Consistency* for each combination is presented, indicating the rate at which the combination results in the selected outcome; scores of 0.75 or below exhibit substantial inconsistency (Ragin 2018). The most beneficial combination in each table is highlighted, with consideration given to consistency, coverage, causal essentiality, and simplicity. In some instances, as noted appropriately, no beneficial combination of practices is observed within the collected set of cases with sufficient coverage consistency to warrant further analysis.

On-Time Completion: Beneficial Principles

When analyzing combinations of principles consistently resulting in on-time completion for *Low Hedonic* projects, no intermediate solutions were found meeting the selected thresholds for frequency and consistency. Parsimonious solutions are presented in **Table 46**, although none possess sufficient coverage or consistency to warrant a more detailed analysis of supporting practices. Over 41% of Low Hedonic cases failed this measure of success, as shown in **Figure 23**, which may explain the lack of any combination consistently resulting in success, across a sufficient number of cases.

Table 46*: On-Time Completion: Beneficial Principles* - Low Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1	⊗	●	⊗		0.25	0.02	0.49
2		⊗	●	⊗	0.24	0.00	0.50
3	⊗	⊗	●		0.32	0.00	0.58
4		⊗	⊗	●	0.30	0.00	0.69
5	⊗		⊗	●	0.28	0.00	0.64
6	⊗	⊗		●	0.37	0.01	0.67
7	●		●	⊗	0.29	0.06	0.54

A single beneficial intermediate solution was found to consistently result in on-time completion for the set of *High Hedonic* cases, as shown in **Table 47**. For projects in which hedonic requirements are critical to success, strong adherence to the principles of Expectation Clarity and

Rigorous Project Approval, while avoiding adherence to Linked Boundary Objects, is therefore recommended to maximize the chance of success on this measure. The combination is present in 18% of all successfully on-time projects in this set of cases, and by itself explains those 18%. Approximately 81% of projects relying on this combination reported strong on-time completion.

Table 47: *On-Time Completion: Beneficial Principles* - High Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1	●	●		⊗	0.18	0.18	0.81

On-Time Completion: Beneficial Practices

As no beneficial combination of principles with sufficient coverage or consistency was found within the set of *Low Hedonic* projects, no further analysis involving supporting practices is possible. Projects in the *High Hedonic* set were found to consistently achieve on-time completion by adhering to only two principles, however, which allows for an analysis of the specific practices supporting those principles. The results are shown in **Table 48**. The fifth combination, as highlighted, most consistently results in on-time delivery, and involves the strong use of every identified practice supporting these two principles, with the noteworthy exception of standardized roles, titles, and responsibilities.

Failure to Deliver on Time: Critical Principles

Next, analysis was conducted to identify combinations of film industry principles that consistently resulted in a failure to deliver on time, for projects in the set of *Low Hedonic* cases. The second combination, as detailed in **Table 49**, was selected as the most critical, on the basis of consistency, coverage, and simplicity. Projects that did not adhere to the principle of Expectation Clarity consistently failed to deliver on time, although those which did not adhere to the principle of Rigorous Project Approval failed nearly as often, as did those not adhering to both Benefits

Management and Linked Boundary Objects. As each combination listed here also appeared in the parsimonious solutions resulting from this analysis, each is of core causal essentiality, as indicated by the larger marks used in this table.

Table 48: *On-Time Completion: Beneficial Practices* - High Hedonic *Cases (see Table 45 for definitions of indicators)*

Principle	Practice	1	2	3	4	5
Expectation Clarity	We used standardized roles, titles, and responsibilities.	●	●	●	●	⊗
	We defined and documented our roles and responsibilities.	●	●	●		●
	We provided access to role and project details before hiring or assigning team members to the project.			●	⊗	●
Rigorous Project Approval	Our project approval decision was a competitive and highly selective filter.		⊗	●	●	●
	Our funding and staffing were limited until we received the project approval decision.	⊗		●	●	●
	We used a formal project approval process.	●	●		●	●
	The authority to approve our project for production was restricted to a select group of designated decision makers.	●	●	⊗	●	●
	We carefully conducted a detailed estimated of the project's expenses, duration, and expected benefits before the project was approved.	●	●	●	●	●
	Raw Coverage	0.22	0.18	0.13	0.17	0.12
	Unique Coverage	0.07	0.03	0.06	0.05	0.02
	Consistency	0.81	0.77	0.88	0.83	0.95

Table 49: *Failure to Deliver on Time: Critical Principles* - Low Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1		⊗			0.45	0.07	0.81
2	⊗				0.52	0.16	0.89
3			⊗	⊗	0.33	0.03	0.90

This analysis was repeated for the set of *High Hedonic* cases, as shown in in **Table 50**. Here, the first combination is selected as the most critical, despite slightly lower consistency, due to its simplicity, causal essentiality, and higher coverage. Projects that rated hedonic requirements as highly critical to success consistently failed to deliver on-time after very weak adherence to the principles of Expectation Clarity and Linked Boundary Objects. To minimize the chance of failure on this metric, projects in this category should avoid this combination.

Table 50: *Failure to Deliver on Time: Critical Principles* - High Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1	⨂			⨂	0.28	0.10	0.78
2	⊗	⊗	⊗		0.22	0.04	0.81

Failure to Deliver on Time: Critical Practices

The most critical combination of principles consistently resulting in a failure to deliver on time, for the set of *Low Hedonic* cases, included less than three elements. It was therefore possible to repeat the analysis using the three associated supporting practices. This analysis, as shown in **Table 51**, found a single intermediate solution consistently resulting in failure. Cases in which the criticality of hedonic requirements to success was perceived as low consistently failed to deliver on time if they did not define and document their roles and responsibilities, or provide access to role and project details before hiring or assigning team members. This combination of elements explained 33% of failed cases in this set, and resulted in an 85% failure rate.

Table 51: *Failure to Deliver on Time: Critical Practices* - Low Hedonic *Cases (see Table 45 for definitions of indicators)*

Principle	Practice	1
Expectation Clarity	We used standardized roles, titles, and responsibilities.	
	We defined and documented our roles and responsibilities.	⊗
	We provided access to role and project details before hiring or assigning team members to the project.	⊗
	Raw Coverage	0.33
	Unique Coverage	0.33
	Consistency	0.85

Next, a similar analysis was conducted for the set of *High Hedonic* project cases, using the practices found to support the principles of Expectation Clarity and Boundary Objects. Strong avoidance of these two principles appeared in the most critical combination of principles consistently leading to a failure to deliver on time, for this set of cases. As shown in **Table 52**, a single intermediate solution was found, involving the avoidance of all three practices supporting the principle of Expectation Clarity.

Table 52: *Failure to Deliver on Time: Critical Practices* - High Hedonic *Cases (see Table 45 for definitions of indicators)*

Principle	Practice	1
Expectation Clarity	We used standardized roles, titles, and responsibilities.	⊗
	We defined and documented our roles and responsibilities.	⊗
	We provided access to role and project details before hiring or assigning team members to the project.	⊗
Linked Boundary Objects	We used formal change control for key project artifacts, such as UI mockups, architecture diagrams, design documents, or similar project records.	
	We used standardized templates for project management processes, such as Story Cards, forms for capturing requirements, architectural diagrams, or similar project records.	
	We had a clear process to update all related project documents when changes were made to one document (for example, when a UI mockup changed, matching updates were made to architecture diagrams and test cases).	
	We developed a set of interconnected project documents, such as mockups and architecture diagrams, based on detailed scope statement, to facilitate collaboration across project teams and stakeholders.	
	Raw Coverage	0.27
	Unique Coverage	0.27
	Consistency	0.82

Adherence to Estimated Budget: Beneficial Principles

In an analysis of successful adherence to an estimated budget, no intermediate solutions were found of beneficial combinations of principles for projects in the *Low Hedonic* set of cases. Parsimonious solutions are shown in **Table 53**, although no combination meets the desired thresholds for both coverage and consistency. This may be due to a relative lack of successful cases in this set; almost 30% of *Low Hedonic* projects failed this measure of success, as shown in **Figure 23**.

Table 53: *Adherence to Estimated Budget: Beneficial Principles* - Low Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1	⊗	●	⊗		0.24	0.00	0.58
2		⊗	●	⊗	0.25	0.00	0.65
3	⊗	⊗	●		0.29	0.00	0.64
4		⊗	⊗	●	0.25	0.00	0.73
5	⊗		⊗	●	0.26	0.00	0.71
6	⊗	⊗		●	0.30	0.01	0.66
7	●		●	⊗	0.30	0.08	0.69

A similar analysis of projects in the *High Hedonic* set identified two combinations of principles which consistently resulted in successful completion within budget estimates. The second combination shown in **Table 54** was selected, due it its higher consistency. This involves strong adherence to the principles of Expectation Clarity, Benefits Management, and Linked Boundary Objects, while avoiding similar use of Rigorous Project Approval. Because this combination has more than three elements, technical limitations in the available software prevent further analysis into the practices supporting these principles.

Table 54: *Adherence to Estimated Budget: Beneficial Principles* - High Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1		●		⊗	0.20	0.11	0.78
2	●	⊗	●	●	0.16	0.06	0.80

Adherence to Estimated Budget: Beneficial Practices

No determination of beneficial practices consistently resulting in successful adherence to estimated budget was possible. No beneficial combination of guiding principles was identified for projects in the set of *Low Hedonic* cases, and the most beneficial combination for *High Hedonic* cases was comprised of more than two elements.

Failure to Deliver Within Budget: Critical Principles

An examination of principles which, in combination, consistently resulted in budgetary failure for projects in the Low Hedonic set was then conducted. Three combinations were found, with the highlighted row in **Table 55** selected as the most beneficial due it its higher coverage and consistency. Projects in this set consistently failed to deliver within budget while adhering strongly to Rigorous Project Approval and avoiding similar use of Expectation Clarity.

Table 55: *Failure to Deliver Within Budget: Critical Principles* - Low Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1	⊗	●			0.41	0.16	0.87
2		⊗	●		0.37	0.11	0.82
3			⊗	●	0.25	0.04	0.74

When this analysis was repeated for projects in the *High Hedonic* set, no intermediate solution was found which met the defined thresholds for frequency and consistency. While parsimonious solutions are presented in **Table 56**, the most critical combination involves more than two elements, preventing an examination of the associated practices.

Table 56*: Failure to Deliver within Budget: Critical Principles* - High Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1	●	⊗		⊗	0.17	0.00	0.71
2	●	⊗	⊗		0.16	0.00	0.71
3		⊗	●	⊗	0.19	0.00	0.74
4	⊗	⊗	●		0.22	0.03	0.75
5	●		⊗	●	0.19	0.00	0.65
6		●	⊗	●	0.20	0.00	0.67

Failure to Deliver Within Budget: Critical Practices

Because the most critical combination of elements consistently resulting in budgetary failure for projects in the *Low Hedonic* set had less than three elements, it was possible to repeat the analysis using all of the associated practices. This analysis, shown in **Table 57**, found that projects which did not provide potential team members with information about the project and their roles before hiring or assignment decisions were made consistently failed to deliver on budget, despite adherence to four practices supporting Rigorous Project Approval.

Table 57: *Failure to Deliver within Budget: Critical Practices* - Low Hedonic *Cases (see Table 45 for definitions of indicators)*

Principle	Practice	1
Expectation Clarity	We used standardized roles, titles, and responsibilities.	
	We defined and documented our roles and responsibilities.	
	We provided access to role and project details before hiring or assigning team members to the project.	⊗
Rigorous Project Approval	Our project approval decision was a competitive and highly selective filter.	
	Our funding and staffing were limited until we received the project approval decision.	●
	We used a formal project approval process.	●
	The authority to approve our project for production was restricted to a select group of designated decision makers.	●
	We carefully conducted a detailed estimated of the project's expenses, duration, and expected benefits before the project was approved.	●
	Raw Coverage	0.27
	Unique Coverage	0.27
	Consistency	0.88

A similar analysis of critical practices for projects in the *High Hedonic* set was not possible, as the most critical combination of principles for projects in that set contained more than two principles.

Delivery of Promised Scope: Beneficial Principles

Projects in the set of Low Hedonic cases were found to consistently deliver promised features and scope through strong adherence to the principles of Expectation Clarity, Benefits Management, and Linked Boundary objects, as shown in **Table 58**. This combination was present in 50% of successful cases, and by itself accounts for 28%, with 90% consistency. As more than three elements are present, however, it is not possible to conduct a similar examination of the practices supporting these principles.

Table 58: *Delivery of Promised Scope: Beneficial Principles* - Low Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1		⊗	⊗	⊗	0.20	0.05	0.79
2	●	●	⊗		0.25	0.06	0.92
3	⊗	●	●		0.27	0.06	0.83
4	●		●	●	0.50	0.28	0.90

When repeated for the set of *High Hedonic* cases, four relatively consistent combinations were identified, as shown in **Table 59**. The second combination, involving strong adherence to the principles of Rigorous Project Approval and Benefits Management, was selected due its high coverage, consistency, and relative simplicity.

Table 59: *Delivery of Promised Scope: Beneficial Principles* - High Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1		●		⊗	0.18	0.01	0.93
2		●	●		0.81	0.08	0.93
3	⊗	⊗	⊗		0.11	0.02	0.90
4	●		●	●	0.71	0.03	0.93

Delivery of Promised Scope: Beneficial Practices

While no analysis of beneficial combinations of practices within the set of *Low Hedonic* cases was possible because the most beneficial combination of principles was composed of more than two elements, examination of *High Hedonic* cases revealed seven relatively consistent combinations. Combination #3, as detailed in **Table 60**, was selected for recommendation, due to its high consistency and coverage. Projects in the set of *High Hedonic* cases were consistently able to deliver promised features and scope by using all of the practices supporting Rigorous Project Approval and by reporting frequent updates on progress and expenses and measuring and reporting actual delivered benefits.

Failure to Deliver Promised Scope: Critical Principles

Next, an analysis was conducted to determine combinations of principles which consistently resulted in a failure to deliver promised features and scope, for projects in the set of *Low Hedonic* cases. This analysis returned no intermediate solutions. Several parsimonious solutions are shown in **Table 61**, but none meets the desired threshold for consistency and coverage.

When this analysis was repeated for the *High Hedonic* set of cases, similar results were found. No intermediate solutions were found, and while several parsimonious solutions are shown **Table 62**, no identified combination meets the desired threshold for consistency and coverage.

Failure to Deliver Promised Scope: Critical Practices

Examination of specific practices consistently resulting in a failure to deliver promised features and scope was not possible, as no combination of critical principles meeting with the necessary minimum coverage and consistency were found in either set of cases.

Table 60: *Delivery of Promised Scope: Beneficial Practices* - High Hedonic *Cases (see Table 45 for definitions of indicators)*

Principle	Practice	1	2	3	4	5	6	7
Rigorous Project Approval	Our project approval decision was a competitive and highly selective filter.		●	●	●	●	⊗	⊗
	Our funding and staffing were limited until we received the project approval decision.	⊗	●	●	●	●	●	●
	We used a formal project approval process.	●	●	●	●			●
	The authority to approve our project for production was restricted to a select group of designated decision makers.	●	●	●	●	⊗	●	●
	We carefully conducted a detailed estimated of the project's expenses, duration, and expected benefits before the project was approved.	●	●	●		●	●	⊗
Benefits Management	Before starting development, we defined specific overage thresholds that would trigger corrective actions, such as a replanning session, if the project went over budget or schedule.				⊗	●	●	⊗
	We reported regular and frequent updates on the project's progress and expenses.	●	●	●	●	●	●	●
	We conducted and published a final accounting of expenses and delivered scope.	●	●		●	●	●	⊗
	We measured and reported actual delivered benefits.	●		●	●	●	●	⊗
	Raw Coverage	0.18	0.46	0.48	0.15	0.07	0.12	0.04
	Unique Coverage	0.08	0.01	0.04	0.01	0.02	0.03	0.00
	Consistency	0.96	0.96	0.96	0.97	0.93	0.96	0.88

Table 61: *Failure to Deliver Promised Scope: Critical Principles* - Low Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1	⊗	●	⊗		0.39	0.04	0.60
2		⊗	●	⊗	0.32	0.00	0.52
3	⊗	⊗	●		0.45	0.00	0.63
4		⊗	⊗	●	0.29	0.00	0.53
5	⊗		⊗	●	0.34	0.00	0.60
6	⊗	⊗		●	0.44	0.00	0.62
7	●		●	⊗	0.27	0.00	0.40

Table 62: *Failure to Deliver Promised Scope: Critical Principles* - High Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1	●	⊗		⊗	0.30	0.00	0.52
2	●	⊗	⊗		0.29	0.00	0.51
3		⊗	●	⊗	0.39	0.00	0.60
4	⊗	⊗	●		0.37	0.00	0.51
5	●		⊗	●	0.40	0.00	0.55
6	●		●	●	0.42	0.00	0.56

Stakeholder Satisfaction: Beneficial Principles

As shown in **Table 63**, several combinations of principles allowed projects within the set of *Low Hedonic* cases to consistently satisfy stakeholders. The 4th combination, highlighted, involved strong adherence to Expectation Clarity, Benefits Management, and Linked Boundary Objects, and was selected for recommendation due to its high consistency and coverage.

Table 63: *Stakeholder Satisfaction: Beneficial Principles* - Low Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1		⊗	⊗	⊗	0.20	0.06	0.84
2	●	●	⊗		0.25	0.07	0.94
3	⊗	●	●		0.28	0.06	0.90
4	●		●	●	0.51	0.28	0.95

The same combination of principles was also found to consistently result in high reported levels of stakeholder satisfaction in the set of *High Hedonic* projects, as shown in **Table 64**.

Table 64: *Stakeholder Satisfaction: Beneficial Principles* - High Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1		●		⊗	0.17	0.01	0.86
2		●	●		0.81	0.08	0.93
3	⊗	⊗	⊗		0.11	0.02	0.90
4	●		●	●	0.73	0.03	0.95

Stakeholder Satisfaction: Beneficial Practices

Unfortunately, while both sets of cases shared the most beneficial combination of principles consistently resulting in high levels of stakeholder satisfaction, similar Qualitative Comparative Analysis at the level of supporting practices is not possible because this combination involves more than two principles.

Failure to Satisfy Stakeholders: Critical Principles

An evaluation of principles consistently resulting in very low levels of stakeholder satisfaction in the set of *Low Hedonic* cases found no intermediate solution. Parsimonious solutions are detailed in **Table 65**. The most critical combination has more than two elements, preventing a deeper analysis of supporting practices.

Table 65*: Failure to Satisfy Stakeholders: Critical Principles* - Low Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1	⊗	●	⊗		0.53	0.11	0.71
2		⊗	●	⊗	0.39	0.00	0.57
3	⊗	⊗	●		0.48	0.00	0.59
4		⊗	⊗	●	0.36	0.00	0.57
5	⊗		⊗	●	0.39	0.00	0.60
6	⊗	⊗		●	0.46	0.00	0.56
7	●		●	⊗	0.37	0.03	0.47

Similar results were found in the set of *High Hedonic* cases, as shown in **Table 66**. Again, no intermediate solutions were identified, and the parsimonious solutions detailed here do not present sufficient coverage or consistency.

Table 66: *Failure to Satisfy Stakeholders: Critical Principles* - High Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1	●	⊗		⊗	0.31	0.00	0.55
2	●	⊗	⊗		0.32	0.00	0.60
3		⊗	●	⊗	0.37	0.00	0.59
4	⊗	⊗	●		0.38	0.01	0.54
5	●		⊗	●	0.44	0.00	0.63
6		●	⊗	●	0.46	0.01	0.64

Failure to Satisfy Stakeholders: Critical Practices

No examination of combinations of practices consistently resulting in very low levels of stakeholder satisfaction was possible for either set of cases. No critical combination of guiding principles was found to consistently result in failure on this measure of success within the set of *High Hedonic* cases, and the most critical combination in the set of *Low Hedonic* cases involved more than two principles.

Overall Project Success: Beneficial Principles

Using the aggregate measure of Overall Project Success, three combinations of principles which consistently resulted in high average success across all four directly measured project outcomes were found within the set of *Low Hedonic* cases. Although they have similar and relatively low levels of consistency, the second combination, as shown in **Table 67**, also appeared as a parsimonious solution, and is therefore of core essentiality. It was selected for recommendation for that reason, and because it has higher coverage and greater simplicity than other options. Adherence to only the principle of Rigorous Project Approval was present in 80%

of successful projects in the *Low Hedonic* set, and 12% of those successes adhered only to this principle. Projects in the set which adhered strongly to only this principle achieved high levels of success 70% of the time.

Table 67: *Overall Project Success: Beneficial Principles* - Low Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1	⊗				0.51	0.09	0.70
2		●			0.80	0.12	0.70
3			●	●	0.67	0.02	0.70

A similar analysis, conducted with the set of *High Hedonic* cases, returned four possible combinations, each with higher levels of consistency. The second combination, shown in **Table 68**, was selected for recommendation due to its higher coverage. For projects in this set, strong adherence to the principles of Rigorous Project Approval and Benefits Management resulted in overall success in 88% of cases, and this combination was used in 86% of highly successful projects. The fourth combination is also noteworthy, as strong adherence to Expectation Clarity, Benefits Management, and Linked Boundary Objects also led to overall success with equal consistency, although this combination appears slightly less often within the available data. Together, these combinations imply that all four principles were beneficial in *High Hedonic* projects.

Table 68: *Overall Project Success: Beneficial Principles* - High Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1		●		⊗	0.20	0.01	0.89
2		●	●		0.86	0.07	0.88
3	⊗	⊗	⊗		0.11	0.01	0.81
4	●		●	●	0.76	0.02	0.88

Overall Project Success: Beneficial Practices

The most beneficial combination of principles resulting in overall project success in the set of *Low Hedonic* cases involved only one principle: Rigorous Project Approval. It was therefore possible to repeat the fuzzy-set qualitative comparative analysis using all of the identified practices supporting that principle, as shown in **Table 69**. The first combination, highlighted, was selected for recommendation due to its higher consistency, coverage, and increased simplicity. Projects within this set of cases consistently achieved high average levels of success, across all four measures of success, by ensuring their project approval decision was a competitive filter and by restricting decision-making authority to a select group. These projects also did not restrict spending or staffing for projects prior to a formal approval decision. It is noteworthy that the first two elements, as listed in the table below, are of core essentiality, while the third is peripheral.

In the set of *High Hedonic* project cases, many effective combinations of practices supporting the two most beneficial principles were found. As detailed in **Table 70**, each has relatively high consistency, but the first combination was selected for recommendation due to its higher coverage and increased simplicity. This combination involves strong use of three practices supporting Rigorous Project Approval and three supporting Benefits Management, while avoiding using the project approval decision as a competitive filter, and resulted in high levels of overall success in 95% of projects.

Table 69: *Overall Project Success: Beneficial Practices* - Low Hedonic *Cases (see Table 45 for definitions of indicators)*

Principle	Practice	1	2
Rigorous Project Approval	Our project approval decision was a competitive and highly selective filter.	●	⊗
	Our funding and staffing were limited until we received the project approval decision.	⊗	●
	We used a formal project approval process.		•
	The authority to approve our project for production was restricted to a select group of designated decision makers.	•	•
	We carefully conducted a detailed estimated of the project's expenses, duration, and expected benefits before the project was approved.		•
	Raw Coverage	0.32	0.23
	Unique Coverage	0.23	0.14
	Consistency	0.82	0.80

Overall Project Failure: Critical Principles

In the set of *Low Hedonic* cases, strong avoidance of Expectation Clarity resulted in overall failure, averaged across all four direct measures of outcomes, in 72% of cases. This result, highlighted in **Table 71**, was also identified as a parsimonious solution, indicating causal essentiality. As such, it was selected for recommendation over the avoidance of both Expectation Clarity and Linked Boundary Objects, which resulted in overall failure slightly more often, although with lower coverage, and both findings may be of note.

A similar examination involving the set of *High Hedonic* cases found two combinations which resulted in overall project failure, at similar levels of consistency. Both combinations, shown in **Table 72**, involve more than two principles, and do not allow a more detailed examination of the associated supporting practices. It is nevertheless noteworthy that together, these two combinations involve the avoidance of all four film industry principles.

Table 70: *Overall Project Success: Beneficial Practices* - High Hedonic *Cases (see Table 45 for definitions of indicators)*

Principle	Practice	1	2	3	4	5	6	7
Rigorous Project Approval	Our project approval decision was a competitive and highly selective filter.	⊗	●	●	●	●	⊗	●
	Our funding and staffing were limited until we received the project approval decision.		●	●	●	●	●	●
	We used a formal project approval process.	●	●	●	●			●
	The authority to approve our project for production was restricted to a select group of designated decision makers.	●	●	●	●	⊗	●	●
	We carefully conducted a detailed estimated of the project's expenses, duration, and expected benefits before the project was approved.	●	●	●		●	●	⊗
Benefits Management	Before starting development, we defined specific overage thresholds that would trigger corrective actions, such as a replanning session, if the project went over budget or schedule.				●	●	●	⊗
	We reported regular and frequent updates on the project's progress and expenses.	●	●	●	●	●	●	●
	We conducted and published a final accounting of expenses and delivered scope.	●	●		●	●	●	⊗
	We measured and reported actual delivered benefits.	●		●	●	●	●	⊗
	Raw Coverage	0.20	0.50	0.52	0.16	0.09	0.13	0.05
	Unique Coverage	0.08	0.01	0.04	0.11	0.03	0.02	0.01
	Consistency	0.95	0.92	0.91	0.90	0.96	0.92	0.88

Table 71: *Overall Project Failure: Critical Principles* - Low Hedonic *Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1		⊗			0.58	0.10	0.71
2	⊗				0.62	0.15	0.72
3	⊗			⊗	0.42	0.05	0.77

Table 72: *Overall Project Failure: Critical Principles - High Hedonic Cases (see Table 45 for definitions of indicators)*

#	Expectation Clarity	Rigorous Project Approval	Benefits Management	Linked Boundary Objects	Coverage		Consistency
					Raw	Unique	
1	⊗		⊗	⊗	0.32	0.03	0.76
2	⊗	⊗	⊗		0.33	0.05	0.78

Overall Project Failure: Critical Practices

As shown in **Table 73**, because the combination of principles most consistently resulting in project failure for *Low Hedonic* projects involved only the avoidance of Expectation Clarity, it was possible to repeat the analysis using all of the principles supporting that practice. No intermediate solutions were found, although parsimonious solutions are presented here. The first combination is selected for recommendation, due to its greater simplicity and higher coverage: projects in this set of cases consistently failed, on average across all four measures of success, by avoiding the use of standardized roles and responsibilities. Use of this practice should therefore be recommended to *Low Hedonic* projects to minimize the chance of overall project failure.

Table 73: *Overall Project Failure: Critical Practices* - Low Hedonic *Cases (see Table 45 for definitions of indicators)*

Principle	Practice	1	2
Expectation Clarity	We used standardized roles, titles, and responsibilities.	⊗	
	We defined and documented our roles and responsibilities.		⊗
	We provided access to role and project details before hiring or assigning team members to the project.		●
	Raw Coverage	0.45	0.17
	Unique Coverage	0.34	0.06
	Consistency	0.83	0.85

Unfortunately, because the most critical combination of principles leading to similar levels of failure within the set of *High Hedonic* project cases involved the avoidance of Expectation Clarity, Rigorous Project Approval, and Benefits Management, no direct analysis of the supporting practices is possible. Limitations in the available software do not allow the analysis of causal recipes involving more than ten elements, while these three principles are supported by twelve identified practices. Even without examination of the supporting practices, however, it can be recommended that *High Hedonic* projects adhere to these three principles to minimize their chance of overall failure.

Hedonic Requirements vs Overall Success Without Benefits Management

As shown above, projects in the set of *Low Hedonic* cases consistently achieved overall success through adherence to the principle of Rigorous Project Approval. For the set of *High Hedonic* projects, similar levels of success were achieved through adherence to both Rigorous Project Approval and Benefits Management, suggesting that the additional principle of Benefits Management may be an important managerial approach in projects where hedonic considerations play a more crucial role. This allows for a comparison of the perceived criticality of hedonic requirements to overall project success in project cases that did not report strong adherence to Benefits Management, as shown in **Figure 24**.

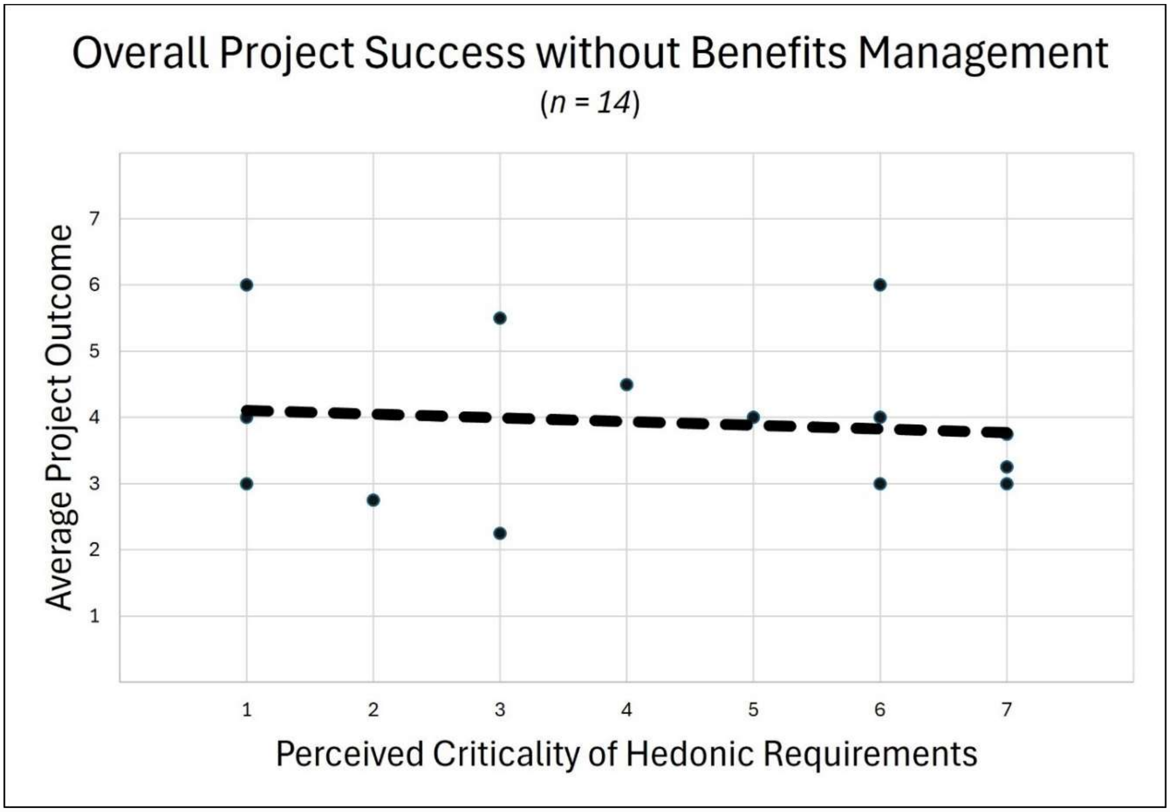

***Figure 24**: Hedonic Requirements vs. Overall Project Success Without Benefits Management*

Only 14 of the 262 complete project cases reported low adherence to Benefits Management, indicated by an average rating of less than three for the set of four supporting practices. In the full set of cases, the relationship between the perceived criticality of hedonic requirements and overall project success shows a weak but statistically significant positive correlation, with a coefficient of 0.17 at a confidence level over 99.9%, as shown in **Figure 21**. In contrast, the same relationship in the small set of cases not adhering to Benefits Management shows a slightly negative correlation of -0.05, where a higher perceived criticality of hedonic requirements appears to result in reduced overall project success. Unfortunately, the number of cases in this set is too small to support any conclusion, and the relationship is not statistically significant ($p = 0.7$).

CHAPTER 5: DISCUSSION

Facilitating Inter-Industry Learning

As discussed in Chapter One, many industries rely on temporarily assembled project teams for the delivery of work. While a robust body of generalized guidance on project management has been developed (Project Management Institute 2021), the application of such standardized concepts must be shaped to fit the needs of each industry, in much the same way that a dramatic text must be interpreted to fit a specific troupe of actors (Lehner 2009). Comparison to industry-agnostic processes may help to identify areas where additional management activity could help to reduce project risk, but such high-level advice often lacks detail sufficient to guide any effective and specific implementation.

For example, the PMI's Guide to the Project Management Body of Knowledge states that "Project success is dependent on effective communication (Project Management Institute 2021)." Instructions on how to implement an effective and efficient communication plan in a specific project are not provided, however. Other than noting that any such plan should support a small set of goals, such as "facilitate rapid feedback (Project Management Institute 2021)," managers are left to design a project communication plan themselves. Although just one part of an overall management plan, this requires significant effort, and necessarily includes consideration of communication goals, available channels, the design of required artifacts and processes, frequency, recency, role alignment, and many other potential factors. As a result, while abstract and generalized guidance is essential for the gradual evolution of project management theory, each projectized industry has also developed a body of industry-specific interpretations of these standardized principles.

Unfortunately, industry-specific knowledge of *what works* and *what doesn't*, slowly developed through hard-won experience, often remains locked within that original domain (Hawkey 2016). Practitioners in different projectized industries acquire incompatible mental models, including vocabulary, management structures, and beliefs in the relative importance of personal attributes (Edmondson and Harvey 2018). This hinders the face-to-face interaction necessary to convey complex procedures (Spraggon and Bodolica 2012), and creates barriers to inter-industry learning.

Adding to this challenge, in some cases, effective management practices may be discarded as alternatives become codified within an industry as *best known methods* (Eisenhardt and Martin 2000). Cognitive lock-in on existing expertise can occur when collaborative partners share similar knowledge bases, which may also limit innovation and obscure new technologies and possibilities (Enkel and Heil 2014). Individual teams, organizations, and entire industries may cling to familiar routines through inertia, and only slowly and linearly elaborate upon existing knowledge rather than exploring the benefits of more drastic changes (Eisenhardt and Martin 2000).

Adding to these challenges, even management practices that have been successful in one context can result in failure when implemented elsewhere unless they are carefully adapted to fit the new environment. This adaptation requires a deep understanding of both the source and target industries (Philipp, Tobisch and Matthes 2022, Wallace, Iyer and Chen 2022). Successful innovation also requires reframing existing knowledge by decoupling it from the domain in which it was developed, allowing old ideas to be combined into new configurations (Hargadon 2002). Because of these factors, process innovation in projectized industries is reduced and the translation of successful processes between industries occurs more rarely than the elaboration of existing industry-specific processes (Hawkey 2016).

As each industry-specific project management body of knowledge grows increasingly dissimilar from its conceptual neighbors, the potential value of comparing industry-specific practices increases. The refinement and advancement of generalized industry-agnostic project management theory is essential for the domain to continue to mature, but a simultaneous effort at translating detailed industry-specific applications of such theory should receive equal attention. Seemingly intractable problems faced by a project team in one industry may already have well-established solutions in widespread use in another. By systematically comparing and translating these industry-specific practices, there is significant potential for the innovative application of lessons learned within one domain to a more diverse set of project environments.

Chapter One presented a repeatable method to facilitate such inter-industry learning, combining and formalizing the approaches used in a set of exemplar studies. Each previous effort attempted a single-direction, one-time translation of management practices from one industry to another. The Real-to-Real method, illustrated in **Figure 1** and detailed in **Table 1**, attempts to provide a generalized and reusable framework allowing such efforts to be repeated across multiple industry pairings. While the abstraction of practitioner experience to the level of generalized project management theory necessarily results in the loss of valuable detail, the Real-to-Real method preserves information on domain-specific applications of project management theory required for the effective translation of knowledge across industries.

An illustrative use of this method was presented in Chapter Two, resulting in the translation of film production management practices to software development projects. The process began by selecting a suitable target industry and identifying a potential barrier to project success, based on a review of the available literature. Here, prior research on software development project management has suggested that existing management practices used in that industry are a poor fit for hedonic requirements, which specify the intended emotional result of the user, although no attempt to empirically measure the effect of such requirements on project outcomes had yet been made (Callele, Neufeld and Schneider 2005, Diefenbach and Hassenzahl 2011, Ameller, et al. 2012).

Then, a second industry was chosen as a source of inspiration: the film production industry, which routinely deals with hedonic requirements and shares many characteristics with software development (Persse 2008, Rhyne 2008, Farina 2022). A holistic analysis of film production principles revealed four evident principles shaping that industry's approach to managing projects, detailed in **Table 7**. Following the Real-to-Real process, these principles were used as conceptual intermediaries to bridge the target and source industries, and allowed for the identification of existing software development practices that mirror or parallel film production practices. Each of the software development practices in **Table 8** through **Table 11** also support or adhere to the principles guiding film production project management, and, if used to guide the management of a software development project, could allow a software team to approach their work in a manner similar to a film production team. The full mapping of principles to specific practices in both industries is shown in **Appendix A**.

Empirical validation opportunities for this example use of the method are limited to the examination of existing project records, so no attempt was made to develop entirely new software development practices. It is possible that novel tasks and duties, designed to more fully support film production principles, could mirror film industry practices more closely than any existing software development practice. In future efforts using this method and attempting the development of such new methods, it is noteworthy that, in comparison to the level of abstraction in generalized project management theory, such as the broad guidance on project communication planning discussed above, a greater level of detail has been retained in this illustrative use of the Real-to-Real method.

For example, to support the principle of Benefits Management, it is suggested here that software projects could 'report progress and expenses frequently.' Any team attempting to instantiate that practice in order to benefit from the film industry's body of knowledge, however, could refer to the film industry's commonly used Daily Production Report. By referencing the source industry's associated practices, software teams could benefit from a wealth of supporting information on the recommended level of detail, necessary recency and frequency, the breadth of organizational distance of distribution, the appropriate severity and immediacy of managerial responses, and the project roles that should be involved. Even the format of the film industry's Daily Production Report could be used to design a similar report suitable for software development. In each use of the Real-to-Real method, the implementation of practices in the source industry can be used to guide parallel implementation in the target industry.

It is also interesting that, although a robust body of prior research has suggested that managers of dynamic and creative projects should seek to embrace flexibility (Shenhar 2001, Lampel and Germain 2015), the film industry's approach to project management cleaves to a heavily standardized and predictive methodology. Organizational structures within the industry are "rigidly hierarchical (Introna, Cushman and Moore 2000)," which also appears to conflict with calls within the literature for egalitarian practices in projects that must develop innovative products (Joyce and McGee 1997, Jain, Triandis and Weick 2010). In addition, although the film industry's long success in meeting a wide array of hedonic requirements is evident, none of the observed practices or identified principles explicitly refer to planning, documenting, communicating, or testing the intended emotional response of the viewer. It appears that the set of film production practices used almost universally across the industry are non-obvious solutions to that challenge, and may only address such requirements in gestalt. To address these points of apparent incongruence, and to support the use of the Real-to-Real method in translating practices between other industry parings, it was therefore essential to thoroughly verify and validate these findings.

Verification

Translation of Practices Between Industries

First, a series of semi-structured interviews with practitioners in the film production industry was conducted. These interviews benefited from the participation of five experienced film producers, including three participants who have held production roles on Oscar-winning films, one participant who was currently producing a major Hollywood film, and one whose career has included production roles on films that have earned more than $10 billion in total box office results. The full set of participants, shown in **Table 12**, held a total of 81 years of professional experience, and an average of 16 years working in film production. Their extensive experience and willingness to devote considerable time to these discussions made these interviews an exceptional opportunity to enhance the understanding of film production practices detailed in Chapter Two (Hawkey and Vans 2024).

These interviews intended to confirm the understanding, developed through the available literature, of each film industry practice presented in Chapter Two, and the nearly universal use of each practice in projects across the industry. In a virtual card-sorting exercise described in Chapter Three and exemplified by Moore and Benbasat (1991) and Thatcher, et al. (2018), participants were also asked to match each practice to the principle that it best supports, verifying the association of specific practices to guiding principles shown in **Table 3** through **Table 6**. Lastly, although the conceptual framework was unfamiliar to each participant, these interviews also sought to affirm that each synthesized principle shown in **Table 7** accurately describes a portion of the film industry's approach to producing films (Hawkey and Vans 2024).

Participants almost universally affirmed the description of each practice as detailed in Chapter Two and the ubiquity of use in film production projects of all sizes and genres, regardless of union affiliation. As shown in **Table 22**, the sets of practices believed to support the principles of Expectation Clarity and Benefits Management each received 100% agreement with practitioners, while the practices supporting Linked Boundary Objects and Rigorous Project Approval received 98% and 95% agreement, respectively. The relatively small set of nonmatching responses is discussed in Chapter Four. Although the names and definitions assigned to each principle in **Table 7**, and the concept of guiding managerial principles in general, appeared novel to the interviewed film producers, each participant also affirmed the descriptive power of these four principles in explaining the industry's project management methodology (Hawkey and Vans 2024).

These results are particularly encouraging, as they begin to verify the underlying framework developed in this illustrative use of the Real-to-Real method. Each principle is intended to form a conceptual bridge between the domains of film production and software development, and each span must therefore be supported by strong foundations on both sides. This initial set of interviews verified a sound connection between film industry practices and the identified principles, with 98% agreement on the expected pairing of practices to principles. In addition to affirming the connection between each practice and its associated principle, these discussions also confirmed the accuracy of the holistic review of film production practices detailed in Chapter Two (Hawkey and Vans 2024). The synthesis of these guiding principles has been verified, suggesting that they form a reliable pathway for transferring hard-won practitioner experience across industries.

Next, a second series of similarly structured interviews was held with a set of experienced software development project managers. Six professionals participated, with an average of 19 years of professional experience and a combined total of 116 years, as shown in **Table 13**. These working practitioners hailed from multiple firms across multiple industries, and held a diverse array of formal project management certifications. Five of the most popular certifications in the United States and United Kingdom were represented, including Certified Scrum Master, Project Management Professional, Member of the Association for Project Management, and certifications in Lean Six Sigma and Scaled Agile Framework. One participant approached these discussions with 24 years of working experience without holding a formal certification in project management, offering valuable insights informing these findings from a different perspective (Hawkey and Vans 2024). The depth of experience and diversity of formal training among these participants enabled a robust examination of the proposed software development practices and provided broad support to this example translation effort.

Just as the initial set of interviews, with experienced film producers, verified the foundations supporting one side of each conceptual bridge, these interviews aimed to confirm equally strong footings on the software development side. After a discussion of each principle, participants were again asked to match each software development practice to the principle that it best supports, in a virtual card-sorting exercise. In unstructured discussions, each project manager's professional opinion on the potential value of each practice within the domain of software engineering was also solicitated (Hawkey and Vans 2024). Thus, these interviews not only aimed to verify the effectiveness of each practice in supporting its corresponding guiding principle, but also provided valuable insights into the overall relevance and potential impact of these practices.

The results of the structured portions these discussions are summarized in **Table 27**. The participating project managers unanimously agreed with the set of three practices believed to adhere to the principle of Expectation Clarity. The sets of practices intended to support the principles of Benefits Management and Linked Boundary Objects each received 92% agreement. Each of these principles is mapped to four practices suitable for software development teams, as shown in **Appendix A**. Across all six interviews, these two sets of four practices each received two nonmatching answers. The five practices associated with the principle of Rigorous Project Approval found 87% agreement, with four out of 30 responses not matching the expected principle, as shown in **Table 24**. Of the sixteen software development practices mapped during these exercises, only one, "facilitate collaboration by deriving supporting artifacts, such as mockups, from a detailed scope statement," intended to support the principle of Linked Boundary Objects and mirror the film industry's script breakdown process, was paired to an unexpected principle by two participants. On average, participants agreed with 93% of the expected pairings of practice to principle, strongly affirming the support provided by the identified set of practices to each principle (Hawkey and Vans 2024).

The results from this second series of interviews were also encouraging and verified the accurate translation of principles to domain-specific practices. As well as confirming a strong connection between each practice and its associated principle, participants also strongly endorsed the value of these practices for software development projects. While overall agreement was slightly lower at 93%, this level of consistency still provides robust support for the validity of the identified practices (Hawkey and Vans 2024).

This illustrative example of the Real-to-Real method sought to translate film production practices to software development. Together, these two series of interviews verified the accuracy of that translation, confirming that the method effectively identified parallel practices in both industries. By extrapolating practices to guiding principles, the Real-to-Real method has allowed for the identification of software development practices that mirror film industry practices and reflect adherence to the same principles, thus enabling software teams to benefit from decades of film industry experience. At the same time, valuable detail describing the film production industry's execution of these practices, the ground-level truth of assignable tasks and duties, has been retained and can be used to shape implementations of the software development practices to closely match film production practices.

While this initial research has confirmed the method's ability to identify parallel practices, the next step is to empirically validate the effect, if any, of the identified software development practices in projects with varying levels of hedonic requirements. Although this example use of the Real-to-Real method elected to identify existing software development practices, it is equally possible to derive entirely new practices for the target industry. Newly developed practices could potentially cleave even more closely to each principle, and thus more effectively mirror source industry practices, but this effort's opportunities to empirically validate the efficacy of any practice are necessarily limited to the examination of existing project records, as testing novel domain-specific practices in new software development projects is beyond the scope of this illustrative example.

This example use of the method also focused on a demonstrative pairing of target and source industries, but many other potential pairings are possible. The strong consensus revealed in these interviews suggests that the Real-to-Real method may enable similarly accurate translations between other domains.

Comparison of Film and Software Methodological Approaches

As discussed in the previous section, experienced practitioners in both film production and software development were interviewed in order to verify the descriptions of film industry practices given in Chapter Two and the mapping of principles to practices shown in **Appendix A**. In each interview, the four synthesized principles shown in **Table 7** were presented and discussed. Participants were then asked to match 16 specific practices to the principle that each best supported. Although the scope of each interview was almost identical, the difference in duration and the nature of discussions between the two sets of participants provide an interesting contrast that may reflect the distinct culture of these industries. On average, interviews with film producers took 64% longer to complete, at 1 hour and 4 minutes, than interviews with software development project managers, at only 39 minutes. The difference can be attributed to several factors that emerged during the interview process.

Software development project managers often seemed to grasp the described principles and the process of pairing practices to principles quickly, likely through familiarity with formal project management methodologies encouraging the use of similarly generalized concepts, such as Waterfall and Agile Scrum. In contrast, the concept of project management as a formal discipline does not have the same presence in the film industry, which instead relies on deeply embedded, industry-specific practices that have become standardized over time. The participating film producers appeared to approach the principles and practices discussed in each interview from a more practical, experience-based perspective, where tasks are performed according to tradition, rather than as one possible instantiation of generalized procedures or underlying theoretical frameworks.

As an example, based on the relevant literature and these interviews, it appears that any experienced producer in the film industry would understand what it means for a film to be 'in development,' and could describe such a project's status, progress, and activities in detail. References to generalized concepts from the wider project management body of knowledge are absent, however, and the film industry's development phase is not conceived of or described as simply one type of project initiation, allowing for the potential comparison to initiation activities used in other types of projects.

Discussions with film producers frequently involved a detailed exploration of specific practices, as participants often seemed to work through the implications of each in real-time. Other than conflating the industry's greenlighting decision with *project approval*, these interviews did not refer to generalized project management terminology, but film industry participants still often appeared to be considering their industry's practices in a structured way for the first time.

For example, when asked to confirm the accuracy of even a seemingly simple generalized statement, such as 'during production, progress and expenses are reported daily or weekly,' participants often needed to reflect on their experiences before answering. In one discussion, an experienced film producer began by noting that the number of scenes filmed and *hot costs*, or actualized expenses, are reported to the Assistant Director each day. They then added that the Assistant Director uses this data to compile the Daily Production Report. After apparent further consideration, they then reflected that the Daily Production Report is distributed to the project's production office, film studio, and financers, before then conclusively affirming the accuracy of the original statement. The overall impression was that, while participants were deeply familiar with each of these tasks, the idea that each task related to an overall goal of 'reporting progress and expenses daily' was new. Instead, these activities were followed by rote, and were not previously conceived as a means to an end, or as just one possible method among other possibilities. The act of linking these activities together, conceptually, and of evaluating the accuracy of the presented statement was not difficult, but it did appear to be *new* to several participants.

This is not to say that the management of film production projects is predictable. Even experienced film producers have said that no two of their projects have ever shared the same financing structure (Hofmann 2002a). One experienced producer interviewed here noted that filmmaking is "not an exact science." Another explained that "if you ask a producer what they do, they'll all give you a different answer," and lamented that "there is never enough information" and "we never know how well [a film] will do until it's happening." The industry's lack of reference to a generalized project management framework, coupled with the unique and varied nature of each film project, perhaps contributed to this more reflective and sometimes exploratory approach.

The difference in tone and duration of these interviews suggests that while software development teams operate in a domain that conceptualizes projects in general terms, film producers operate within a domain characterized by formalization without generalization. The film industry's practices are highly specialized and inward facing, focusing on the specific needs of filmmaking rather than drawing from a broader project management body of knowledge.

The apparent contrast in conceptual approach revealed during these discussions highlights the benefits of the Real-to-Real method. While the fully generalized approach to project management offered by the PMI is essential for developing an overall body of knowledge (Project Management Institute 2021), valuable details are necessarily and unavoidably lost through abstraction. The resulting standardized frameworks must then be tailored for every industry, and to every unique project. Over time, each industry therefore develops a unique body of knowledge of *what works* and *what doesn't*. Industry-specific process may become moribund, as practitioners eschew process innovation in favor of codified best practices (Eisenhardt and Martin 2000, Enkel and Heil 2014). The film industry is likely only one example of an industry that relies on formalized practices developed from decades of practical experience rather than through reference to generalized principles. Other creative industries, such as live theater, music, and circuses, may have each developed similarly valuable and distinct bodies of knowledge (Simon 2006).

The Real-to-Real method generalizes to the level of guiding principles without losing information on the original supporting practices. Detail on the implementation and application of each principle – the industry's ground-level truth of *what works* – is not lost, and is essential in developing or identifying parallel practices. Domain knowledge is not discarded in favor of generalization, but translated for use in another domain. While the PMI's generalized approach is essential for advancing project management as a discipline, the Real-to-Real method might play an equally important role in facilitating the transfer of deeply ingrained, experience-based practices between projectized industries.

Validation

With the accuracy of the translation in this example use of the Real-to-Real method successfully verified, it was now necessary to empirically validate the effect of the identified principles and practices in software development projects with varying levels of hedonic requirements. As outlined in Chapter Three, this included consideration of several key questions. Firstly, identifying the relationship, if any, between software development project outcomes and hedonic requirements. Then, to determine whether any combination of the identified principles and practices consistently results in improved project outcomes, and whether the most beneficial combination varies in projects with differing levels of hedonic requirements. Although the practitioner interviews suggest that this illustrative use of the Real-to-Real method has successfully identified software development practices that mirror film industry practices, the potential benefits of those practices still needed to be established.

For this study, project success is defined using three classic metrics: on-time completion, adherence to the estimated budget, and the delivery of promised scope. Additionally, stakeholder satisfaction is included as an indirect measure of the benefits achieved, given that a more precise quantification of realized value may have been challenging to assess at scale. Although alternative success metrics have been proposed (Khoza and Marnewick 2020), they were considered potentially difficult for participants to evaluate both objectively and efficiently. To encourage a high response rate and avoid overwhelming participants, the survey was also designed with a limited number of questions. Lastly, an aggregate score, averaging these four individual measures, is used to determine the overall success of each project.

Several hypotheses were developed to guide this phase of research. First, it was hypothesized that a combination of the identified principles and practices would be consistently associated with project success, across all five measures of success. Secondly, it was expected that as the level of hedonic requirements increases, project outcomes would correspondingly decrease in projects that did not adhere to this combination of principles and practices. This study also expected that, to consistently achieve success across these measures, projects with higher levels of hedonic requirements would need to utilize more of the identified principles and practices than projects with lower levels. Lastly, it was hypothesized that this use of the Real-to-Real method has successfully translated domain-specific practices across industries which lead to improved outcomes when used in projects that have characteristics similar to those in the source industry.

A practitioner survey was conducted to address these research questions and examine the associated hypotheses. As detailed in Chapter Three, interactive recruitment messages, in a question-and-answer format including prewritten responses detailing this research, were sent to 30,462 users of a popular online professional networking platform. Each targeted user met several inclusion criteria, including having a profile page set to English, at least five years of professional experience as an IT Project Manager (or a related title, such as Scrum Master). To minimize the potential effects of cultural differences, participation was also restricted to residents of the United States, United Kingdom, Canada, Australia, and New Zealand. These countries share closely similar cultural characteristics (Minkov and Kaasa 2022), although limitations of the selected networking platform precluded the addition of other culturally similar countries.

Participants were invited to consider a recent project that they had managed to completion, that had involved developing or configuring software. The instructions also noted that projects with any final outcome were suitable, regardless of success. The survey then asked these experienced practitioners to rate the accuracy of 21 statements describing that project, which included consideration of project outcomes, the perceived criticality of hedonic requirements, and the use of the 16 software development practices translated from the film production industry in this example of the Real-to-Real method. The full set of statements is presented in **Appendix B**. Seven response options were provided for each statement, ranging from *Not at all accurate* to *Extremely accurate*. This design, measuring the accuracy of statements written in straightforward, nontechnical language, sought to assess the fidelity of implementation of each practice, both in quality and consistency. The intent was to encourage participants to reflect on how rigorously each practice was followed during the project.

A total of 307 responses, collected over a period of 108 days, were retained for analysis, each describing a unique software development project from the point of view of the project manager. Together, these responses formed an informative dataset of project cases, which were analyzed in several ways to sequentially address this effort's research questions.

Overview of Survey Population

Demographic data on survey participants was not collected to ensure the anonymity of participants and encourage more honest and candid responses. As each survey response was triggered from an initial recruitment message, however, the demographic profile of message recipients offers a partial validation that the survey responses were drawn from a suitably diverse population. Details on these recipients, all of whom met the inclusion criteria discussed earlier, is presented in **Table 28** through **Table 32**.

Recipients in the United States accounted for the largest portion of opened recruitment messages, at just over 38%. As shown in **Table 28**, the remaining portions correspond roughly to the population size of each country: the United Kingdom, followed by Australia, Canada, and finally New Zealand, where 1.85% of messages were opened. It is interesting that the rate at which recipients in each country elected to open messages followed an almost perfectly inverse pattern: 59% of recipients in New Zealand opened their messages, while just over half of recipients in the United States opted to ignore them. Future research efforts might therefore allocate their budget more strategically, focusing on the regions with the highest response rate, regardless of their overall population.

The list of metropolitan areas accounting for the largest portions of opened messages is shown in **Table 29**. Notably, three cities in the United Kingdom are among the top eight, with recipients in the London area accounted for 11.7% of all opened messages - over four times more than were opened in New York, the next highest city. Interestingly, no cities in California, including the so-called 'Silicon Valley,' appear on the list, despite reasonable expectations that many Information Technology Project Managers would be located there. While it may seem unusual that nearly 12% of all opened recruitment messages were opened by recipients in London, this concentration is likely acceptable given the city's prominence as a global hub for technology and business. Additionally, it's reasonable to expect that the intended target audience is more concentrated in urban rather than rural areas.

The breakdown of opened messages by industry, as shown in **Table 30**, presents a smoother distribution. Recipients employed in the Construction industry received and opened the largest portion of messages, at 12.35% and 11.6%, respectively. The IT Services and IT Consulting industries accounted for slightly fewer opened messages, at just under 10%. Although this ordering may seem surprising, it is important to note that the recruiting platform categorized the Technology, Information, and Internet industry separately, which accounted for an additional 7.6%. A similar listing of opened messages by the size of each recipient's employer is shown in **Table 31**, which also presents a relatively smooth distribution. Neither analysis reveals significant anomalies, suggesting a useful and unweighted distribution of recruitment messages across multiple industries and company sizes.

Although efforts were made during recruitment to encompass a wide variety of job titles by including 24 related roles, such as Scrum Master and Technical Project Manager, it was anticipated that the largest percentage of software development project managers would be employed under the title of Information Technology Project Manager. Surprisingly, this title does not appear anywhere on the list of recipient titles opening the largest portions of messages, shown in **Table 32**. Instead, the relatively generic title of Project Manager accounted for nearly half of all opened messages. While the title of Scrum Master does appear on this list, it is also surprising that several unanticipated titles, such as Construction Manager, Engagement Manager, and Delivery Manager each accounted for a higher percentage of opened messages. Although recipients were required to have at least 5 years of experience in any of the selected titles, no restriction was placed on their currently held title. These results therefore suggest a broader range of career paths for software development project managers than originally anticipated, which may present an opportunity for future research.

While no similar demographic information is available for the set of recipients who ultimately completed the survey, this review of the overall population who received recruitment messages is encouraging. The messages were opened by a diverse range of individuals across various industries, company sizes, geographic locations, and job titles, all of whom had significant experience. Although the relative concentration of messages opened in the London area was unanticipated, this broad range of perspectives lends credibility to the findings derived from the subsequent analysis.

Software Development Project Outcomes

Software development projects are often at risk of exceeding their estimated budget, falling behind schedule, and failing to achieve desired results. For example, previous research has found that only 28% of software projects are executed successfully (Khoza and Marnewick 2020), and that 26% of software implementation projects finish significantly over budget (Budzier and

Flyvbjerg 2012). Worse still, these risks have unfortunately remained largely unchanged for decades (Flyvbjerg, Budzier and Lee, et al. 2022).

Rather than repeating earlier research by attempting to collect and compare estimated budgets to actual expenses, this practitioner survey began by asking responding project managers to consider a recent project they had managed to completion which had involved developing or configuring software. Respondents were then asked to rate the accuracy of four statements describing successful project outcomes, such as "The project was completed within or below budget." Seven possible responses were provided, ranging from *Not at all accurate* to *Extremely accurate*. The full set of survey statements is included in **Appendix B**. Although this approach does not allow the calculation of specific overages, it encouraged project managers to reflect, in hindsight, on each project's overall success in meeting expectations.

This design intentionally introduces a degree of ambiguity when interpreting project outcomes. The lack of a binary system of classification for *success* and *failure* reflects real-world complexities and requires interpretation for ratings that fall in the middle of the scale. For example, a rating of *Moderately accurate* for the statement "The project was completed on schedule" does not provide enough information to determine how far off schedule the project was, either in terms of calendar time or as a percentage of the intended schedule. Instead, it measures the perceived success of the project in meeting its desired schedule, which may not reflect mathematical reality.

Similarly, it may also be worth considering whether a project for which the statement "Project stakeholders were satisfied with the results of the project" was rated as *Extremely accurate* would be considered a failure within the sponsoring organization, even if the statements relating to its budget, schedule, and scope received much lower ratings. If stakeholders were completely satisfied, do other measures of success remain relevant? The attempt to capture a broad range of outcomes complicates direct comparison to past research, which often categorized projects strictly as *successes* or *failures*, or involved the direct calculation of specific overages.

As a real-world example of ambiguous project outcomes, consider the development of *Halo: Combat Evolved*, one of the first games available for Microsoft's then-new Xbox system. Played from the first-person perspective of the player character, gameplay primarily centered on running, jumping, and shooting a wide variety of aliens. The capability for competitive multiplayer matches was later added, and *Halo* went on to become one of the most popular, critically acclaimed, and successful video games of all time, inspiring a long list of sequels. For a researcher attempting to separate projects into examples of *success* or *failure*, however, some difficulties are apparent (OXM Staff 2015).

When the development of *Halo* began, the game was originally intended to be played from a top-down perspective. Rather than focusing on controlling a single character, gameplay centered on strategy, with players indirectly controlling large groups of troops in coordinated combat. This original vision of the game also relied heavily on narrative delivered through text. Later in development, perspective was changed to third-person, directly behind and above a now-central character, and gameplay shifted towards controlling that character specifically. The change to a first-person perspective occurred later still, and after the development studio was purchased by Microsoft and the game was selected as a launch title for the new Xbox, the budget swelled again. This allowed for additional scope, such as hiring the Chicago Symphony Orchestra to record a new soundtrack for the game (OXM Staff 2015).

How then, should this project be categorized? Despite the long-running and international success of the final product, development surely exceeded its original schedule, budget, and scope rather dramatically. A comparison of actual development duration, costs, and scope to the original estimates for the much more modest game envisioned during project initiation would likely be misleading. Should the determination of *success* and *failure* therefore be predicated on only the final approved estimates, if changes were made to original estimates during development? If so, what would then distinguish this project from one that had simply overrun its budget or schedule through mismanagement, with no exculpatory increase in scope? If sponsors eventually approve a budget that matches actual expenses, was there no overage?

The question is not entirely academic. For example, much research has attempted to compare success rates between projects following predictive, Waterfall-style methodologies and those adhering to adaptive, Agile methods (Dybå and Dingsøyr 2008, Budzier and Flyvbjerg 2013b, Serrador and Pinto 2015, Khoza and Marnewick 2020, Flyvbjerg, Budzier and Lee, et al. 2022). Unlike earlier predictive methods, however, Agile development does not normally call for complete estimates of schedule, budget, and scope in advance, and instead relies on short term planning horizons. Thus, when categorizing *success* or *failure*, projects following predictive methods may be held to long-term and inflexible estimates, while agile projects are allowed to frequently reset their stated goals until the end of development. When the determination of *success* or *failure* may have significant career impacts on the manager and team, a desire to reframe project outcomes may also encourage miscategorization when relying only binary outcomes.

This discussion will generally treat responses of *Very* and *Extremely accurate* as indicative of success, and responses of *Not at all* or *Slightly accurate* as indicative of failure. There is value in the breadth of outcomes captured by the full range of responses, however. Simplifying the nuanced results shown in **Figure 7** through **Figure 11** into binary categories would risk missing the varying degrees of success represented in this set of project cases. It is suggested that future research should consider similar gradations to better capture diverse project outcomes.

Survey responses related to project outcomes are summarized in **Table 33**. The 307 software development projects included in this analysis appeared to struggle primarily with adherence to schedule, as the survey statement corresponding to that goal received the lowest overall average accuracy rating, at 4.1 out of 7. This outcome also saw the highest percentage of low accuracy ratings and the second-lowest percentage of high accuracy ratings. Almost 22% of projects rated the statement "The project was completed on schedule" as either *Not at all* or *Slightly* accurate, suggesting that more than one in five projects finished significantly behind schedule.

Responses to the statement "The project was completed within or below budget" generally followed a more balanced distribution, with 12% of responding practitioners rating the statement as *Not at all accurate* and another 12% rating it *Extremely accurate*. Just over one quarter of all responses considered it *Very accurate*, however, helping to draw the average slightly above the mathematical midpoint, to 4.4 out of 7. Nevertheless, it appears that both budget and schedule remain challenging measures of success.

Measures of delivered scope and stakeholder satisfaction received comparatively higher average ratings, at 5.5 out of 7. These measures also received a significantly larger number of high ratings, with almost 65% of projects indicating the successful delivery of promised features and scope, and over 61% of projects reporting high levels of stakeholder satisfaction. Perhaps most notably, these measures also saw far fewer apparent failures, with less than 5% of projects rating either statement as *Not at all* or *Slightly* accurate.

The dataset allows for several determinations of *success* and *failure*. As shown in **Figure 11**, just over a quarter received high average ratings across all four outcomes. If this is used as the threshold for *success*, almost three quarters of projects were less than successful, with an average rating across the four measured outcomes of less than 6 out of 7. Considered another way, almost half of the projects in this set appear to have been at least moderately successful, with average ratings corresponding to *Moderately* and *Fairly accurate*. Strikingly, less than one in forty projects reported low average ratings across all measures of success, suggesting that very few projects fail on every front simultaneously. Another plausible definition of failure would include projects with a response of *Not at all* or *Slightly* accurate to at least one of the four outcomes; this would result in a roughly 30% rate of failure and 70% rate of success, although many of those 'successes' may be more accurately considered moderate failures.

Overall, these findings highlight the complexity of defining success in software development projects. While a significant portion of projects may not meet all traditional success criteria, these results also indicate that outright failure across all dimensions is rare. The relative weighting of importance between schedule, budget, scope, stakeholder satisfaction, and other possible goals also likely varies between organizations and across projects. Just as there may be no best-fit methodology for all projects, there may be no one-size-fits-all measure of success.

Perception of Hedonic Requirements

Determining the level of hedonic requirements in each project case was critical to this research. In order to evaluate the most beneficial combination of the identified principles and practices in projects with varying levels of hedonic requirements, the collected data needed to allow for the categorization of projects according to the degree by which consideration of intended user emotional responses shaped the design of the system. Unfortunately, directly measuring the impact of these types of requirements in each project would have involved a review of project records, interviews with stakeholders, and the development of an objective method of measurement.

Instead, this practitioner survey asked respondents to rate the accuracy of the statement "It was critical to project success that the end user experienced or avoided specific emotional reactions, such as satisfaction, security, frustration, or fear." This design presented the concept of hedonic requirements in straightforward, nontechnical language, and provided several possible examples. As a result, this statement measured the project manager's perception of the criticality of hedonic requirements, in hindsight. The distribution of responses is shown in **Figure 12**.

While the full range of possible responses was covered, almost half of all participants rated this statement as either *Very* or *Extremely* accurate. Conversely, less than 14% rated it as *Slightly* or *Not at all* accurate. Although the perceived criticality of hedonic requirements was not universal, the preponderance of high ratings appears to conflict with previous research, which has reported that many software development projects never formally identify or document hedonic requirements (Callele, Neufeld and Schneider 2005), and may even lack a shared vocabulary for doing so (Ameller, et al. 2012). These results imply a remarkable level of familiarity with these types of requirements and a widespread acceptance of their importance in system design.

These findings further highlight the critical role that hedonic requirements play in the success of software development projects. The contrast between these results and earlier research suggests that the industry's understanding of the topic has progressed, with practitioners placing more emphasis on the emotional responses of end users than has been previously documented. The gap between current practices and existing literature illustrates a need for further research to document industry advancements on this subject. Based on these practitioner responses, it may now be possible to develop effective methods for identifying, documenting, and measuring hedonic requirements – and it appears that such methods may be critical to the industry.

Prevalence of the Identified Principles and Practices in Software Development

In the review of film industry project management practices presented in Chapter Two, four guiding principles emerged as critical to the industry's approach to management projects. These principles, detailed in **Table 7**, were used to identify specific practices suitable for software development that would mirror or parallel film production practices. The full mapping of principles to practices in both industries is shown in **Appendix A**.

The bulk of the practitioner survey focused on measuring the use of these sixteen practices in the collected set of software development projects. Continuing with the same instructions as in earlier sections, respondents were presented with a series of statements describing the use of these practices, and asked to rate the accuracy of each. The full set of survey statements is included in **Appendix B**. As each practice is intended to support one of the guiding principles, it is possible to evaluate each project's overall adherence to each principle by averaging the ratings for the set of associated practices. The distribution of these average ratings, for all four principles, is shown in **Figure 13** through **Figure 16**, and summarized in **Table 34**.

While the average adherence to each principle is relatively consistent within the collected set of project cases, there are notable differences in the relative distribution of projects with very weak and very strong adherence to each principle. For example, 35% of all projects reported high overall adherence to the principle of Benefits Management, which calls for the estimation, tracking, and reporting of actual progress, spending and outcomes (Hawkey and Vans 2024). These projects rated the accuracy of statements related to usage of the four identified supporting practices as *Very* or *Extremely accurate*, on average. In comparison, only 25% of projects reported strong adherence to the principle of Rigorous Project Approval, or the goal of using formal project approval decisions, based on detailed analysis, to authorize project proposals for full development

(Hawkey and Vans 2024). This disparity implies that managerial rigor is often applied only after project proposals are approved, which may indicate a potential barrier to success.

Approximately one of twenty projects reported low adherence to the principle of Expectation Clarity, with ratings for the three supporting practices corresponding to *Slightly* or *Not at all accurate*, on average. This principle calls for projects to enable team members to understand their own and other's responsibilities, select suitable projects, and commit to roles in which they will excel (Hawkey and Vans 2024). Even fewer projects reported low adherence to the principle of Benefits Management, with only 1.5% of projects rating statements on the use of the four associated practices as highly inaccurate.

This indicates that support for the principle of Benefits Management is particularly widespread in the software development industry. Supporting this finding, of the 16 practices included in the survey, those supporting Benefits Management received the highest and third-highest average rating, as shown in **Table 35**. It is striking, therefore, that another practice supporting Benefits Management received the lowest average rating, detailed in **Table 36**. The associated statement reads "Before starting development, we defined specific overage thresholds that would trigger corrective actions, such as a replanning session, if the project went over budget or schedule." Such thresholds would be similar to film industry practices (DeFillippi and Arthur 1998, Persse 2008), and 83% of the experienced software development project managers interviewed in this research agreed the practice was suitable for software development and would directly contribute towards Benefits Management. As there is no readily apparent barrier to adoption, this finding suggests that such thresholds be more widely recommended in practitioner training and relevant literature.

The Effects of Hedonic Requirements on Software Project Outcomes

In Chapter Two, the Real-to-Real method, illustrated in **Figure 1** and detailed in **Table 1**, was used to translate management practices – assignable tasks and duties – from the film production industry to the domain of software development. The film industry was selected as a source of inspiration, as its many similarities with software development projects may have led to the development of different approaches to shared challenges. The film industry's evident expertise in managing hedonic requirements seemed particularly relevant to improving software development project outcomes.

Hedonic requirements are a type of non-functional requirement seeking to increase use and enjoyment of the system (Hassenzahl, Beu and Burmester, Engineering Joy 2001), which inform the broader consideration of User Experience (UX) (Quiñones and Rusu 2019). They specify the intended emotional response of the user, the means by which to achieve it, and the artistic context in which the experience is to occur (Callele, Neufeld and Schneider 2008, Callele, Neufeld and Schneider 2009a). As user-facing software is an experiential product (Persse 2008), such aesthetic considerations are often critical to the success of the product, but are inherently difficult to identify, specify, and represent (Callele, Neufeld and Schneider 2006, Diefenbach and Hassenzahl 2011).

Prior research has found that existing software development practices struggle to elicit hedonic requirements, and may overestimate the importance of pragmatic qualities (Diefenbach and Hassenzahl 2011). Users tend to describe their preferred UX based only on pragmatic qualities, often believing they are specifying hedonic elements even while limiting their responses to purely functional aspects (Maier and Berry 2018). Although aesthetic and emotional qualities are essential to the success of many software products (Callele, Neufeld and Schneider 2009b), research has found that many projects never formally identify or document hedonic requirements

(Callele, Neufeld and Schneider 2005). Other studies have reported that software architects lack a common vocabulary for describing hedonic qualities, that most projects do not document non-functional requirements at all, and found no instances of projects considering hedonic requirements specifically (Ameller, et al. 2012).

The first software development project management methodologies were derived from large engineering projects that attempted to predict and estimate all work in advance (Bennington 1983, Project Management Institute 2021, Wysocki 2019). Later, adaptive methodologies such as Agile Scrum were developed, calling for shorter planning horizons and the incremental delivery of completed features (Highsmith and Cockburn 2001, Cohn 2004). While earlier predictive methods continue to be widely used, these adaptive methodologies have grown increasingly popular (Butler, Vijayasarathy and Roberts 2020, Reed and Angolia 2023).

Despite their differences, however, most popular software development methodologies inherently follow a normative-positivist conceptual approach and implicitly assume that project requirements and outcomes are both knowable and measurable in advance (Fortune and White 2006, Budzier and Flyvbjerg 2013a). Reflecting this belief, in most popular methodologies, project goals are selected before the full development team is formed, as shown in **Figure 2** (adapted from Cohn 2004, Ruparelia 2010, and Wysocki 2019). This sequencing reflects the inherent belief that requirements can be specified before iterative collaboration involving the full team. Software products are intangible, and cannot be held, touched, or felt, so attempts to specify all requirements before the delivery of a working product or prototype may provide only an illusion of control (Budzier and Flyvbjerg 2013a).

There is an apparent logical mismatch in applying such normative-positivist approaches to the development of experiential and intangible products for which aesthetic considerations are inherently difficult to plan, define, discuss, or test but are often critical to the user experience. In the example use of the Real-to-Real method provided in Chapter Two, this apparent gap was selected as an illustrative potential barrier to project success within the software development industry. Although the challenge of hedonic requirements is well represented in the existing body of software development project management literature, no prior attempt has been made to empirically measure the effect of such requirements on project outcomes. This research therefore sought to examine the relationship between hedonic requirements and project outcomes within the set of project cases developed through the practitioner survey, although no specific hypotheses were stated.

It is noteworthy that this research did not directly measure the level of hedonic requirements in these project cases. Doing so would necessarily have involved a review of project records, interviews with stakeholders, and the development of an objective method of measurement. Instead, the practitioner survey asked software project managers to rate the accuracy of the statement, "It was critical to project success that the end user experienced or avoided specific emotional reactions while using the software, such as satisfaction, security, frustration, or fear." This statement avoided the term *hedonic requirements*, which may have been unfamiliar to some respondents, and included examples using simple, everyday language. As a result, this research measured the project manager's perception of the criticality of hedonic requirements, necessarily in hindsight.

As shown in **Figure 17** through **Figure 21** and detailed in **Table 37**, this analysis found a weak but statistically significant positive correlation between the perceived criticality of hedonic requirements and project success, across all five measures of success. Surprisingly, this finding appears to conflict with the existing literature, which suggests that higher levels of hedonic requirements would negatively affect project outcomes. Within this set of 307 project cases, an increase to the perceived criticality of emotional requirements to project success is matched by a corresponding improvement to project outcomes.

In addition, when projects cases are categorized according to the perceived criticality of hedonic requirements, the disparity of outcomes is even more starkly apparent. The set of cases in which hedonic requirements were rated as highly critical to success, here termed *High Hedonic*, reported appreciably higher average outcomes than the set of projects in which the statement asserting such criticality was rated as either *Slightly* or *Not at All* accurate, designated here as *Low Hedonic* cases. As shown in **Figure 22** and **Figure 23**, and summarized in **Table 38**, this difference was striking across all five measures of success, with projects in the set of *High Hedonic* cases achieving high overall success at a rate approximately six times higher than that found in the contrasting *Low Hedonic* set.

In addition, project failure rates, for all measured outcomes, were higher in the set of *Low Hedonic* cases. For example, over 41% of projects in this category reported very low adherence to their estimated schedule, while just over 17% of *High Hedonic* projects indicated similar challenges. Although outright failures were rare in both categories, the rate of overall failure in the *Low Hedonic* group was approximately double that in the *High Hedonic* set.

It is interesting to reconcile these results with existing theory. As the examination of this relationship was also tangential to the main thrust of this research, the collected dataset may lack additional data necessary to fully explore the mechanisms or processes underlying this relationship, although the observed association of hedonic requirements to project outcomes appears robust. A potential hint, however, may lie in the design of the survey.

Prior research has clearly established the importance of hedonic requirements. This survey has found that project managers who agree that such requirements are critical to success lead more successful projects. Conversely, managers who reported that hedonic requirements were not critical to success experienced worse outcomes, across all measures of success. It is possible that measuring that understanding in each project manager, rather than the actual level of hedonic requirements in each project, identified managers who are more capable of leading successful projects. Based on their reported results, it appears that the group of managers who did not agree that these types of requirements were critical to success may have been incorrect.

A comparison of management activity between the *High Hedonic* and *Low Hedonic* cases supports this interpretation. When survey responses measuring use of the practices supporting each principle were averaged, *High Hedonic* projects were found to have higher overall adherence to all four film industry principles, as shown in **Table 39**. Similarly, although the most prevalent and least prevalent specific practices in each group were similar, as detailed in **Table 40** through **Table 43**, projects in the *High Hedonic* set indicated approximately 33% greater utilization of each practice, on average. This suggests that projects in the *High Hedonic* set benefitted from more rigorous and active project management than those in the *Low Hedonic* set, which may help to explain their greater rates of success.

High Hedonic projects showed stronger adherence to film industry principles, indicated higher utilization of many of the identified software development practices, and reported better outcomes than projects whose managers did not agree that hedonic requirements were critical to success. In contrast, *Low Hedonic* cases showed weaker adherence to each principle, lower utilization of many identified practices, and reported both a higher rate of failure and lower average outcomes. This supports the value of active project management in general, and validates the effectiveness of the identified principles and practices in projects with critical hedonic requirements.

Unfortunately, because *Low Hedonic* cases reported overall lower utilization of all identified principles and practices, the reduced outcomes found in these cases may be explained by a decreased reliance on project management in general. While these results suggest that the set of identified practices are beneficial in managing hedonic requirements, this initial analysis is therefore perhaps insufficient to determine whether these principles and practices combine to effectively support hedonic requirements specifically, or to determine the recommended *best practices* for practitioners beginning a software development project in either category. Based only on this initial analysis, it remains possible that projects in the *Low Hedonic* may also have experienced better outcomes if they had adhered more strongly to all of the identified practices.

Therefore, to conclusively determine the effectiveness of these principles and practices in addressing hedonic requirements specifically, and to thereby evaluate the results of this illustrative use of the Real-to-Real method in general, it was also necessary to identify the most beneficial combinations of these principles and practices for *High* and *Low Hedonic* projects separately. By comparing these recipes for success, it will be possible to determine whether translating film industry practices to software development has resulted in useful advice for managers on how to quickly tailor existing management methodologies to more effectively fit project needs.

fsQCA: Beneficial Principles and Practices for Software Projects with Varying Levels of Hedonic Requirements

To fully validate the results of the example use of the Real-to-Real method presented in Chapter Two, it was necessary to determine whether the most beneficial combination of principles and practices varies with the perceived criticality of hedonic requirements. The maximum benefits of each practice are expected only when performed in combination with others; none are wholly sufficient to manage a complex project alone. Each project case was thus essentially managed using a networked set of interconnected practices, and should not be treated as a discrete entity that can be individually evaluated (Fiss 2007). Thus, it was necessary to identify causal configurations of these elements that were associated with improved project outcomes, across all five measures of success, in the set of 262 complete project cases developed through the practitioner survey. Additionally, because there are surely many ways for a project to fail and many combinations of management practices that allow for the possibility of success, it was necessary to also consider *equifinality*, or the possibility of multiple combinations leading to the same outcome (Fiss 2007, Fiss 2011).

As detailed in Chapter Three, fuzzy-set Qualitative Comparative Analysis (fsQCA) inherently assumes equifinality, and can be used to identify combinations of causal conditions that consistently lead to an outcome (Ragin and Sonnett 2005, Lo, Rey-Marti and Botella-Carrubi 2020). In this method, the set of project cases is treated as a set of configurations of causal elements (Fiss 2007, Bacon, Williams and Davies 2020). Each case is therefore a single occurrence of one combination of interrelated components and outcomes (Ordanini, Parasuraman and Rubera 2014).

In fsQCA, analysis begins by categorizing each case into sets according to the degree of membership in each set. Using specialized software developed by Ragin and Davey (2022), analysis began with this process of calibration, as detailed in Chapter Three. Then, the calibrated set of cases was divided into groups: 129 *High Hedonic* projects, in which the survey statement that hedonic requirements were critical to project success was rated as either *Very accurate* or *Extremely accurate*, and 34 *Low Hedonic* cases, in which the same statement was rated as either *Slightly* or *Not at all* accurate. This split was necessary to fully address the research questions and hypotheses detailed in Chapter Three, and allowed for the most beneficial combinations of principles and practices to be analyzed separately for projects with differing perceptions on the criticality of hedonic requirements.

Each of the four principles describing the film industry's approach to project management, detailed in **Table 7**, is supported by 3-5 specific practices identified during this research. The full mapping of principles to practices in both industries is shown in **Appendix A**. Unfortunately, technical limitations within the available software prevent the examination of combinations involving more than ten elements, which precluded fsQCA analysis of the full set of 16 practices being evaluated here (Ragin 2018). The available guidance recommends relying on higher-order concepts that each incorporate several variables (Kent 2008), so an aggregate measure of each project's overall adherence to each of the four principles was calculated, using the average rating given to the set of associated supporting practices.

Analysis then sought combinations of beneficial principles for all five measures of project success, separately for the sets of *High Hedonic* and *Low Hedonic* cases. In instances where the most effective combination involved less than three principles, however, it was possible to re-run the analysis using all of the practices supporting the remaining and essential principles. Lastly, the process was then repeated to identify combinations of principles and associated practices that consistently result in failure, for each measure of failure, separately for *High Hedonic* and *Low Hedonic* projects. This process, shown in **Figure 6**, allowed for 28 total iterations of fuzzy-set Qualitative Comparative Analysis, as outlined in **Table 44**.

Each iteration began by producing a truth table, listing all possible combinations of the elements and outcomes under consideration. As described more fully in Chapter Three, each table also denotes the frequency, coverage, and consistency of every combination observed within the set of project cases. These truth tables are presented in **Appendix C**. Then, using Boolean algebraic reduction and counterfactual analysis of hypothetical combinations not occurring within the set of recorded cases, combinations of causally essential elements were identified. These recipes of effective principles and practices are detailed in **Table 46** through **Table 73**, which include consideration of causally essential elements consistently associated with success or failure for all five measured project outcomes.

Beneficial Principles and Practices for On-time Delivery

As shown in **Figure 23**, over 41% of *Low Hedonic* projects failed to deliver on time, which may help to explain why no combination of principles is apparent within the set of cases that consistently results in success. Several managerial approaches which consistently led to failure were identified, however, with the failure to adhere to Expectation Clarity identified as the most significant, as shown in **Table 49**. Further analysis, shown in **Table 51** and involving the three practices supporting this principle, found that approximately 85% of projects in which hedonic requirements were not considered critical to success failed to deliver on time after not defining and documenting roles and responsibilities and by not providing role and project details before hiring or assigning team members to the project. These two practices may therefore be recommended to projects in this category as a key enabler of schedule success.

In contrast, *High Hedonic* projects consistently found success through adherence to both Expectation Clarity and Rigorous Project Approval, while avoiding the use of Linked Boundary Objects, as shown in **Table 47**. Further analysis of the practices supporting the two recommended principles found that the most beneficial combination, detailed in **Table 48** and resulting in success with 95% consistency, involved the use of almost every identified supporting practice, with the sole exception of reliance on standardized roles and responsibilities. In projects where hedonic considerations are critical to success, on-time delivery is enabled through the rigorous application of both principles.

Expectation Clarity seeks to increase commitment within the project team, while Rigorous Project Approval attempts to ensure that only the most competitive proposals are approved for production. In software development projects facing a high degree of change due to the inherent difficulty of aesthetic and emotional design considerations, these two principles may form a foundation for strong adherence to an estimated schedule, although standardized roles and responsibilities may lack the flexibility needed in such projects.

Additionally, for *High Hedonic* projects, the avoidance of both Expectation Clarity and Linked Boundary Objects most effectively resulted in failure on this metric, as shown in **Table 50**. Analysis involving all of the practices found to support these principles found that, specifically, failure along this measure is fostered through the avoidance of every practice supporting Expectation Clarity, as shown in **Table 52**. None of the practices supporting Linked Boundary Objects appeared to consistently result in failure, either in their application or avoidance. As the avoidance of Linked Boundary Objects was found to contribute to both failure and success, this principle may be irrelevant to on-time delivery. Projects adhering to Linked Boundary Objects seek to encourage collaboration and innovation, which may not directly help in the adherence to an estimated schedule.

While the principle of Expectation Clarity appears to be critical for the on-time delivery of projects in both sets of cases, it is noteworthy that projects in the *High Hedonic* category needed to utilize more of the identified principles and practices to achieve a similar level of success. Although they found no consistent route to success, *Low Hedonic* projects needed only to define and document their roles and responsibilities and provide role and project details before hiring or assigning team members to minimize their chance of failure. *High Hedonic* projects, in addition to these two practices, also needed to use standardized roles and responsibilities to minimize their chance of failure, and to incorporate all five practices supporting Rigorous Project Approval to maximize their chance of success.

Beneficial Principles and Practices for Delivery Within Budget

Projects in the set of *Low Hedonic* cases also faced considerable challenges in delivering within budget, with almost 30% of projects in the set reporting failure on this metric, as shown in **Figure 23**. No combination of principles was found to consistently result in successfully staying within budget, as detailed in **Table 53**, although the avoidance of Expectation Clarity was found to consistently result in failure despite strong adherence to Rigorous Project Approval, as shown in **Table 55**. More specific analysis found that not providing role and project details before hiring or assigning team members was a key indicator of budgetary failure, even after utilizing four practices supporting Rigorous Project Approval, detailed in **Table 57**. While many interpretations are possible, this further highlights the importance of fostering team commitment through Expectation Clarity and suggests that even the rigorous filtering of project proposals may not result in the accurate estimation of project costs.

In contrast, *High Hedonic* projects were able to most consistently deliver within budget through adherence to three principles: Expectation Clarity, Benefits Management, and Linked Boundary Objects, although Rigorous Project Approval was found to be unhelpful to success in these cases as well, as shown in **Table 54**. In addition, as shown in **Table 56**, these projects most consistently reported failure on this metric after avoiding both Expectation Clarity and Rigorous Project Approval, despite engaging in Benefits Management. This further underscores the importance of Expectation Clarity, while suggesting that Rigorous Project Approval neither helps nor hinders. Unfortunately, as both these combinations involve more than two principles, no more detailed examination of practices was possible. It is however noteworthy that the most beneficial combinations for projects in the *High Hedonic* set are again more complex than those for the *Low Hedonic* set.

Beneficial Principles and Practices for Delivery of Promised Scope

As shown in **Table 58**, *Low Hedonic* projects were able to successfully deliver promised features and scope by adhering to three principles: Expectation Clarity, Benefits Management, and Linked Boundary Objects, with 90% consistency. Unfortunately, as more than ten practices are associated with these principles, a more detailed evaluation of their most effective combination is not possible with the currently available software. In addition, no combination of principles was found to consistently result in the failure of this goal, as shown in **Table 61**.

Although *High Hedonic* projects also achieved success through adherence to the same three principles, with even higher consistency, the simpler combination of Rigorous Project Approval and Benefits Management was selected for recommendation. This approach appears slightly more often within the available data, as detailed in **Table 59**. Although projects in this set were able to successfully deliver promised features and scope with 96% consistency using this combination, the necessary set of supporting practices reveals the complexity of that task. All five practices supporting Rigorous Project Approval, as detailed in **Table 60**, were required, as were two supporting Benefits Management: frequent reporting of progress and expenses and the measurement and reporting of actual achieved benefits. Again, no combination of principles was found to consistently result in failure on this metric, as shown in **Table 62**. Ultimately, despite the presence of an effective combination using only two principles, it appears that all four principles contribute towards this challenging goal.

Beneficial Principles and Practices for Stakeholder Satisfaction

The combination of Expectation Clarity, Benefits Management, and Linked Boundary objects was the most effective method for satisfying stakeholders in both the *High* and *Low Hedonic* cases, as shown in

Table 63 and **Table 64**. This approach was equally consistent for both groups, despite lower average success rates for *Low Hedonic* cases, as shown in **Figure 22** and **Figure 23**. Supporting this finding, the avoidance of both Expectation Clarity and Benefits Management was found to most consistently result in the failure of this goal in *Low Hedonic* projects, despite adherence to Rigorous Project Approval, as shown in **Table 65**. This reinforces the importance of Expectation Clarity and Benefits Management to this measure of success, while suggesting that approving only the most competitive proposals may not delight stakeholders. No combination of principles was found to consistently result in failure for *High Hedonic* projects, and as both of the identified combinations involved more than three principles, no evaluation of associated practices was possible.

Key Findings: Beneficial Principles and Practices for Overall Project Success

While the detailed analysis of each individual project outcome above provides insight into the potential benefits of each principle and practice, consideration of the aggregate measure of Overall Project Success likely offers the clearest evidence of their effectiveness in projects with varying levels of hedonic requirements. This analysis resulted in separate recommendations for each set of projects.

To allow a direct comparison, the combinations of film industry principles that are most effective in consistently achieving overall project success are detailed for both sets of cases in **Table 74**, in which Consistency has been abbreviated '*C*.' Projects in which hedonic requirements were not considered critical were able to achieve high levels of success, on average across all four measured project outcomes, simply by relying only on the principle of Rigorous Project Approval. Although the consistency of this result is relatively low, it has strong coverage within this set of cases, and adherence to this principle is of core essentiality. In contrast, projects in which the criticality of hedonic requirements was rated very high were able to consistently achieve similar levels of success through strong adherence to Benefits Management in addition to Rigorous Project Approval. As shown in **Table 68**, these projects also achieved overall success, with equal consistency, through adherence to Expectation Clarity, Benefits Management, and Linked Boundary Objects, suggesting that all four principles are beneficial when hedonic requirements are critical to success. This interpretation is further supported by the observation that projects in the *High Hedonic* set consistently experienced overall failure through the avoidance of all four principles, as shown in **Table 72**.

Table 74: *Overall Project Success: Beneficial Principles* - Low *vs.* High Hedonic *Cases (see Table 45 for definitions of indicators)*

	Expectation Clarity	**Rigorous Project Approval**	**Benefits Management**	**Linked Boundary Objects**	Raw Coverage.	Unique Coverage	*C.*
Low Hedonic		●			.80	.12	.70
High Hedonic		•	•		.86	.07	.88

For comparison, combinations of principles which most effectively resulted in high levels of project failure are shown in **Table 75**. *Low Hedonic* projects consistently experienced overall failure after avoiding only the principle of Expectation Clarity; this element is also of core essentiality, although the consistency is again relatively low. Projects in the *High Hedonic* set more consistently failed, on average across all measures, without adherence to Expectation Clarity, Rigorous Project Approval, and Benefits Management.

A deeper level of analysis was also possible for both Overall Project Success and Overall Project Failure, involving combinations of the specific practices found to support the most effective principles for overall success. The combinations of practices detailed in **Table 76** enable projects in each set to consistently achieve high levels of overall success, with practices to avoid shown in strikethrough. For each set of projects, these lists form a recommended list of assignable tasks and duties in order to maximize the chance of success. The use of standardized roles and responsibilities should also be recommended for *Low Hedonic* projects, as its absence consistently results in overall failure, as shown in **Table 73**, although its addition here would invalidate the calculated coverage and consistency scores of the presented beneficial combination. Unfortunately, combinations of practices consistently resulting in overall project failure for *High Hedonic* projects could not be similarly evaluated, as it involves too many causal elements for the available software.

Table 75: *Overall Project Failure: Critical Principles* - Low *vs.* High Hedonic *Cases (see Table 45 for definitions of indicators)*

	Expectation Clarity	**Rigorous Project Approval**	**Benefits Management**	**Linked Boundary Objects**	Raw Coverage.	Unique Coverage	C.
Low Hedonic	⨂				.62	.11	.72
High Hedonic	⊗	⊗	⊗		.33	.05	.78

The comparison of average project outcomes, shown in **Figure 22** and **Figure 23**, to the average adherence to each film industry principle in both sets of cases, detailed in **Table 39**, suggested that the identified principles and practices are critical for software development projects with high levels of hedonic requirements. As *High Hedonic* projects reported greater average adherence to every principle, however, this left open the possibility that their apparent relationship to the success of those cases was simply a result of a more active approach to project management in general. While this still allows for their recommendation to software development projects of all types, it is insufficient to tie these principles and practices to the management of hedonic requirements specifically.

***Table 76**: Overall Project Success: Beneficial Practices* - Low *vs.* High Hedonic *Cases*

Principle	*Low Hedonic*	*High Hedonic*
Rigorous Project Approval	Our project approval decision was a competitive and highly selective filter.	~~Our project approval decision was a competitive and highly selective filter.~~
	~~Our funding and staffing were limited until we received the project approval decision.~~	We used a formal project approval process.
	The authority to approve our project for production was restricted to a select group of designated decision makers.	The authority to approve our project for production was restricted to a select group of designated decision makers.
		We carefully conducted a detailed estimated of the project's expenses, duration, and expected benefits before the project was approved.
Benefits Management		We reported regular and frequent updates on the project's progress and expenses.
		We conducted and published a final accounting of expenses and delivered scope.
		We measured and reported actual delivered benefits.
Overall Coverage	0.32	0.20
Unique Coverage	0.23	0.08
Consistency	0.82	0.95

The results of the fuzzy-set Qualitative Comparative Analysis discussed above, however, address that remaining question. To achieve similar levels of overall success, projects in which hedonic requirements were considered critical needed to use more of the identified principles and practices than were needed in projects where such requirements were considered less important. In addition, as shown in **Table 68** and **Table 72**, the use of all four principles consistently led to success, while the avoidance of all four principles consistently led to failure, in projects where hedonic requirements are considered critical. This evidences their specific applicability to the challenge of managing aesthetic and emotional design considerations, and conclusively determines that this illustrative use of the Real-to-Real method successfully identified existing software development project management practices that effectively support hedonic requirements. The practices listed in **Table 76** comprise simple, heuristic guidance to software development project managers on how to quickly and effectively tailor their managerial approach in response to hedonic requirements. The Real-to-Real method can now be confidently recommended for the translation of management practices between other industry pairings.

CHAPTER SIX: CONCLUSION

This research began by examining the challenges and potential value in translating specific project management practices, developed through hard-won experience, between industries. Each projectized industry has developed a separate body of knowledge over time, containing valuable advice on practical implementations of *what works* and *what doesn't*, but this practitioner expertise often remains locked behind the conceptual barriers separating domains. Generalized and industry-agnostic guides to managing projects are essential for the advancement of theory and maturing the discipline as a whole, but unavoidably result in the loss of valuable detail.

In response, this effort proposed the Real-to-Real method of inter-industry learning, illustrated in **Figure 1** and detailed in **Table 1**. In this method, key elements of processes used in earlier efforts at transferring domain-specific project management practices between industries are combined and formalized, as discussed in detail in Chapter One. To translate practices from a source industry to a target industry, this method involves developing a set of generalized principles to serve as a conceptual intermediary, allowing for the development or identification of assignable tasks and duties suitable for the target domain that mirror or parallel those in the source industry. This method involves a lower level of abstraction than the development of industry-agnostic principles, and retains valuable data on the source industry's implementation and application of each practice. This data can be used to shape target industry practices to more closely match those in the source industry, leading to a set of practices beneficial in projects that share characteristics with the source industry. If widely adopted, the Real-to-Real method could significantly increase the flexibility of existing project management methodologies. Practitioners could rapidly tailor their managerial approach to fit the unique requirements of each project by drawing on valuable insights into *what works* and *what doesn't* that have proven effective in industries with similar characteristics.

To illustrate the use of the Real-to-Real method, an example case was described in detail in Chapter Two. The software development industry was selected as a suitable target, and a review of existing literature identified the management of hedonic requirements, which specify the intended emotional response of the user, as a potential barrier to project success in that industry. To address that challenge, a review of potential candidates identified the film production industry as a possible source of inspiration, due to that industry's many shared characteristics with software development and expertise in managing emotional requirements. Then, a holistic analysis of film industry practices suggested the existence of four guiding principles shaping that industry's approach to managing projects, detailed in **Table 7**. Completing the example, existing software development management practices were then identified which would also support each principle, thus mirroring practices used in film production. The full mapping of principles to practices in both industries is shown in **Appendix A**. By identifying sets of practices that are effective in projects with differing levels of hedonic requirements, this illustrative use of the Real-to-Real method enhances the resiliency and adaptability of existing software development project management methodologies, and helps enable teams to quickly respond to diverse challenges.

To confirm these results and support the use of the Real-to-Real method in other industry pairings, a study was then conducted to verify and validate these findings, as described in Chapter Three. First, a series of interviews with experienced film producers, detailed in **Table 12**, verified the association between film industry practices and the synthesized principles. The results of these interviews are summarized in **Table 22**. Then, a second series of interviews with experienced software development project managers, shown in **Table 13**, similarly verified the relationship between each principle and a set of existing software development practices, as detailed in **Table 27**. By independently confirming either side of the Real-to-Real method's conceptual bridge, these interviews affirmed the overall accuracy of the translation.

Then, to empirically validate the benefits of the identified principles and practices for software development projects seeking to manage hedonic requirements, a survey of software development practitioners was conducted. The results of this survey were used to develop a set of 307 software development project cases, each containing information on the perceived criticality of hedonic requirements, usage of the 16 identified practices, and five measures of project outcomes. The full set of survey statements is provided in **Appendix B**.

Although demographic data on survey participants was not collected to ensure anonymity and encourage sincere responses, the population of recruitment message recipients spanned a broad range of industries, company sizes, geographic areas, and job titles, as detailed in **Table 28** through **Table 32**. Critically, each respondent also had at least five years of professional experience related to managing software development projects. The results of the survey therefore appear to be robust, and should lend credibility to the resulting findings.

To allow multiple gradations of success in measuring project outcomes, this survey asked participating project managers to rate the accuracy of a series of statements describing separate measures of success, such as "The project was completed on schedule." This approach does not allow for the calculation of specific overages, but encouraged respondents to reflect on each project's overall success in meeting expectations. These results are shown in **Figure 7** through **Figure 11** and summarized in **Table 33**.

An analysis of these outcomes, across the full set of 307 software development project cases, suggests that 22% of projects finished significantly behind schedule. Fewer projects appear to struggle with adherence to their estimated budget, with an equal 12% of respondents rating a survey statement describing budgetary success as either *Not at all* or *Extremely accurate*, indicating a balanced distribution between those that significantly exceeded their budget and those able to deliver within it. Measures of the successful delivery of promised features and stakeholder satisfaction saw comparatively higher outcomes, with most projects reporting success on both metrics, and less than 5% of projects indicating significant problems on either front.

The analysis of project outcomes enabled by this survey matches the complexity of defining success in software development. While only a quarter of projects in the set achieved high average ratings across all four outcomes, suggesting that most projects fall short of meeting all traditional criteria for success, outright failure is rare. Nearly half of the projects in this set reported moderate success, and less than one in forty failed significantly across all measures. The many contrasting definitions of *success* and *failure* enabled by this data set are evidence of varying degrees of success, which should be included alongside any consideration of binary *success* and *failure*. The relative importance of project goals may also differ between organizations and projects. Ultimately, just as there is no single best-fit methodology for managing all projects, there may be no universal measures of success or failure.

For each project case, this survey also measured the manager's perception of the criticality of hedonic requirements to project success. The distribution of responses is shown in **Figure 12**. Prior research has reported that hedonic requirements are inherently difficult to identify, specify, and represent (Callele, Neufeld and Schneider 2006, Diefenbach and Hassenzahl 2011), that many projects never formally identify or document them (Callele, Neufeld and Schneider 2005), and that practitioners may lack a shared vocabulary and framework for doing so (Ameller, et al. 2012). It is striking, therefore, that almost half of all respondents strongly agreed that such requirements are critical to success, with less than one in six expressing strong disagreement.

These findings highlight the growing importance of hedonic requirements in software development. The apparent contrast with earlier research suggests that the industry has advanced in recognizing the importance of planning and measuring user emotional responses in software system design. This gap between current practices and existing literature should be explored, as these responses suggest that it may now be feasible to develop effective methods for identifying, documenting, and measuring hedonic requirements. Given the strong level of agreement evident in this survey, hedonic requirements are critical to the industry, and such methods may address a rapidly growing need.

The example use of the Real-to-Real method presented in Chapter Two identified four guiding principles that shape the film industry's approach to managing projects and 16 existing software development practices that align with and support these principles. The complete set of principles and practices is detailed in **Appendix A**. The practitioner survey also measured the use of these practices in each software development project, and by averaging responses for the practices associated with each principle, it is possible to estimate each project's overall adherence to each guiding principle. The distribution of these average ratings is shown in **Figure 13** through **Figure 16** and summarized in **Table 34**. While this analysis determined that the average overall adherence to each principle is relatively similar, two important conclusions are possible.

First, the principle of Benefits Management, which calls for the estimation, tracking, and reporting of actual progress, spending, and outcomes (Hawkey and Vans 2024), was the most widely followed principle in the surveyed projects. Over 80% of project managers reported *Strong* or *Moderately Strong* average adherence to the set of practices supporting this principle. In addition, of the 16 practices examined by the survey, two practices supporting Benefits Management received the highest and third-highest average rating. It is striking, therefore, that another practice supporting this principle, "Define overage thresholds that trigger corrective action when a project goes over budget or schedule," received the lowest overall rating.

Although these results suggest widespread adherence to the principle of Benefits Management in the industry, it seems that this supporting practice may be underutilized. In the semi-structured practitioner interviews conducted during this research, 83% of the participating software development project managers agreed that the use of this practice would help projects adhere to the principle of Benefits Management. One Technical Program Manager stated, "I like the idea of some kind of formal review [after hitting a threshold] – a conscious decision to continue, or to stop, together." Another explained that such thresholds would "help provide a collective understanding, across everyone, that when the project goes over schedule, we all know." Given the relative popularity of other practices supporting Benefits Management, and the ease of implementing predefined overage thresholds, it is suggested that practitioner training and project management guides be updated to recommend this practice.

Secondly, it is also noteworthy that the principle of Rigorous Project Approval, which calls for projects to ensure the use of formal project approval decisions, based on detailed analysis, to authorize projects proposals for full development (Hawkey and Vans 2024), had the lowest percentage of projects with strong adherence. Only a quarter of the surveyed projects reported strong alignment with this principle, as shown in **Figure 14**. When considered alongside the relative popularity of Benefits Management, this suggests that managerial rigor is at times only applied after projects are approved for production. This may highlight a gap in existing practices, as even the best management techniques may be ineffective when applied to a poorly conceived project. The relative popularity of these two principles implies that careful precision may occur later in the project than would be most effective, and possibly that decision-makers may not be subjecting themselves to the same standards applied to rest of the project team. Given the evident popularity and import of Benefits Management, it is suggested that teams more widely adopt the use of Rigorous Project Approval as an enabling precursor.

By comparing the perceived criticality of hedonic requirements to project outcomes across the full set of 307 cases, it was also possible to empirically examine the effect such requirements have on success. A weak but statistically significant positive relationship between the project manager's perception of the criticality of hedonic requirements and project success was found, across all five measures of success, as shown in **Figure 17** through **Figure 21** and detailed in **Table 37**.

This relationship suggests that existing software development practices may adequately support these types of requirements, conflicting with existing research. It also suggests, however, that an understanding of the importance of hedonic requirements, and perhaps a willingness to engage with them based on that understanding, is key to project success, as managers who did not agree with their importance experienced reduced outcomes across all measures. Although these results do not disconfirm a broad recommendation of the identified principles and practices to all software development projects, regardless of their level of hedonic requirements, they strongly support their application to projects in which hedonic considerations are critical.

This analysis was then strengthened by categorizing project cases according to the perceived criticality of hedonic requirements and comparing outcomes between groups with high and low perceived criticality. The results are shown in **Figure 22** and **Figure 23**; projects in which hedonic requirements were considered critical achieved high levels of success more frequently, and high levels of failure less frequently, across all five outcomes, than projects in which they were not considered critical. It is noteworthy here that the first group of projects adhered more closely, on average, to all four film industry principles, as shown in **Table 39**. Together, these results show the effectiveness of the film industry principles in managing software development hedonic requirements, as the greater adherence seen in projects where these requirements were critical is paired with greatly improved outcomes.

Because projects in which hedonic requirements were considered critical adhered more closely to every principle, however, their improved outcomes may simply have resulted from a more active approach to project management in general. These initial results were sufficient to strongly recommend the identified film industry principles and associated software development practices to software projects with high levels of hedonic requirements. However, these findings did not eliminate the possibility that the principles and practices would be equally helpful in all software development projects, irrespective of their level of hedonic requirements, and did not address that challenge directly.

To more precisely evaluate the effectiveness of the identified principles and practices in managing hedonic requirements specifically, the subset of 262 complete project cases were then analyzed using an iterative process of fuzzy-set Qualitative Comparative Analysis, described in detail in Chapter Three and illustrated in **Figure 6**. This method treated each case as a configuration of causal elements, and identified causally essential combinations of the identified principles and practices that were consistently associated with success or failure, for all five project outcomes. Project cases in which hedonic requirements were considered highly critical to success were analyzed separately from cases in which their criticality was rated very low. This allowed for the comparison of beneficial principles and practices across software development projects with varying perceptions of the importance of these emotional and aesthetic elements.

Each of the film industry principles and associated supporting software development practices is a generally beneficial project management technique, and none appear to be essentially detrimental. Careful analysis was therefore required to evaluate differences in their relative effectiveness to software development projects of varying levels of hedonic requirements. Twenty-eight iterations of fuzzy-set Qualitative Comparative Analysis were conducted to meet this challenge, as summarized in **Table 44**. The most effective combinations of principles and practices, in meeting each measured outcome, for projects with high and low levels of hedonic requirements, are presented in **Table 46** through **Table 66**.

The aggregate measure of Overall Project Success is of primary importance, however. Here, despite the general applicability of each principle and practice to project management in general, starkly different recommendations are found for software development projects with high and low levels of hedonic requirements. While both types of projects found consistent routes to success, projects in which the end user's emotional reactions were critical needed to rely on more of the identified principles and practices than those in which they were not. In addition, as shown in **Table 68**, all four principles appear beneficial to the overall success of projects in which hedonic requirements are considered critical, while the avoidance of all four consistently led to overall failure, as shown in **Table 72**. The separate and distinct sets of recommended practices, detailed in **Table 76**, offer simple, direct guidance to project managers on how to quickly and effectively tailor their managerial approach according to the criticality of hedonic requirements. These results also confirm the applicability of the recommended principles and practices to addressing hedonic requirements specifically, thus validating the results of this illustrative use of the Real-to-Real method.

Review of Results

The research conducted to verify and validate this illustrative use of the Real-to-Real method was shaped by four hypotheses, which addressed four research questions. With the results discussed above, a final review is now possible.

Review of Research Hypotheses

Four hypotheses were formed to design the methods of this study. Each is discussed in detail in Chapter Three, while conclusions based on the results of this study are provided below.

H1. A combination or combinations of the identified management principles and practices lead software development projects to meet or exceed predefined criteria for success across the measures of adherence to budget, adherence to schedule, delivery of expected scope, stakeholder satisfaction, and an aggregated score of overall project success.

- Effective combinations of the identified principles and practices which consistently resulted in success were identified for every measured project outcome. Hypothesis One is confirmed, and results are detailed in **Table 46** through **Table 76**.

H2. As the criticality of hedonic requirements increases, there is a corresponding decrease in the success of software development projects which do not adhere to that combination of principles and practices, across the measures of adherence to budget, adherence to schedule, delivery of expected scope, stakeholder satisfaction, and an aggregated score of overall project success.

- In the full set of project cases, there is a weak but statistically significant positive correlation between the perceived criticality of hedonic requirements and project success across all measures of success. These findings are presented in **Figure 17** through **Figure 21**. The recommended principles for overall success include Rigorous Project Approval for all project types and Benefits Management for projects with high levels of hedonic requirements specifically, as detailed in **Table 76**. As shown in **Figure 24**, in projects which did not adhere to the principle of Benefits Management, the correlation between hedonic requirements and overall success is no longer statistically significant and appears to have an inverse correlation. The number of such cases in the current dataset is insufficient to support any firm conclusion, however, so Hypothesis Two is <u>neither confirmed nor disconfirmed</u>.

H3. To consistently achieve a predefined level of success, projects that rate the criticality of hedonic requirements above a predetermined level must adhere to more of the identified principles and practices than projects with rates below this threshold.

- Hypothesis Three is <u>confirmed</u>, as detailed in **Table 76** and discussed in Chapter Four. Furthermore, as shown in **Table 68**, all four principles appear to be beneficial for projects in which hedonic requirements are critical to success, while the avoidance of all four consistently led to overall failure, as shown in **Table 72**.

H4. The Real-to-Real method enables the translation of domain-specific management practices between industries, leading to improved project outcomes in the target industry when the translated practices are applied to projects with characteristics similar to those in the source industry.

- The accuracy of translation was first verified through interviews with practitioners in both industries. The results are summarized in **Table 22** and **Table 27**. The benefits of these translated practices to software development projects with characteristics similar to film production – those which rated hedonic requirements as critical - were then empirically validated through twenty-eight iterations of fuzzy-set Qualitative Comparative Analysis, discussed in Chapter Four and detailed in **Table 46** through **Table 76**. Together, these findings <u>confirm</u> Hypothesis Four.

Review of Research Questions

The scope of this research was intended to address four initiating questions. Each is discussed in Chapter Three, and detailed results are presented in Chapter Four and discussed in Chapter Five. As a final review, each question and summarized findings are presented here.

R1. How do software development project outcomes differ as the criticality of hedonic requirements increases?

- Although prior research suggests that hedonic requirements are not well addressed by existing software development methodologies, this research found a consistent and statistically significant weak positive correlation between the perceived criticality of hedonic requirements and all five measures of project success. Although this appears to suggest that project outcomes improve as the level of hedonic requirements informing the system design increases, this appears both illogical and unlikely, given the normative-positivist conceptual approach of current software development methods. Instead, it is suggested that these findings merely further underscore the importance of hedonic requirements to success, and have found that project managers who understand that relationship and engage with such requirements lead projects more effectively and therefore report improved outcomes. Supporting this interpretation, Project Managers who reported that hedonic requirements were not critical to success also reported a higher percentage of failed projects and a lower percentage of successful projects, across every measure, as shown in **Figure 22** and **Figure 23**. They also reported lower adherence to all four project management principles, as shown in **Table 39**, suggesting a less active approach to project management in general. It therefore seems that the effective project management of software development involves consideration of hedonic requirements. It also appears that practitioners have outpaced the relevant literature, and may have developed effective methods for managing hedonic requirements that should be documented.

R2. What combination of the project management practices identified from the film industry are associated with improved project outcomes when used in software development projects?

- All four principles appear to be beneficial in projects with critical hedonic requirements, as shown in **Table 68**, while the avoidance of all four consistently led to failure, as shown in **Table 72**. Recommendations of specific practices supporting these principles vary according to the criticality of end user emotional reactions to the success of the system. These results are summarized in **Table 76** and discussed in Chapter Five.

R3. Do software development projects with differing levels of hedonic requirements benefit from different combinations of the identified practices?

- Yes, as noted above.

R4. Has the Real-to-Real process identified beneficial software development practices that mirror film production practices?

- Yes. Interviews with practitioners in both industries verified the accuracy of translation, and the benefits of the identified practices have now been empirically validated.

Research Results

Together, the findings reviewed above verify and validate the example use of the Real-to-Real method. The results of this illustrative example provide simple, heuristic guidance to software development teams on how to quickly and effectively tailor existing methodologies to better fit the criticality of hedonic requirements in each project. In addition, the success of this example is evidence that the method is suitable for repeated use in translating practitioner knowledge of *what works* and *what doesn't* between other domain pairings, and that there is substantial potential value in such inter-industry learning.

Implications for Theory and Practice

The results of this study provide intriguing suggestions for the software development industry, the film production industry, and the continued development of the generalized project management body of knowledge. This work provides clear, actionable guidance to practitioners in both fields, adds to existing theory, and highlights valuable opportunities for additional research.

Across the full set of 307 project cases developed through the practitioner survey, the principle of Benefits Management saw the strongest average adherence. Two of the practices supporting this principle were also the first- and third-highest utilized, out of the set of 16 considered by the survey. It is noteworthy, therefore, that another practice supporting Benefits Management, despite apparent simplicity and ease of adoption, saw the least average usage. Interviewed practitioners almost universally agreed this practice would support Benefits Management, and several specifically noted its appeal. Given the apparently widespread use of Benefits Management in the industry, it is therefore recommended that project teams select, in advance of development, overage thresholds that would trigger corrective action, such as a replanning session, if the project goes over budget or schedule.

Approximately 35% of the surveyed projects reported high adherence to the principle of Benefits Management, while only 25% indicated similar adherence to Rigorous Project Approval. This suggests that, at times, managerial rigor is only applied after project proposals are approved for production, and that decision-makers may not be subjecting themselves to the same standards applied to the rest of the time. While experienced practitioners may find this unsurprising, project management is most effective when applied early in the project, and no amount of effort may save a poorly conceived project from failure. Rigorous Project Approval was also determined to be a crucial element in the success of all software development projects, regardless of their level of hedonic requirements. It is recommended, therefore, that adherence to Rigorous Project Approval be increased, across the industry.

This research also attempted to empirically measure the effect of hedonic requirements, which specify the intended emotional response of the user, on software development project outcomes. As shown in **Figure 17** through **Figure 21** and discussed in Chapter Five, within the set of 307 software development project cases collected for this study, a weak but statistically significant positive correlation was found between project outcomes and the perceived criticality of hedonic requirements. This relationship is evident across the four measured outcomes of on-time completion, adherence to an estimated budget, the delivery of promised scope, and stakeholder satisfaction, each as rated by the project manager after project completion. It also holds true for the aggregate score of Overall Project Success, calculated as the average of these four measures.

It is noteworthy that the practitioner survey used in this study measured the project manager's perception of the criticality of hedonic requirements to project success, rather than attempting to more directly measure the number, type, or magnitude of such requirements. Project managers who perceived hedonic requirements as critical to success reported improved outcomes, across all measures, compared to those who did not. This pattern appears to underscore and confirm the importance of such requirements; it seems that only one of these groups correctly grasped their significance. Although these findings suggest that current software development management practices may adequately support hedonic requirements, it is recommended that project training programs and the documentation of the generalized body of knowledge be updated to reflect this significance more explicitly.

This research offers specific guidance to software development practitioners on tailoring their managerial approach to fit the criticality of hedonic requirements in each project. The practices detailed in **Table 76** consistently lead to overall success and represent key management methods for projects with high and low levels of such requirements. Further research into the mechanisms by which these practices address the challenge of hedonic requirements may be possible, and they are recommended for inclusion in project management training across the industry.

In addition, based on the review of film production literature and the interviews with experienced film producers conducted during this research, it appears that the management of film projects is formalized but not generalized. Although the industry encourages deep technical knowledge of existing *best practices*, exploration of novel techniques may be limited. Even experienced practitioners may seldom question the goals underlying industry-standard processes and artifacts. Additionally, references to the wider body of project management knowledge are rarely made within existing practitioner guides, potentially curtailing the consideration of alternative practices. As a result, process innovation appears infrequent within the film industry; more than one experienced film producer interviewed here opined that film industry production processes have remained largely unchanged 'for 100 years.'

To an outsider, the industry's longstanding adherence to these standardized processes seems to conflict with project outcomes within the industry. Approximately 95% of all film projects are canceled before entering production (Eliashberg, Hui and Zhang 2007). Among those that do proceed, nearly four out of five films fail to recover their production costs at the box office (De Vany and Walls 1999). Together, these measures suggest that only approximately 1% of film projects are ultimately profitable, although the landscape of the industry may have changed significantly since these earlier studies. While the exploration of specific alternative practices is beyond the scope of this research, examination of the generalized body of knowledge curated by the Project Management Institute (2021) may be helpful. Additionally, the Real-to-Real method proposed in this paper could also be used to examine and adapt management practices from other creative industries to film production.

Advances in generative AI made while this research was conducted may soon enable significant changes to both software development and film production. In both industries, projects that would have once required the complex planning, integration, and validation of multiple workstreams over extended periods may soon be simplified. In the near future, similar results may be possible through much smaller projects, or be trivially achievable. Despite these changes, large-scale software development will continue, potentially on a scale not currently possible. The recommended practices detailed in **Table 76** are likely to remain beneficial and relevant, even in projects which partially automate production though generative AI.

The findings discussed earlier also suggest that the Real-to-Real method could enable many projectized industries to draw valuable insights from practitioner expertise developed in other domains. It provides both practitioners and researchers with a structured, repeatable process for delving into other industries for inspiration. The work begun in this paper can be continued and extended by using the Real-to-Realm method to translate management practices between a broad range of additional industry pairs, beyond the film and software industries examined in this study.

Limitations of the Study

This study has several limitations that should be acknowledged. First, the holistic analysis of film production practices presented in Chapter Two was conducted from an outsider's perspective, and may have lacked the contextual insight of an experienced practitioner. Also, while each group of practitioners achieved a notable level of consensus, expanding the interview series to include a wider range of film producers and software development project managers may also have provided further insights. Similarly, increasing the number of project cases in the study may have revealed alternative beneficial combinations of the identified principles and practices. The practitioner survey also relied on self-reported data, which may suffer from response bias, particularly in the retrospective assessment of completed projects. Furthermore, project cases were sought from a limited cultural and linguistic context, and these results may not be generalizable to all software development teams globally. Also, as noted in Chapter Three, the available Qualitative Comparative Analysis software is unable to examine combinations with more than 10 causal elements, which required the use of aggregate measures aligning to each principle rather directly analyzing combinations involving all 16 identified practices. Lastly, this example use of the Real-to-Real method was restricted to the identification of existing software development practices, rather than exploring the construction of novel practices that might more closely mirror film production practices.

Suggestions for Future Research

Several other potentially valuable avenues for extending and enhancing this research are clear. Of perhaps primary relevance to researchers, the widespread agreement that consideration of the end-user's emotional reactions when using the software is critical to success appears to conflict with existing research. This suggests that practitioners in the industry have developed an understanding of these requirements, and perhaps methods and practices, not yet documented in the literature. Given the criticality of these types of requirements to the industry, reaffirmed by this research, it is suggested that this topic be further explored.

In addition, although this effort was limited to the selection of existing software development practices, future research could explore the development of novel practices which more closely parallel film production. For example, to more closely mirror the film industry's use of standardized project artifacts and roles, similarly standardized job titles and project records could be developed for use in the software development industry. The benefits of the resulting practices could then be measured in newly commissioned software development projects willing to experiment with tailored methodologies.

Although much of this research was predicated on a holistic overview of the selected source industry, a closer look at film production methods may also prove fruitful in managing hedonic requirements. For example, the intended emotional reaction of the viewer to each scene is likely first determined by the scriptwriter, then conveyed to the director and cast through discussion and reshaped during rehearsal. These intended audience reactions may also often be noted in the marginalia of the script, although perhaps not in any rigorously defined manner. Finally, during production, the director must then somehow confirm that each captured shot meets these emotional expectations before determining the *take* a success and moving on. Conventions within the industry for such elicitation, documentation, and validation of emotional requirements may allow the identification of parallel activities suitable for project management which prove even more beneficial than those identified in this research. Such a study would likely involve lengthy on-set research across multiple active film projects.

The illustrative use of the Real-to-Real method presented in Chapter Two could also be reversed, and used to translate software development practices to the domain of film production, possibly via the existing Agile Principles, which guide the management of many software projects (Highsmith and Cockburn 2001).

The method could also be used to translate practitioner experience of *what works* and *what doesn't* between many other industry pairs. For example, practices from the construction industry, where requirements may often be more predictable and estimable, may prove beneficial if translated for use in software development projects with low levels of hedonic requirements. The field of Model Based Systems Engineering may hold valuable insights for the film production industry, and the film production principles discussed in this work may also benefit multimedia projects combining film production with software development (Hannington and Reed 2007). Advances in the software available for Qualitative Comparative Analysis may also enable the consideration of more complex combinations of management practices.

In addition, it is noteworthy that available practitioner guides to film industry project management rarely reference the generalized project management concepts and terminology used in other industries (Rhyne 2008). The industry has proven to be a popular domain for scholars in marketing, new product development, and other areas, due to the public availability of project outcomes and other data (Eliashberg, 2006). Within the developing body of film production project management research, several attempts at mapping film production practices to the PMI's generalized phases, process groups, and knowledge areas have unfortunately yielded little consensus (Katsiris 2007, Rhyne 2008), however. While no such effort may prove definitive, a systematic review of film production project management literature incorporating a process of ontological meta-analysis and synthesis could help to identify industry topics that have been only lightly studied or entirely overlooked (Ramaprasad and Syn 2015, Tate, et al. 2015). Such a review might therefore help to identify fertile areas for future research.

As discussed in Chapter Five, many film production practices, which have long since been codified as *best practices* within the industry, appear to conflict with existing theory on the effective management of creative projects. For example, while the value of personal relationships greatly increases in fast-paced, dynamic projects (Joyce and McGee 1997), and management methods should grow increasingly flexible, the film industry has been described as "rigidly hierarchical (Introna, Cushman and Moore 2000)." This seems to contrast with current literature, which advises that egalitarian practices are more effective in Creative projects, and that complex projects involving highly knowledgeable team members should shift away from bureaucracy (Jain, Triandis and Weick 2010). This gap should be rigorously explored to determine if the literature should be updated, or whether the film industry may benefit from the experience of other projectized industries.

Final Remarks

I hope that the Real-To-Real method presented here sparks inspiration in other researchers who may be dissatisfied with their own industry's practices or are curious to explore lessons learned in others. While the standardized guidance and abstract frameworks available in the generalized body of knowledge serve to advance the theory of project management, the design and tailoring of project-specific processes and artifacts is frequently left to practitioners and, unfortunately, the devil is often in the details. Learning from the experience of others is always a *best practice*, and while opportunities near at hand may be convenient, the solutions to seemingly intractable problems may already exist further afield.

And now, unusually for an academic work, but in a nod to the film industry upon which much of this research is based:

THE END

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Appendix A: Mapping of Film Production Practices to Principles and Parallel Practices in Software Development (Hawkey and Vans 2024)

Table 77: *Mapping of Film Production Practices to Principles and Parallel Practices (1)*

<table>
<tr><th>Film Production Management Practices</th><th>Principles</th><th>Software Development Management Practices</th></tr>
<tr><td>Independent film projects often use the same job titles as union film projects.</td><td rowspan="4"><u>Expectation Clarity</u>
Enable team members to understand their own and others’ responsibilities, select suitable projects, and commit to roles in which they will excel.</td><td>Use standardized roles, titles, and responsibilities.</td></tr>
<tr><td>The financer, producer, and director formally commit to a film project in writing, with their key responsibilities clearly defined.</td><td>Define and document roles and responsibilities.</td></tr>
<tr><td>Apart from unexpected changes, cast duties, expectations, requirements, and schedule are clearly spelled out before they formally join the project.</td><td rowspan="2">Provide access to role and project details before hiring or assigning team members.</td></tr>
<tr><td>Unions and guilds, such as SAG-AFTRA, provide detailed descriptions of job roles and titles.</td></tr>
<tr><td>The greenlighting decision approves a proposed film project for production.</td><td rowspan="5"><u>Rigorous Project Approval</u>
Ensure the use of formal project approval decisions, based on detailed analysis, to authorize projects for full development.</td><td>Project approval (Go / No-Go decision) is a competitive and highly selective filter.</td></tr>
<tr><td>Greenlighting calls for detailed cost and benefit analysis.</td><td>Limit funding and staffing before project approval (Go / No-Go decision).</td></tr>
<tr><td rowspan="2">Many proposed films are never greenlit for production.</td><td>Use a formal project approval (Go / No-Go decision) process.</td></tr>
<tr><td>Centralize project approval (Go / No-Go) decision authority in a few key decision makers.</td></tr>
<tr><td>Very few individuals in each organization have the authority to greenlight a proposed project.</td><td>Conduct a detailed ROI analysis before project approval (Go / No-Go decision).</td></tr>
</table>

Table 78: *Mapping of Film Production Practices to Principles and Parallel Practices (2)*

Film Production Management Practices	Principles	Software Development Management Practices
During production, progress and expenses are reported daily or weekly.	**<u>Benefits Management</u>** Estimate, track, and report actual progress, spending, and outcomes.	Define overage thresholds that trigger corrective action when a project goes over budget or schedule.
Box office results and industry awards are widely reported in the media.		Report progress and expenses frequently.
Going over budget or over schedule is noticed quickly, and causes discussion and changes to the plan.		Conduct and publish a final accounting of expenses and delivered scope.
Projects end with a financial audit by a third party.		Measure and report actual delivered benefits.
The *script breakdown* turns the script into call sheets, shooting schedules, location lists, and others.	**<u>Linked Boundary Objects</u>** Improve communication and collaboration by using a set of standardized documents and by tracking revisions.	Use formal change control for key project artifacts.
Changes to the script are printed on new colors of paper.		Use standardized project templates.
Scripts all use the same formatting.		Follow a defined process to propagate changes approved to one artifact to other artifacts.
All film projects use a set of documents that are familiar to the cast and crew, such as call sheets, shooting schedules, production reports, etc.		Facilitate collaboration by deriving supporting artifacts, such as mockups, from a detailed scope statement.

Appendix B: Software Development Project Manager Survey Statements

Table 79: *Software Development Project Manager Survey Statements*

#	Statement
1	The project was completed on schedule.
2	The project was completed within or below budget.
3	The project delivered promised features and scope.
4	Project stakeholders were satisfied with the results of the project.
5	It was critical to project success that the end user experienced or avoided specific emotional reactions while using the software, such as satisfaction, security, frustration, or fear.
6	We used standardized roles, titles, and responsibilities.
7	We defined and documented our roles and responsibilities.
8	We provided access to role and project details before hiring or assigning team members to the project.
9	Our project approval process was competitive, ensuring that only the most promising proposals were approved for production.
10	Our funding and staffing were limited until we received the project approval decision.
11	We used a formal project approval process.
12	The authority to approve our project for production was restricted to a select group of designated decision makers.
13	We carefully conducted a detailed estimation of the project's expenses, duration, and expected benefits before the project was approved.
14	Before starting development, we defined specific overage thresholds that would trigger correction actions, such as a replanning session, if the project went over budget or schedule.
15	We reported regular and frequent updates on the project's progress and expenses.
16	We conducted and published a final accounting of expenses and delivered scope.
17	We measured and reported actual delivered benefits.
18	We used formal change control for key project artifacts, such as UI mockups, architecture diagrams, design documents, or similar project records.
19	We used standardized templates for project management processes, such as Story Cards, forms for capturing requirements, architectural diagrams, or similar project records.
20	We had a clear process to update all related project documents when changes were made to one document (for example, when a UI mockup changed, matching updates were made to architecture diagrams and test cases).
21	We developed a set of interconnected project documents, such as mockups and architecture diagrams, based on detailed scope statement, to facilitate collaboration across project teams and stakeholders.

Appendix C: Reduced Truth Tables Resulting from Fuzzy-Set Qualitative Comparative Analysis

The iterative process of fuzzy-set Qualitative Comparative Analysis shown in **Figure 6** produced, as an intermediate step, a set of truth tables. Each truth table was generated using specialized QCA software developed by Ragin and Davey (2022), and lists possible combinations of causal elements. For each combination, the *number* column indicates the number of occurrences within the data set. *Raw Consistency* describes the proportion of cases that display the desired outcome. *PRI Consistency* and *SYM Consistency* are offered as alternative measures (Ragin 2018). Truth tables represent an important step in the analysis, and should always be presented wherever possible (Kent 2008). Doing so increases the validity of the resulting intermediate solutions presented in Chapter Four, and strengthens the rigor of the analytic process (Pappas and Woodside 2021).

During the data calibration process, 0.001 was added to all causal conditions, as is generally recommended (Fiss 2011, Pappas and Woodside 2021). Then, aligning with the 7-point scale resulting from the practitioner survey described in Chapter Three, 6 was used as the minimum threshold for full membership, 2 as the maximum threshold for full non-membership, and 4 as the crossover point of maximum ambiguity when calculating each membership score (Park and Fiss 2020). Using the resulting data, truth tables were constructed including every possible combination of the film industry principles detailed in **Table 7**, for all five measures of project success. This set of five tables was developed separately for the sets of *High* and *Low Hedonic* project cases, as described in Chapter Three. Then, after the most beneficial combination of principles was identified for each set of cases and each project outcome, this process was repeated using all identified practices supporting those principles. This process was then repeated, seeking to identify combinations of principles and practices that consistently led to failure, separately across all measures of success, and for the sets of *High* and *Low Hedonic* cases.

Unfortunately, technical limitations within the available software limit analysis to ten causal conditions, which prevented this more detailed analysis of practices when the most beneficial combination of principles included more than two elements. In other instances, no combination of principles was found meeting the thresholds for consistency and coverage. This analysis resulted in 28 truth tables.

To comply with the formatting requirements of the software, each project outcome, film industry principle, and software development practice was abbreviated during this analysis, as presented in tables **Table 80**, **Table 81**, and **Table 82**, respectively.

Before continuing to the analysis of intermediate and parsimonious solutions, as described in Chapter Three and presented in Chapter Four, each truth table was first reduced. Only combinations occurring more than twice within the dataset, and with a consistency of 0.80 or higher were retained, as recommended (Kent 2008, Ragin 2018). These reduced truth tables are presented in **Table 83** through **Table 110**. Due to limitations on table width, combinations in each table with the lowest consistency scores have been omitted where necessary.

Table 80: *Abbreviations of Project Outcomes Used in fsQCA*

Project Outcome	fsQCA Software Abbreviation
On-Time Completion	POSCHD
Adherence to Estimated Budget	POBUGT
Delivery of Promised Scope	POSCOP
Stakeholder Satisfaction	POSSAT
Overall Project Success	PRJSUC

Table 81: *Abbreviations of Film Industry Principles Used in fsQCA*

Film Industry Principle	fsQCA Software Abbreviation
Expectation Clarity	EXPCLAR
Rigorous Project Approval	RIGAPP
Benefits Management	BENMAN
Linked Boundary Objects	BNDOBJ

Table 82: *Abbreviations of Software Development Practices Used in fsQCA*

Film Industry Principle	Software Development Project Management Practices	fsQCA Software Abbreviation
Expectation Clarity	Use standardized roles, titles, and responsibilities.	ECSRAR
	Define and document roles and responsibilities.	ECDDRR
	Provide access to role and project details before hiring or assigning team members.	ECFTTF
Rigorous Project Approval	Project approval (Go / No-Go decision) is a competitive and highly selective filter.	RAFILT
	Limit funding and staffing before project approval (Go / No-Go decision).	RAREST
	Use a formal project approval (Go / No-Go decision) process.	RAFPAP
	Centralize project approval (Go / No-Go) decision authority in a few key decision makers.	RACENT
	Conduct a detailed ROI analysis before project approval (Go / No-Go decision).	RAROIA
Benefits Management	Define overage thresholds that trigger corrective action when a project goes over budget or schedule.	BMOVTH
	Report progress and expenses frequently.	BMFREQ
	Conduct and publish a final accounting of expenses and delivered scope.	FMAUDT
	Measure and report actual delivered benefits.	BMABEN
Linked Boundary Objects	Use formal change control for key project artifacts.	BOFCCP
	Use standardized project templates.	BOTEMP
	Follow a defined process to propagate changes approved to one artifact to other artifacts.	BOPROP
	Facilitate collaboration by deriving supporting artifacts, such as mockups, from a detailed scope statement.	BOBRKD

Table 83: *fsQCA Truth Table: On-time Completion - Principles* - Low Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	POSCHD	raw consist.	PRI consist.	SYM consist
1	1	0	1	3	0	0.67	0.38	0.38
1	0	1	1	4	0	0.65	0.31	0.31
1	1	0	0	2	0	0.55	0.15	0.15
1	1	1	1	12	0	0.52	0.29	0.30
0	1	1	1	3	0	0.52	0.07	0.07
1	0	0	0	2	0	0.51	0.04	0.04
0	0	0	0	2	0	0.46	0.00	0.00
0	1	1	0	2	0	0.41	0.02	0.02

Table 84*: fsQCA Truth Table: On-time Completion - Principles* - High Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	POSCHD	raw consist.	PRI consist.	SYM consist
1	1	0	0	2	1	0.82	0.60	0.60
1	1	1	0	5	1	0.81	0.60	0.60
1	0	1	1	4	0	0.78	0.59	0.59
0	1	1	1	9	0	0.77	0.60	0.62
1	1	1	1	93	0	0.76	0.70	0.75
0	1	1	0	3	0	0.73	0.38	0.38
0	1	0	0	3	0	0.72	0.39	0.39
0	0	0	0	2	0	0.69	0.35	0.36
0	0	0	1	3	0	0.68	0.33	0.33

Table 85: *fsQCA Truth Table: On-time Completion - Practices* - High Hedonic

ECSRAR	0	1	1	1	1	1	1	1	1	1	0	0
ECDDRR	1	1	1	1	0	1	1	1	1	1	0	0
ECFTTF	1	1	1	1	0	0	1	0	1	1	0	0
RAFILT	1	1	1	1	1	1	0	0	0	1	0	0
RAREST	1	1	1	0	1	1	0	0	1	1	1	0
RAFPAP	1	0	1	1	1	1	1	1	1	1	1	0
RACENT	1	0	0	1	1	1	1	1	1	1	1	1
RAROIA	1	1	1	1	1	1	1	1	1	1	0	0
number	2	2	6	9	3	9	3	2	4	59	3	2
POSCHD	1	1	1	1	1	1	1	1	1	0	0	0
raw consist.	0.96	0.94	0.89	0.88	0.87	0.86	0.86	0.84	0.84	0.80	0.74	0.71
PRI consist.	0.91	0.84	0.79	0.78	0.65	0.71	0.41	0.54	0.65	0.73	0.17	0.17
SYM consist	0.91	0.84	0.79	0.81	0.71	0.71	0.53	0.54	0.65	0.79	0.17	0.17

Table 86: *fsQCA Truth Table: Failure to Deliver on Time - Principles* - Low Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	~POSCHD	raw consist.	PRI consist.	SYM consist
0	0	0	0	2	1	1	1	1
0	1	1	0	2	1	0.99	0.98	0.98
1	0	0	0	2	1	0.98	0.96	0.96
0	1	1	1	3	1	0.95	0.89	0.93
1	1	0	0	2	1	0.92	0.85	0.85
1	0	1	1	4	1	0.85	0.69	0.69
1	1	0	1	3	0	0.80	0.62	0.62
1	1	1	1	12	0	0.78	0.67	0.70

Table 87: *fsQCA Truth Table: Failure to Deliver on Time - Principles* - High Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	~POSCHD	raw consist.	PRI consist.	SYM consist
0	0	0	1	3	1	0.84	0.67	0.67
0	1	1	0	3	1	0.83	0.60	0.62
0	0	0	0	2	1	0.82	0.62	0.64
0	1	0	0	3	1	0.82	0.61	0.61
1	1	0	0	2	0	0.73	0.40	0.40
1	1	1	0	5	0	0.71	0.39	0.40
1	0	1	1	4	0	0.69	0.41	0.41
0	1	1	1	9	0	0.63	0.36	0.38
1	1	1	1	93	0	0.39	0.24	0.25

Table 88: *fsQCA Truth Table: Failure to Deliver on Time - Practices* - Low Hedonic

ECSRAR	ECDDRR	ECFTTF	number	~FPOSCHD	raw consist.	PRI consist.	SYM consist
1	0	0	5	1	0.86	0.80	0.80
1	1	0	11	0	0.79	0.70	0.80
1	1	1	15	0	0.64	0.55	0.60

Table 89: *fsQCA Truth Table: Failure to Deliver on Time - Practices* - High Hedonic

ECSRAR	0	0	0	1	1	1	0	1	1	1	1
ECDDRR	0	0	0	1	1	1	0	0	1	1	1
ECFTTF	0	0	0	1	1	0	1	0	1	0	1
BOFCCP	0	0	1	0	0	0	1	1	1	1	1
BOTEMP	0	0	1	0	0	0	1	1	0	1	1
BOPROP	0	0	1	0	1	0	1	1	1	1	1
BOBRKD	1	0	1	0	1	0	1	1	1	1	1
number	2	2	2	3	2	3	2	2	3	8	74
~POSCHD	1	1	1	0	0	0	0	0	0	0	0
raw consist.	0.99	0.91	0.82	0.76	0.76	0.76	0.74	0.72	0.69	0.61	0.41
PRI consist.	0.97	0.73	0.35	0.26	0.32	0.32	0.37	0.37	0.35	0.25	0.24
SYM consist	0.97	0.91	0.35	0.30	0.32	0.32	0.37	0.37	0.35	0.25	0.26

Table 90: *fsQCA Truth Table: Delivery Within Budget - Principles* - Low Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	POBUGT	raw consist.	PRI consist.	SYM consist
0	0	0	0	2	0	0.73	0.55	0.55
1	1	0	0	2	0	0.65	0.42	0.42
1	1	0	1	3	0	0.61	0.31	0.31
1	0	0	0	2	0	0.59	0.34	0.34
1	0	1	1	4	0	0.59	0.17	0.18
0	1	1	0	2	0	0.56	0.22	0.22
1	1	1	1	12	0	0.55	0.38	0.39
0	1	1	1	3	0	0.54	0.18	0.18

Table 91: *fsQCA Truth Table: Delivery Within Budget - Principles* - High Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	POBUGT	raw consist.	PRI consist.	SYM consist
1	1	0	0	2	1	0.86	0.67	0.67
1	1	1	0	5	1	0.85	0.70	0.71
0	1	1	0	3	1	0.85	0.65	0.65
0	1	0	0	3	1	0.84	0.66	0.66
1	0	1	1	4	1	0.80	0.61	0.62
0	1	1	1	9	0	0.80	0.66	0.66
1	1	1	1	93	0	0.78	0.73	0.77
0	0	0	1	3	0	0.75	0.43	0.45
0	0	0	0	2	0	0.72	0.43	0.43

Table 92: *fsQCA Truth Table: Failure to Deliver Within Budget - Principles* - Low Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	~POBUGT	raw consist.	PRI consist.	SYM consist
0	1	1	1	3	1	0.90	0.82	0.82
1	0	1	1	4	1	0.89	0.79	0.82
0	1	1	0	2	1	0.88	0.78	0.78
1	1	0	1	3	1	0.83	0.69	0.69
1	0	0	0	2	0	0.79	0.66	0.66
1	1	0	0	2	0	0.75	0.58	0.58
1	1	1	1	12	0	0.71	0.60	0.61
0	0	0	0	2	0	0.66	0.45	0.45

Table 93: *fsQCA Truth Table: Failure to Deliver Within Budget - Principles* – High Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	~POBUGT	raw consist.	PRI consist.	SYM consist
0	0	0	1	3	0	0.79	0.53	0.55
0	0	0	0	2	0	0.79	0.57	0.57
0	1	1	0	3	0	0.72	0.35	0.35
1	1	0	0	2	0	0.71	0.33	0.33
0	1	0	0	3	0	0.69	0.34	0.34
1	0	1	1	4	0	0.69	0.38	0.38
1	1	1	0	5	0	0.64	0.29	0.29
0	1	1	1	9	0	0.61	0.34	0.34
1	1	1	1	93	0	0.36	0.21	0.23

Table 94: *fsQCA Truth Table: Failure to Deliver Within Budget - Practices* - Low Hedonic

ECSRAR	1	1	1
ECDDRR	1	1	1
ECFTTF	0	1	1
RAFILT	0	1	1
RAREST	1	1	0
RAFPAP	1	1	1
RACENT	1	1	1
RAROIA	1	1	1
number	3	5	3
~POBUGT	1	0	0
raw consist.	0.97	0.67	0.56
PRI consist.	0.94	0.57	0.35
SYM consist	0.94	0.57	0.35

Table 95: *fsQCA Truth Table: Delivery of Promised Scope - Principles* - Low Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	POSCOP	raw consist.	PRI consist.	SYM consist
1	1	0	0	2	1	0.96	0.93	0.93
1	1	1	1	12	1	0.94	0.92	0.94
1	0	1	1	4	1	0.91	0.83	0.83
1	1	0	1	3	1	0.91	0.84	0.88
1	0	0	0	2	1	0.88	0.78	0.78
0	1	1	0	2	1	0.85	0.72	0.79
0	0	0	0	2	1	0.84	0.70	0.70
0	1	1	1	3	1	0.83	0.70	0.70

Table 96: *fsQCA Truth Table: Delivery of Promised Scope - Principles* - High Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	POSCOP	raw consist.	PRI consist.	SYM consist
1	1	1	0	5	1	0.97	0.95	0.95
0	0	0	1	3	1	0.96	0.91	0.95
1	1	0	0	2	1	0.95	0.91	0.91
1	0	1	1	4	1	0.95	0.92	0.92
1	1	1	1	93	1	0.95	0.94	0.96
0	1	1	1	9	1	0.93	0.90	0.91
0	1	1	0	3	1	0.92	0.84	0.84
0	0	0	0	2	1	0.90	0.79	0.79
0	1	0	0	3	1	0.88	0.77	0.77

Table 97: *fsQCA Truth Table: Delivery of Promised Scope - Practices* - High Hedonic

RAFILT	1	1	1	1	0	0	0	1	1	1	1	0	1
RAREST	1	1	1	1	1	0	0	1	1	0	1	1	0
RAFPAP	1	1	1	0	0	1	1	1	1	1	1	1	1
RACENT	1	1	1	0	1	1	1	1	1	1	1	1	1
RAROIA	1	1	0	1	1	1	1	1	1	1	1	1	1
BMOVTH	1	0	0	1	1	1	0	1	1	1	0	1	0
BMFREQ	1	1	1	1	1	1	1	1	1	1	1	1	1
BMAUDT	0	0	1	1	1	1	1	1	1	1	1	1	1
BMABEN	1	1	1	1	1	1	1	0	1	1	1	1	1
number	6	2	2	2	2	3	2	3	52	8	9	4	2
POSCOP	1	1	1	1	1	1	1	1	1	1	1	1	1
raw consist.	1.00	1.00	1.00	1.00	1.00	0.99	0.98	0.98	0.98	0.97	0.97	0.96	0.95
PRI consist.	1.00	1.00	1.00	1.00	1.00	0.97	0.96	0.96	0.97	0.96	0.95	0.93	0.88
SYM consist	1.00	1.00	1.00	1.00	1.00	0.97	0.96	0.96	0.98	0.96	0.95	0.93	0.88

Table 98: *fsQCA Truth Table: Failure to Deliver Promised Scope - Principles* - Low Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	~POSCOP	raw consist.	PRI consist.	SYM consist
0	0	0	0	2	0	0.63	0.30	0.30
0	1	1	1	3	0	0.62	0.30	0.30
1	0	0	0	2	0	0.60	0.22	0.22
0	1	1	0	2	0	0.57	0.19	0.21
1	0	1	1	4	0	0.57	0.17	0.17
1	1	0	1	3	0	0.51	0.12	0.12
1	1	0	0	2	0	0.49	0.07	0.07
1	1	1	1	12	0	0.34	0.05	0.06

Table 99: *fsQCA Truth Table: Failure to Deliver Promised Scope - Principles* – High Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	~POSCOP	raw consist.	PRI consist.	SYM consist
0	1	0	0	3	0	0.62	0.23	0.23
0	0	0	0	2	0	0.61	0.21	0.21
0	1	1	0	3	0	0.57	0.16	0.16
1	1	0	0	2	0	0.54	0.09	0.09
0	0	0	1	3	0	0.54	0.05	0.05
1	0	1	1	4	0	0.42	0.08	0.08
1	1	1	0	5	0	0.41	0.05	0.05
0	1	1	1	9	0	0.37	0.09	0.09
1	1	1	1	93	0	0.15	0.04	0.04

Table 100: *fsQCA Truth Table: Stakeholder Satisfaction - Principles* – Low Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	POSSAT	raw consist.	PRI consist.	SYM consist
1	1	0	1	3	1	0.98	0.97	0.97
1	0	1	1	4	1	0.98	0.96	0.96
1	1	1	1	12	1	0.97	0.95	0.98
1	1	0	0	2	1	0.92	0.83	0.83
0	1	1	0	2	1	0.91	0.84	0.84
0	1	1	1	3	1	0.88	0.79	0.79
0	0	0	0	2	1	0.86	0.74	0.74
1	0	0	0	2	1	0.85	0.66	0.72

Table 101: *fsQCA Truth Table: Stakeholder Satisfaction - Principles* - High Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	POSSAT	raw consist.	PRI consist.	SYM consist
1	1	1	1	93	1	0.96	0.96	0.97
1	0	1	1	4	1	0.95	0.91	0.91
0	0	0	0	2	1	0.94	0.87	0.87
0	1	1	1	9	1	0.94	0.90	0.91
0	0	0	1	3	1	0.93	0.84	0.84
1	1	0	0	2	1	0.93	0.84	0.84
1	1	1	0	5	1	0.91	0.85	0.86
0	1	1	0	3	1	0.91	0.81	0.81
0	1	0	0	3	1	0.90	0.79	0.79

Table 102: *fsQCA Truth Table: Failure to Satisfy Stakeholders - Principles* - Low Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	~POSSAT	raw consist.	PRI consist.	SYM consist
1	0	0	0	2	0	0.66	0.26	0.28
0	0	0	0	2	0	0.61	0.26	0.26
1	1	0	0	2	0	0.59	0.17	0.17
0	1	1	1	3	0	0.54	0.21	0.21
0	1	1	0	2	0	0.53	0.16	0.16
1	1	0	1	3	0	0.51	0.03	0.03
1	0	1	1	4	0	0.47	0.04	0.04
1	1	1	1	12	0	0.30	0.02	0.02

Table 103: *fsQCA Truth Table: Failure to Satisfy Stakeholders - Principles* - High Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	~POSSAT	raw consist.	PRI consist.	SYM consist
0	0	0	1	3	0	0.65	0.16	0.16
0	1	0	0	3	0	0.64	0.21	0.21
1	1	0	0	2	0	0.62	0.16	0.16
0	1	1	0	3	0	0.62	0.19	0.19
0	0	0	0	2	0	0.61	0.13	0.13
1	1	1	0	5	0	0.49	0.14	0.14
1	0	1	1	4	0	0.44	0.09	0.09
0	1	1	1	9	0	0.41	0.09	0.09
1	1	1	1	93	0	0.15	0.03	0.03

Table 104: *fsQCA Truth Table: Overall Project Success - Principle* - Low Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	PRJSUC	raw consist.	PRI consist.	SYM consist
1	1	0	1	3	1	0.90	0.71	0.71
1	1	0	0	2	1	0.88	0.52	0.56
1	0	1	1	4	1	0.87	0.58	0.58
0	1	1	1	3	1	0.87	0.42	0.43
0	0	0	0	2	1	0.87	0.53	0.58
1	1	1	1	12	1	0.83	0.64	0.73
0	1	1	0	2	1	0.80	0.18	0.29
1	0	0	0	2	0	0.80	0.21	0.21

Table 105: *fsQCA Truth Table: Overall Project Success - Principles* - High Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	PRJSUC	raw consist.	PRI consist.	SYM consist
1	1	0	0	2	1	0.96	0.87	0.87
1	1	1	0	5	1	0.95	0.87	0.87
0	1	0	0	3	1	0.93	0.73	0.73
1	0	1	1	4	1	0.93	0.84	0.84
0	1	1	1	9	1	0.93	0.86	0.86
0	1	1	0	3	1	0.92	0.71	0.72
1	1	1	1	93	1	0.91	0.88	0.94
0	0	0	0	2	1	0.88	0.55	0.60
0	0	0	1	3	1	0.88	0.59	0.59

Table 106: *fsQCA Truth Table: Overall Project Success - Practices* - Low Hedonic

RAFILT	1	1	0	0	1	0
RAREST	0	0	1	0	1	0
RAFPAP	1	0	1	1	1	1
RACENT	1	1	1	1	1	1
RAROIA	1	0	1	1	1	0
number	3	2	4	3	8	2
PRJSUC	1	1	1	0	0	0
raw consist.	0.91	0.85	0.81	0.78	0.75	0.59
PRI consist.	0.83	0.60	0.55	0.36	0.49	0.05
SYM consist	0.83	0.74	0.70	0.46	0.63	0.06

Table 107: *fsQCA Truth Table: Overall Project Success - Practices* - High Hedonic

RAFILT	1	1	1	1	0	1	1	0	1	1	1	0	1
RAREST	0	1	1	1	0	1	0	0	1	1	1	1	1
RAFPAP	1	0	1	1	1	1	1	1	1	1	1	1	1
RACENT	1	0	1	1	1	1	1	1	0	1	1	1	1
RAROIA	1	1	1	1	1	1	1	1	1	1	1	1	1
BMOVTH	0	1	0	1	0	1	1	1	1	1	0	1	0
BMFREQ	1	1	1	1	1	1	1	1	1	1	1	1	1
BMAUDT	1	1	0	0	1	1	1	1	1	1	1	1	1
BMABEN	1	1	1	1	1	0	1	1	1	1	1	1	0
number	2	2	2	6	2	3	8	3	4	52	9	4	2
PRJSUC	1	1	1	1	1	1	1	1	1	1	1	1	1
raw consist.	1.00	1.00	0.99	0.98	0.98	0.98	0.97	0.97	0.96	0.94	0.94	0.94	0.93
PRI consist.	1.00	1.00	0.97	0.95	0.91	0.91	0.95	0.90	0.89	0.92	0.89	0.85	0.64
SYM consist	1.00	1.00	0.97	0.95	0.91	0.93	0.98	1.00	1.00	0.98	0.91	0.85	0.64

Table 108: *fsQCA Truth Table: Overall Project Failure - Principles* - Low Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	~PRJSUC	raw consist.	PRI consist.	SYM consist
1	0	0	0	2	1	0.95	0.79	0.79
0	1	1	1	3	1	0.90	0.56	0.57
0	1	1	0	2	1	0.87	0.44	0.71
1	1	0	0	2	1	0.86	0.41	0.44
0	0	0	0	2	1	0.83	0.39	0.42
1	0	1	1	4	1	0.82	0.42	0.42
1	1	0	1	3	0	0.75	0.29	0.29
1	1	1	1	12	0	0.64	0.24	0.27

Table 109: *fsQCA Truth Table: Overall Project Failure - Principles* - High Hedonic

EXPCLAR	RIGAPP	BENMAN	BNDOBJ	number	~PRJSUC	raw consist.	PRI consist.	SYM consist
0	0	0	0	2	1	0.83	0.36	0.40
0	0	0	1	3	1	0.82	0.41	0.41
0	1	0	0	3	1	0.81	0.27	0.27
0	1	1	0	3	0	0.79	0.27	0.28
1	1	0	0	2	0	0.74	0.13	0.13
1	1	1	0	5	0	0.64	0.13	0.13
1	0	1	1	4	0	0.63	0.16	0.16
0	1	1	1	9	0	0.54	0.14	0.14
1	1	1	1	93	0	0.26	0.05	0.06

Table 110: *fsQCA Truth Table: Overall Project Failure - Practices* - Low Hedonic

ECSRAR	ECDDRR	ECFTTF	number	~PRJSUC	raw consist.	PRI consist.	SYM consist
1	0	0	5	0	0.71	0.31	0.35
1	1	0	11	0	0.70	0.36	0.55
1	1	1	15	0	0.46	0.21	0.24