

THESIS

PROJECT-LEVEL CASH FLOW MANAGEMENT IN ELECTRICAL  
SUBCONTRACTING: AN INTEGRATED BEHAVIORAL-STRATEGIC  
FRAMEWORK FOR CAUSES, STRATEGIES, AND TRAINING

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## ABSTRACT

### PROJECT-LEVEL CASH FLOW MANAGEMENT IN ELECTRICAL SUBCONTRACTING: AN INTEGRATED BEHAVIORAL-STRATEGIC FRAMEWORK FOR CAUSES, STRATEGIES, AND TRAINING

Project-level cash flow management is one of the most critical challenges in electrical subcontracting, where firms operate under tight billing cycles, high material costs, and structural payment vulnerabilities. Prior research has remained fragmented and disconnected from the behavioral patterns and training needs that drive financial performance. This study addresses that gap through a three-phase mixed-methods design involving 34 NECA member electrical contractors. Phase 1 applied inductive thematic analysis to identify seven causes of lengthy accounts receivable, five internal behaviors, seven external behaviors, and 47 managerial strategies. Phase 2 employed a Delphi expert rating process in which 27 panelists evaluated each strategy on a 100-point scale, identifying two Highly Effective and thirteen Effective strategies among others, with reliability confirmed through Cronbach's alpha of 0.93, Kendall's W of 0.115 ( $p < 0.001$ ), and mean Spearman correlation of 0.348. Phase 3 generated 12 training themes organized into four modules structured using Bloom's Revised Taxonomy. The findings were synthesized into a behavioral-strategic mapping framework connecting causes, behaviors, strategies, and training needs across five thematic clusters. The study contributes the first expert-consensus strategy ranking, the first practitioner-derived financial training framework, and the first integrated behavioral-strategic mapping framework tailored to electrical subcontracting.

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## CHAPTER 1: INTRODUCTION

### 1.1. Introduction

The construction industry is one of the most financially complex and high-risk sectors of the global economy, characterized by long project durations, significant upfront capital requirements, and a multi-tiered payment chain that creates persistent liquidity challenges for firms at every level (Koopman & Cumberlege, 2021). At the center of these challenges is cash flow defined as the balance between cash received and cash paid over a given period which is widely regarded as the lifeblood of construction firms and the single most critical determinant of their financial survival (Navon, 1996). Research consistently demonstrates that more construction companies fail due to insufficient liquidity than due to any other cause, with cash flow related challenges accounting for approximately 83% of all construction company failures (Mutti & Hughes, 2002).

Within the construction payment chain, subcontractors occupy a particularly vulnerable position. They contribute between 80% and 90% of total project work yet are structurally dependent on the payment practices of owners and general contractors who control the flow of funds (Ghali, 2023; Lucko, 2016). This dependency is institutionalized through contractual mechanisms such as pay-when-paid clauses, retainage withholding, and extended payment terms that routinely expose subcontractors to payment cycles of 60 to 90 days or longer (Cunningham, 2013). Among subcontractors, electrical contractors face particularly acute cash flow challenges due to their high material intensity and with procurement costs exceeding 50% of direct project costs combined with complex billing requirements, frequent change orders, and the timing mismatch

between front-loaded expenditures and back-loaded payment receipts (Ghali, 2023; Lucko, 2016).

While prior research has identified causes of poor cash flow and proposed managerial strategies, it remains fragmented and largely generic (Akinsiku & Ajayi, 2016; Odeyinka et al., 2003; Shash & Qarra, 2018). Causes are examined in isolation, behavioral drivers are addressed separately from their managerial responses, and no study has developed a validated, consensus-based set of strategies tailored specifically to electrical subcontractors. A detailed discussion of the research gap and problem statement is presented at the conclusion of Chapter 2. This study addresses these gaps by developing a comprehensive, behavior-oriented understanding of project-level cash flow management in electrical subcontracting, guided by five research questions:

- **RQ1:** What are the primary causes of project-level cash flow challenges and lengthy accounts receivable in the electrical subcontracting industry?
- **RQ2:** What internal organizational behaviors contribute to project-level cash flow problems in electrical subcontracting firms?
- **RQ3:** What external stakeholder behaviors exacerbate project-level cash flow challenges for electrical subcontractors?
- **RQ4:** What managerial strategies are perceived as most effective by industry experts in improving project-level cash flow performance in electrical subcontracting?
- **RQ5:** What principles should inform the development of a project-level cash flow training framework for electrical contractors?

This study makes four contributions to the body of knowledge. First, it provides the first practitioner-validated account of how causes, internal behaviors, and external behaviors interact within the electrical subcontracting context. Second, it produces the first expert-consensus ranking of cash flow improvement strategies for this industry using a structured Delphi methodology. Third, it develops the first practitioner-derived financial training framework for electrical subcontracting structured using Bloom's Revised Taxonomy. Fourth, it introduces a behavioral-strategic mapping framework that connects causes, behaviors, strategies, and training into a coherent practice-oriented model addressing the fragmentation that has characterized prior research.

This dissertation is organized into six chapters. Chapter 2 reviews the existing literature on cash flow in construction, causes of problems, behavioral drivers, and managerial strategies. Chapter 3 describes the three-phase research methodology. Chapter 4 presents the results across all five research questions. Chapter 5 discusses the findings and presents the behavioral-strategic mapping framework. Chapter 6 concludes with recommendations for practice and future research.

## CHAPTER 2: LITERATURE REVIEW

This chapter presents a comprehensive review of existing literature on project-level cash flow management in the construction industry, with particular focus on the operational and financial realities of electrical subcontracting. The review is organized to build progressively from foundational concepts to industry-specific challenges, establishing the theoretical and empirical context within which this study's research questions are situated.

The chapter begins by defining cash flow in the construction context and examining its critical role in organizational survival and financial stability. It then explores the causes of cash flow problems across the project life cycle, from pre-contract planning through execution, billing, and external macroeconomic influences, providing a structured understanding of where and how financial vulnerabilities emerge. The behavioral dimension of cash flow management is then examined, distinguishing between internal managerial behaviors and external stakeholder behaviors that amplify cash flow problems beyond their structural causes. The chapter subsequently narrows its focus to the subcontracting context, examining the structural position of subcontractors within the payment chain and the specific operational complexities that make electrical subcontractors particularly vulnerable to cash flow challenges. Finally, the chapter reviews the managerial strategies proposed in existing literature for improving cash flow performance, identifying both their contributions and their limitations as a foundation for the empirical work undertaken in this study. The chapter concludes with a problem statement that synthesizes the identified gaps and establishes the objectives and research questions guiding the study

## **2.1. Cash Flow in Construction**

Cash flow in the construction industry is defined as the balance between the amounts of cash received and paid by a business over a specific period, often associated with a particular project (Koopman & Cumberlege, 2021). It is widely regarded as the “lifeblood” and one of the most critical resources for construction firms. Its importance is further amplified by the long duration of construction projects, which typically require substantial capital outlays over extended periods (Koopman & Cumberlege, 2021). At the project level, cash flow represents the complete record of all cash disbursements and earnings generated throughout project execution (H. K. Park, Han, & Russell, 2005). Within construction literature, it is more specifically described as the difference between income inflows and expense outflows, including overhead costs (Navon, 1996). While a firm may sustain operations for a limited period without generating profit, or even while incurring losses, it cannot survive without sufficient liquidity. A lack of cash can lead to failure even when a project shows a positive financial balance (Navon, 1996; H. K. Park et al., 2005). This underscores the critical role of effective cash flow management in ensuring long-term organizational sustainability (Navon, 1996).

An effective cash flow management system also enhances a company’s credibility with potential financing sources (Navon, 1996). It signals that liquidity requirements are anticipated, temporary, and manageable, thereby increasing lenders’ confidence and willingness to provide financing at lower costs (Navon, 1996). Conversely, significant fluctuations in cash flow can elevate the perceived risk for lenders, leading to higher external financing costs and, ultimately, increasing the overall cost of the project (Mohagheghi, Mousavi, & Vahdani, 2017).

A construction company’s success is closely tied to its ability to maintain liquidity, defined as the availability of cash to support daily operational activities (Navon, 1996; H. K. Park et al., 2005).

A critical insight emphasized in construction literature is that profitability does not guarantee survival (Navon, 1996; H. K. Park et al., 2005). While a firm may continue operating for a transitional period without generating profit, or even while incurring losses, it may fail immediately if it lacks sufficient cash to meet short-term obligations such as payroll and supplier payments (Navon, 1996; H. K. Park et al., 2005). Without a consistent inflow of cash, business operations can come to a halt regardless of the number of ongoing or future projects, as employees, financial institutions, and suppliers typically have limited tolerance for payment delays (Koopman & Cumberlege, 2021).

Empirical evidence further highlights the significance of financial factors in construction company failures (H.-K. Park, 2004; H. K. Park et al., 2005). Research indicates that budgetary and macroeconomic issues, including cash flow-related challenges, account for approximately 83% of all construction company failures (Mutti & Hughes, 2002). Additionally, more than 60% of contractor failures have been directly attributed to economic factors (H.-K. Park, 2004; H. K. Park et al., 2005).

The concept of the “domino effect” provides further insight into the vulnerability of construction firms. Company failure is often not the result of internal technical deficiencies, but rather the consequence of external financial shocks, such as client insolvency or delayed payments from upstream contractors (Mutti & Hughes, 2002). This phenomenon, referred to as the domino theory, demonstrates how a technically competent firm can be driven into insolvency due to its position within the project cash conversion cycle (Mutti & Hughes, 2002).

## **2.2. Causes of Cash Flow Problems in Construction**

The construction industry suffers significantly from poor cash flow management, which is often the primary driver behind firm instability (Mutti & Hughes, 2002; H. K. Park et al., 2005). High Failure Rates: More construction companies fail due to a lack of liquidity for day-to-day activities than due to inadequate management of other resources (Mutti & Hughes, 2002; H. K. Park et al., 2005). The industry is plagued by late payments, which can be detrimental to contractor survival and cause project delays (Koopman & Cumberlege, 2021). When clients delay payments, contractors often face "domino effects" where they cannot pay their own workers, wholesalers, or subcontractors, potentially pulling those firms into insolvency as well (Koopman & Cumberlege, 2021).

The causes of poor cash flow in construction are numerous and are often tied to specific stages of the project life cycle, from initial tendering to final closeout.

### **2.2.1. Pre-Contract and Planning Phase**

Cash flow challenges often originate during the pre-contract and planning phase, where early decisions establish the financial foundation of the project (Emani, 2022). Inadequate planning and poor forecasting are among the most significant contributors (Emani, 2022). Research indicates that approximately 75% of change orders, which are a major source of cash flow disruption, could be avoided through more effective initial planning (Emani, 2022). Inaccurate projections at this stage frequently lead to unexpected liquidity shortfalls, creating financial strain as the project progresses (Koopman & Cumberlege, 2021; Mohagheghi et al., 2017).

These issues are further compounded by competitive market pressures. In highly competitive environments, firms often reduce profit margins to secure contracts, while consultants may

accept lower fees, leading to rushed design processes with insufficient senior-level review (Koopman & Cumberlege, 2021). Such practices increase the likelihood of errors and changes during later stages, which in turn negatively impact cash flow (Koopman & Cumberlege, 2021).

In addition, a lack of risk awareness exacerbates financial vulnerability, as firms may enter into contracts without conducting thorough credit assessments of clients or may overlook potential bad debt risks in pursuit of increased sales volume (Li, 2008).

Unrealistic scheduling assumptions also contribute significantly to early-stage cash flow challenges (Assaad, El-Adaway, & Abotaleb, 2020). Failure to account for uncertainties in activity durations or to include adequate contingency buffers often results in overly optimistic schedules (Assaad et al., 2020). These unrealistic expectations directly affect progress-based billing and delay the alignment between work performed and payments received (Assaad et al., 2020).

Collectively, these factors highlight how deficiencies in early-stage planning and decision-making can create conditions that negatively influence cash flow throughout the project life cycle.

### **2.2.2. Construction and Execution Phase**

During the construction and execution phase, cash flow challenges become more pronounced as actual project conditions deviate from initial plans (Emani, 2022). Design changes and variations represent one of the primary sources of disruption (Emani, 2022). Design deficiencies and owner-initiated modifications, which account for a significant proportion of project changes, require costly adjustments and alter the planned sequence of work (Emani, 2022). Furthermore, delays in

issuing or approving change orders prolong the payment cycle, creating additional pressure on project liquidity(Chadee, Ali, Gallage, & Rathnayake, 2023)

Material and schedule delays also play a critical role in exacerbating cash flow problems (Omopariola, Windapo, Edwards, & Thwala, 2020). The non-availability of specified materials or reduced labor productivity can lead to schedule overruns, which may trigger liquidated damage and increase financial obligations (Omopariola et al., 2020). These delays disrupt the balance between expenditures and incoming payments, thereby intensifying cash flow constraints (Omopariola et al., 2020). Similarly, unforeseen site conditions introduce additional financial burdens, as unanticipated issues often require expenditures that were not accounted for in the original project budget (Emani, 2022).

Rework and out-of-sequence work further contribute to financial inefficiencies during execution (Flentje, Zuo, Jin, & Xia, 2014). Ineffective communication and coordination among project stakeholders, particularly across different disciplines, can result in design conflicts and execution errors (Flentje et al., 2014). These issues lead to rework, which is estimated to account for between 5% and 20% of total contract value, representing a substantial source of cost overruns and wasted resources (Flentje et al., 2014). Collectively, these factors demonstrate how deviations from initial plans during the execution phase directly translate into financial instability and increased pressure on project-level cash flow.

### **2.2.3. Monthly Billing and Administrative Processing**

Cash flow challenges also arise during the recurring cycles of invoicing, certification, and payment processing, where inefficiencies directly hinder the inflow of cash (Akinsiku & Ajayi, 2016). Clerical errors in submitted claims represent a common issue, as contractors frequently

provide incomplete documentation, incorrect calculations, or fail to follow required procedures. Such deficiencies often result in rejection of claims and reset the payment cycle, thereby delaying cash inflows (Akinsiku & Ajayi, 2016).

In addition, disagreements over valuation contribute significantly to delayed payments (Akinsiku & Ajayi, 2016). Conflicts between contractors and certifying parties regarding the percentage of completion or the valuation of executed work often lead to unbilled accounts receivable and withheld payments, further constraining liquidity (Akinsiku & Ajayi, 2016).

These challenges are exacerbated by administrative inefficiencies and bureaucratic processes (Chadee et al., 2023). Extended processing times by government agencies, financial institutions, or project stakeholders, often compounded by understaffing, delay the conversion of approved progress into actual cash receipts (Chadee et al., 2023).

Furthermore, invoicing hurdles related to procedural and system-based requirements can delay both submission and approval (Al-Hussein, 2014). Issues such as discrepancies in purchase order systems, including enterprise platforms like SAP, or variations in client-specific invoicing requirements, create additional barriers to timely payment processing.(Al-Hussein, 2014). Collectively, these administrative and procedural inefficiencies highlight how delays in billing and certification cycles directly disrupt project-level cash flow.

#### **2.2.4. External and Macroeconomic Factors**

External and macroeconomic factors can influence project cash flow at any stage of the project life cycle and are often beyond the direct control of individual firms (Chadee et al., 2023).

Political instability and bureaucratic environments, particularly in the public sector, contribute to inconsistent payment practices (Chadee et al., 2023). Factors such as partisanship, regulatory

inefficiencies, and corruption can create uncertainty in payment timelines and reduce the reliability of cash inflows (Chadee et al., 2023).

The use of contractual provisions such as “pay-when-paid” clauses can force subcontractors to absorb significant delays in receiving funds, amplifying financial risk (Al-Hussein, 2014; Mutti & Hughes, 2002).

Macroeconomic conditions also play a critical role in shaping cash flow dynamics (Mohagheghi et al., 2017; OGUNDARE & OLATUNJI). Factors such as inflation, volatile foreign exchange rates, and high interest rates on borrowing increase the cost of external financing and place additional pressure on project liquidity (Mohagheghi et al., 2017; OGUNDARE & OLATUNJI). In parallel, the construction industry is often characterized by a persistent culture of delayed payments, where clients do not adhere to agreed payment timelines and treat late payment as an acceptable norm (OGUNDARE & OLATUNJI). This systemic issue further exacerbates cash flow challenges and increases the financial burden on contractors (OGUNDARE & OLATUNJI).

#### **2.2.5. Financial and Strategic Mismanagement**

In addition to external and project-related factors, internal financial and strategic mismanagement plays a significant role in exacerbating cash flow challenges in construction (Laitinen & Laitinen, 1998). These issues are behavioral in nature and tend to persist throughout the organization’s operations, influencing financial performance across multiple projects (Laitinen & Laitinen, 1998).

A key contributor is the lack of financial literacy and effective cash flow management practices among project managers (Laitinen & Laitinen, 1998). Many practitioners rely on intuition and experience rather than systematic financial forecasting and analytical tools, which can result in

poor financial planning and unexpected liquidity constraints (Laitinen & Laitinen, 1998). This deficiency in financial competence limits the ability of firms to proactively manage cash inflows and outflows (Laitinen & Laitinen, 1998).

Strategic financial practices, such as front-loading, further complicate cash flow dynamics (Mutti & Hughes, 2002). Contractors may intentionally assign higher values to early project activities to accelerate initial cash inflows (Mutti & Hughes, 2002). While this approach may provide short-term liquidity benefits, it often creates financial imbalances in later stages of the project, requiring firms to secure new contracts to sustain operations (Mutti & Hughes, 2002).

Poor accounting practices also contribute to hidden financial risks (Jung, You, Chi, Yu, & Hwang, 2018). In some cases, firms engage in practices such as inflating unbilled accounts receivable to conceal financial losses and present a more favorable financial position to creditors (Jung et al., 2018). This “creative accounting” obscures the true financial health of the organization and can delay necessary corrective actions (Jung et al., 2018).

Additionally, retention practices imposed by owners place further strain on contractor cash flow (H.-K. Park, 2004). It is common for owners to withhold between 5% and 10% of the project value until project completion (H.-K. Park, 2004). While intended as a performance guarantee, retention can keep contractors in a negative cash position for extended periods, increasing reliance on external financing and heightening financial risk (H.-K. Park, 2004).

Collectively, these factors demonstrate how internal financial practices and strategic decisions can significantly influence project-level cash flow performance.

### **2.3. Behavioral Drivers of Cash Flow Problems**

Behavioral drivers represent the psychological motives, strategic choices, and cultural attitudes of stakeholders that directly influence cash flow outcomes (Houge & Loughran, 2000; Laitinen & Laitinen, 1998). Existing literature suggests that cash management extends beyond a purely technical function of balancing accounts and is instead deeply embedded in managerial decision-making processes, which are shaped by motives such as transaction, precautionary, and speculative considerations (Laitinen & Laitinen, 1998). In high-risk industries such as construction, these behavioral factors become particularly significant, as they often manifest in the form of inadequate financial control or reactive decision-making in response to perceived market fluctuations. Such behaviors can lead to ineffective cash management practices and increased financial vulnerability (Alimoradian, Jakubiak, Loisel, & Salhi, 2023; Laitinen & Laitinen, 1998).

#### **2.3.1. Internal Behaviors**

Internal behavioral drivers originate within the firm's management and are closely associated with managerial judgment, accounting practices, and the ability to respond effectively to financial distress. These behaviors influence how financial information is interpreted and acted upon, ultimately affecting project-level cash flow performance (Houge & Loughran, 2000).

One of the most significant behavioral drivers is the presence of cognitive errors, particularly the tendency of managers and investors to focus on reported earnings rather than underlying cash flow performance (Houge & Loughran, 2000). This fixation on earnings leads to an anchoring bias, where decision-makers underestimate the importance of cash flow components and fail to recognize the temporary nature of accrual-based earnings compared to the persistence of actual

cash flows (Houge & Loughran, 2000). As a result, financial decisions may be based on misleading indicators, increasing the risk of liquidity issues. (Houge & Loughran, 2000).

Earning management practices further exacerbate this problem (Houge & Loughran, 2000).

Firms with high accruals are more likely to engage in active manipulation of reported earnings to present a favorable financial position (Houge & Loughran, 2000). While such practices may yield short-term benefits or positive market perceptions, they often result in long-term financial instability when reported earnings are not supported by actual cash inflows (Houge & Loughran, 2000). This disconnect between accounting performance and cash realization can lead to significant cash flow deficits (Houge & Loughran, 2000).

Behavioral constraints become more pronounced when firms experience financial distress (Laitinen & Laitinen, 1998). As liquidity levels approach critical thresholds, managerial behavior tends to shift, and decision-making becomes constrained (Laitinen & Laitinen, 1998). In such situations, managers lose the flexibility, or “degrees of freedom,” needed to respond effectively to external factors such as transaction volumes or interest rate changes (Laitinen & Laitinen, 1998). This reduced responsiveness limits the firm’s ability to adjust cash management strategies and increases the likelihood of a liquidity collapse (Laitinen & Laitinen, 1998).

Additionally, many firms adopt a static approach to cash flow management, relying on information from a single point in time rather than employing dynamic models that account for the evolving nature of financial risk (Heitmann et al., 2026; Laitinen & Laitinen, 1998). This lack of forward-looking analysis prevents managers from anticipating potential payment delays or financial disruptions, thereby limiting their ability to take proactive corrective actions (Heitmann et al., 2026; Laitinen & Laitinen, 1998). Consequently, firms are often unable to adjust their cash

positions in a timely manner, which further exacerbates cash flow challenges (Heitmann et al., 2026; Laitinen & Laitinen, 1998).

Managerial incompetence and limited financial literacy are frequently identified as key contributors to poor cash flow performance (Li, 2008). Many failures are attributed to a lack of risk awareness and the persistent underutilization of formal financial control tools (Li, 2008). In practice, project managers often rely on experience-based judgment rather than systematic financial forecasting, which increases the likelihood of unexpected liquidity shortfalls and financial distress (H.-K. Park, 2004)

### **2.3.2. External Behaviors**

External behavioral drivers stem from the recurring practices of clients, the strategic decisions of project participants, and the broader socio-economic environment (Akinsiku & Ajayi, 2016; Chadee et al., 2023). These behaviors influence cash flow outcomes by shaping payment practices, financial priorities, and responses to market conditions (Akinsiku & Ajayi, 2016; Chadee et al., 2023).

Strategic withholding and mismanagement of funds represent a significant external behavioral driver (Akinsiku & Ajayi, 2016; Chadee et al., 2023). Clients may deliberately delay or withhold payments to improve their own financial position, thereby transferring liquidity pressure onto contractors (Akinsiku & Ajayi, 2016; Chadee et al., 2023). Additionally, unethical practices and opportunistic behaviors within procurement processes can lead to the misallocation or mismanagement of project funds, further disrupting cash flow stability (Akinsiku & Ajayi, 2016; Chadee et al., 2023).

Political and bureaucratic influences are particularly evident in public sector projects (Chadee et al., 2023). Payment delays may result from political partisanship, reallocation of funds, or administrative inefficiencies (Chadee et al., 2023). In some cases, external events such as economic downturns or global crises are used to justify delays, masking underlying organizational inefficiencies (Chadee et al., 2023).

Recurring customer behaviors also contribute to cash flow volatility (Shah, Kumar, Kim, & Choi, 2017). Patterns such as selective purchasing under low-margin conditions or inconsistent transaction behaviors increase uncertainty in future cash inflows (Shah et al., 2017). These behaviors can elevate the cost of capital and reduce overall financial stability (Shah et al., 2017). Similarly, adverse payment patterns, including delayed payments and defaults on receivables, constrain working capital and disrupt financial planning, often reflecting the customer's own liquidity challenges. (Heitmann et al., 2026)

External responses to market conditions further influence cash flow dynamics. During periods of economic uncertainty, stakeholders may adopt a “flight-to-safety” approach, reallocating resources toward lower-risk options to preserve capital. While such behavior may temporarily stabilize certain financial positions, it also reflects the sensitivity of cash flows to broader market fluctuations (Alimoradian et al., 2023). In addition, herd behavior can amplify financial instability, as collective actions driven by peer influence or reputational concerns may trigger rapid shifts in financial decisions, including mass withdrawals or delayed commitments (Alimoradian et al., 2023).

Finally, behavioral inertia plays a role in shaping external financial interactions (Alimoradian et al., 2023). Stakeholders often adhere to default payment or investment patterns unless they are prompted by significant changes in the operating environment (Alimoradian et al., 2023). As a

result, substantial shifts in cash flow behavior may only occur when external conditions or institutional frameworks actively drive behavioral change (Alimoradian et al., 2023).

Collectively, these external behaviors highlight the extent to which cash flow performance is influenced by factors beyond the direct control of individual firms.

## **2.4. Cash Flow Challenges in Subcontracting (with Focus on Electrical Subcontractors)**

Subcontractors play a fundamental role in the construction industry, contributing to approximately 80% to 90% of total project work (Ghali, 2023). Despite their critical involvement in achieving project objectives related to schedule, cost, and quality, subcontractors are particularly vulnerable to financial challenges, which are frequently identified as a primary cause of firm failure (Lucko, 2016).

Existing literature emphasizes that effective cash flow management is central to the financial viability of subcontracting firms, as their operational stability is highly dependent on consistent and timely cash inflows (Lucko, 2016). This dependency is further intensified in specialized trades, such as electrical contracting, where project execution involves complex coordination and significant upfront financial commitments (Lucko, 2016).

### **2.4.1. Structural Position of Subcontractors in the Payment Chain**

The construction industry operates as a complex, multi-tiered network of interdependent contractual relationships, commonly referred to as the supply chain (Cunningham, 2013). Within this downstream payment hierarchy, subcontractors occupy a particularly vulnerable position, as their cash flow is largely dependent on the administrative efficiency and ethical practices of upstream parties. (Cunningham, 2013).

Subcontractors typically operate within a conditional payment structure, often described as the “pay-to-pay” cycle. Under clauses such as “pay-when-paid,” “pay-if-paid,” or “pay-when-certified,” subcontractors receive payment only after the general contractor has been paid by the project owner.(Cunningham, 2013). This structure inherently delays cash inflows and transfers financial risk downstream.

As a result, subcontractors frequently experience extended time lags in payment (Lucko, 2016). Due to their position at the end of the payment chain, waiting periods for payment commonly range between 60 and 90 days and, in some cases, may exceed one year (Lucko, 2016). These delays create sustained pressure on liquidity and limit the ability of subcontractors to manage ongoing operational costs (Lucko, 2016).

This vulnerability is further intensified by an imbalance in bargaining power (Cunningham, 2013). Smaller subcontracting firms are often constrained between general contractors, who control the flow of payments, and suppliers, who control access to materials and credit (Cunningham, 2013). This structural imbalance is frequently exploited by upstream parties, particularly those who deliberately delay payments to optimize their own cash positions, thereby shifting financial strain onto subcontractors (Cunningham, 2013).

#### **2.4.2. Financial Vulnerability of Subcontractors**

The financial vulnerability of subcontractors is further exacerbated by the widespread use of retainage practices (Lucko, 2016). Owners and general contractors typically withhold between 5% and 10% of the total project value as retention until project completion (Lucko, 2016) . For subcontractors, this withheld amount often constitutes a significant portion, if not entirety, of their profit margin (Lucko, 2016). Consequently, they may operate in a negative cash flow

position throughout the project duration, only recovering retained earnings at the final account stage (Cunningham, 2013).

In addition, subcontractors are particularly sensitive to inflation and fluctuations in material prices instability (Youssef, Ibrahim, & El-Badawy Hafez, 2023). Due to their relatively limited financial capacity, they are less able to absorb increases in the cost of materials and labor instability (Youssef et al., 2023). This heightened exposure to cost volatility further constrains liquidity and increases financial risk, especially in periods of economic instability (Youssef et al., 2023).

#### **2.4.3. Complexity of Electrical Subcontracting Work**

Electrical subcontractors face distinct operational complexities that significantly amplify the financial risks inherent in construction projects (Ghali, 2023). One of the primary challenges is the high material intensity associated with electrical work (Ghali, 2023). Material procurement can account for more than 50% of direct construction costs, and electrical systems often require specialized and high-cost components that must be procured well in advance of installation (Ghali, 2023; Lucko, 2016; Rajabi & Yakhchali, 2025). This creates substantial upfront financial commitments that must be managed before any corresponding revenue is realized (Rajabi & Yakhchali, 2025).

This challenge is further compounded by the mismatch between expenditure timing and installation activities (Ghali, 2023; Lucko, 2016). Electrical subcontractors typically incur significant front-loaded costs during the procurement phase, while installation work is often scheduled toward the later stages of the project, such as after the building is enclosed (Ghali, 2023; Lucko, 2016). As a result, there is a considerable time lag between when costs are incurred

and when payments, including the release of retention, are received (Lucko, 2016; Rajabi & Yakhchali, 2025).

Electrical work is highly susceptible to design defects and owner-initiated modifications, which account for a high volume of change orders (Lucko, 2016). Research indicates that projects can experience from 2 to over 300 change orders, causing constant pressure on the budget and schedule (Lucko, 2016).

Administrative complexity also contributes to financial strain (Lucko, 2016). The technical nature of electrical systems requires a high volume of Requests for Information (RFIs) to clarify design intent and resolve coordination issues (Lucko, 2016). Delays in responding to RFIs or in converting them into approved change orders can stall progress and delay billing, thereby disrupting the cash flow cycle and increasing liquidity challenges for subcontractors (Lucko, 2016).

Taken together, these factors show that the complexity of electrical subcontracting work increases financial risk and worsens cash flow challenges for subcontractors.

## **2.5. Managerial Strategies for Cash Flow Management**

### **1. Forecasting and Planning Tools**

Construction firms utilize a range of forecasting and planning techniques to identify potential liquidity shortages and establish financial baselines for project execution (Odeyinka, Kaka, & Morledge, 2003; Shash & Qarra, 2018). Effective forecasting enables contractors to anticipate cash flow fluctuations and improve financial decision-making throughout the project lifecycle (Odeyinka et al., 2003).

Traditional forecasting methods commonly include the use of computer spreadsheets and detailed cost breakdown approaches, where Bill of Quantities (BOQ) items are linked to project schedules to estimate cash inflows and outflows over time(Odeyinka et al., 2003). Additional approaches include value-based models, cost-based models, and simplified “short-cut” techniques that rely on historical S-curves from previous projects to predict cash flow trends (Mutti & Hughes, 2002; Odeyinka et al., 2003).

More advanced analytical methods have also been developed to address uncertainty and improve prediction accuracy (Mutti & Hughes, 2002). These include techniques such as logit transformation, neural networks, and fuzzy logic models, which are designed to handle the uncertainty and variability associated with construction projects(Mutti & Hughes, 2002). Furthermore, the integration of the Analytic Hierarchy Process (AHP) with stochastic simulation methods has been proposed to evaluate the impact of multiple risk factors on project cash flow performance(Liu, Zayed, & Li, 2009).

In addition, scenario-based planning and “what-if” analysis are widely recommended as proactive financial management strategies(Shash & Qarra, 2018). These approaches allow managers to assess the potential effects of issues such as delayed owner payments, schedule overruns, or the loss of anticipated financing sources, thereby improving preparedness for adverse financial conditions (Shash & Qarra, 2018).

## **2. Cash Flow Monitoring and Control**

Continuous cash flow monitoring and control serve as critical mechanisms for identifying financial risks and preventing insolvency during project execution (Odeyinka et al., 2003). Effective oversight enables firms to track financial performance, detect deviations from planned

cash flow patterns, and implement corrective actions before liquidity problems escalate (Odeyinka et al., 2003).

One of the primary control strategies involves establishing and maintaining a cash flow baseline for budgetary purposes (Shash & Qarra, 2018). Developing a financial baseline allows firms to compare planned and actual cash movements throughout the project lifecycle, thereby supporting more effective financial control and decision-making (Shash & Qarra, 2018).

Periodic financial analysis and reconciliation are also widely adopted practices in construction cash flow management (Omopariola et al., 2020). Firms commonly perform financial reviews on weekly, monthly, quarterly, or annual intervals to evaluate project performance and monitor liquidity conditions (Omopariola et al., 2020). Standard practices include monthly cost-value reconciliation and the comparison of actual income and expenditures against forecasted values (Liu et al., 2009; Odeyinka et al., 2003). These processes help managers identify discrepancies early and make timely adjustments to financial plans and project operations (Liu et al., 2009; Odeyinka et al., 2003).

In addition, liquidity oversight is essential to ensure that firms can meet short-term financial obligations despite ongoing financial pressures such as retained performance guarantees (Pordea, David, & Mateş, 2020). Monitoring indicators such as operating cash flow and current liquidity ratios provides insight into the organization's financial stability and ability to sustain operations throughout the project duration (Pordea et al., 2020).

### **3. Commercial and Bidding Strategies**

A further set of tactics works by manipulating the timing and volume of revenue at the front end of a project, shaping the contractor's cash position before significant work is even underway (Oladimeji & Aina, 2021).

The most common of these is front-end loading, whereby contractors artificially overprice work executed early in the program is mobilization, the site office, substructure while correspondingly underpricing later items so that the total contract sum remains unchanged (Oladimeji & Aina, 2021). The cash benefit is considerable: this practice has been shown to reduce a project's overdraft requirement by approximately 11.4% (Cui, Hastak, & Halpin, 2010).

A related technique, over-measurement, achieves a similar effect during interim valuations by certifying work at a higher level of completion than has actually been achieved, thereby boosting early cash inflow (Adjei, Fugar, Adinyira, Edwards, & Pärn, 2018; Odeyinka et al., 2003).

**Tender Unbalancing:** A dimension of risk management where prices are manipulated during the bidding stage, requiring competent personnel to manage associated risks (Odeyinka et al., 2003; Oladimeji & Aina, 2021).

Tender unbalancing represents a further dimension of risk management, one in which item prices are deliberately manipulated during the bidding stage (Oladimeji & Aina, 2021). As this practice carries its own exposure, executing it effectively depends on competent personnel capable of managing the associated risks (Oladimeji & Aina, 2021). Profit margins are adjusted with similar strategic intent (Oladimeji & Aina, 2021). In highly competitive markets, firms may reduce their margins simply to win contracts and sustain their volume of work, or they may apply a "cost item-based distribution," allocating markup to specific items in a way that favors the contractor's cash position (Oladimeji & Aina, 2021).

#### **4. Payment and Credit Management**

Leveraging external parties allows contractors to use third-party funds as working capital (Cui et al., 2010; Oladimeji & Aina, 2021).

A final group of strategies centers on leveraging external parties, allowing contractors to draw on third-party funds as a source of working capital (Cui et al., 2010). Chief among these is the management of trade credit (Cui et al., 2010). By receiving materials from suppliers under a grace period of 30 to 60 days before payment falls due, contractors are able to defer their cash outflows and hold onto working capital longer (Cui et al., 2010).

#### **5. Scheduling and Optimization**

A final category of strategies integrates time and money directly, treating the sequence of physical work as something to be optimized for cash flow rather than for technical efficiency alone (Samer Ezeldin & Ali, 2017). The foundational principle here is finance-based rescheduling, which departs from conventional technical scheduling such as the Critical Path Method by ordering activities according to the availability of funds rather than technical logic alone (Al-Joburi, Al-Aomar, & Bahri, 2012).

Within this approach, several mechanisms allow managers to fine-tune the alignment of expenditure and income (Samer Ezeldin & Ali, 2017). The utilization of lag and float is one: by inserting time delays into non-critical activities, kept within their total float, managers can push expenses backward or pull receipts forward without jeopardizing the schedule (Samer Ezeldin & Ali, 2017).

Critical chain buffering serves a complementary protective function, using project buffers to safeguard completion dates and feeding buffers for both inflow and outflow to prevent delays in

non-critical activities from reaching the critical path and disrupting the subsequent billing cycle (Kulejewski, Ibadov, Rosłon, & Zawistowski, 2021). Finally, the scattering of works by reducing the number of activities performed simultaneously lowers the demand for funds during the most financially demanding periods of a project (Kulejewski et al., 2021).

## **6. Operational and Relationship Management**

For an electrical subcontractor, success rests not only on technical execution but on two closely related capabilities: managing quality and cultivating strong stakeholder relationships (Adjei et al., 2018; Kulejewski et al., 2021). Quality management begins with rigorous supervision, which serves as the contractor's primary defense against defects. Work completed to standard the first time spares the contractor the substantial cost of rectifying defective work which is an expense that can rapidly erode already thin cash reserves (Adjei et al., 2018).

Stakeholder relationships, meanwhile, function as a parallel safeguard. Trust built with owners and suppliers through repeated, mutually beneficial dealings lowers the likelihood of project failure and, just as importantly, improves access to credit (Al-Joburi et al., 2012; Shash & Qarra, 2018).

The value of this trust is most evident under financial strain, when established goodwill enables owners and contractors to cooperate in salvaging a struggling project and limiting disruption to the workforce.(Al-Joburi et al., 2012; Chadee et al., 2023)

### **2.6. Problem Statement**

Project-level cash flow continues to be one of the most critical and unresolved challenges in construction management, particularly for electrical subcontractors who operate under tight billing cycles, labor-intensive operations, high upfront material costs, and delayed upstream

payments (Ghali, 2023). Due to their downstream position in the construction payment chain, electrical subcontractors are especially vulnerable to liquidity pressure, prolonged accounts receivable, and financial instability (Cunningham, 2013; Ghali, 2023; Lucko, 2016).

Existing literature has identified numerous causes of poor cash flow, including delayed payments, administrative inefficiencies, change order delays, poor forecasting, contractual risk transfer, and macroeconomic pressures (Akinsiku & Ajayi, 2016; Chadee et al., 2023; Emani, 2022; Mohagheghi et al., 2017). Previous studies have also proposed various managerial practices for improving cash flow management, such as forecasting tools, monitoring techniques, and financial control methods (Liu et al., 2009; Odeyinka et al., 2003; Shash & Qarra, 2018).

However, existing research remains fragmented and largely descriptive. Causes of cash flow problems are often examined in isolation, while management strategies are typically presented as broad or generic recommendations without linking them to the specific internal and external behaviors that intensify project-level cash flow problems.

Furthermore, the industry still lacks a systematic and evidence-based understanding of which managerial strategies are most effective. To date, no study has developed and validated a comprehensive set of managerial strategies for project-level cash flow improvement using a structured, consensus-driven approach tailored to the realities of subcontractors, particularly electrical subcontractors. As a result, firms and project managers have limited empirical guidance on the managerial actions that most effectively improve cash flow performance.

Existing literature discusses individual behavioral drivers affecting cash flow performance; however, these behaviors are addressed separately across different studies and contexts, with

limited effort to systematically connect them to project-level cash flow causes, managerial strategies, and financial training needs.

No study has systematically connected the causes of cash flow problems, the behavioral drivers that exacerbate them, and the managerial strategies that address them within a single integrated framework tailored to electrical subcontracting

Therefore, the objective of this study is to develop a comprehensive and behavior-oriented understanding of project-level cash flow management in electrical subcontracting by examining the causes of lengthy accounts receivable, the internal and external behaviors that exacerbate cash flow problems, and the managerial strategies and training principles needed to improve cash flow performance. Beyond addressing each of these dimensions independently, the study synthesizes the findings into a behavioral-strategic mapping framework that systematically connects causes, behaviors, strategies, and training needs providing the first integrated, practice-oriented model for project-level cash flow improvement tailored to the realities of electrical subcontracting. To achieve this objective, the study addresses the following research questions:

- (1) What are the primary causes of project-level cash flow challenges and lengthy accounts receivable in the electrical subcontracting industry?
- (2) What internal organizational behaviors contribute to project-level cash flow problems in electrical subcontracting firms?
- (3) What external stakeholder behaviors exacerbate project-level cash flow challenges for electrical subcontractors?
- (4) What managerial strategies are perceived as most effective by industry experts in improving project-level cash flow performance in electrical subcontracting?

(5) What principles should inform the development of a project-level cash flow training framework for electrical contractors?

## CHAPTER 3: METHODOLOGY

This study adopted a multi-phase qualitative and consensus-based research design to investigate the causes, behaviors, and managerial strategies associated with project-level cash flow challenges in the electrical construction industry. The methodology was developed in direct alignment with the research problem identified in the literature review, namely the lack of an integrated and evidence-based understanding of the factors contributing to project-level cash flow problems and the managerial actions most effective in improving financial performance. The study combined inductive thematic analysis with the Delphi method to generate industry-informed findings while establishing expert consensus regarding effective managerial practices. The research methodology is illustrated in Figure 1, with detailed process maps for each phase provided in Figures 3, 4, and 5.

As outlined in the problem statement, the research methodology was organized around five research questions, each addressed through a distinct phase or analytical approach.. The first phase implemented inductive thematic coding and qualitative analysis of industry responses collected for RQ1, RQ2, RQ3, and RQ4. RQ1 examined the primary causes of project-level cash flow challenges and lengthy accounts receivable in the electrical subcontracting industry. RQ2 investigated the internal organizational behaviors that contribute to project-level cash flow problems, while RQ3 focused on the external stakeholder behaviors that exacerbate cash flow challenges for electrical subcontractors. RQ4 explored the managerial strategies currently used by industry professionals to improve project-level cash flow performance.

Each research question was addressed through a corresponding open-ended prompt distributed to participants, as summarized in Table 1.

Table 1 : Specific open-ended prompts distributed to participants and their corresponding research questions.

| Research Question                          | Open-Ended Prompt                                                                                                                                                                        |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RQ1: Causes of lengthy accounts receivable | "What are the current challenges your company faces in collecting payments, and what do you believe are the primary causes of lengthy accounts receivable in the construction industry?" |
| RQ2: Internal organizational behaviors     | "What internal organizational behaviors or practices within your company do you believe contribute to or worsen project-level cash flow problems?"                                       |
| RQ3: External stakeholder behaviors        | "What behaviors from external stakeholders such as owners, general contractors or suppliers do you believe exacerbate cash flow challenges for electrical subcontractors?"               |
| RQ4: Managerial strategies                 | "What are some of the successful managerial strategies for improving project-level cash flows?"                                                                                          |
| RQ5: Training framework principles         | "From your perspective, what fundamental principles should be included in the development of a project-level cash flow training program?"                                                |

Inductive thematic analysis was employed to systematically code participant responses, identify recurring concepts, group related codes into categories, and develop themes representing major industry patterns and operational practices. This qualitative phase enabled the study to move beyond fragmented issues discussed in prior literature and establish a comprehensive understanding of the financial, contractual, managerial, and behavioral dimensions influencing project-level cash flow performance.

The second phase implemented the Delphi method specifically for RQ4 to evaluate and validate the effectiveness of the managerial strategies identified during the thematic analysis phase. The Delphi methodology was selected because it provides a structured and rigorous process for obtaining consensus among industry experts while minimizing the influence of dominant participants and group bias. In this phase, the 47 coded managerial strategies derived exclusively from participant responses in Phase 1 were redistributed to the expert panel for independent quantitative rating using a 100-point effectiveness scale. Each panelist submitted their ratings anonymously, and consensus was determined based on predefined mean score and standard deviation thresholds. Following the completion of the rating process, a summary report of the results was distributed to all participants. This phase enabled the study to prioritize and rank the managerial strategies perceived as most effective for improving project-level cash flow management within electrical contracting environments.

The third phase addressed RQ5, which explored the fundamental principles that should guide the development of a project-level cash flow training program for electrical contractors. This phase applied the same inductive thematic coding process used in Phase 1 to a separate open-ended prompt distributed to the same 34 participants. The 12 training themes identified from participant

responses were subsequently organized into four training modules based on conceptual relatedness and functional similarity. Bloom's Revised Taxonomy of Educational Objectives was then applied to assign each theme to one of three learning levels: Knowledge, Application, or Evaluation to structure the framework in a manner that supports progressive skill development

among electrical contractors. The detailed Phase 3 process is illustrated in Figure 4.

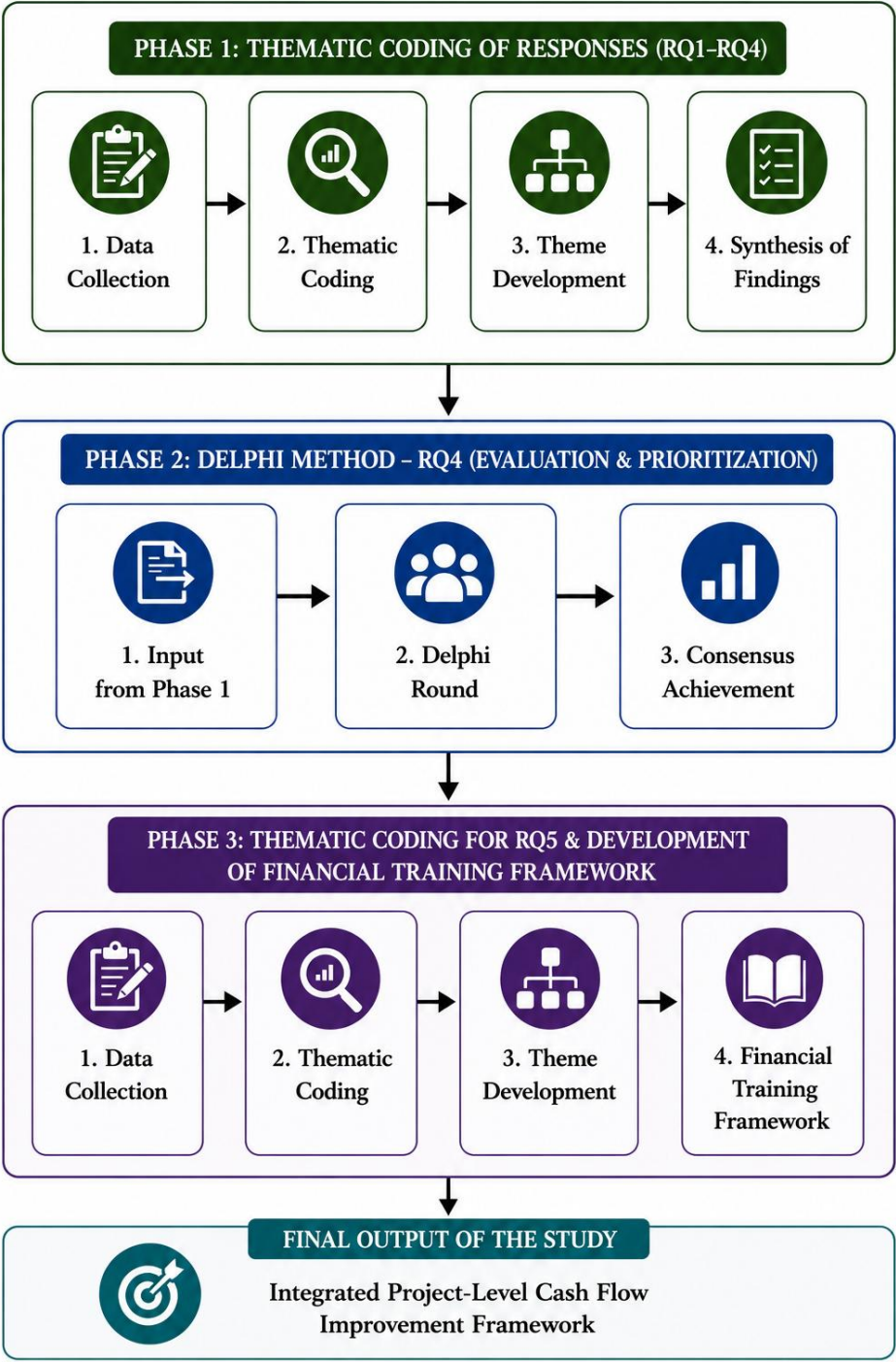


Figure 1: Methodology Overview Map

### **3.1. Data Collection - Purposeful Sampling**

A purposeful sampling strategy was employed in this study to recruit participants with direct, relevant, and specialized expertise in electrical contracting and project-level cash flow management. This approach was selected to ensure that the Delphi panel consisted of knowledgeable practitioners capable of offering informed judgments. Accordingly, recruitment targeted electrical contractors and members of the National Electrical Contractors Association (NECA), representing a wide range of organizational sizes, geographic regions, market sectors, and professional roles (e.g., executives, project managers, financial personnel, and field supervisors).

To initiate sampling, an overview of the study and an invitation to participate were distributed via email to 114 NECA association chapters across the United States, with additional outreach to selected Electrical Contractors Association chapters in Canadian cities. Chapters were asked to disseminate the invitation to their member firms. This initial outreach resulted in 62 contractors expressing interest in joining the Delphi panel, of which 34 ultimately provided complete written responses to the Phase 1 qualitative prompt. This exceeded the commonly referenced Delphi benchmark of approximately 20 informed participants, which is often considered sufficient to support stability and validity in expert consensus exercises.

To characterize the sample and support meaningful interpretation of the results, participants were asked to report demographic information about their firms. The first indicator of organizational size was annual revenue, which ranged from approximately \$1 million to \$1 billion. This revenue diversity was important for evaluating whether cash flow challenges and managerial strategies vary across small, medium, and large contractors. Firm size classifications followed the U.S. Small Business Administration (SBA) threshold of \$19 million in annual receipts; firms with \$19

million or less were designated “small,” those between \$19 million and \$100 million “medium,” and those above \$100 million “large.” As shown in Table 2, the sample included contractors across all size categories, with substantial representation from medium-sized firms and meaningful coverage from both smaller and larger organizations.

A second measure of organization size the number of employees was collected to account for differences that revenue alone may not reveal. Some firms generate high revenue with relatively few employees due to specialization or equipment-intensive installation work, whereas others rely heavily on labor for distribution wiring, lighting, or communication systems. Thirty participants provided employee counts, as shown in Table 3, while four did not specify this information.

To ensure diversity in market sectors, participants were also asked to identify the types of projects in which they regularly work. Because cash flow dynamics vary significantly across sectors, representation from multiple markets was essential for generalizability. Respondents reported working across numerous sectors, including commercial, industrial, government, utilities, multi-family, healthcare, education, data centers, transportation, fire alarm, communications, and other low-voltage systems. The frequency with which these categories appeared across responses indicated broad sectoral coverage.

Finally, participants reported on the geographic regions in which their firms operate. Although it was not necessary for all 50 U.S. states or all Canadian provinces/territories to be individually represented, regional diversity was important to avoid geographically skewed perspectives. Responses included national contractors working across the entire United States, as well as firms from distinct regions such as the Midwest, Southwest, Southeast, Northwest, and Western Canada. Recruitment support from NECA chapters and ELECTRI-International leadership helped ensure balanced regional representation. Overall, 27 U.S. states and Canadian provinces

were explicitly represented, with national firms indirectly covering additional areas as shown in Figure 2.

Collectively, the purposeful sampling process yielded a Delphi panel with substantial diversity in organizational size, market specialization, and geographic reach, ensuring that the strategies and insights identified in round 1 reflected a broad cross-section of industry practice and enhanced the generalizability of the study's findings.

Table 2: Revenue Size of Participating Firms

| Range (in Millions)   | Number of Participants Firms | Percent of Participants |
|-----------------------|------------------------------|-------------------------|
| Small (\$1 - \$19)    | 9                            | 26.5%                   |
| Medium (\$19 - \$100) | 16                           | 47%                     |
| Large (> \$100)       | 9                            | 26.5%                   |

Table 3: Number of Employees of Participating Firms

| Ranges (No. Of Employees) | Number of Participant Firms | Percent of Participants |
|---------------------------|-----------------------------|-------------------------|
|---------------------------|-----------------------------|-------------------------|

|                 |    |       |
|-----------------|----|-------|
| Small (4 to 50) | 8  | 26.7% |
| Medium (50-200) | 11 | 36.7% |
| Large (>200)    | 11 | 36.7% |

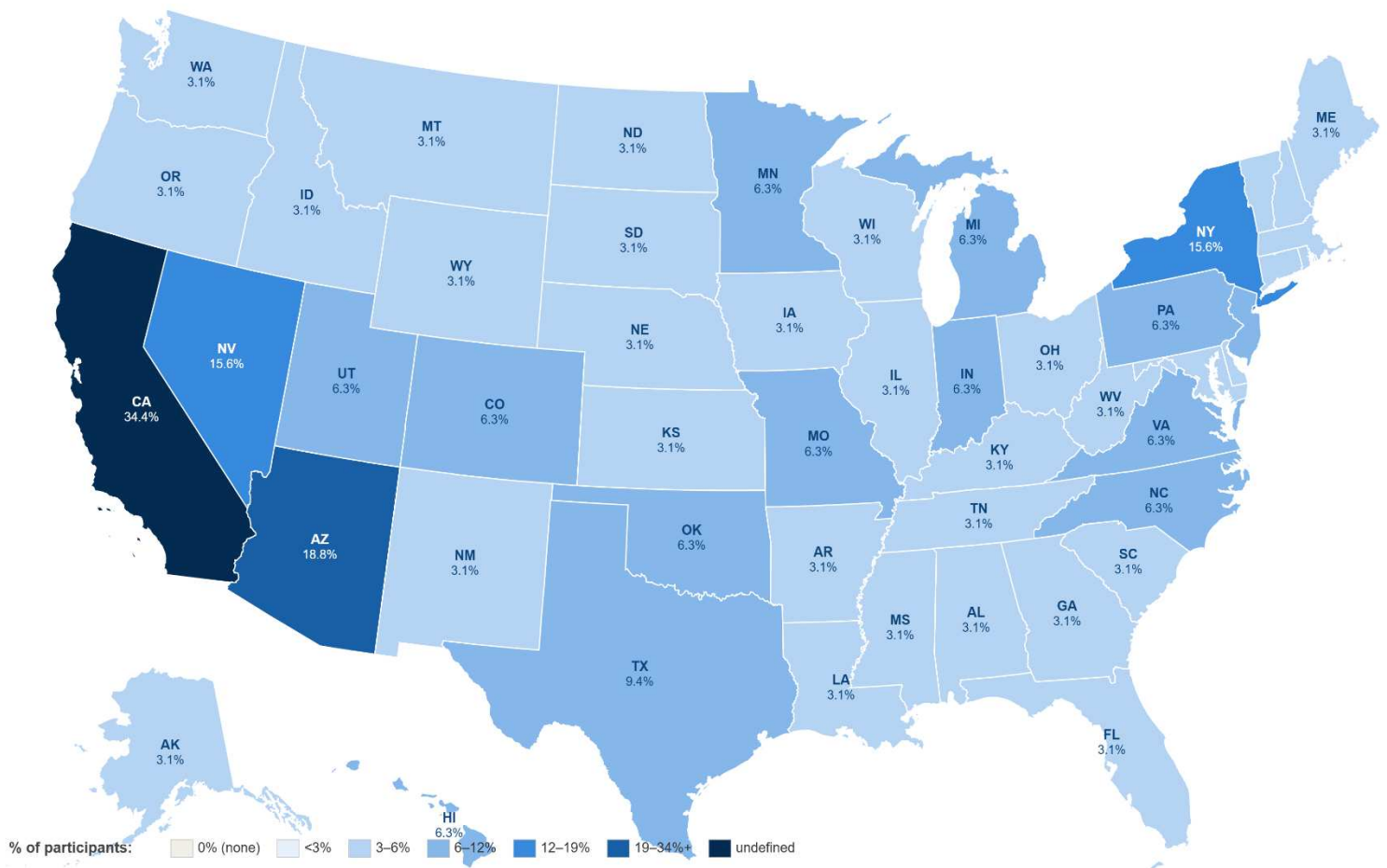


Figure 2: Participant Geography - % of Respondents by State.

### 3.2. Phase 1 – Thematic Coding of Responses

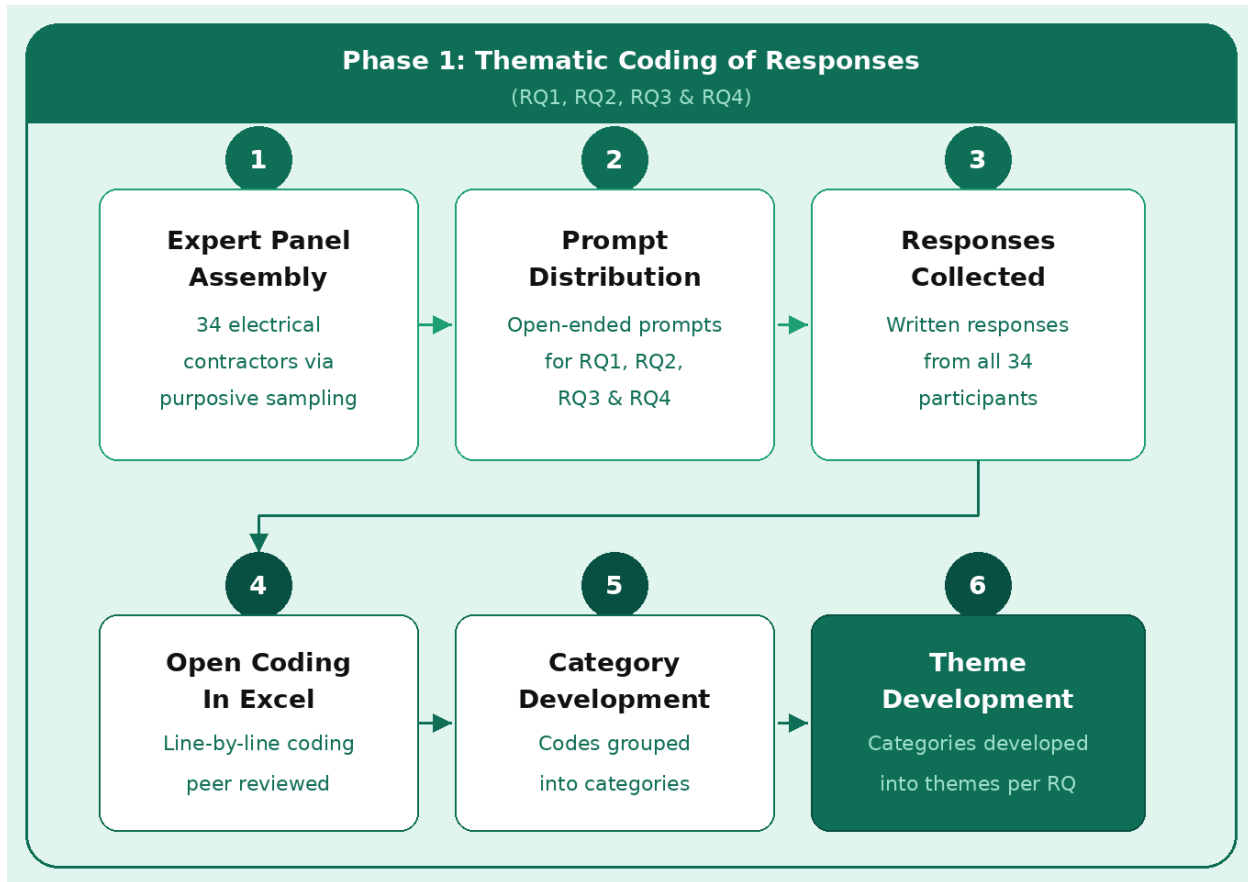


Figure 3 : Phase 1 Methodology Map

The responses collected in Phase 1 were analyzed using an inductive thematic analysis approach. Thematic analysis is a widely utilized qualitative method for identifying, organizing, and interpreting patterns of meaning within textual data. Central to this process is coding, which involves assigning concise labels to segments of text that capture the essential idea or concept conveyed. As (Williams & Moser, 2019) describe, a qualitative code often takes the form of a word or short phrase that represents an essence-capturing attribute of the data. Coding enables the researcher to organize narrative input into analytically meaningful units while preserving the contextual integrity of the original responses.

The analysis followed an inductive orientation, consistent with grounded theory traditions, in which themes are allowed to emerge from the data rather than being imposed through predetermined categories. This requires sustained engagement with the dataset and sensitivity to recurring concepts, relationships, and variations across responses. As (Charmaz, 2006) notes, qualitative analysis is characterized by a continual interplay between researcher and data, where early interpretations evolve through iterative comparison and refinement.

This inductive thematic analysis was applied to the open-ended responses collected from the 34 participating electrical contractors across Research Questions 1, 2, 3, 4, and 5. Each research question was treated as a distinct analytical unit, with the coding process conducted separately for each question to ensure that emerging themes remained grounded in the specific focus of each inquiry. The full participant response to each open-ended prompt served as the unit of analysis, allowing the complete context of each participant's perspective to be preserved throughout the coding process.

The coding process began with open coding, during which each response was reviewed in its entirety to identify discrete concepts relevant to the research question. These initial codes were provisional, intentionally broad, and numerous, allowing the full nuance of participant perspectives to be captured. Following (Lincoln, 1985) characterization, the coding process involved iteratively grouping, regrouping, and relinking related codes to consolidate meaning and develop more coherent categories. Because multiple plausible labels may describe an emerging pattern, determining the most appropriate code often reflects analytic judgment "more art than science" (Williams & Moser, 2019). All coding was conducted manually using

Microsoft Excel, where participant responses and their corresponding codes, categories, and thematic assignments were systematically organized and tracked across all research questions.

After initial coding, conceptually similar codes were organized into higher-order thematic categories. This step aligns with the recommendations of (Franz & Roberts, 2022), who emphasize grouping coded statements into categories that represent overarching patterns within the dataset. To strengthen the reliability of the analysis, one researcher conducted the initial coding, and a second researcher performed an independent peer review of the codes, categories, and thematic assignments for each research question. Where disagreements arose between the two researchers, they were resolved through discussion and mutual consensus, ensuring that the final thematic structure reflected a shared and defensible interpretation of the data.

Following open coding, conceptually related codes were grouped into higher-order categories, and broader themes were then identified to represent the major patterns across participant responses. The specific themes and categories identified for each research question are presented in Chapter 4.

### **3.3. Phase 2 – Delphi Method**

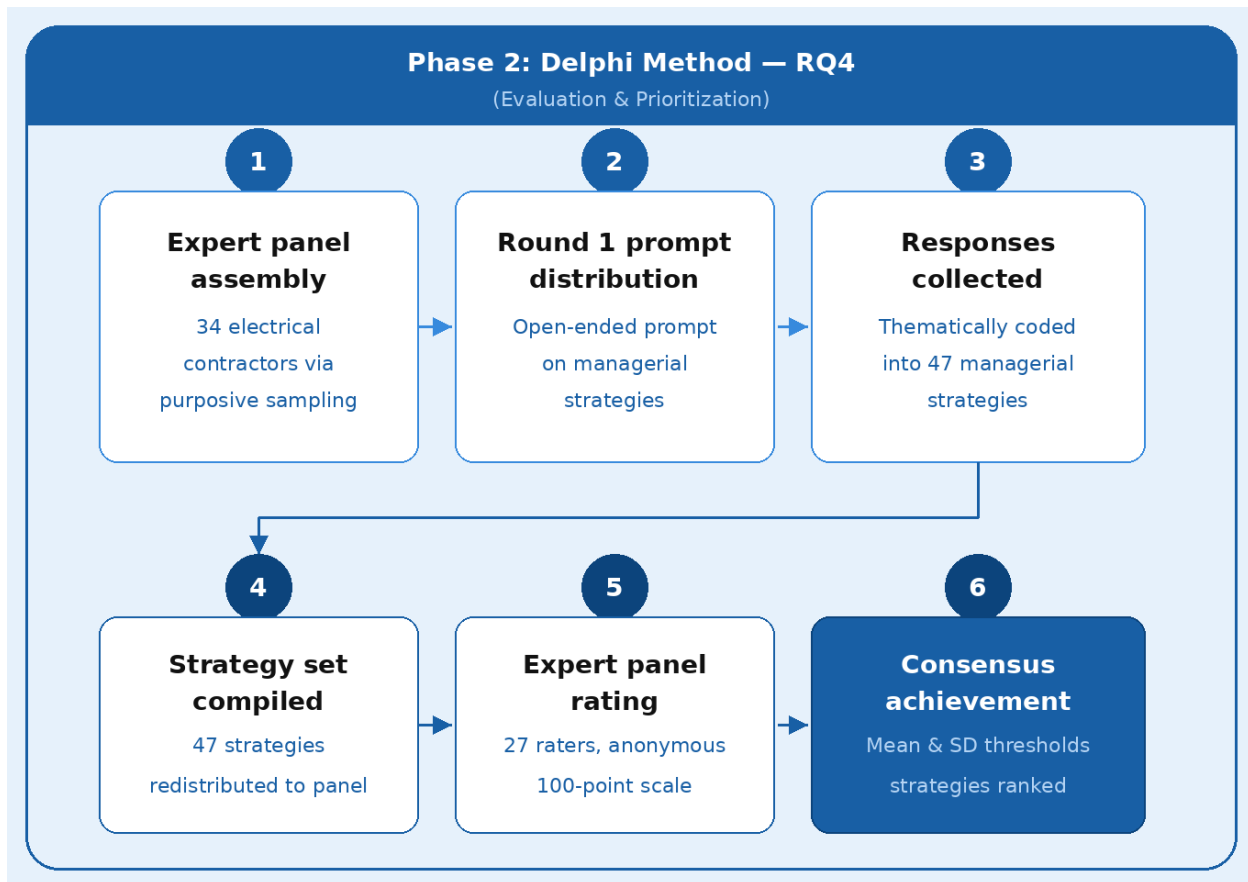


Figure 4: Phase 2 Methodology Map

### 3.3.1. Rationale for the Delphi Method

While thematic coding of Phase 1 responses was sufficient to identify and organize the range of managerial strategies reported by industry practitioners, it was not designed to determine which strategies are most effective, most widely supported, or most actionable in practice. Thematic analysis alone reflects what participants mentioned but does not provide a basis for prioritizing strategies or distinguishing those with broad expert support from those that are context-specific or peripheral. To address this limitation, the Delphi method was incorporated as a structured quantitative layer to complement and extend the qualitative findings.

Among the available methods for obtaining expert consensus, the Delphi method was selected over alternatives such as focus groups, nominal group technique, and structured surveys for three specific reasons. Unlike focus groups, the Delphi method preserves the anonymity of individual responses, which minimizes the influence of dominant participants and reduces social pressure to conform, thereby producing more independent and honest evaluations (Skulmoski, Hartman, & Krahn, 2007). Unlike structured surveys, the Delphi method is designed specifically to move a panel toward consensus through a systematic rating process rather than simply measuring opinion at a single point in time, making it the appropriate choice when the research goal is to establish what the expert community collectively endorses as effective practice rather than merely describing what individual practitioners think (Okoli & Pawlowski, 2004). Unlike nominal group technique, which requires participants to be physically present and deliberate together, the Delphi method allows geographically dispersed experts to participate independently, which was essential given that the panel in this study comprised electrical contractors drawn from multiple regions across the United States.

Specifically, the Delphi process served five interconnected purposes in this study. First, it enabled the prioritization of strategies by moving beyond a descriptive list to a ranked understanding of which strategies are perceived as most influential in improving project-level cash flow (Okoli & Pawlowski, 2004). Second, it provided validation of the qualitatively derived strategy set by confirming through independent expert rating that the identified strategies are perceived as genuinely effective in practice, not merely mentioned (Skulmoski, Hartman, & Krahn, 2007). Third, it reduced subjectivity inherent in thematic coding alone by introducing a structured consensus-based evaluation that minimized reliance on researcher interpretation (Linstone & Turoff, 1975). Fourth, it ensured industry applicability by grounding the

effectiveness ratings in the direct experience of electrical contractors, ensuring that the prioritized strategies reflect the realities of subcontracting rather than construction broadly (Keeney, McKenna, & Hasson, 2010). Fifth, it supported the development of a practical cash flow improvement framework by producing a consensus-ranked set of strategies that could serve as an evidence-based foundation for industry guidance and financial training (Hsu & Sandford, 2007; Von Der Gracht, 2012).

### **3.3.2. Round 1: Qualitative Data Collection**

Phase 1 of the Delphi process initiated the collection of qualitative insights from industry experts on managerial strategies that influence project-level cash flow. After assembling the expert panel through purposive sampling, the first-round prompt was distributed to participants via email. Experts were asked to provide open-ended written responses to the following question:

"What are some of the successful managerial strategies for improving project-level cash flows?"

This prompt was intentionally broad to elicit diverse perspectives and allow respondents to share any practices they perceived as relevant, regardless of perceived magnitude, frequency, or direction, to ensure the broadest possible range of perspectives was captured. Participants also submitted demographic information, including annual revenue, type of work, geographic region, and number of employees, to characterize the participant pool and support contextual interpretation of the findings. All responses received in this phase were compiled and prepared for inductive thematic coding, which served as the foundation for developing the strategy set used in the subsequent rating phase.

### **3.3.3. Round 2: Quantitative Rating**

The second phase of the Delphi process transitioned from qualitative exploration to quantitative evaluation by asking the expert panel to independently assess the effectiveness of the strategies identified in Round 1. To maintain anonymity and minimize the influence of dominant participants, each panelist submitted their ratings independently without knowledge of other participants' identities or evaluations. Following the completion of the rating process, a summary report of the results was distributed to all participants.

The complete set of forty-seven coded managerial strategies derived from Round 1 was redistributed to the original panelists for independent numerical rating. Of the 34 experts who participated in the qualitative round, 27 provided ratings in this phase, representing a retention level well within acceptable norms for Delphi research and exceeding the commonly recommended minimum of 20 active respondents for reliable consensus development. This phase was designed to measure expert agreement, quantify perceived effectiveness, and establish a ranked understanding of which managerial strategies are most influential in improving project-level cash flow.

### **3.3.4. Rating Scale**

A 100-point scale was used to capture expert ratings rather than a conventional 5-point Likert scale. While Likert scales are commonly used in Delphi studies, their limited response options restrict sensitivity and force participants to express their judgments in broad increments, which can obscure meaningful differences in perceived effectiveness between strategies. This limitation is particularly relevant when evaluating managerial strategies that may vary incrementally in relevance or applicability across firms. Consistent with recommendations in recent research (Pathuri, Killingsworth, & Mehany, 2022), the 100-point scale enabled participants to express

their evaluations with greater precision and allowed the analysis to capture more subtle degrees of differentiation. For example, a score of 100 represents a strategy perceived as universally effective regardless of firm context, whereas a score near 80 may reflect strong support tempered by situational considerations. The continuous scale provided a more flexible and intuitive means for experts to express their judgments, enhancing the overall validity and interpretability of the consensus outcomes.

### **3.3.5. Consensus Criteria**

Consensus plays a central role in Delphi-based research, as it reflects the degree of shared opinion and collective judgment among participants (Von Der Gracht, 2012). Although the Delphi technique is widely used, the definition and operationalization of consensus remain among its most debated methodological components. Prior studies have demonstrated considerable variation in how consensus thresholds are established. Some researchers have defined consensus as occurring when approximately 75% of respondents select either a 4 or 5 on a 5-point Likert scale (Von Der Gracht, 2012), while others have adopted a simple majority of 51% agreement (Loughlin & Moore, 1979), and additional studies have relied on arbitrarily selected criteria without methodological justification (Diamond et al., 2014). This lack of standardization highlights the importance of establishing thresholds that are explicitly justified and appropriate to the goals and analytic needs of research.

The consensus thresholds applied in this study were deliberately set at a higher standard than those used in many prior Delphi studies. While some researchers have defined consensus as a simple majority of 51% agreement (Loughlin & Moore, 1979) or as 75% of respondents selecting a positive rating (Von der Gracht, 2012), this study adopted mean score and standard deviation thresholds across a 100-point scale to capture more precise and nuanced degrees of

expert agreement. This decision was justified by the relatively large number of strategies under evaluation and the practical implications of classifying a strategy as Highly Effective within an industry-facing framework which is a classification that carries direct guidance for practitioners and therefore warranted a more rigorous standard of consensus. The use of a 100-point scale rather than a conventional 5-point Likert scale further enhanced the sensitivity of the consensus measurement by allowing experts to express fine-grained distinctions in perceived effectiveness that a coarser scale would obscure (Pathuri et al., 2021).

In this study, a robust consensus threshold was adopted given the relatively large number of strategies under evaluation and the implications of classifying a strategy as highly effective within an industry-facing cash flow management framework. Consensus was determined based on the mean rating score and standard deviation submitted by the panel, according to the following criteria:

- If the mean rating was 90 or higher and the standard deviation did not exceed 10, the strategy was classified as Highly Effective.
- If the mean rating was 80 or higher and the standard deviation did not exceed 15, the strategy was classified as Effective.
- If the mean rating was 70 or higher and the standard deviation did not exceed 20, the strategy was classified as Moderately Effective.
- If the mean rating was 60 or higher and the standard deviation did not exceed 30, the strategy was classified as Minimally Effective.

### **3.4. Phase 3 - Financial Training Framework Development**

#### **3.4.1. Overview**

The third phase of the study addressed Research Question 5, which explored the fundamental principles that should guide the development of a project-level cash flow training program for electrical contractors. This phase followed the same inductive thematic coding process employed in Phase 1, applied to the open-ended responses provided by the same 34 participating electrical contractors. Participants were asked to respond to the following prompt:

"From your perspective, what fundamental principles should be included in the development of a project-level cash flow training program?"

All 34 participants responded to this question, generating a total of 93 coded responses. The coding process followed the same steps described in Phase 1, including data familiarization, open coding, category development, and peer review by a second researcher, with disagreements resolved through discussion and mutual consensus.

Figure 5 provides a visual overview of the Phase 3 process, illustrating the sequential steps from data collection and thematic coding through module organization, Bloom's Taxonomy application, and the development of the financial training framework.

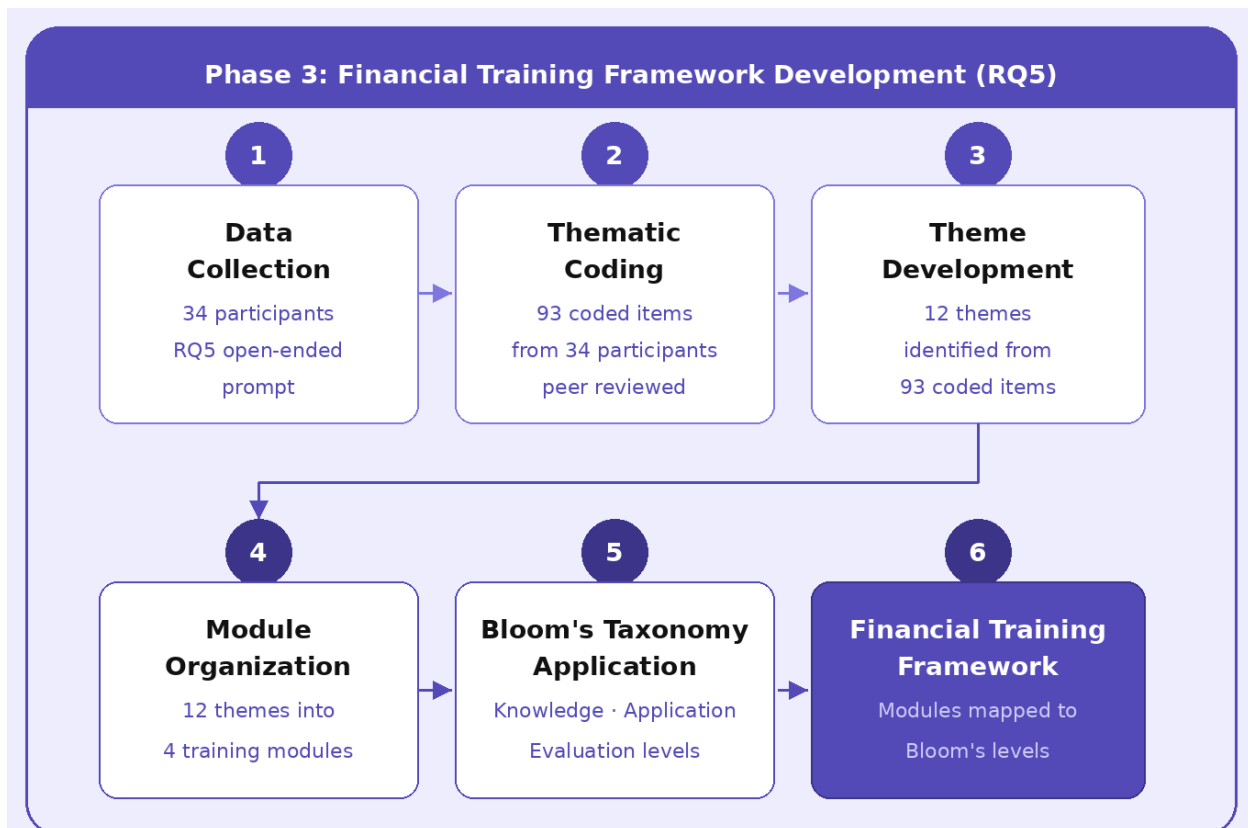


Figure 5 : Phase 3 Methodology Map

### 3.4.2. Module Organization

Following the completion of thematic coding, the 12 training themes identified from participant responses were organized into four training modules based on conceptual relatedness and functional similarity. Themes that addressed related knowledge domains or operational functions were grouped together into a single module to create a coherent and logically sequenced training structure, consistent with established principles of instructional design that emphasize organizing learning content into meaningful clusters to reduce cognitive load and support knowledge transfer ((Anderson & Krathwohl, 2001). The complete module structure and theme assignments are presented in Chapter 4

### 3.4.3. Application of Bloom's Revised Taxonomy

To structure the training framework in a manner that supports progressive skill development, Bloom's Revised Taxonomy of Educational Objectives was adopted as the instructional design framework (Anderson & Krathwohl, 2001). Bloom's Revised Taxonomy is one of the most widely used frameworks in educational and professional training design and provides a hierarchical classification of learning objectives that moves from foundational cognitive processes to higher-order thinking and judgment (Anderson & Krathwohl, 2001; Krathwohl, 2002). The revised taxonomy classifies learning into six hierarchical levels: Remember, Understand, Apply, Analyze, Evaluate, and Create. For the purposes of this training framework, three levels were selected as most applicable to the professional development context of electrical contracting:

1. **Knowledge Level (Remember & Understand)** This level focuses on the learner's ability to recall, define, and explain foundational concepts. Training objectives at this level address topics where practitioners must first build awareness and conceptual understanding before they can act. A representative objective at this level would be: "Define cash flow and explain the difference between cash flow and profitability." The themes assigned to this level and the rationale for their assignment are presented in Chapter 4.
2. **Application Level (Apply & Analyze)** This level focuses on the learner's ability to use knowledge in real project situations and to analyze financial information to support decision-making. Training objectives at this level are process-driven and require hands-on practice with project-level financial tasks. A representative objective would be: "Prepare a monthly invoice using proper documentation and backup materials." The

themes assigned to this level and the rationale for their assignment are presented in Chapter 4.

3. **Evaluation Level (Evaluate & Create)** This level represents the highest order of thinking addressed in the framework and focuses on the learner's ability to assess financial situations, make strategic decisions, and develop improvement plans. Training objectives at this level require judgment and strategic thinking beyond procedural execution. A representative objective would be: "Evaluate a project's cash flow position and develop a corrective action plan." The themes assigned to this level and the rationale for their assignment are presented in Chapter 4.

The assignment of each training theme to a Bloom's level was determined by identifying the expected learning outcome for each topic specifically, whether the primary goal of training was to build awareness and understanding (Knowledge), develop procedural competence (Application), or cultivate strategic judgment and decision-making capability (Evaluation). The complete mapping of training themes to modules and Bloom's levels is presented in Chapter 4

### **3.5. Data Validity and Reliability**

Ensuring the validity and reliability of research findings is a fundamental requirement of rigorous academic inquiry, as it determines the extent to which the study's conclusions accurately represent the phenomenon under investigation and can be trusted by the broader research community (Creswell & Clark, 2007). In mixed-methods research, validity and reliability must be addressed separately for qualitative and quantitative components, as each requires distinct measures appropriate to its analytical nature. In this study, qualitative validity was strengthened through a series of procedural measures applied across Phases 1, 2, and 3, including an inductive data-driven coding approach, data familiarization, peer review, researcher positionality

acknowledgment, and the use of direct participant quotes to anchor findings in raw data. Quantitative reliability was assessed in Phase 2 through three statistical measures: Cronbach's alpha, Kendall's coefficient of concordance, and Spearman's rank correlation coefficient. Figure 6 provides a visual summary of the validity and reliability measures employed across the study.

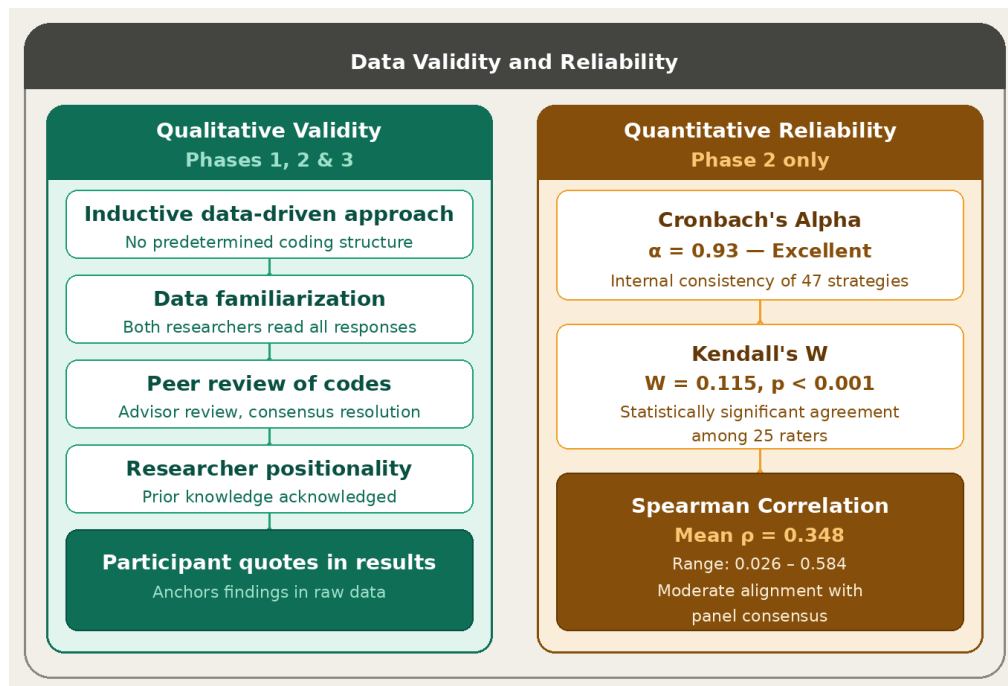


Figure 6 : Data Validity and Reliability

### 3.5.1. Qualitative Validity

Qualitative validity depends on the rigor of the analysis procedures employed by the researcher rather than on statistical measures alone (Creswell & Clark, 2007). In qualitative research, validity is concerned with whether the findings accurately represent the perspectives and experiences of participants and whether the analytical process is transparent and defensible. To strengthen the validity of the qualitative findings in this study, several measures were adopted.

First, an inductive data-driven approach was followed throughout the coding process, meaning that no predetermined coding structure was imposed on the data. Instead, themes and categories were allowed to emerge directly from participant responses, reducing the risk of researcher bias shaping the findings prematurely (Charmaz, 2006). This approach is particularly appropriate given that the study explores an area where a comprehensive, consensus-based understanding of managerial strategies and behavioral drivers is limited in existing literature.

Second, both members of the research team familiarized themselves with the full set of participant responses prior to coding by reading all 34 responses in their entirety. This familiarization process ensured that the subsequent coding was grounded in a thorough understanding of the data rather than surface-level impressions (Williams & Moser, 2019).

Third, to further strengthen validity, direct participant quotes were retained and used in the results chapter to support the identified themes. The use of participant voices as evidence anchors the findings in the raw data and provides readers with a transparent basis for evaluating the interpretations presented (Creswell & Clark, 2007).

Fourth, peer review was conducted by a second researcher who independently reviewed the codes, categories, and thematic assignments produced during the initial coding phase. Where disagreements arose, they were resolved through discussion and mutual consensus. This peer review process adds an additional layer of scrutiny to the analytical decisions made during coding and reduces the likelihood of idiosyncratic or unsupported interpretations (Franz & Roberts, 2022).

Fifth, researcher positionality was acknowledged throughout the study. The primary researcher holds prior knowledge of the construction industry, which may influence the interpretation of participant responses. To manage this potential bias, the inductive coding approach was strictly followed, and all coding decisions were subject to peer review, ensuring that emerging themes reflected participant perspectives rather than researcher assumptions.

It is acknowledged that member checking, whereby findings are returned to participants for verification, was not conducted in this study. This decision was made to preserve the anonymity of the Delphi panel, as returning individualized interpretations to participants could compromise the confidentiality commitments made during recruitment.

### **3.5.2. Quantitative Reliability**

To assess the internal consistency of expert ratings across the 47 managerial strategies evaluated in Phase 2, Cronbach's alpha was calculated. Cronbach's alpha is the most widely used measure of internal consistency in survey-based research and reflects the degree to which raters respond consistently across items (Mallery & George, 2000). It is calculated using the following equation:

$$= \frac{n}{n-1} \left( 1 - \frac{\sum_{i=1}^n \sigma_{Y_i}^2}{\sigma_X^2} \right)$$

Equation 1: Cronbach's Alpha  $\alpha$

Where:

- $n$  = number of items (strategies) being rated
- $\sigma_{Y_i}^2$  = variance of each individual item  $i$  across raters
- $\sigma_X^2$  = variance of the total scores across all items

The analysis was conducted using the ratings provided by 25 panelists who submitted complete responses across all 47 strategies. Two panelists with incomplete responses were excluded from the reliability analysis, consistent with standard practice for Cronbach's alpha calculation. The analysis yielded a coefficient of  $\alpha = 0.93$ , which is classified as excellent and indicates a high degree of consistency in how the expert panel rated the managerial strategies across all categories (Mallery & George, 2000). This result supports the reliability of the consensus outcomes derived from the Delphi rating phase and confirms that the panel's judgments were stable and coherent across the full strategy set.

#### **3.5.2.1. Consensus Agreement Measures**

To supplement the predefined mean and standard deviation consensus thresholds, two additional statistical measures were employed to assess the degree of agreement among raters across the 47 managerial strategies: Kendall's coefficient of concordance ( $W$ ) and Spearman's rank correlation coefficient ( $\rho$ ).

Kendall's  $W$  is the most appropriate measure for assessing agreement among multiple raters simultaneously and is widely used in Delphi studies for this purpose (Diamond et al., 2014). It ranges from 0 (no agreement) to 1 (perfect agreement), with values closer to 1 indicating stronger consensus. It is calculated using the following equation:

$$W = \frac{12S}{k^2(n^3 - n)}$$

Equation 2: Kendall's Coefficient of Concordance (W)

Where:

- $S$ = sum of squared deviations of the rank sums from the mean rank sum
- $k$ = number of raters
- $n$ = number of items (strategies) being rated

The statistical significance of W was evaluated using a chi-square approximation:

$$\chi^2 = k(n - 1)W$$

Equation 3: Chi Square

With degrees of freedom  $df = n - 1$  .

Equation 4: Degrees of Freedom.

The overall Kendall's W was 0.115 ( $S = 621,138$ ;  $\chi^2 = 132.16$ ;  $df = 46$ ;  $p < 0.001$ ), indicating that while the absolute level of concordance is modest, the agreement among raters was statistically significant and not attributable to chance. This finding is consistent with documented patterns in Delphi studies evaluating large item sets, where W values are naturally lower due to the increased difficulty of achieving uniform agreement across many items (Schmidt, 1997).

To complement Kendall's W, Spearman's rank correlation coefficient was calculated for each individual rater against the group mean rating, providing a measure of how consistently each rater's relative rankings aligned with the overall panel consensus. Spearman's rho is calculated as:

$$\rho = 1 - \frac{6\sum d_i^2}{n(n^2 - 1)}$$

Equation 5: Spearman's Rank Correlation Coefficient ( $\rho$ ).

Where:

- $d_i$  = difference between the ranks assigned by the individual rater and the group mean for each strategy  $i$
- $n$  = number of strategies

Spearman's rank correlation coefficients ranged from  $\rho = 0.026$  to  $\rho = 0.584$ , with a mean of  $\rho = 0.348$ , indicating moderate overall alignment between individual judgments and the panel consensus. The variation across raters reflects the diversity of organizational contexts represented in the panel, including differences in firm size, geographic region, and market sector.

It is acknowledged that Kendall's W values in Delphi studies with large item sets tend to be lower in absolute magnitude, as agreement becomes more difficult to achieve across a greater number of items. Therefore, W is interpreted alongside its statistical significance and the Spearman correlations rather than as a standalone indicator of consensus (Schmidt, 1997).

Table 4: Summary of Quantitative Reliability Measures

| Measure                       | Value                      | Interpretation                                      |
|-------------------------------|----------------------------|-----------------------------------------------------|
| Cronbach's Alpha ( $\alpha$ ) | 0.93                       | Excellent internal consistency across 47 strategies |
| Kendall's W                   | 0.115, $p < 0.001$         | Statistically significant agreement among 25 raters |
| Spearman $\rho$ (Mean)        | 0.348 (range: 0.026–0.584) | Moderate alignment with panel consensus             |

This chapter outlined the three-phase research methodology employed to address the five research questions guiding this study. Phase 1 applied inductive thematic coding to responses collected from 34 electrical contractors to identify themes related to cash flow causes, behaviors, and managerial strategies. Phase 2 employed the Delphi method to evaluate and prioritize the 47 strategies identified in Phase 1 through an anonymous expert rating process. Phase 3 applied thematic coding to RQ5 responses, and the resulting 12 training themes were organized into four modules structured using Bloom's Revised Taxonomy. The validity and reliability of the study were confirmed through both qualitative and quantitative measures, as detailed in this chapter. The findings generated across all three phases are presented in Chapter 4.

## CHAPTER 4: RESULTS

This chapter presents the findings of the study organized by phase, reflecting the three-phase research methodology described in Chapter 3, and within each phase by research question. Phase 1 findings, derived from inductive thematic analysis of open-ended responses collected from 34 electrical contractors, are presented for RQ1, RQ2, RQ3, and RQ4. Phase 2 findings, derived from the Delphi expert rating process, are presented for RQ4 and include strategy effectiveness classifications and consensus agreement analysis. Phase 3 findings, derived from thematic analysis of RQ5 responses, present the training themes, module structure, and Bloom's Taxonomy mapping that informed the development of the financial training framework. Together, the findings across all three phases provide an integrated and evidence-based understanding of the causes, behavioral contributors, managerial strategies, and training needs associated with project-level cash flow management in the electrical subcontracting industry. A detailed description of participant demographics is provided in Chapter 3. The findings presented in this chapter are based on responses collected from the 34 electrical contractors who participated in the study.

### **4.1. Phase 1 Results - Thematic Analysis (RQ1, RQ2, RQ3 & RQ4)**

Phase 1 of the study applied inductive thematic analysis to open-ended responses collected from 34 electrical contractors across four research questions. Each research question was analyzed independently, with codes grouped into categories and subsequently developed into themes representing the major patterns across participant responses. The findings for each research question are presented in the sections that follow.

#### **4.1.1. Research Question 1: Primary Causes of Project-Level Cash Flow Challenges and Lengthy Accounts Receivable**

Open ended Prompt: What are the primary causes of project-level cash flow challenges and lengthy accounts receivable in the electrical subcontracting industry?

The thematic analysis of participant responses to the first open-ended prompt yielded seven themes representing the primary causes of lengthy accounts receivable in the electrical subcontracting industry. A total of 117 coded responses were generated across all 34 participants.

Table 5 presents the frequency distribution of identified themes.

Table 5: Frequency Analysis for RQ1

| No | Theme                                                          | Frequency |
|----|----------------------------------------------------------------|-----------|
| 1  | Payment, Approval, and Administrative Delays by Owners and GCs | 38        |
| 2  | Compliance and Documentation Issues                            | 21        |
| 3  | Unfavorable Contract Conditions                                | 21        |
| 4  | Weak Prequalification and Contract Negotiation                 | 14        |
| 5  | Slow Change Order Processing                                   | 11        |
| 6  | Poor Internal Systems and Staff Capabilities                   | 8         |
| 7  | Owner Funding Issues                                           | 4         |

##### **1. Payment, Approval, and Administrative Delays by Owners and GCs**

The most frequently cited cause of lengthy accounts receivable, accounting for 38 coded responses, was payment, approval, and administrative delays initiated by owners and general

contractors. Participants described a systemic pattern in which invoices passed through multiple approval layers before payment was released, creating prolonged payment cycles that were largely outside the control of the electrical subcontractor. One participant captured the ripple effect of these delays: *"Typically, billing goes through multiple channels prior to getting to the money, so when one party holds a billing an extra day or week, our payment gets stretched out further"* (R5). Another noted the practical reality of payment timelines: *"Our minimum days outstanding is 50 days in a perfect scenario... a more realistic number is 65 days outstanding"* (R18). Participants also highlighted the deliberate nature of some delays, with one respondent stating that *"owners and GCs deliberately delay payments to hold money longer"* and that *"lack of consequences encourages delayed payments"* (R1). Approval processes were described as particularly burdensome, with invoices taking *"anywhere from 90 to 365 days+ to move through multiple layers of approval"* (R6).

## **2. Compliance and Documentation Issues**

The second theme, tied in frequency at 21 responses, addressed compliance and documentation challenges that delay payment. Participants consistently described situations where missing or incomplete documents including lien releases, certified payroll records, and packing slips provided owners and GCs with justification to withhold payment. One participant noted the breadth of documentation required: *"Project documents, lien waivers, certified payroll, and various other documents can and will slow up payment"* (R18). Another highlighted how incomplete invoicing gave clients leverage: *"Completeness and accuracy of invoicing allowing customers an excuse to delay payment"* (R29). The challenge of managing varied documentation requirements across different clients was also noted: *"Meeting the different needs of each customer's billing requirements is challenging to manage"* (R9).

### **3. Unfavorable Contract Conditions**

Also appearing 21 times, unfavorable contract conditions were identified as a structural cause of payment delays. Participants described contracts that lacked enforceable payment terms, contained pay-when-paid clauses, or failed to protect the subcontractor's right to timely payment. One participant described the vulnerability of subcontractors in the payment chain: *"We have very little control over the timing of cash flows from the owner to the general contractor"* (R9). Another noted the lack of visibility in upstream payment terms: *"We do not have access to GC payment terms with the owner nor are we included in their negotiations"* (R18).

### **4. Weak Prequalification and Contract Negotiation**

Fourteen responses identified weak prequalification and contract negotiation practices as contributing to lengthy accounts receivable. Participants described entering projects without adequately screening clients for financial reliability or negotiating protective payment terms. One respondent emphasized the downstream consequences: *"Our billing is dependent on all subs getting theirs in accurately and on time. We are only as good as the weakest link"* (R18).

### **5. Slow Change Order Processing**

Eleven responses addressed slow change order processing as a significant contributor to payment delays. Participants described situations where work proceeded based on verbal approvals, but formal change orders were not issued for weeks or months, preventing billing. One participant described the financing burden this creates: *"This practice forces the contractor to finance all changes until a contract change is approved by the owner and issued by the GC"* (R18). Another noted: *"Customers are quick to say 'proceed' on revisions and adds but not as quick to issue the corresponding change order to bill against"* (R34).

## **6. Poor Internal Systems and Staff Capabilities**

Eight responses identified internal weaknesses including inadequate billing systems, insufficient staffing, and limited financial knowledge among project managers as contributing factors to delayed collections. One participant noted the organizational impact: *"Not tracking completed quantities delays recognizing receivable at the time the work is performed"* (R26).

## **7. Owner Funding Issues**

The least frequently cited theme, appearing four times, addressed situations where owners lacked sufficient funding to pay contractors on time. Projects often proceeded without secured financing, or owners faced their own cash flow problems that rippled down the payment chain. One participant described a common scenario: *"Clients asking for work they don't have funded"* (R14). Another pointed to broader financing failures: *"The projects are not funded properly, or the government agency hangs on to the money for other means"* (R21). Banking delays were also cited as a contributing factor: *"Banks not funding timely"* (R24). While less common than other themes, participants noted that owner funding problems created significant disruptions entirely outside the subcontractor's control: *"Decreased liquidity of our customers"* (R29).

### **4.1.2. Research Question 2: Internal Organizational Behaviors Contributing to Project-Level Cash Flow Problems**

Open ended prompt: What internal organizational behaviors contribute to project-level cash flow problems in electrical subcontracting firms?

The thematic analysis of participant responses to the second open-ended prompt yielded five themes representing the internal organizational behaviors that contribute to project-level cash flow problems. Table 6 presents the frequency distribution of identified themes.

Table 6: Frequency Analysis for RQ2

| No | Theme                                                      | Frequency |
|----|------------------------------------------------------------|-----------|
| 1  | Internal Skills Gap, Poor Training, and Staffing Shortages | 15        |
| 2  | Contract and Project Setup Oversight                       | 15        |
| 3  | Poor Billing Practices and Delayed Invoicing               | 14        |
| 4  | Weak Cash Flow Ownership and Accountability                | 14        |
| 5  | Poor Communication                                         | 10        |

### 1. Internal Skills Gap, Poor Training, and Staffing Shortages

The most frequently cited internal behavior, appearing 15 times, was the skills gap among project managers and field personnel, compounded by inadequate training and staffing shortages. Participants described project managers who lacked financial knowledge, billing software skills, and contract awareness needed to manage cash flow effectively. One participant captured the breadth of this gap: *"Lack of basic financial acumen trained project managers"* (R18). Another described the systemic nature of the problem: *"If inexperience is the determining factor, companies need to train rather than expect their employees to learn from trial and error"* (R1). The absence of formal training on billing strategies was also highlighted: *"Train in developing cash-generating SOVs, general construction cash flow concepts, strategically working with subcontractors to bill every month and bill completely"* (R3). Staffing shortages further

compounded these issues, with one participant noting: *"Late invoicing due to being understaffed, we are implementing processes to fix this"* (R14).

## **2. Contract and Project Setup Oversight**

Also appearing 15 times, contract and project setup oversights were identified as a significant internal contributor to cash flow problems. Participants described situations where payment terms were not clearly established at project start, change orders were poorly managed, and billing requirements were overlooked. One participant noted the downstream consequences of weak setup: *"Our team sometimes fails to clearly highlight payment expectations at the beginning of a project or does not account for a client's historical payment behavior"* (R6).

Another described the impact of poor change order management: *"Holding the customer accountable to approving COs, not properly documenting and managing change orders can lead to disputes"* (R11). Performing out-of-scope work before formal authorization was also flagged: *"Performing out-of-scope services when change order or amended PO has not been executed"* (R29).

## **3. Poor Billing Practices and Delayed Invoicing**

Fourteen responses identified poor billing practices and delayed invoicing as internal behaviors that worsen cash flow. Participants described project managers who deprioritized billing, submitted incomplete documentation, or delayed invoice preparation until well into the following month. One participant described the cumulative effect: *"Our project managers are not prepared to provide our project accountants with that information, sometimes not until mid-month of the following month... putting us 60 days out on cash"* (R8). Another noted the tendency to delay billing during busy periods: *"All of us get busy and billing is sometimes put on the back burner"*

*while field problems are being addressed"* (R19). Incomplete or inaccurate invoices was also identified as giving clients leverage: *"Completeness and accuracy of invoicing allowing customers an excuse to delay payment; not billing timely"* (R29).

#### **4. Weak Cash Flow Ownership and Accountability**

Also appearing 14 times, weak cash flow ownership and accountability was identified as a pervasive internal behavior that undermines financial performance. Participants described organizations where cash flow was treated as a finance department responsibility rather than a shared operational priority, and where project managers lacked accountability for billing and collections outcomes. One participant was direct about the misalignment: *"Operations not owning cash flow thinking it's a finance issue"* (R3), adding that *"ops has much more impact than finance in collection issues and cash generation"* (R3). The absence of leadership emphasis was also cited: *"Lack of a top-down CEO requirement that cash flow is as important as margin and profitability to a company's strength"* (R3). One participant described the broader organizational culture issue: *"Paperwork and accounting as well as collecting cash are secondary to getting the work done"* (R26).

#### **5. Poor Communication**

Ten responses identified poor internal communication as a contributing factor to cash flow problems. Participants described breakdowns between project managers and accounting teams, insufficient follow-up on overdue payments, and a reluctance among project managers to have difficult conversations with clients about collections. One participant identified communication

as the root cause: *"Communication is the number one issue internally when cash flow is delayed... poor communication inherently slows down the invoicing process and cash flow as a result"* (R9). Another described a common avoidance pattern: *"PM not wanting to call, not wanting to negotiate when needed, procrastination by our PMs"* (R7). Overreliance on email rather than direct communication was also flagged: *"Overreliance on emails, rather than phone calls"* (R12).

#### **4.1.3. Research Question 3: External Stakeholder Behaviors Exacerbating Project-Level Cash Flow Challenges**

RQ3: What external stakeholder behaviors exacerbate project-level cash flow challenges for electrical subcontractors?

The thematic analysis of participant responses to the third open-ended prompt yielded seven themes representing the external stakeholder behaviors that exacerbate project-level cash flow challenges. Table 7 presents the frequency distribution of identified themes.

Table 7: Frequency Analysis for RQ 3

| No | Theme                                                        | Frequency |
|----|--------------------------------------------------------------|-----------|
| 1  | Delayed and Disorganized Payment Practices by Owners and GCs | 21        |
| 2  | Strategic Withholding and Financial Leverage                 | 17        |
| 3  | Communication Gaps and Accountability Avoidance              | 15        |

|   |                                                           |    |
|---|-----------------------------------------------------------|----|
| 4 | Unfair Payment Practices and Power Differences            | 15 |
| 5 | Staffing Shortages and Skills Gap                         | 8  |
| 6 | Proactive Cash Flow Strategies                            | 6  |
| 7 | Bureaucratic Delays from Public and Institutional Clients | 6  |

## 1. Delayed and Disorganized Payment Practices by Owners and GCs

The most frequently cited external behavior, appearing 21 times, was delayed and disorganized payment practices by owners and general contractors. Participants described systemic inefficiencies in billing systems, inconsistent invoice processing, and extended payment cycles that created significant unpredictability for electrical subcontractors. One participant described the organizational dysfunction at the GC level: *"Outdated or poorly organized accounting systems... missed invoices, disorganized payment schedules, and extended delays"* (R6). Another noted the practical consequence of extended cycles: *"Typical pay cycle of 60+ days"* (R11). The compounding effect of multiple parties in the payment chain was also highlighted: *"On larger projects, one contractor fighting to get paid can hold up all others"* (R32). Participants also described situations where GC billing departments were stretched thin: *"GC billing departments stretched thin across projects"* (R1), reducing their capacity to process invoices efficiently.

## 2. Strategic Withholding and Financial Leverage

Seventeen responses identified deliberate withholding of payments and the strategic use of financial leverage by owners and GCs as significant external behavior. Participants described owners and GCs who intentionally delayed payments to manage their own cash positions at the

expense of subcontractors. One participant described the deliberate nature of this behavior: *"At times, external members may intentionally delay payments for cash flow management"* (R6). The use of change orders as leverage was widely reported: *"Client holding change orders can affect us tremendously... using change orders as leverage"* (R1). One participant described the financial burden this placed on smaller firms: *"Billing going back to June delayed until November... painful for us being a smaller company"* (R8). The practice of floating money to earn interest before paying subcontractors was also cited: *"If a GC is floating money held back... the interest earned can be large"* (R28).

### **3. Communication Gaps and Accountability Avoidance**

Fifteen responses identified communication gaps and accountability avoidance among external stakeholders as behaviors that worsen cash flow. Participants described GCs and owners who failed to communicate invoice status, avoided difficult billing conversations, and lacked accountability for resolving payment disputes. One participant described a common experience: *"Most of the time, you are notified when you follow up on payment or when they get ready to cut your check"* (R1). Another highlighted the lack of transparency from GCs: *"Disrespect in GCs not communicating when they are holding up payment"* (R12). Owner representatives were also described as failing to take responsibility: *"Owners reps are not held accountable on their timeliness to resolve discrepancies"* (R17). One participant emphasized the need for proactive engagement: *"All parties involved should be appraised of the process and its importance, so delays are minimized"* (R24).

### **4. Unfair Payment Practices and Power Differences**

Also appearing 15 times, unfair payment practices and structural power imbalances were identified as external behaviors that systematically disadvantaged electrical subcontractors. Participants described a construction payment ecosystem where owners and GCs held disproportionate power and used it to shift financial risk onto subcontractors. One participant described the expectation bluntly: *"Owners and GCs literally planning around subs carrying the project financially"* (R3). The pay-when-paid structure was identified as a key mechanism for transferring financial risk: *"Pay-when-paid structure creates a domino effect, impacting cash flow for everyone down the line"* (R6). One participant noted that this practice was sometimes used beyond its legal validity: *"Others will argue that they'll pay when, or if, paid by the owner, but... that is no longer a lawful reason to withhold payment"* (R19). The indifference of some clients to subcontractor cash flow was also described: *"It's not their money, so who cares?"* (R28).

## **5. Staffing Shortages and Skills Gap**

Eight responses identified staffing shortages and skills gaps among external stakeholders particularly at the GC and owner level as behaviors that slow payment processing and worsen cash flow for subcontractors. Participants described GC project coordinators managing too many projects simultaneously: *"GC project coordinators can cover several projects at one time with many subcontractors on every one of those projects"* (R1). The industry-wide nature of the problem was noted: *"People are spread thin with little experience and there is no incentive to fix this"* (R1). Public agencies were also cited as understaffed: *"Lack of personnel at these public agencies"* (R7), while paradoxically, overstaffing in some cases also created inefficiency: *"Too many personnel... bored and not on top of things"* (R7).

## **6. Proactive Cash Flow Strategies**

Six responses, while addressing external behaviors, also highlighted proactive steps that electrical subcontractors can take to mitigate the impact of external cash flow disruptions. Participants described strategies such as front-loading schedules of values, submitting invoices early, and carefully selecting project partners. One participant emphasized the importance of SOV strategy: *"It is extremely important to create a front-loaded SOV, submit that SOV as soon as possible"* (R1). Another described the value of selective partnership: *"Choose good partners to work with"* and *"if not paid in acceptable terms renegotiate better terms or discontinue future opportunities"* (R16). Requiring change order approval before starting work was also recommended: *"Ensure all change orders approved before work starts"* (R16).

## **7. Bureaucratic Delays from Public and Institutional Clients**

The least frequently cited external behavior, which appeared six times, was bureaucratic delays from public sector and institutional clients. Participants described rigid administrative processes, excessive oversight layers, and inflexible billing systems that significantly slowed payment in public projects. One participant captured the inherent slowness of public sector payment: *"Payment for government entities, city, state, county, feds, banks, owners are just naturally slow"* (R7). The complexity of public sector oversight was also highlighted: *"Lots of oversight... council meetings, association meetings, pay app software inflexibility"* (R7). Rigid stored material billing restrictions in public project specifications were also cited: *"Public agencies have rigid specs on stored material billing"* (R17).

#### 4.1.4. Research Question 4: Managerial Strategies for Improving Project-Level Cash Flow

Open ended prompt: What managerial strategies are perceived as most effective by industry experts in improving project-level cash flow performance in electrical subcontracting?

The thematic analysis of participant responses to the fourth open-ended prompt yielded 47 coded managerial strategies, which were subsequently organized into five categories representing the major domains of cash flow management practice. Table 8 presents the five strategy categories identified through thematic coding.

Table 8: Strategy Categories from Phase 1 Thematic Coding

| Category     | Category Name              | No. of Strategies<br>(n=47) | Percentage of<br>Strategies |
|--------------|----------------------------|-----------------------------|-----------------------------|
| A            | Operations & Procedures    | 11                          | 23%                         |
| B            | Training                   | 10                          | 21%                         |
| C            | Bidding & Contract Terms   | 13                          | 28%                         |
| D            | Communication & Analytics  | 6                           | 13%                         |
| E            | Organizational Development | 7                           | 15%                         |
| <b>Total</b> |                            | <b>47</b>                   | <b>100%</b>                 |

The 47 managerial strategies identified through thematic coding were organized into five categories. Category A - Operations & Procedures included 11 strategies focused on invoicing, billing processes, collections, and quality control. Category B - Training included 10 strategies covering financial concepts, billing approaches, and change order management. Category C - Bidding & Contract Terms was the largest category with 13 strategies, representing 28% of all

identified strategies, and addressed customer prequalification, contract negotiation, and risk management. Category D - Communication & Analytics included 6 strategies related to measurement, accountability, forecasting, and relationship management. Category E - Organizational Development included 7 strategies addressing leadership focus, staffing, business planning, and financial reserves. These 47 strategies were subsequently redistributed to the expert panel for quantitative rating in Phase 2, the results of which are presented in Section 4.3.

## **4.2. Phase 2 Results - Delphi Method (RQ4)**

### **4.2.1. Strategy Effectiveness Classifications**

The second phase of the study asked 27 expert panelists to independently rate each of the 47 managerial strategies on a 100-point scale, where a score of 100 indicated absolute confidence that the strategy would improve project-level cash flow, and a score of 0 indicated absolute confidence that it would cause poor cash flow. A score of 50 indicated a neutral position. Mean scores and standard deviations were calculated for each strategy, and effectiveness classifications were assigned based on the predefined thresholds established in the methodology. At the consensus level, no strategies were considered uniformly ineffective. However, several strategies received individual ratings below 50 from specific participants, reflecting variation in how practitioners perceive certain approaches based on their firm context and market experience.

The results identified two Highly Effective strategies, thirteen Effective strategies, fifteen Moderately Effective strategies, sixteen Minimally Effective strategies, and one Less Effective strategy. Each strategy is identified by an alphanumeric code where the letter denotes the category and the number denotes the strategy's position within that category (e.g., A5 refers to the fifth strategy in Category A - Operations & Procedures)

Table 9 presents a summary of the number of strategies per effectiveness level and category, providing an overview of how the 47 managerial strategies were distributed across the five categories and four effectiveness classifications following the Delphi rating process.

Table 9: Number of Strategies per Effectiveness Level and Category

| Category                     | Highly Effective | Effective | Moderately Effective | Minimally Effective | Less Effective | Total     |
|------------------------------|------------------|-----------|----------------------|---------------------|----------------|-----------|
| A- Operations & Procedures   | 2                | 4         | 2                    | 3                   | 0              | 11        |
| B-Training                   | 0                | 3         | 3                    | 4                   | 0              | 10        |
| C-Bidding & Contract Terms   | 0                | 0         | 4                    | 8                   | 1              | 13        |
| D-Communication & Analytics  | 0                | 3         | 2                    | 1                   | 0              | 6         |
| E-Organizational Development | 0                | 3         | 4                    | 0                   | 0              | 7         |
| <b>Total</b>                 | <b>2</b>         | <b>13</b> | <b>15</b>            | <b>16</b>           | <b>1</b>       | <b>47</b> |

The results revealed that no strategies were classified as uniformly ineffective at the consensus level, indicating that all 47 strategies carry at least some positive value for improving project-level cash flow. The zeros in the table reflect the absence of strategies from a given category at a particular effectiveness level, not that those strategies were considered ineffective. The detailed effectiveness classifications for each level are presented in the sections that follow.

## 1. Highly Effective Strategies

Two strategies achieved a mean score of 90 or above with a standard deviation not exceeding 10, classifying them as Highly Effective. Both strategies belonged to Category A -Operations & Procedures, reflecting the panel's strong consensus that operational discipline in invoicing and collections represents the highest-impact approach to improving project-level cash flow as shown in Table 10.

Table 10: Highly Effective Managerial Strategies

| No. | Managerial Strategy                                                                                         | Mean Score | St. Dev. |
|-----|-------------------------------------------------------------------------------------------------------------|------------|----------|
| A5  | Maintain timely and consistent invoicing to prime contractor or owner                                       | 94.63      | 9.09     |
| A6  | Maintain timely and consistent follow-up with owner or prime contractor, especially chronically slow payers | 92.59      | 9.54     |

## 2. Effective Strategies

Thirteen strategies achieved a mean score above 80 with a standard deviation less than 15, classifying them as Effective. These strategies span four of the five categories, with Category C - Bidding & Contract Terms being the only category without a strategy at this level of effectiveness as shown in Table 11.

Table 11: Effective Managerial Strategies

| No. | Managerial Strategy | Mean Score | St. Dev. |
|-----|---------------------|------------|----------|
|-----|---------------------|------------|----------|

| <b>Category A: Operations &amp; Procedures</b>   |                                                                                                                              |       |       |
|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-------|-------|
| A1                                               | Establish clear collections processes with specific trigger points                                                           | 88.15 | 12.87 |
| A7                                               | Implement an invoice checklist to ensure comprehensive billings, necessary paperwork, lien releases, back-up documents, etc. | 88.15 | 12.41 |
| A8                                               | Negotiate supplier terms, especially on larger projects                                                                      | 85.77 | 14.88 |
| A9                                               | Make quality control a priority to avoid rework and rejected invoices                                                        | 85.42 | 12.92 |
| <b>Category B: Training</b>                      |                                                                                                                              |       |       |
| B14                                              | Schedule of Values - how to appropriately front-end load and sustain cash flow through completion                            | 88.85 | 20.46 |
| B18                                              | Change order management, formalize authorization procedures, include profit escalation and integrate with WIP report         | 89.54 | 10.20 |
| B21                                              | Understand principles of producing profits, profit fade, and the difference between cash flow and profitability              | 87.12 | 12.97 |
| <b>Category D: Communication &amp; Analytics</b> |                                                                                                                              |       |       |
| D35                                              | Emphasize and teach communication                                                                                            | 88.89 | 13.47 |
| D37                                              | Expect follow-up responses from PMs on under-performing projects, including a recovery plan                                  | 89.69 | 12.65 |
| D38                                              | Constantly work to establish and maintain professional relationships of trust with all project stakeholders                  | 89.58 | 14.25 |
| <b>Category E: Organizational Development</b>    |                                                                                                                              |       |       |
| E42                                              | Establish collection accountability with project managers                                                                    | 85.00 | 12.81 |
| E43                                              | Executives must have consistent focus and procedure on cash flow and cash forecasting                                        | 87.88 | 14.15 |
| E47                                              | Maintain cash reserves and credit access to weather financial ebbs and flows of economic change.                             | 93.80 | 11.66 |

3. It is worth noting that strategy E47 achieved a mean score of 93.80, which exceeded the Highly Effective mean threshold of 90. However, its standard deviation of 11.66 exceeded the required threshold of 10, and therefore it was classified as Effective rather than Highly

Effective. The distinction was driven by a single respondent who rated the strategy at 50, which elevated the standard deviation beyond the required threshold.

#### 4. Moderately Effective Strategies

Fifteen strategies achieved a mean score above 70 with a standard deviation less than 20, classifying them as Moderately Effective. All five categories were represented at this level as shown in Table 12.

Table 12: Moderately Effective Managerial Strategies

| Managerial Strategy No.                                                                                       | Mean Score | St. Dev. |
|---------------------------------------------------------------------------------------------------------------|------------|----------|
| <b>Category A: Operations &amp; Procedures</b>                                                                |            |          |
| A2 Finance Department prepares monthly cash flow report with executive notes                                  | 82.96      | 17.45    |
| A3 Project executives review change order status frequently with PM                                           | 84.27      | 16.05    |
| <b>Category B: Training</b>                                                                                   |            |          |
| B13 Teach cash flow concepts including billings, collections, vendor management, pay-when-paid, and retainage | 85.19      | 16.84    |
| B17 Understand the Work in Progress report including over/under billings                                      | 84.81      | 18.03    |
| B19 Learn to hold professional conversations about SOV, payment terms, collections, and cash flow needs       | 85.74      | 17.69    |
| <b>Category C: Bidding &amp; Contract Terms</b>                                                               |            |          |
| C22 Know your customers well, with attention to their Days in AP                                              | 79.63      | 16.75    |
| C25 Pre-bid internal meeting with estimating, project management, accounting, and legal                       | 80.00      | 17.72    |
| C27 Review contract thoroughly and negotiate late fees and payment terms at preconstruction                   | 82.78      | 19.48    |
| C32 Know when partial retainage can be released                                                               | 86.81      | 19.48    |

| <b>Category D: Communication &amp; Analytics</b> |                                                                                         |       |       |
|--------------------------------------------------|-----------------------------------------------------------------------------------------|-------|-------|
| D36                                              | Establish measurement and accountability on a monthly basis for project-level cash flow | 87.31 | 15.25 |
| D39                                              | Use forecasting tools for cash flow management from the beginning of the project        | 81.54 | 19.38 |
| <b>Category E: Organizational Development</b>    |                                                                                         |       |       |
| E41                                              | Have a full-time dedicated collections representative when financially feasible         | 81.15 | 19.81 |
| E44                                              | Update the company's business plan recognizing strengths and weaknesses                 | 78.80 | 19.38 |
| E45                                              | Ensure business development is aligned with company goals                               | 84.80 | 15.84 |
| E46                                              | Create a culture of holding regular value-driven meetings                               | 85.20 | 18.28 |

## 5. Minimally Effective Strategies

Sixteen strategies achieved a mean score above 60 with a standard deviation less than 30, classifying them as Minimally Effective. This classification observed the greatest variance in mean scores across strategies. Category E- Organizational Development had no strategies at this level as shown in Table 13.

Table 13: Minimally Effective Managerial Strategies

| Managerial Strategy No.                        | Mean Score                                                                             | St. Dev.    |
|------------------------------------------------|----------------------------------------------------------------------------------------|-------------|
| <b>Category A: Operations &amp; Procedures</b> |                                                                                        |             |
| A4                                             | Establish recognition program that rewards operations teams for cash flow improvements | 67.50 22.06 |

|     |                                                                                            |       |       |
|-----|--------------------------------------------------------------------------------------------|-------|-------|
| A10 | Hold in-person billing reviews with owner/prime contractor when possible                   | 65.58 | 24.63 |
| A11 | Establish a procedure of duplicity in reviewing billings prior to sending them to customer | 74.80 | 21.19 |

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#### **Category B: Training**

|     |                                                                         |       |       |
|-----|-------------------------------------------------------------------------|-------|-------|
| B12 | Teach business acumen including managerial accounting principles        | 84.62 | 20.20 |
| B15 | SOVs to always be reviewed by executive-level personnel                 | 87.00 | 21.24 |
| B16 | Understand how to maximize billings and ethical limits of over-billings | 87.00 | 21.24 |
| B20 | Learn to leverage trade discounts to incentivize early payment terms    | 80.19 | 23.14 |

---

#### **Category C: Bidding & Contract Terms**

|     |                                                                                          |       |       |
|-----|------------------------------------------------------------------------------------------|-------|-------|
| C23 | Only pursue new customers when aligned with business plan and risk management plan       | 76.26 | 24.99 |
| C24 | Establish a pre-bid checklist including prequalification of owner and prime contractor   | 78.46 | 20.04 |
| C26 | Establish a premium mark-up for slow-paying customers                                    | 77.33 | 27.12 |
| C28 | Require SOV from sub-tier contractors                                                    | 77.58 | 27.12 |
| C29 | Threaten legal action when appropriate                                                   | 76.30 | 21.55 |
| C30 | Understand supply chain dynamics and establish procedures for pre-ordering key materials | 80.62 | 23.46 |
| C31 | Always check insurance limits for materials in storage                                   | 76.92 | 25.06 |
| C33 | For small projects, negotiate down-payment terms especially with new customers           | 78.89 | 24.86 |

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#### **Category D: Communication & Analytics**

|     |                                                                                  |       |       |
|-----|----------------------------------------------------------------------------------|-------|-------|
| D40 | Use automated analytics software to improve timeliness and accuracy of billings. | 76.46 | 24.86 |
|-----|----------------------------------------------------------------------------------|-------|-------|

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## **6. Less Effective Strategy**

One strategy was classified as Less Effective, achieving a mean score above 60 but with a standard deviation exceeding 30, indicating the highest level of disagreement among raters as shown in Table 14.

Table 14: Less Effective Managerial Strategy

| No. | Managerial Strategy                                   | Mean Score | St. Dev. |
|-----|-------------------------------------------------------|------------|----------|
| C34 | If possible, increase invoice frequency to two weeks. | 69.42      | 30.38    |

Strategy C34 was the only strategy to receive multiple individual ratings of zero, with five participants rating it below 50 and six participants rating it between 95 and 100, reflecting a fundamental disagreement among experts about its applicability. The high standard deviation of 30.38 indicates that this strategy's effectiveness is highly context-dependent, with some practitioners finding it highly valuable while others consider it counterproductive.

#### 4.2.2. Consensus Agreement Analysis

To assess the degree of agreement among the 25 raters across the 47 managerial strategies, Kendall's coefficient of concordance (W) and Spearman's rank correlation coefficients were calculated.

The overall Kendall's W was 0.115 ( $S = 621,138$ ;  $\chi^2 = 132.16$ ;  $df = 46$ ;  $p < 0.001$ ), indicating that while the absolute level of concordance is modest, the agreement among raters was statistically significant and not attributable to chance. This finding is consistent with documented patterns in Delphi studies evaluating large item sets, where W values are naturally suppressed by the increased difficulty of achieving uniform agreement across many items (Schmidt, 1997). The

statistical significance of the result confirms that the panel's collective rankings reflect a meaningful and non-random pattern of consensus.

Spearman's rank correlation coefficients between individual rater rankings and the group mean ranged from  $\rho = 0.026$  to  $\rho = 0.584$ , with a mean of  $\rho = 0.348$ , indicating moderate overall alignment between individual judgments and the panel consensus. The variation across raters reflects the diversity of organizational contexts represented in the panel, including differences in firm size, geographic region, and market sector, which is expected in a study designed to capture broad industry perspectives.

To assess consensus among raters, three statistical measures were calculated: Cronbach's alpha, Kendall's coefficient of concordance (W), and Spearman's rank correlation coefficient.

Cronbach's alpha yielded  $\alpha = 0.93$ , indicating excellent internal consistency across the 47 strategies. The overall Kendall's W was 0.115 ( $S = 621,138$ ;  $\chi^2 = 132.16$ ;  $df = 46$ ;  $p < 0.001$ ), and Spearman's rank correlation coefficients ranged from  $\rho = 0.026$  to  $\rho = 0.584$  with a mean of  $\rho = 0.348$ . Kendall's W was also calculated separately for each of the five strategy categories, as presented in Table 15.

Table 15: Kendall's W and Statistical Significance by Strategy Category

| Category                      | W     | $\chi^2$ | df | p-value |
|-------------------------------|-------|----------|----|---------|
| A - Operations & Procedures   | 0.254 | 63.38    | 10 | < 0.001 |
| B -Training                   | 0.049 | 11.12    | 9  | 0.267   |
| C - Bidding & Contract Terms  | 0.047 | 14.09    | 12 | 0.295   |
| D - Communication & Analytics | 0.051 | 6.35     | 5  | 0.274   |

|                                |       |       |   |       |
|--------------------------------|-------|-------|---|-------|
| E - Organizational Development | 0.105 | 15.72 | 6 | 0.015 |
|--------------------------------|-------|-------|---|-------|

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*Statistically significant at  $p < 0.05$*

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The strongest agreement was observed in Category A (Operations & Procedures;  $W = 0.254$ ,  $p < 0.001$ ), suggesting that experts reached the highest level of consensus regarding operational and procedural strategies for cash flow improvement. Category E (Organizational Development) also demonstrated statistically significant agreement ( $W = 0.105$ ,  $p = 0.015$ ). Categories B, C, and D did not reach statistical significance, which may reflect the greater variability in how firms across different sizes and sectors approach training, bidding, and communication strategies. These findings are interpreted alongside the mean score and standard deviation consensus thresholds established in the methodology, which remain the primary basis for strategy classification.

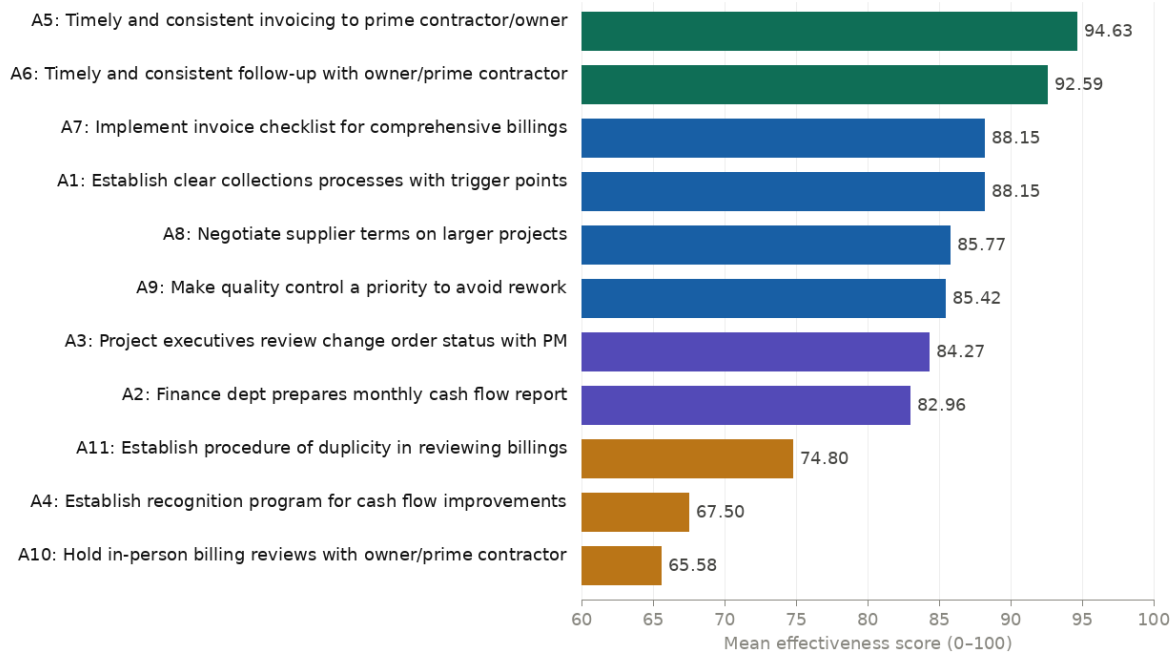
To provide a visual representation of the effectiveness ratings across all five strategy categories, Figures 7 through 11 present horizontal bar charts illustrating the mean score of each strategy within its respective categories. Strategies are ranked from highest to lowest mean score and color-coded according to their effectiveness classification: Highly Effective, Effective, Moderately Effective, Minimally Effective, and Less Effective as defined by the consensus thresholds established in the methodology. These figures complement the detailed effectiveness

tables presented in the preceding sections and allow for a direct visual comparison of strategy ratings within each category.

Figure 7: Mean Effectiveness Scores - Category A: Operations & Procedures

**Category A — Operations & Procedures**

■ Highly Effective ■ Effective ■ Moderately Effective ■ Minimally Effective ■ Less Effective



## Category B — Training

■ Highly Effective ■ Effective ■ Moderately Effective ■ Minimally Effective ■ Less Effective

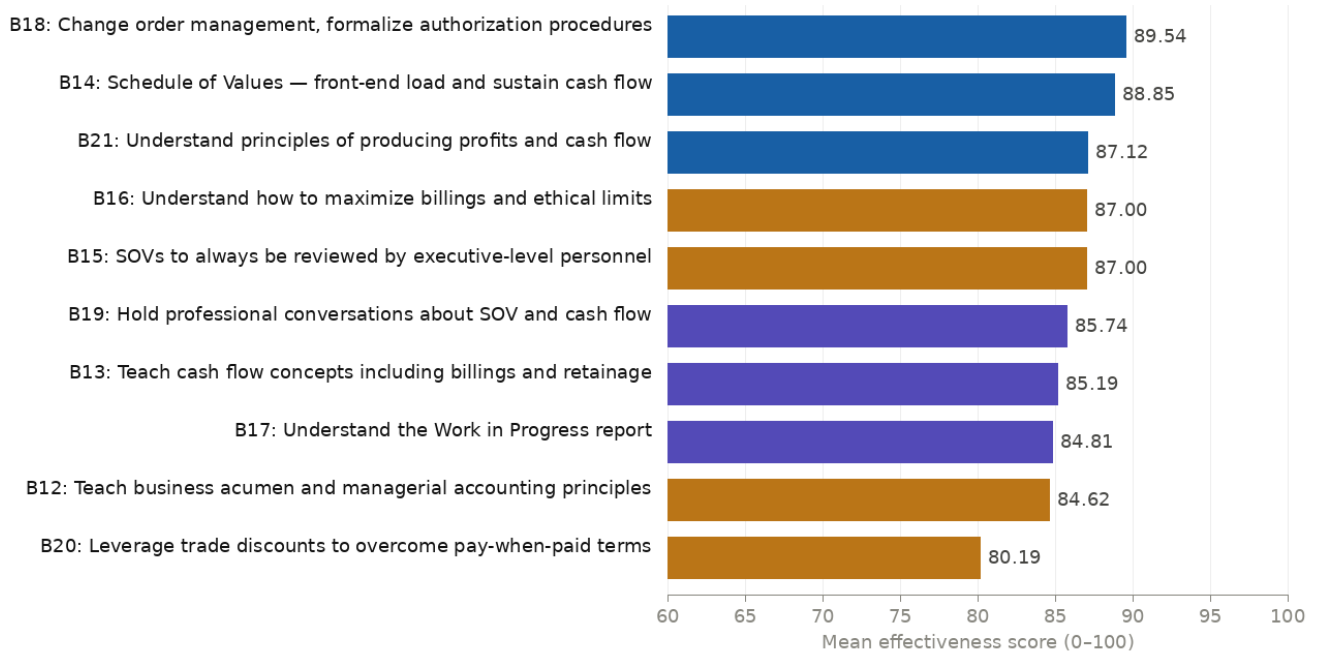


Figure 8: Mean Effectiveness Scores - Category B: Training

### Category C — Bidding & Contract Terms

■ Highly Effective 
 ■ Effective 
 ■ Moderately Effective 
 ■ Minimally Effective 
 ■ Less Effective

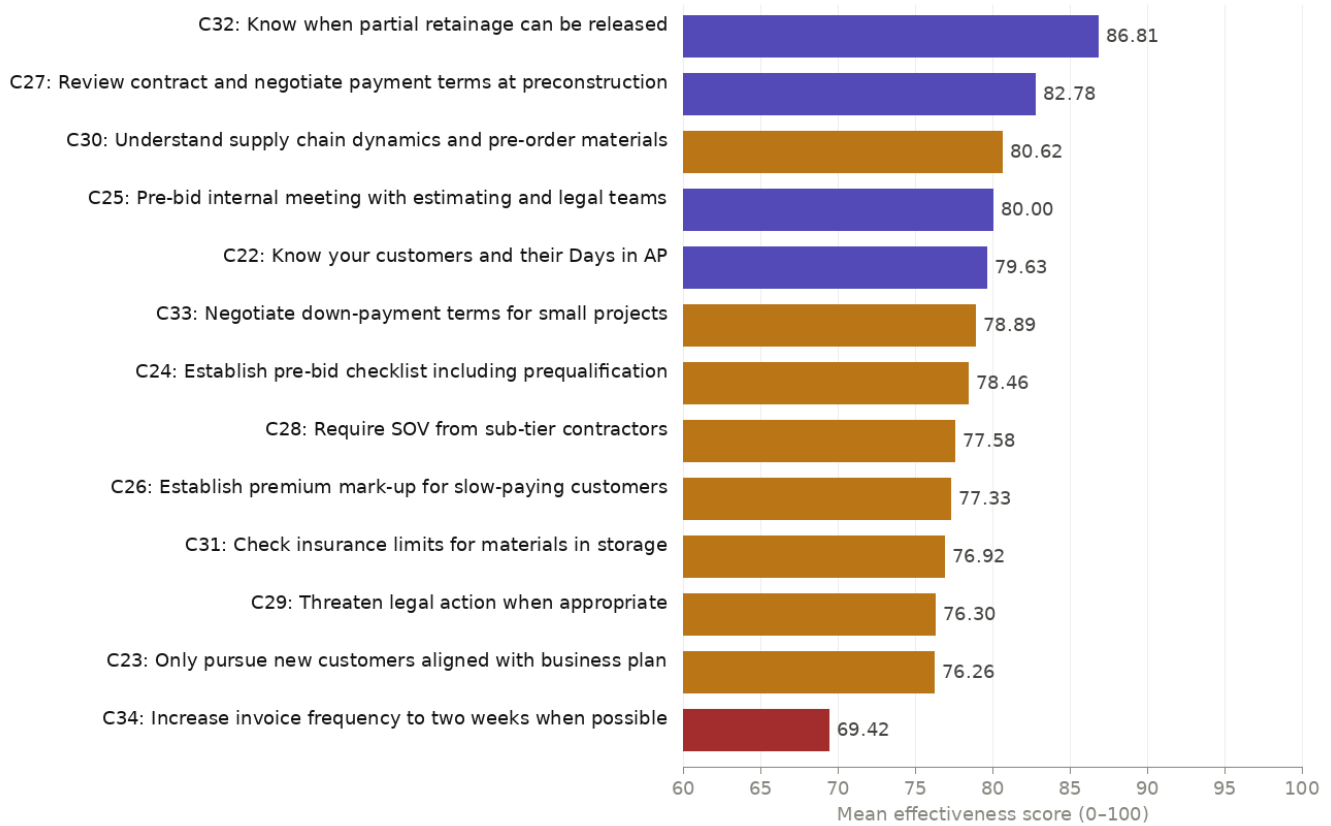


Figure 9: Mean Effectiveness Scores - Category C: Bidding & Contract Terms

### Category D — Communication & Analytics

■ Highly Effective 
 ■ Effective 
 ■ Moderately Effective 
 ■ Minimally Effective 
 ■ Less Effective

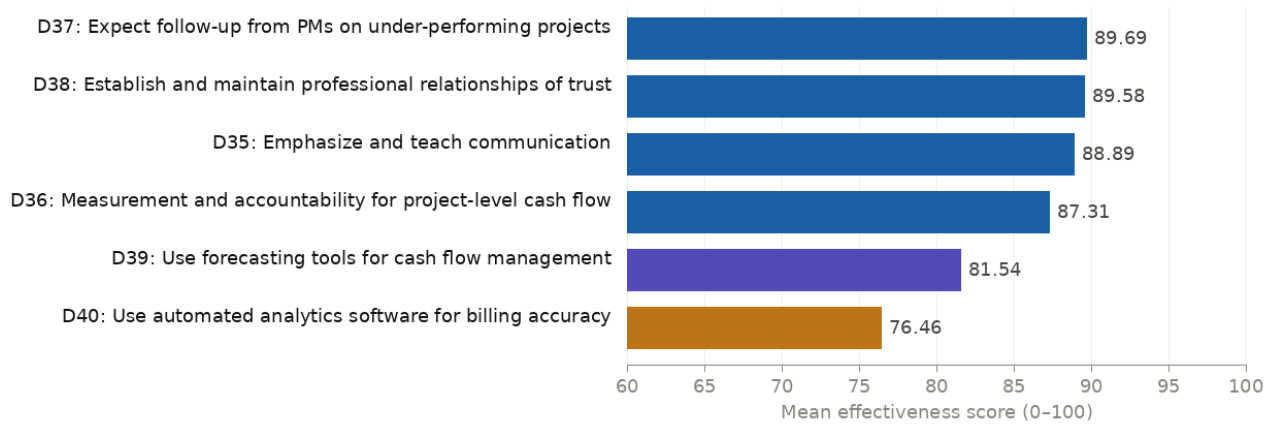


Figure 10: Mean Effectiveness Scores - Category D: Communication & Analytics

### Category E — Organizational Development

■ Highly Effective 
 ■ Effective 
 ■ Moderately Effective 
 ■ Minimally Effective 
 ■ Less Effective

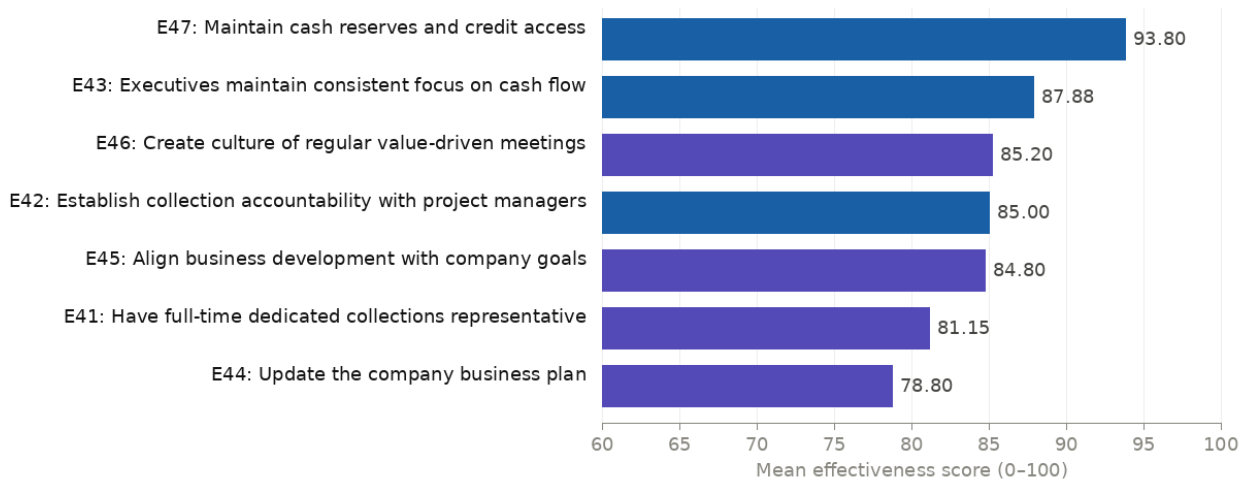


Figure 11: Mean Effectiveness Scores - Category E: Organizational Development

### **4.3. Phase 3 Results - Financial Training Framework (RQ5)**

#### **4.3.1. Overview**

The third phase of the study addressed RQ5, which explored the fundamental principles that should guide the development of a project-level cash flow training program for electrical contractors. The same inductive thematic coding process applied in Phase 1 was used to analyze responses to the following open-ended prompt distributed to all 34 participants:

"From your perspective, what fundamental principles should be included in the development of a project-level cash flow training program?"

All 34 participants responded to this prompt, generating a total of 93 coded items. Thematic analysis yielded 12 training themes, which were subsequently organized into four training modules based on conceptual relatedness and functional similarity. Bloom's Revised Taxonomy of Educational Objectives was then applied to assign each theme to one of three learning levels: Knowledge, Application, or Evaluation to structure the framework in a manner that supports progressive skill development. The findings are presented in the sections that follow.

#### **4.3.2. RQ5 Thematic Findings**

The thematic analysis of participant responses yielded 12 training themes representing the fundamental principles that participants believed should be incorporated into a project-level cash flow training program. Table 16 presents the frequency distribution of identified themes.

Table 16: Frequency Analysis for RQ5

| Theme                                         | No. of Responses | Frequency |
|-----------------------------------------------|------------------|-----------|
| Invoicing and Billing Processes and Practices | 25               | 26.88%    |
| Strategic Financial Planning                  | 13               | 13.98%    |
| Contract & Change Order Management            | 11               | 11.83%    |
| Cash Flow Management                          | 9                | 9.68%     |
| Vendor & Subcontractor Management             | 7                | 7.53%     |
| Mentorship & Leadership                       | 6                | 6.45%     |
| Communication                                 | 6                | 6.45%     |
| Schedule of Values                            | 5                | 5.38%     |
| Customer Management                           | 3                | 3.23%     |
| Compliance                                    | 2                | 2.15%     |
| Update & Control                              | 2                | 2.15%     |
| Accounting                                    | 1                | 1.08%     |
| Total                                         | 93               | 100%      |

The most frequently cited training theme was Invoicing and Billing Processes and Practices, accounting for 26.88% of all coded responses. This finding is consistent with the Phase 1 results, where poor billing practices and delayed invoicing were identified as a primary internal behavioral contributor to cash flow problems. Strategic Financial Planning was the second most cited theme at 13.98%, followed by Contract and Change Order Management at 11.83%. Together these three themes accounted for more than half of all coded training responses, suggesting that participants view financial planning, billing discipline, and contract management as the most critical areas for training investment. The remaining nine themes each accounted for less than 10% of responses individually, reflecting a broad but less concentrated set of additional training needs.

### 4.3.3. Module Structure

The 12 training themes were organized into four training modules based on conceptual relatedness and functional similarity. Table 17 presents the module structure and theme assignments.

Table 17: Training Module Structure and Theme Assignments

| Module                                 | Training Theme                     | No. of Responses | Frequency |
|----------------------------------------|------------------------------------|------------------|-----------|
| Module 1: Financial Fundamentals       | Accounting                         | 1                | 1.08%     |
|                                        | Cash Flow Management               | 9                | 9.68%     |
|                                        | Strategic Financial Planning       | 13               | 13.98%    |
| Module 2: Billing & Revenue Management | Invoicing and Billing Processes    | 25               | 26.88%    |
|                                        | Schedule of Values                 | 5                | 5.38%     |
|                                        | Update & Control                   | 2                | 2.15%     |
| Module 3: Contract & Risk Management   | Contract & Change Order Management | 11               | 11.83%    |
|                                        | Compliance                         | 2                | 2.15%     |
|                                        | Vendor & Subcontractor Management  | 7                | 7.53%     |
|                                        |                                    |                  |           |
| Module 4: Stakeholder Management       | Customer Management                | 3                | 3.23%     |
|                                        | Communication                      | 6                | 6.45%     |
|                                        | Mentorship & Leadership            | 6                | 6.45%     |
| Total                                  |                                    | 93               | 100%      |

#### 4.3.4. Bloom's Taxonomy Mapping

Bloom's Revised Taxonomy of Educational Objectives was applied to assign each training theme to one of three learning levels based on the expected cognitive outcome of training in that area.

Figure 12 presents the complete mapping of training themes to modules and Bloom's learning levels.

**Financial Training Framework — Module Structure**

|                                    | Knowledge     | Application                                         | Evaluation                        |
|------------------------------------|---------------|-----------------------------------------------------|-----------------------------------|
| Module 1<br>Financial Fundamentals | Accounting    | Cash Flow Management                                | Strategic Financial Planning      |
| Module 2<br>Billing & Revenue Mgmt | —             | Invoicing & Billing Processes<br>Schedule of Values | Update & Control                  |
| Module 3<br>Contract & Risk Mgmt   | Compliance    | Contract & Change Order Management                  | Vendor & Subcontractor Management |
| Module 4<br>Stakeholder Management | Communication | Customer Management                                 | Mentorship & Leadership           |

Figure 12 : Financial Training Framework - Themes Mapped to Modules and Bloom's Revised Taxonomy Levels

## CHAPTER 5: DISCUSSION

This chapter interprets and contextualizes the findings presented in Chapter 4 in relation to the existing body of literature reviewed in Chapter 2. The discussion is organized to reflect the three-phase research methodology, addressing each research question in sequence before synthesizing the findings into an integrated discussion of how causes, behaviors, managerial strategies, and training needs collectively inform a comprehensive understanding of project-level cash flow management in electrical subcontracting. A central contribution of this chapter is the development of a causal diagram that maps the relationships between the identified causes of lengthy accounts receivable, the internal and external behaviors that exacerbate cash flow problems, and the managerial strategies validated through the Delphi process. This integrated mapping addresses a gap identified in the problem statement, namely the absence of a systematic framework that connects behavioral drivers to managerial responses within the electrical subcontracting context. The chapter concludes with implications for practice and research and study limitations.

### **5.1. Discussion of Phase 1 Findings - Thematic Analysis**

#### **5.1.1. RQ1 - Causes of Lengthy Accounts Receivable**

The seven themes identified under RQ1 largely confirm what existing literature has documented as the primary causes of cash flow challenges in construction, while extending prior knowledge in important ways specific to electrical subcontracting. Payment delays, unfavorable contract conditions, and documentation issues the three most frequently cited themes align directly with the literature on late payments, pay-when-paid clauses, and administrative inefficiencies as

systemic contributors to subcontractor financial instability (Akinsiku & Ajayi, 2016; Al-Hussein, 2014; Cunningham, 2013; Mutti & Hughes, 2002).

This study extends literature in two important ways. First, participants did not describe payment delays as administrative mistakes, they described them as intentional. Owners and GCs were explicitly characterized as deliberately holding payment to manage their own cash positions. This shifts the problem from a procedural issue to a behavioral one, which has direct implications for how subcontractors should respond. Second, the practice of proceeding with change order work based on verbal approval without a formal change order in place creates a financing burden that is particularly common in electrical subcontracting but has received little attention in prior literature (Lucko, 2016).

The practical implication is that electrical subcontractors are systematically financing upstream parties without compensation is a structural dynamic that is more deeply embedded in industry culture than prior literature acknowledges and that generic cash flow management strategies fail to adequately address.

While prior research has addressed many of these causes individually, it has remained fragmented and largely context-agnostic, without systematic linkage to the specific operational realities of electrical subcontractors (Akinsiku & Ajayi, 2016; Chadee et al., 2023; Emani, 2022). This study addresses that gap by providing the first practitioner-validated, industry-specific account of how these causes interact and compound one another within the electrical subcontracting context.

### **5.1.2. RQ2 - Internal Organizational Behaviors**

This study extends literature in two important ways. First, participants described a clear pattern where billing was regularly pushed aside in favor of field work; project managers were explicitly described as deprioritizing invoicing when projects got busy. Literature acknowledges poor billing as a problem but does not capture the fact that this is often a conscious choice rather than a lack of capacity. Second, poor communication between project managers and accounting teams emerged as a primary internal driver extending the literature beyond individual financial competence to include how teams communicate as a distinct contributor to cash flow problems.

The practical implication is that improving cash flow in electrical subcontracting requires more than training. It requires a cultural shift in how firms define who is responsible for billing and collections at the project level. Section 5.4 explores how the managerial strategies identified in Phase 2 directly address these internal behaviors.

While prior literature has acknowledged internal behaviors as contributors to cash flow problems, these have typically been discussed in broad terms without linking them to specific practices within electrical subcontracting (Laitinen & Laitinen, 1998; Li, 2008). This study addresses that gap by identifying the specific internal behaviors that most commonly undermine cash flow performance in this context, grounded in the direct experience of industry practitioners.

### **5.1.3. RQ3 - External Stakeholder Behaviors**

The seven themes identified under RQ3 confirm and extend the existing literature on external behavioral drivers of cash flow challenges for electrical subcontractors. Delayed and

disorganized payment practices, strategic withholding, and unfair payment practices and power differences are the three most frequently cited themes which align directly with the literature on client-initiated payment delays, opportunistic financial behavior, and the structural power imbalance between upstream and downstream parties in the construction payment chain (Akinsiku & Ajayi, 2016; Chadee et al., 2023; Cunningham, 2013).

This study extends the literature in two important ways. First, participants did not describe strategic withholding as an occasional or exceptional practice, but they described it as standard industry behavior. Owners and GCs were characterized as routinely planning around subcontractors carrying the project's financial burden. This goes beyond what the literature describes as opportunistic behavior and points to a more deeply institutionalized exploitation of the subcontractor's downstream position. Second, GC staffing shortages and skills gaps among upstream parties were identified as a direct contributor to payment delays which is a finding that has received little attention in prior literature. Participants described GC coordinators managing too many projects at once, reducing their capacity to process invoices efficiently and creating downstream cash flow disruptions that were entirely outside the subcontractor's control.

The practical implication is that external behaviors represent a structural and cultural challenge that internal improvements alone cannot solve. Addressing them requires strategic responses such as selective customer management, proactive contract negotiation, and deliberate relationship building; all of which are reflected in the managerial strategies validated in Phase 2. Section 5.4 maps these external behaviors to the strategies most effective in mitigating their impact.

While prior literature has identified external behavioral drivers of cash flow problems, these have typically been examined across general construction contexts without capturing their specific manifestation in electrical subcontracting (Akinsiku & Ajayi, 2016; Chadee et al., 2023). This study addresses that gap by providing a practitioner-validated account of the external stakeholder behaviors that most directly disrupt cash flow for electrical subcontractors, establishing an empirical foundation for targeted managerial responses.

## **5.2. Discussion of Phase 2 Findings - Delphi Method (RQ4)**

The Delphi rating process produced a consensus-based ranking of 47 managerial strategies across five categories, providing the first empirically validated, expert-consensus prioritization of cash flow improvement strategies tailored specifically to the electrical subcontracting industry. The findings confirm key principles in existing literature while extending prior knowledge in ways that have direct practical significance.

The two Highly Effective strategies: timely and consistent invoicing and timely follow-up with owners and prime contractors confirm what the literature has consistently identified as foundational cash flow management practices (Odeyinka et al., 2003; Shash & Qarra, 2018). The strong consensus around these two strategies, with mean scores above 92 and standard deviations below 10, reflects a level of agreement rarely observed in Delphi studies and confirms that operational billing discipline is universally recognized as the highest-impact cash flow practice regardless of firm size or market context. The high ratings assigned to relationship management and collection accountability strategies similarly align with the literature on stakeholder cooperation and professional trust as mechanisms for reducing payment delays (Mutti & Hughes, 2002).

This study extends the literature in three important ways. First, no prior study has subjected a comprehensive strategy set to structured expert consensus evaluation within the electrical subcontracting context. The ranking produced here moves beyond descriptive recommendations to provide a clearly prioritized hierarchy of strategies, giving practitioners direct guidance on where to focus managerial attention. Second, the finding that Category C-Bidding and Contract Terms produced no Highly Effective or Effective strategies is significant. Despite the literature's emphasis on contract negotiation and prequalification as important cash flow tools (Al-Hussein, 2014; Cunningham, 2013), practitioners consistently rated these strategies as Moderately or Minimally Effective, suggesting their impact is more limited and context-dependent than operational and relationship-based strategies. Third, the distinction between strategies with high mean scores but high standard deviations reveal an important nuance that some strategies are highly effective in certain firm contexts but not universally applicable. Strategies such as B15 and B16 achieved mean scores of 87.00 but were classified as Minimally Effective due to standard deviations exceeding 20, reflecting significant disagreement among raters that the mean score alone does not capture.

The practical implication is that electrical subcontractors should prioritize operational billing discipline and relationship management above all other cash flow strategies. The consensus data shows that the highest-return investments are in consistent invoicing, proactive follow-up with slow payers, and establishing clear collection accountability at the project manager level. These are not complex or expensive interventions; they are disciplined operational behaviors any firm can implement regardless of size or market position. The finding that no strategies were classified as uniformly ineffective also suggests that the full set of 47 strategies represents a

legitimate toolkit, and that the primary question for practitioners is not which strategies to use but which to prioritize given their specific context.

Prior literature has proposed cash flow management strategies in general construction contexts, but no study has developed and validated a comprehensive, consensus-ranked set of strategies tailored specifically to electrical subcontractors (Liu et al., 2009; Odeyinka et al., 2003; Shash & Qarra, 2018). This study addresses that gap by providing the first expert-consensus ranking of project-level cash flow improvement strategies in this context, offering practitioners an empirically grounded and prioritized framework for decision-making.

### **5.3. Discussion of Phase 3 Findings - Financial Training Framework (RQ5)**

The thematic analysis of RQ5 responses identified 12 training themes from 93 coded items across all 34 participants, which were subsequently organized into four modules and structured using Bloom's Revised Taxonomy. The findings confirm the need for financial training in the electrical subcontracting industry while extending the literature by providing the first empirically derived and practitioner-validated training framework specifically designed for this context.

The dominance of invoicing and billing processes as the most frequently cited training theme accounting for 26.88% of all coded responses directly confirms the literature's identification of poor billing practices and limited financial literacy among project managers as primary contributors to cash flow underperformance (H.-K. Park, 2004; Laitinen & Laitinen, 1998). The high frequency of strategic financial planning and contract and change order management as training priorities similarly aligns with the literature's recognition that inadequate planning and poor change order management are significant sources of cash flow disruption (Emani, 2022; Shash & Qarra, 2018). The emphasis on mentorship and leadership as a training need further

confirms the literature's observation that financial competence in construction is often developed through experience rather than formal training, creating persistent knowledge gaps across generations of practitioners (Li, 2008).

#### **5.4. Integrated Discussion - Behavioral-Strategic Mapping of Causes, Behaviors, Strategies, and Training**

A central contribution of this study is the development of a behavioral-strategic mapping framework that systematically connects the causes of lengthy accounts receivable identified in RQ1, the internal and external behavioral drivers identified in RQ2 and RQ3, the managerial strategies validated in RQ4, and the training principles identified in RQ5. While prior literature has addressed these dimensions individually, no study has previously mapped their relationships within the specific context of electrical subcontracting. This integrated mapping addresses the core gap identified in the problem statement and represents the primary practical contribution of the study.

The behavioral-strategic mapping framework developed in this study is best understood as a combination of descriptive, conceptual, and analytical elements, each contributing a distinct dimension to its overall structure. At the descriptive level, the framework captures and organizes the causes, behaviors, strategies, and training needs as reported directly by 34 industry practitioners, preserving the practitioner voice and grounding the framework in real operational experience rather than theoretical abstraction. At the conceptual level, the framework goes beyond individual participant responses by organizing findings into five thematic clusters that represent coherent domains of cash flow vulnerability, establishing a structured model that connects four previously fragmented dimensions of the problem into a unified representation. At

the analytical level, the framework draws on systematic inductive thematic coding, Delphi consensus analysis, and cross-RQ pattern recognition to identify the relationships between causes, behaviors, strategies, and training needs relationships that no single participant articulated explicitly but that emerged through the analytical process of comparing and synthesizing findings across all five research questions. The combination of these three dimensions is intentional and reflects the nature of the research design, which was structured to capture practitioner knowledge, organize it conceptually, and analyze it systematically to produce a framework that is simultaneously grounded in industry reality, theoretically coherent, and analytically defensible.

The framework organizes the findings into five thematic clusters, each representing a distinct but interconnected domain of cash flow vulnerability. Figures 13 through 17 present the behavioral-strategic mapping framework for each cluster, illustrating how internal and external behaviors amplify the impact of each cause, and how managerial strategies and training interventions address both the behaviors and their underlying causes.

#### **5.4.1. Framework Development Process**

The behavioral-strategic mapping framework was developed through a systematic cross-thematic analysis applied after all three phases of data collection and analysis were complete. Cross-thematic analysis is a qualitative analytical method used when multiple sets of themes have been generated from different research questions or data sources, and the goal is to identify the connections and patterns that run across all of them rather than examining each set in isolation (Miles, Huberman, & Saldana, 2014). Rather than treating each research question as a separate analytical unit, the full set of themes generated across RQ1, RQ2, RQ3, RQ4, and RQ5 was

examined together to identify higher-order patterns and relationships that would not be visible within any single research question alone.

The process was conducted in five steps. First, all themes generated across the five research questions were compiled together in a single analytical workspace, allowing the researcher to view the complete thematic landscape of the study simultaneously. Second, co-occurrence patterns were examined specifically, which causes from RQ1 consistently appeared alongside which internal behaviors from RQ2 and external behaviors from RQ3 within the same participant responses. When a participant described a cause and described a behavior that amplified that cause, those two themes were treated as connected. Third, conceptual relatedness was assessed beyond co-occurrence, asking whether themes from different research questions described the same underlying cash flow problem from different perspectives. For example, payment delays as a cause and strategic withholding as an external behavior are conceptually related because both describe the same payment chain dynamic where one is from the subcontractor's experience and one from the upstream party's behavior. Fourth, themes that co-occurred frequently and were conceptually related were grouped into clusters, with each cluster representing a coherent and internally consistent domain of cash flow vulnerability. Fifth, the groupings were reviewed and validated by both researchers to confirm that each cluster made logical sense and accurately represented a recognizable real-world problem as described by participants.

The five clusters that emerged from this process were not predetermined. They arose naturally from the patterns observed across participant responses when all themes were examined together. Once the cause-behavior groupings were established, the managerial strategies from RQ4 and the training themes from RQ5 were mapped to each cluster based on which strategies and training

needs most directly addressed the behaviors and causes within that cluster. This mapping was guided by the descriptive content of participant responses, which often explicitly connected problems to solutions, and by the Delphi effectiveness ratings, which confirmed which strategies held the strongest expert consensus for addressing specific operational challenges.

The result is a framework in which every connection between causes, behaviors, strategies, and training is grounded in participant data and supported by a transparent analytical process, ensuring that the relationships the framework represents reflect the operational reality of electrical subcontracting as described by practitioners rather than assumptions imposed by the researcher.

#### **5.4.2. Cluster 1 - Payment and Collections Management**

The most prominent cluster in terms of frequency and participant emphasis centers on payment delays and collections management. Payment and administrative delays by owners and GCs and it is the most frequently cited cause in RQ1 were found to amplify three internal behaviors: poor billing and delayed invoicing, weak cash flow ownership and accountability, and poor communication. Externally, these same causes were associated with delayed and disorganized payment practices, strategic withholding and financial leverage, and unfair payment practices and power differences. When internal billing delays coincide with deliberate payment withholding by upstream parties, the liquidity gap becomes larger than either factor alone would produce.

The Highly Effective strategies identified in Phase 2 which are timely and consistent invoicing (A5) and timely follow-up with slow payers (A6) directly address this cluster by targeting both

the internal billing discipline gap and the external follow-up deficit. The Effective strategies of establishing clear collections processes (A1), implementing invoice checklists (A7), and building collection accountability with project managers (E42, E43) further address the internal behavioral dimension. Training in invoicing and billing processes, cash flow management, and update and control (Module 2) provides the foundational knowledge and skills needed to sustain these behavioral changes over time. This cluster underscores that operational billing discipline is not merely a technical function but a behavioral and cultural priority that requires both managerial reinforcement and formal training investment. Figure 13 illustrates the behavioral-strategic mapping for Cluster 1, showing how payment and administrative delays and owner funding issues amplify internal and external behaviors and the strategies and training interventions that address them

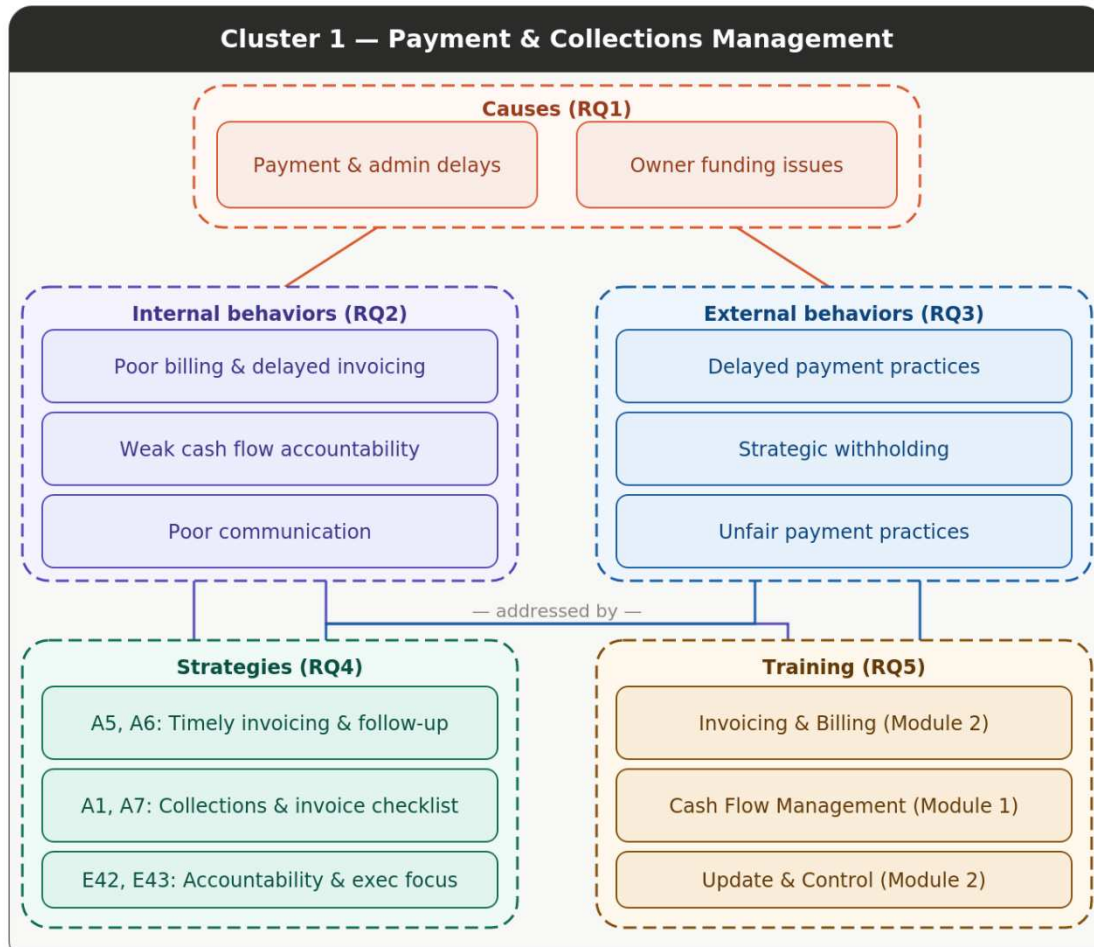


Figure 13: Behavioral-Strategic Mapping Framework - Cluster 1: Payment & Collections Management

### 5.4.3. Cluster 2 - Contract and Change Order Management

The second cluster links unfavorable contract conditions and slow change order processing to internal contract and project setup oversights and poor communication, and externally to communication gaps, accountability avoidance, and bureaucratic delays. This cluster reflects a pattern identified consistently across RQ1, RQ2, and RQ3 that cash flow problems rooted in contract structure are amplified by both internal failures to establish clear terms upfront and external failure to honor or communicate those terms during execution.

The strategies most directly addressing this cluster are change order management formalization (B18), thorough contract review and negotiation at preconstruction (C27), and executive review of change order status (A3), target the front-end contractual behaviors that prevent downstream payment disputes. Training in contract and change order management (Module 3) and schedule of values (Module 2) equips practitioners with the knowledge and skills to negotiate more effectively and manage contractual cash flow risks proactively rather than reactively. Figure 14 presents the behavioral-strategic mapping for Cluster 2, illustrating how unfavorable contract conditions and slow change order processing interact with internal and external behaviors and the strategies and training responses that target them.

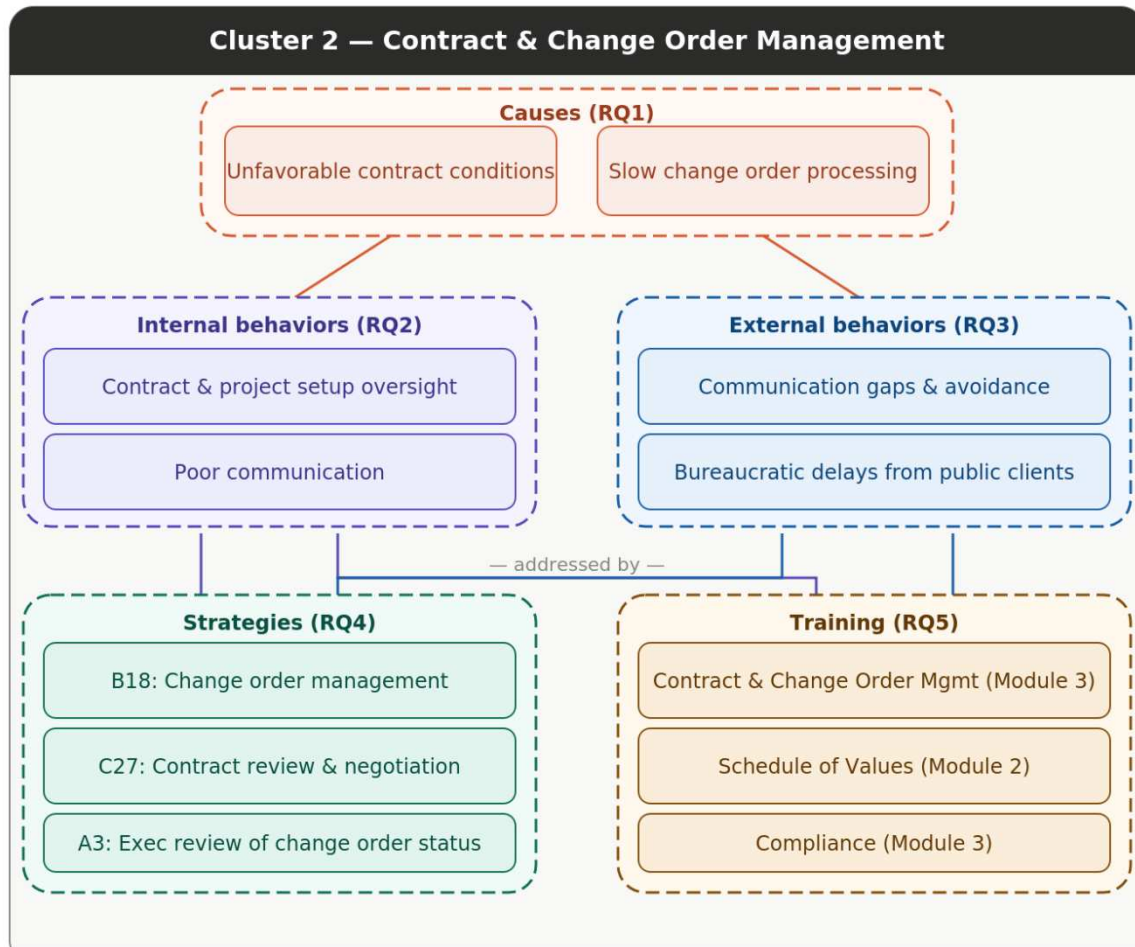


Figure 14: Behavioral-Strategic Mapping Framework - Cluster 2: Contract & Change Order Management

#### **5.4.4. Cluster 3 - Prequalification and Customer Risk**

The third cluster connects weak prequalification and contract negotiation practices to internal behaviors of contract setup oversight and weak accountability, and externally to unfair payment practices and strategic withholding. This cluster reveals that many cash flow problems are effectively selected into firms that fail to screen clients adequately or negotiate protective terms at the outset expose themselves to the full weight of the external behavioral patterns identified in RQ3.

The strategies addressing this cluster are knowing your customers and their payment history (C22, C23), establishing pre-bid checklists (C24, C25), and maintaining cash reserves and credit access (E47) represent a preventive rather than reactive approach to cash flow management. Training in customer management (Module 4), strategic financial planning (Module 1), and vendor and subcontractor management (Module 3) builds the judgment needed to make sound client selection and contract decisions before financial exposure occurs. Figure 15 presents the behavioral-strategic mapping for Cluster 3, showing how weak prequalification practices amplify both internal and external risk behaviors and the strategies and training interventions designed to address them.

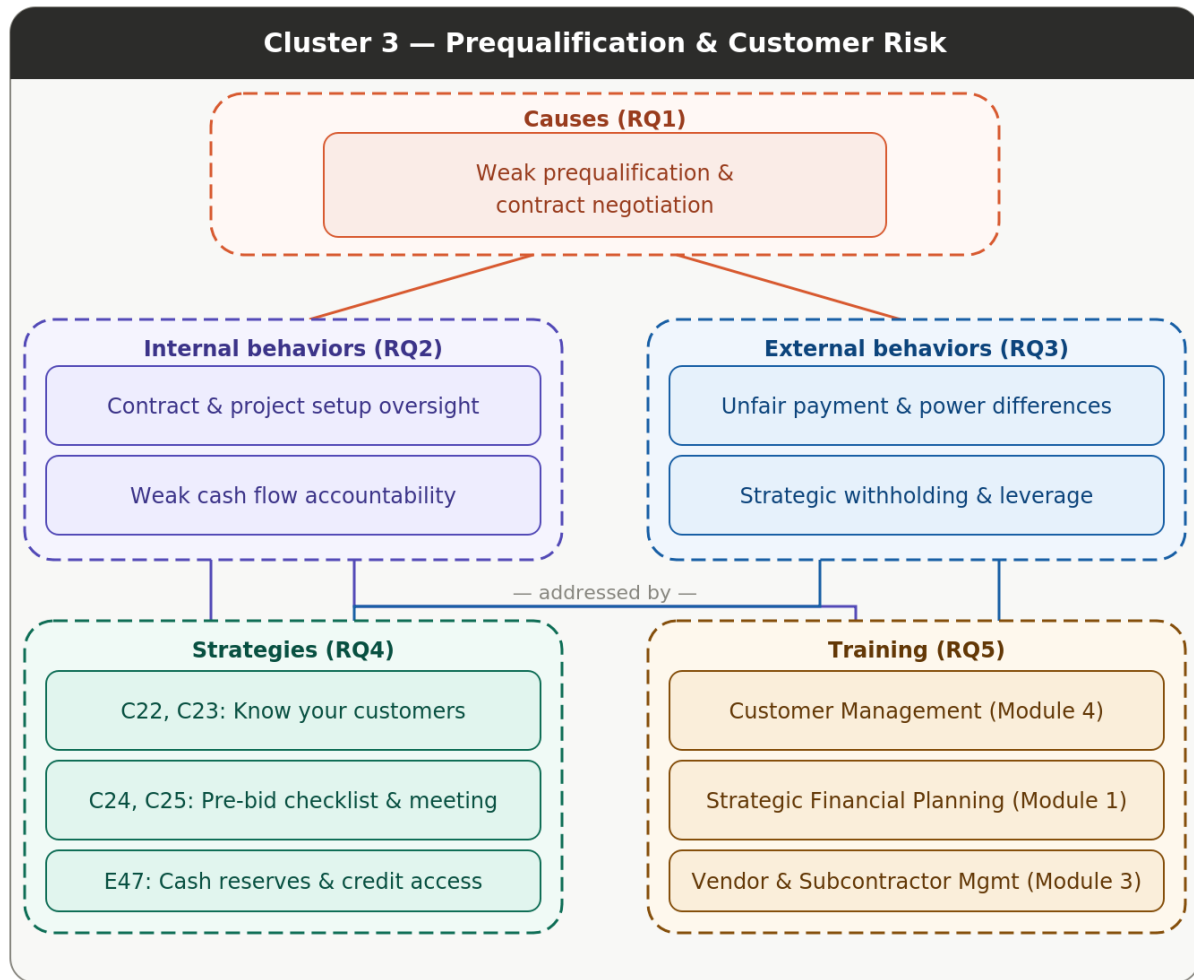


Figure 15 :Behavioral-Strategic Mapping Framework - Cluster 3: Prequalification & Customer Risk

#### **5.4.5. Cluster 4 - Financial Knowledge and Internal Capability**

The fourth cluster links poor internal systems and staff capabilities to internal skills gaps, poor training, and billing deficiencies, and externally to staffing shortages and skills gaps among upstream parties. This cluster is unique in that it identifies a knowledge deficit rather than a behavioral choice as the primary driver participants described project managers who lacked the financial literacy to manage billing, forecasting, and cash flow effectively, not because they were unwilling but because they had never been formally trained to do so.

This finding directly motivates the training framework developed in Phase 3. The strategies addressing this cluster are SOV and profit principles training (B14, B21), measurement and forecasting tools (D36, D39), and teaching communication (D35) are primarily educational in nature, reflecting the study's finding that knowledge development is itself a managerial strategy. Training in accounting, cash flow management, and strategic financial planning (Module 1) and mentorship and leadership (Module 4) address both the technical knowledge gaps and the organizational culture of knowledge transfer that is needed to sustain financial competence across generations of practitioners. Figure 16 presents the behavioral-strategic mapping for Cluster 4, illustrating how poor internal systems and staff capabilities drive knowledge and skill deficits internally and externally and the strategies and training interventions that address them.

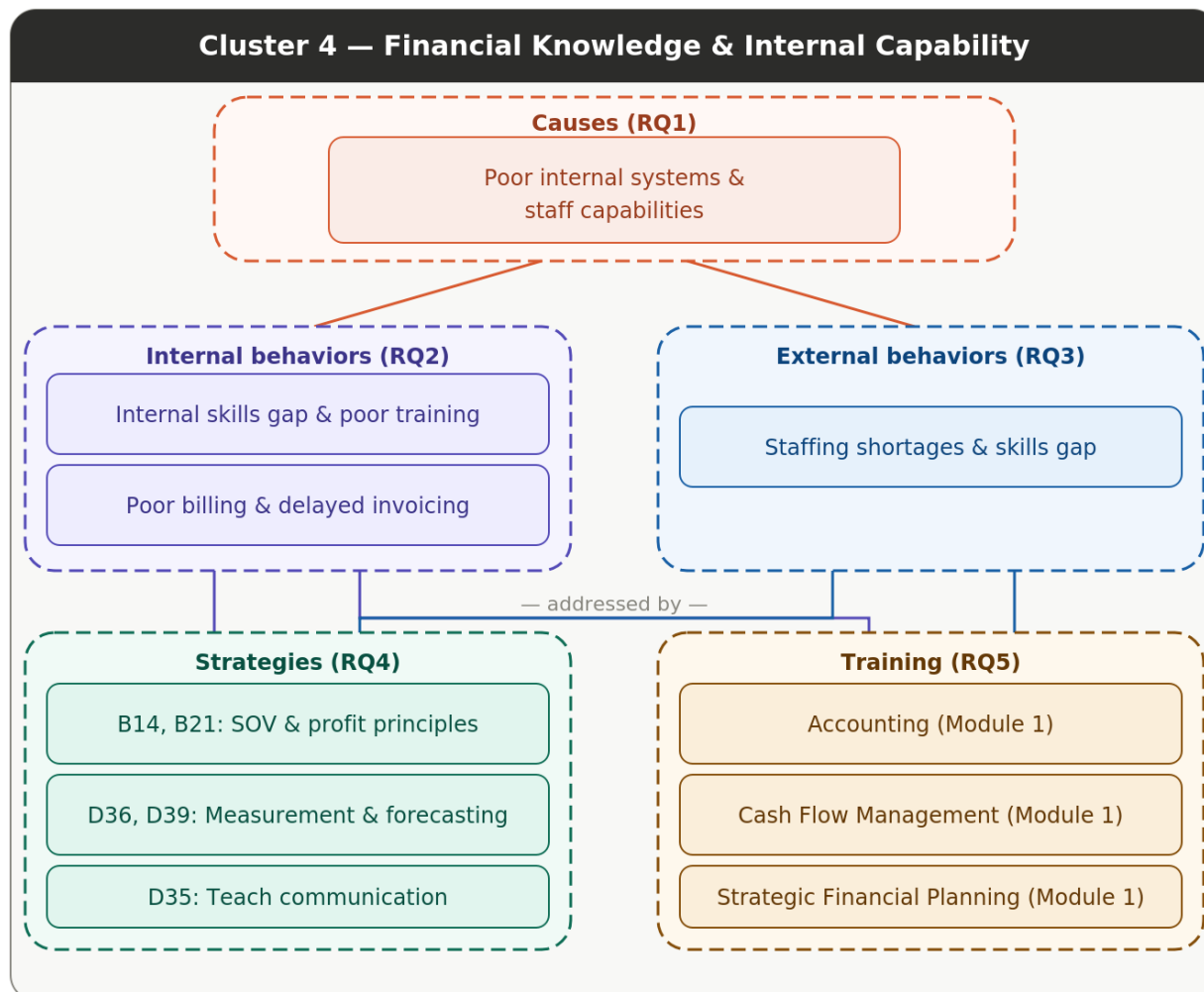


Figure 16 : Behavioral-Strategic Mapping Framework - Cluster 4: Financial Knowledge & Internal Capability

#### 5.4.6. Cluster 5 - Compliance and Documentation

The fifth cluster links compliance and documentation issues to internal billing and setup oversights and externally to communication gaps and delayed payment practices. This cluster reflects the administrative dimension of cash flow management and the recurring friction created when documentation requirements are incomplete, misunderstood, or used strategically by upstream parties to delay payment.

The strategies addressing this cluster are invoice checklists and duplicity review (A7, A11), communication and relationship management (D35, D38), and monthly cash flow reporting (A2) target both the internal accuracy of billing submissions and the external communication needed to resolve documentation disputes promptly. Training in compliance (Module 3), invoicing and billing (Module 2), and communication (Module 4) ensures that practitioners understand both the requirements and the relational skills needed to navigate them effectively. Figure 17 presents the behavioral-strategic mapping for Cluster 5, showing how compliance and documentation issues amplify internal billing oversights and external communication gaps and the strategies and training interventions that address them.

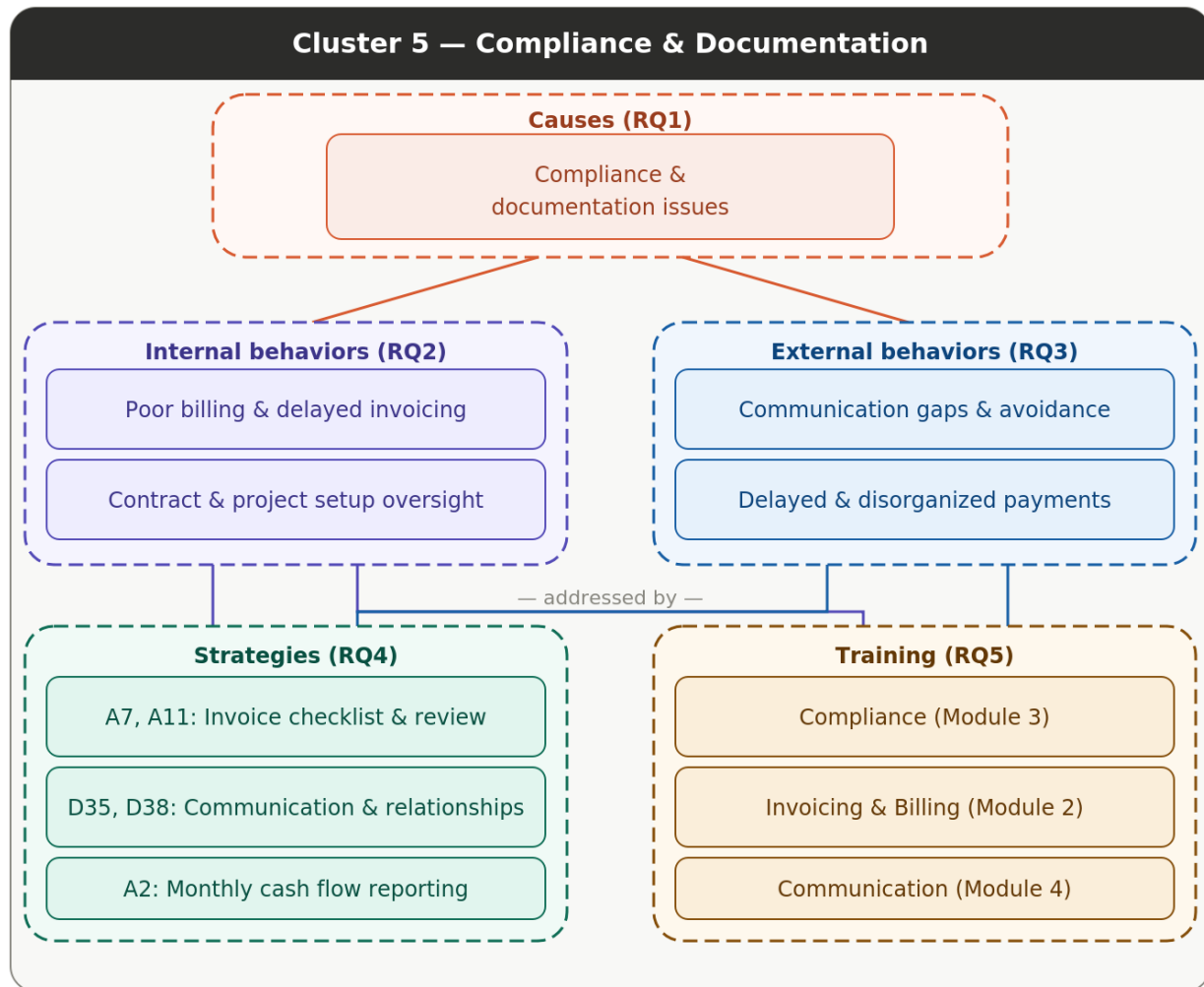


Figure 17: Behavioral-Strategic Mapping Framework - Cluster 5: Compliance & Documentation

#### 5.4.7. Synthesis

Taken together, the five clusters reveal that project-level cash flow challenges in electrical subcontracting are not the result of any single cause or behavior but emerge from the interaction of structural vulnerabilities, behavioral patterns, knowledge deficits, and cultural norms that reinforce one another across the payment chain. Several important patterns emerge from the integrated mapping.

First, internal and external behaviors consistently co-occur around the same causal roots, suggesting that cash flow problems are simultaneously self-inflicted and externally imposed. Addressing only one dimension improving internal billing practices without addressing external payment culture or advocating for payment reform without building internal capability is unlikely to produce sustained improvement.

Second, the most highly rated strategies in Phase 2 address behavioral change rather than structural reform. Timely invoicing, consistent follow-up, and collection accountability are all within the direct control of the electrical subcontractor and do not require upstream parties to change their behavior. This finding is practically significant as it suggests that substantial cash flow improvement is achievable through disciplined internal action even within an unfavorable structural environment.

Third, the training framework developed in Phase 3 directly maps onto the behavioral gaps identified across all five clusters. The dominance of invoicing and billing, strategic financial planning, and contract management as training priorities reflects the same patterns that emerged as causes and behavioral amplifiers in RQ1 through RQ3, confirming that the training needs identified by practitioners are grounded in the actual operational challenges they face.

Finally, the integrated framework demonstrates that cash flow improvement in electrical subcontracting requires a coordinated response across four dimensions simultaneously causes must be understood, behaviors must be addressed, strategies must be implemented, and knowledge must be developed. Interventions that target only one dimension are likely to produce limited and unsustainable results.



## CHAPTER 6: CONCLUSION

This study set out to develop a comprehensive, behavior-oriented understanding of project-level cash flow management in electrical subcontracting by examining the causes of lengthy accounts receivable, the internal and external behaviors that exacerbate them, and the managerial strategies and training principles needed to improve financial performance. The findings across three phases of research, involving 34 electrical contractors and 27 Delphi panelists, collectively address this objective and produce four original contributions to the body of knowledge.

Thematic analysis identified seven causes of lengthy accounts receivable, with payment and administrative delays by owners and GCs emerging as the most prevalent, followed by compliance and documentation issues and unfavorable contract conditions. Five internal behavioral themes and seven external behavioral themes were identified, revealing that cash flow problems are simultaneously self-inflicted and externally imposed. The Delphi rating process produced the first expert-consensus ranking of 47 managerial strategies for electrical subcontracting, with timely and consistent invoicing and timely follow-up with slow payers classified as Highly Effective and confirmed by excellent reliability measures. Thematic analysis of training needs yielded 12 themes organized into four progressive modules structured using Bloom's Revised Taxonomy. These findings were synthesized into a behavioral-strategic mapping framework that connects causes, behaviors, strategies, and training needs across five thematic clusters, providing the first integrated and practitioner-validated model for project-level cash flow improvement in this context.

The practical implications of the study are clear. Electrical subcontracting firms should prioritize operational billing discipline, shift cash flow ownership from finance to operations, invest in structured financial training, use prequalification as a risk management tool, and maintain financial reserves as foundational infrastructure rather than optional contingencies. Industry associations are well positioned to translate the training framework produced by this study into standardized programs that address the financial literacy gaps documented across all five research clusters.

Several limitations should be acknowledged. The study relied on a single Delphi rating round rather than iterative rounds with feedback, which may have limited the refinement of consensus outcomes. The modest Kendall's W value of 0.115, while statistically significant, reflects this limitation and suggests that additional rounds might have produced stronger agreement among raters on the relative ranking of strategies.

The sample was drawn exclusively from NECA member firms, which may not fully represent the diversity of electrical subcontracting firms across different regions, sizes, and market sectors.

Although measures were taken to manage researcher bias through inductive coding, peer review, and advisor oversight, the primary researcher's prior knowledge of the construction industry may have influenced the interpretation of participant responses and the development of the thematic framework. This limitation is inherent in qualitative research and was managed but cannot be fully eliminated.

All data in this study were collected through self-reported open-ended responses and independent ratings, which introduces the possibility of social desirability bias — the tendency of participants to report practices they believe are expected or valued rather than those they actually employ.

While the anonymity of the Delphi process mitigates this concern for the rating phase, the qualitative responses in Phase 1 remain subject to this limitation. Participants may have described ideal practices rather than actual organizational behaviors, which could affect the accuracy of the thematic findings for RQ2, where internal organizational behaviors are the focus.

The behavioral-strategic mapping framework developed in this study represents a conceptual synthesis grounded in practitioner experience, thematic analysis, and expert consensus. The relationships between causes, behaviors, strategies, and training needs are analytically derived and empirically grounded but are not statistically proven causal relationships. The framework describes patterns of association and logical connections identified through cross-thematic analysis rather than establishing directionality or magnitude of effect through quantitative testing. Future research using structural equation modeling or path analysis would be needed to test the strength and statistical validity of the relationships the framework proposes.

Future research should validate the framework longitudinally by tracking firms that implement the identified strategies and measuring actual cash flow outcomes over time. Quantitative methods such as structural equation modeling should be applied to test the strength and direction of the relationships identified in the framework. The study should be extended to other specialty trades to examine whether the findings generalize beyond electrical subcontracting. Financial literacy intervention studies should design and evaluate training programs based on the four-module framework to assess their impact on practitioner competence and firm performance. Finally, standardized project-level cash flow performance metrics should be developed to enable firms to benchmark and track improvement over time.

Project-level cash flow management in electrical subcontracting is a complex challenge that requires coordinated action across causes, behaviors, strategies, and training simultaneously. This

study provides the most comprehensive, empirically grounded, and practically actionable guidance on this challenge that the literature has yet produced, and it is the researcher's hope that its findings translate into measurable improvements in the financial resilience and sustainability of electrical subcontracting firms across the industry.

## REFERENCES

1. Adjei, E. A., Fugar, F. D. K., Adinyira, E., Edwards, D. J., & Pärn, E. (2018). Exploring the significant cash flow factors influencing building projects profitability in Ghana. *International Journal of Construction Engineering and Management*, 7(1), 35-46.
2. Akinsiku, O. E., & Ajayi, O. M. (2016). *Effects of delayed payment of contractors on construction project delivery in Nigeria*.
3. Al-Hussein, R. (2014). A Framework for Examining and Improving the Accounts Payable Process in Construction.
4. Al-Joburi, K. I., Al-Aomar, R., & Bahri, M. E. (2012). Analyzing the impact of negative cash flow on construction performance in the Dubai area. *Journal of management in engineering*, 28(4), 382-390.
5. Alimoradian, B., Jakubiak, J., Loisel, S., & Salhi, Y. (2023). Understanding key drivers of participant cash flows for individually managed stable value funds. *Risks*, 11(8), 148.
6. Anderson, L. W., & Krathwohl, D. R. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives: complete edition*: Addison Wesley Longman, Inc.
7. Assaad, R., El-Adaway, I. H., & Abotaleb, I. S. (2020). Predicting project performance in the construction industry. *Journal of construction engineering and management*, 146(5), 04020030.
8. Chadee, A., Ali, H., Gallage, S., & Rathnayake, U. (2023). Modelling the implications of delayed payments on contractors' cashflows on infrastructure projects.

9. Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*: sage.
10. Creswell, J. W., & Clark, V. P. (2007). Mixed methods research. *Thousand Oaks, CA*.
11. Cui, Q., Hastak, M., & Halpin, D. (2010). Systems analysis of project cash flow management strategies. *Construction management and economics*, 28(4), 361-376.
12. Cunningham, T. (2013). Will the construction contracts bill improve subcontractor cash flow?
13. Diamond, I. R., Grant, R. C., Feldman, B. M., Pencharz, P. B., Ling, S. C., Moore, A. M., & Wales, P. W. (2014). Defining consensus: a systematic review recommends methodologic criteria for reporting of Delphi studies. *Journal of clinical epidemiology*, 67(4), 401-409.
14. Emani, V. V. (2022). Effective change order management: Strategies for minimizing disruptions and cost overruns in construction. *International Journal of Business Quantitative Economics and Applied Management Research*, 7(2).
15. Flentje, C., Zuo, J., Jin, X.-H. S., & Xia, B. (2014). *Comparing the effect of inadequate documentation to the cost management and tendering processes in managing contractor and fixed lump sum contracts in Australia*. Paper presented at the Proceedings of the IX World Congress of ICEC, the International Cost Engineering Council.
16. Franz, B., & Roberts, B. A. (2022). Thematic analysis of successful and unsuccessful project delivery teams in the building construction industry. *Journal of Construction Engineering and Management*, 148(3), 05022001.
17. Ghali, H. (2023). Optimization of Contractor's Cash Flow Based on Subcontractor's Payment Management Plans.

18. Heitmann, F., Hempel, F., Henkelmann, F., Hentschel, G., Herbstreith, H., & Herrmann, H. (2026). Impact of Customer Payment Behavior Analytics on Cash Flow Stability and Financial Planning.
19. Houge, T., & Loughran, T. (2000). Cash flow is king? Cognitive errors by investors. *The Journal of Psychology and Financial Markets*, 1(3-4), 161-175.
20. Hsu, C.-C., & Sandford, B. A. (2007). The Delphi technique: making sense of consensus. *Practical assessment, research, and evaluation*, 12(1).
21. Jung, M., You, S., Chi, S., Yu, I., & Hwang, B.-G. (2018). The relationship between unbilled accounts receivable and financial performance of construction contractors. *Sustainability*, 10(8), 2679.
22. Keeney, S., McKenna, H. P., & Hasson, F. (2010). *The Delphi technique in nursing and health research*: John Wiley & Sons.
23. Koopman, K., & Cumberlege, R. (2021). *Cash flow management by contractors*. Paper presented at the IOP Conference Series: Earth and Environmental Science.
24. Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. *Theory into practice*, 41(4), 212-218.
25. Kulejewski, J., Ibadov, N., Rosłon, J., & Zawistowski, J. (2021). Cash flow optimization for renewable energy construction projects with a new approach to critical chain scheduling. *Energies*, 14(18), 5795.
26. Laitinen, E. K., & Laitinen, T. (1998). Cash management behavior and failure prediction. *Journal of Business Finance & Accounting*, 25(7-8), 893-919.

27. Li, E. (2008). An analysis of the construction of total risk management mechanism for enterprises' accounts receivable. *International Journal of Business and Management*, 3(5), 105-108.
28. Lincoln, Y. S. (1985). *Naturalistic inquiry* (Vol. 75): sage.
29. Linstone, H. A., & Turoff, M. (1975). *The delphi method* (Vol. 1975): Addison-Wesley Reading, MA.
30. Liu, Y., Zayed, T., & Li, S. (2009). *Cash flow analysis of construction projects*. Paper presented at the Canadian Society of Civil Engineering (CSCE) Conference, St. John's.
31. Loughlin, K. G., & Moore, L. F. (1979). Using Delphi to achieve congruent objectives and activities in a pediatrics department. *Academic medicine*, 54(2), 101-106.
32. Lucko, G. (2016). Financial Planning and Management Practices of Electrical Contractors. *Organization, technology & management in construction: an international journal*, 8(1), 0-0.
33. Mallery, P., & George, D. (2000). *SPSS for windows step by step*: Allyn & Bacon, Inc.
34. Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative data analysis*: sage.
35. Mohagheghi, V., Mousavi, S. M., & Vahdani, B. (2017). Analyzing project cash flow by a new interval type-2 fuzzy model with an application to construction industry. *Neural Computing and Applications*, 28(11), 3393-3411.
36. Mutti, C. d. N., & Hughes, W. (2002). *Cash flow management in construction firms*. Paper presented at the 18th Annual ARCOM Conference.
37. Navon, R. (1996). Company-level cash-flow management. *Journal of Construction Engineering and Management*, 122(1), 22-29.

38. Odeyinka, H., Kaka, A., & Morledge, R. (2003). *An evaluation of construction cash flow management approaches in contracting organisations*. Paper presented at the The 19th Annual ARCOM Conference.
39. OGUNDARE, O., & OLATUNJI, O. A. Management of account receivables: a pilot study on three Nigeria construction firms.
40. Okoli, C., & Pawlowski, S. D. (2004). The Delphi method as a research tool: an example, design considerations and applications. *Information & management*, 42(1), 15-29.
41. Oladimeji, O., & Aina, O. O. (2021). Cash flow management techniques practices of local firms in Nigeria. *International Journal of Construction Management*, 21(4), 395-403.
42. Omopariola, E. D., Windapo, A., Edwards, D. J., & Thwala, W. D. (2020). Contractors' perceptions of the effects of cash flow on construction projects. *Journal of Engineering, Design and Technology*, 18(2), 308-325.
43. Park, H.-K. (2004). Cash flow forecasting in construction project. *KSCE Journal of Civil Engineering*, 8(3), 265-271.
44. Park, H. K., Han, S. H., & Russell, J. S. (2005). Cash flow forecasting model for general contractors using moving weights of cost categories. *Journal of management in engineering*, 21(4), 164-172.
45. Pathuri, R. T., Killingsworth, J., & Mehany, M. S. H. M. (2022). Knowledge, skills, and abilities for senior-level construction managers: a us industry-based Delphi study. *International Journal of Construction Education and Research*, 18(3), 234-250.

46. Pordea, D., David, D., & Mateş, D. (2020). The impact of operating cash flow and current ratio on the profitability in construction industry. *Studia Universitatis Vasile Goldiş Arad, Seria Ştiinţe Economice*, 30(1), 22-32.
47. Rajabi, R., & Yakhchali, S. H. (2025). Optimizing cash flow in construction portfolios: A metaheuristic approach from the organization's perspective. *Ain Shams Engineering Journal*, 16(2), 103259.
48. Samer Ezeldin, A., & Ali, G. G. (2017). *Cash flow optimization for construction portfolios*. Paper presented at the International Conference on Sustainable Infrastructure 2017.
49. Schmidt, R. C. (1997). Managing Delphi surveys using nonparametric statistical techniques. *decision Sciences*, 28(3), 763-774.
50. Shah, D., Kumar, V., Kim, K. H., & Choi, J. B. (2017). Linking customer behaviors to cash flow level and volatility: Implications for marketing practices. *Journal of Marketing Research*, 54(1), 27-43.
51. Shash, A. A., & Qarra, A. A. (2018). Cash flow management of construction projects in Saudi Arabia. *Project Management Journal*, 49(5), 48-63.
52. Skulmoski, G. J., Hartman, F. T., & Krahn, J. (2007). The Delphi method for graduate research. *Journal of Information Technology Education: Research*, 6(1), 1-21.
53. Von Der Gracht, H. A. (2012). Consensus measurement in Delphi studies: review and implications for future quality assurance. *Technological forecasting and social change*, 79(8), 1525-1536.
54. Williams, M., & Moser, T. (2019). The art of coding and thematic exploration in qualitative research. *International management review*, 15(1), 45-55.

55. Youssef, M. A., Ibrahim, A. H., & El-Badawy Hafez, M. (2023). Impact factors on subcontractor's cash flow management. *Civil Engineering Journal*, 9(95), 94-104.