

Working Capital Management in Construction Sector: Challenges and Optimization Strategies

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Abstract. The construction industry is characterized by long project cycles, substantial upfront capital requirements, slow cash inflows, and high cash flow volatility, making working capital management a critical factor affecting the survival and development of construction enterprises. This paper focuses on working capital management in the construction sector, systematically analyzing its fundamental concepts, industry-specific features, major challenges, and optimization strategies. Employing literature review and inductive analysis methods, the study delves into common issues such as delayed payments, inefficient accounts receivable and payable management, excessive capital tied up in inventory and work-in-progress and inaccurate financial forecasting. These challenges can be addressed through improved cash flow forecasting and monitoring, optimized accounts receivable and payable processes, enhanced inventory and supply chain coordination, and strengthened policy support. Research shows that the problems in the operational capital management of the construction industry are interrelated and mutually influential. To enhance the efficiency of operational capital, it requires the joint efforts of internal improvement within the enterprise and external cooperation.

Keywords: Working Capital Cycle, Construction Industry, Liquidity Management, Cash Flow, Supply Chain Management

1. Introduction

Working capital and the working capital cycle are key indicators of working capital management (WCM). Working capital (WC) reflects a company's short-term solvency and liquidity and consists of current assets and current liabilities. If current assets exceed liabilities, debt risk is lower and short-term funds are more sufficient; otherwise, debt risk is higher and operating funds are insufficient. The working capital cycle (WCC) measures the days required for a complete business cycle and includes inventory days, receivable days, and payable days. The first two occupy cash flow, while payable days use suppliers' cash flow. Therefore, lower inventory and receivable days and higher payable days are generally preferable.

The construction industry (CI) is a major contributor to the gross domestic product of most economies. Yet, the industry is characterized by poorly performing projects, plagued with cost overruns and delays, with a relatively high-risk nature and marginal returns [1]. The root cause lies

in long project cycles, substantial advance funding requirements, and slow payment recovery. Therefore, working capital is critical to a company's survival and growth.

In terms of profitability, inefficient working capital erodes profits by tying up funds in materials and increasing borrowing costs. Regarding liquidity, delayed payments and high inventory and receivables may leave companies profitable on paper but short of cash, significantly increasing operational risks. Thus, effective working capital management not only reduces corporate risk but also enhances profitability. This article explores the characteristics of the construction industry, the challenges of working capital management and optimization paths, providing practical references for easing cash flow pressure and promoting sustainable industry development.

2. Characteristics of working capital of the construction industry

2.1. Project-based operations and cash flow volatility

In the construction industry, the project is the sole profit-making unit. All revenues, costs, assets, liabilities, and cash flows are linked to construction projects. Therefore, different projects have different construction plans, periods, advance funds, and incomes. For instance, small projects may be completed within months, while large projects may take years. At the same time, a construction company usually handles multiple projects simultaneously, so its cash inflows and outflows are irregular, and resources need to be dynamically allocated. For a specific project, in the early stage, the company needs to make a large upfront capital investment to purchase construction materials and other items, resulting in high cash flow pressure. In the middle stage, the client gradually pays the project funds, but the company still needs to make capital investment that cannot cover cash outflows. After the project is completed and for some time afterwards, the construction company can receive the full income. At this point, the company faces a serious risk of cash flow fluctuations. Profitable companies can still fail. Not because they can't estimate or build, but because they can't manage the cash gap between paying costs and collecting revenue [2].

2.2. Inventory and supply chain management in construction industry

Each engineering contract requires a large amount of construction materials as inventory, and the quantity and standards of inventory needed for each contract are different. This necessitates that construction companies possess strong inventory management and supply chain capabilities. Just-In-Time (JIT) management promotes precision, efficiency and timely delivery. The JIT supply chain can effectively decrease inventory costs, minimize storage requirements and mitigate material wastage, offering a strong solution to long-standing challenges in the construction of supply chain [3]. At present, many construction companies have adopted the JIT system to reduce costs and thereby enhance the efficiency of working capital.

2.3. Regulatory and economic factors affecting working capital

In recent years, the popularity of Environment, Social, Governance has been on the rise, and it has also had an impact on the working capital of the construction industry. Emerging market firms with better ESG have lower WCC. The E and S dimensions negatively affect all WCC components; the G dimension only affects inventory days [4]. At the same time, the macroeconomy also has an impact on the working capital strategy. During periods of increased economic uncertainty, more profitable firms often adopt conservative working capital management strategies [5].

3. Challenges in working capital management in construction industry

3.1. Delayed payment and credit risks

Due to the construction industry's business model of paying first and receiving later, delayed payment is common and can easily trigger cascading credit risks. Based on payment data from 30 UK subcontract projects (355 payments) + a survey of 21 subcontractors. Late payment observed in 77% of projects and 46% of payments. The late release of the second half of retentions is even more severe — upwards of 2.5% of income, sometimes the entire profit, held up nearly two months past the due date [6].

The main reasons are twofold. Firstly, construction projects have long durations and are greatly influenced by market conditions and international relations. Due to long construction periods, the payment of progress payments and the retention refund are both affected by the owner's financial adequacy [7]. As a result, payment collection is highly uncertain and credit risk is difficult to assess. Secondly, each project involves multiple entities, such as the client, contractor, and labor company, which can easily cause cascading payment delays and spread credit risk throughout the business chain.

3.2. Inefficient receivables and payables management

Inefficient management of receivables and payables means that the recovery of accounts receivable (such as project funds, quality guarantee deposits, progress payments, etc.) is slow, with a high risk of bad debts, and the early settlement of accounts payable by the company occupies its working capital or incurs fines due to overdue settlements. If the company's receivables management is poor, it is likely to result in a prolonged occupation of working capital, and new projects will not have sufficient funds to start. This can also lead to a disruption in the capital flow, making it impossible to meet the requirements for the completion of existing projects and increasing the risk of project suspension. However, if the company's payables management is poor, it will reduce the efficiency of its working capital and exacerbate the financial strain. If payables are overdue, it will cause suppliers to run out of stock and reduce the company's reputation and business credit. However, this problem is still quite common in the construction industry. An examination of collection practices of over 400 construction firms revealed a high number of firms with a collection period ratio above 30 days [8].

3.3. High level of work-in-progress and inventory holding

A construction project requires a large amount of building materials to be completed. To prevent the project from being halted due to material supply disruptions and to obtain favorable prices, construction companies often purchase building materials in large quantities to build up inventory. A high level of work in progress leads to a significant occupation of working capital. Moreover, as the construction industry uses the percentage method to recognize revenue, a high proportion of work in progress will also lead to the deduction of project profits. At \$5M revenue, you might carry \$500K–\$750K in WIP at any given time. At \$10M revenue, that WIP position grows to \$1M–\$1.5M in WIP. At \$15M revenue, you may carry \$2M–\$3M in WIP [9]. However, high inventory also occupies working capital and increases storage and management costs, while the risk of inventory depreciation and obsolescence will also increase. A large amount of work in progress and inventory will also prolong WCC and lower the status of the enterprise.

3.4. Inadequate financial planning and forecasting

In the construction industry, cash flow is highly vulnerable and depends heavily on accurate financial forecasting; once forecasts fail, working capital is directly affected. However, because of long project cycles, high upfront funding needs, and delayed payments, forecasting is extremely difficult. Companies that don't use proper financial forecasting often find themselves in risky situations. Many contractors rely on outdated financial information weeks or months behind [10]. At the same time, four gaps lead to forecasting inaccuracies. Four gaps: (1) untracked scope changes, (2) rework/deficiency corrections, (3) subcontractor overruns, (4) timing misalignment between cost incurred and financial report [11]. This increases bad debt risk as receivables become harder to recover. It also causes excessive procurement, raises storage costs, prolongs payable days, and increases the risk of overdue payments, thereby damaging the enterprise's credit standing.

4. Optimization strategies for working capital management

4.1. Enhancing cash flow forecasting and monitoring

To address the lack of professional financial and cash flow forecasting systems in enterprises, we propose two solutions to enhance control over cash flow.

Firstly, establish a dynamic cash flow prediction model based on projects. Cash flow forecasting at the project level should be dynamic and linked to interim payment certificates rather than relying on static annual budgets, especially under volatile contract conditions [12]. This model covers the entire cash flow cycle of the project and is calculated on a regular basis according to the project duration. It also conducts regular reviews of prediction deviations to optimize the accuracy of cash flow calculations.

Secondly, introduce information management tools, such as Enterprise Resource Planning (ERP), and rely on the system to automatically organize data for full-process precise management. This will integrate all business data of the company, coordinate resource allocation, and automatically issue risk warnings. Integrating earned value management with digital construction dashboards can improve project-level monitoring of cost performance and cash flow, thereby supporting more refined working capital control [13]. By improving the forecasting model and digital supervision, we aim to enhance the safety of cash flow and the efficiency of working capital.

4.2. Streamlining accounts receivable and payable processes

In order to enhance the efficiency of working capital and the working capital cycle and reduce the occurrence of bad debts, we need to optimize the processing procedures for accounts receivable and accounts payable. Regarding accounts receivable, we should strengthen the customer credit rating system. A structured client credit assessment system, incorporating indicators, such as past payment behavior and financial leverage, can strengthen proactive accounts receivable management in construction [14]. Before signing the project contract, complete the credit background check of the client company to conduct a detailed investigation into the financial status, default records, etc. and classify them into different levels of credit ratings. For companies with high credit ratings, relatively lenient payment terms can be granted; conversely, stronger constraints should be imposed.

In the management of accounts payable, while maintaining the relationship with suppliers, make reasonable use of the company's credit to extend the payment period, and strive to maximize the benefits for the company. Trade credit is an important and relatively low-cost source of short-term

financing, but in construction supply chains its continued availability depends heavily on stable interfirm relationships and payment practices [15].

4.3. Effective inventory and supply chain coordination

To address excessive inventory accumulation and supply chain fluctuations in the construction industry, a solution combining an ERP system, centralized procurement, and a Just-in-Time (JIT) system is proposed to determine order quantity. Centralized procurement reduces ordering and transportation costs and helps obtain purchase discounts, thereby lowering overall procurement costs. Framework agreements with strategically selected suppliers allow contractors to combine volume discounts (centralized procurement) with site-level flexibility, reducing both unit cost and inventory pressure [16].

However, relying only on managers' experience to determine purchase quantity and timing can easily cause inventory accumulation. Therefore, ERP and JIT systems are introduced to assist. ERP can estimate material demand in different periods and inform suppliers in advance. Moving from traditional batch-and-queue procurement to JIT in construction necessitates strategic supplier partnerships and a shift from adversarial to collaborative contracting [17]. The aim is to reduce time costs, strengthen supplier cooperation, and improve WCC efficiency.

4.4. Policy recommendations for sustainable working capital practices

Enterprises, industries, and the government should perform their respective duties to improve the efficiency and sustainability of working capital.

From the perspective of enterprises, they should strengthen self-responsibility by establishing a risk early warning mechanism, conducting customer credit ratings, limiting senior management power, reducing bad debts in accounts receivable and excess inventory, and maintaining stable cash flow.

At the industry level, industry leaders should take the lead in promoting mutual assistance and mutual benefit.

At the government level, targeted financial support and economic assistance should be provided for small and medium-sized enterprises, especially during economic downturns, to help them overcome liquidity difficulties.

5. Discussion

In the construction industry, working capital management is never isolated; it is mutually reinforcing and interrelated. Delayed payment increases receivable days and causes cash flow shortages. This then makes it difficult to pay suppliers on time, increases payable days, harms the company's reputation, and raises credit and operational risks. In turn, borrowing becomes more expensive and cash flow pressure worsens. Therefore, these problems form a vicious cycle.

Therefore, measures are needed at every stage to break this loop. Firstly, strengthening cash flow forecasting and monitoring can help control fund inflows and outflows, identify cash gaps, raise funds in time, and improve financial planning. Secondly, optimizing accounts receivable and payable management can accelerate collections, improve payment arrangements, strengthen supplier relationships, reduce supply disruption risk, and protect enterprise credit. Thirdly, strengthening inventory management and supply chain collaboration can avoid excessive procurement and work-in-progress accumulation, reduce occupied cash flow, shorten the working capital cycle, and

enhance supply chain stability. Finally, relevant policies can help small and medium-sized enterprises obtain more financing opportunities, improve risk resistance, and promote mutual benefit in the construction industry.

In summary, the most effective approach is not radical reform targeting a single issue, but coordinated and systematic optimization of the entire working capital cycle while ensuring stable project execution and sustainable industrial chain development.

6. Conclusion

This article conducts a comprehensive analysis of the working capital management in the construction industry from three aspects: industry characteristics, main challenges, and optimization paths. Firstly, the article points out the characteristics of the construction industry and the significance of working capital management for the industry. Then, it elaborates that the project-based operation model of the construction industry determines the strong volatility of cash flow. At the same time, a large amount of inventory, reliance on complex supply chains, the strengthening of environmental awareness, and the uncertainty of the macroeconomy have intensified the pressure on working capital. Based on this, the article summarizes the challenges of the construction industry: delayed payment and credit risks, inefficient management of receivables and payables, excessive levels of work-in-progress and inventory, and insufficient financial planning and forecasting.

In response to these problems, the article proposes corresponding optimization strategies. Firstly, enterprises should establish dynamic cash flow prediction models and information systems to enhance their ability in cash flow prediction and monitoring. Secondly, enterprises should strengthen customer credit assessment and make rational use of commercial credit to increase the turnover rate of funds. Thirdly, enterprises should improve the level of inventory and supply chain collaboration to reduce the occupation of funds. Finally, enterprises and the government should collaborate to create a better operating capital environment.

In summary, the operating capital management in the construction industry cannot rely solely on solving a single problem; instead, it should optimize the entire operating capital cycle and the entire industrial chain, create a better business environment, and promote sustainable development.

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