Digital Transformation and Firm Performance: Evidence from U.S. Public Companies (2016–2025)

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Abstract:

In this paper, how digital transformation (DT) affects firms' efficiency and profitability for listed firms in the U.S. over the time period of 2016 to 2025 is studied by using data collected and analyzed from SEC 10-K filings and published annual reports. The observations from datasets indicate that the value of DT intensity is calculated by a latent-topic analysis method utilizing texts concerning strategy, risk, and sustainability. A two-way fixed effect model is established to estimate the relationships between DT and those outcomes, such as asset turnover, operating cycle, gross margin, as well as ROA from a firm's operational performances. Also, estimation findings indicate that more intensive usage of DT may help firms achieve higher asset turnover with shortened operating cycles, primarily caused by better forecasted demand, more facilitated reconciled tasks, and reduced cash held on receivables. Besides, findings are reinforced through controlling for companies' features, where more intense competition in the industry and more volatile industries benefit from the utilization of DT. Finally, results are in favor of that DT serves as a cap concept associated with a firm's technological investment towards good practices to meet demands efficiently in the short term and bring profits in the long run.

Keywords: Digital Transformation; Firm Performance; Operational Efficiency; Cash Conversion Cycle; Panel Data Analysis

1. Introduction

Digital transformation (DT) has become much more than a new IT upgrade. DT now signals a fundamental shift to the manner in which firms structure their production, create value, and manage uncertainty. In recent management literature, it's becoming an important strategic question as to whether managers can transform their products, flows, and models, rather than just focusing on infrastructure [1]. This

wider definition of DT emphasizes that successful digital transformation programs must include a balance between exploring new opportunities and exploiting internal assets to support performance.

Two empirical puzzles motivate this paper. First, scholars have been unable to find the effect of digital efforts in financial results earlier than 4–5 years when comparing across manufacturing, service, or hybrid sector samples of public companies. For example, there's evidence in both manufacturing as well as composite multi-sector data that digital effort intensity is more associated with process-based outputs rather than profitability measures like efficiency and asset utilisation [2]. However, it does develop gradually due to the lagged adoption of internal gains. Secondly, prior studies suggest that the impact of DT isn't always straightforward, given environmental conditions and competition. Instead, turbulent business environments combined with poor management may mean no profit return from digital efforts during market shocks and sudden policy reversals, disrupting internal operations and goals [3].

Based upon this, it examines how DT relates to enterprise efficiency and performance in the US economy. Specifically, firm-level efficiency improvements show a correlation with textual content that indicates a certain level of digital engagement in their most recent disclosures. It matches firm statements along with other accounting details, enabling us to explore qualitative and quantitative interpretations using textual analysis on sustainability, ESG disclosure, and overall firm statement language. The dataset consists of publicly traded firms from the US based from 2016 to 2025 using SEC sustainability information in conjunction with financial statement variables, including standard bookkeeping and profit-based inputs. The primary regression employs a two fixed-effects design that includes lag operators measuring efficiency relationships derived from DT. There's also evidence to suggest differentials among the sample by business maturity or leverage, answering questions concerning whether digitally mature enterprises achieve superior efficiency.

Indeed, this research offers credible evidence via the firm-level operating efficiency and profitability of publicly listed U.S.-based companies to explore how digital transformation affects the firms and what are the implications of the key roles of different digitally enabled processes in contributing to these outcomes under varying competitive and macroeconomic conditions via creating value through demand forecasting, process automation, information sharing, and better decision making.

2. Methodology

To assess the impact of digital initiatives over the years, it prepares an annual panel from firms based on their finan-cial statements from the years 2016–2025, in addition to the corresponding digital content in reports and communications about these changes. To maintain balance between each year, only the firms that were active or available for all these sample years were chosen for the database. Financials and utilities firms are omitted from the data. Continuous variables are winsorized at the 1st percentile and 99th percentile, and logs or log returns are computed when suitable to make data appear more closely aligned around their average rather than exhibiting skewed leftward or rightward distributions. These steps minimize any variance caused by potentially disruptive information, but do not distort underlying information integrity or affect consistency and clarity within texts.

Based on this dataset, a selection of firms' text-based sections will quantify how intensively they are undertaking digital-transformation (DT) projects [2]. For the most recent year covered by the report file (the last fiscal-year end within a company's reported timeframe), strategy, risk, and sustainability (FSDS) is where companies typically provide information about any ongoing DT endeavors (the prior twelve months). A detailed description can be drawn with sentences in this section, as well as similar elements or areas where companies might use key terms expressing their commitment to, approach towards, effort in, impact from, results due to the use of a digital tool, or investment towards transformation purposes. Using such elements compiled from multiple sources, including annual reporting to standardization frameworks and other databases, a dictionary generates the necessary flags to identify the sentences describing either the tools or consequences used to perform such operations. Then, it computes two measures of interest for firms directly related to their decision of transformation via digital means. The first is the total text length across sentence counts in the relevant reports or forms for each of the years studied. The second count flagged elements found in those sentences within every report. Then it calculates the ratio of the number of flagged sentences with respect to the total sentence count. Using this proportional count of flagged elements throughout time periods or different years, it can compare firms across varied years against others in similar durations, especially given consistent usage of these proportional sentence ratios in similar literature contexts and measurement frameworks on transforming the operations of a firm [2-4].

Afterwards, to measure the performance of these transformations across years, two sets of variables will be analyzed, which express outcomes that result from changing operations as described. The first set captures aspects surrounding the level of performance by using measures about operating leverage, which includes both CCC and asset turnover [2]. After breaking down the total measures into individual components, firm CCC consists of three sub-components. Two of them are traditional measures

with time in days to account for days outstanding in the context of accounting. Day sales outstanding accounts for the time period to receive the payment in sales outstanding to generate revenue, while days inventory outstanding describes how much time it takes for a given level of revenue to move through production as raw material, work-in-progress goods, and finished products. Then, this is offset by days' payables outstanding, which represents how long a company continues to defer payment for items owed to various suppliers until settled in accordance with negotiated settlement dates agreed in a purchase contract. The second set includes profit margin and return on assets (ROA) in capturing the resulting profitability through this change [5]. Both concepts are commonly studied in implementing digital initiatives [2, 5]. In addition, other controls are included to address differences between firms in different settings, such as natural logs of total assets as a control variable for firm size, leverage calculated by debt-to-total-assets as a measure for external sources, age which quantifies company duration to reduce effects associated with new market entrants, the ratio of total R&D to total revenues as R&D intensity, and more recent additions with capital intensity as a gauge for manufacturing-related expenses, particularly with respect to fixed capital expenditures as a direct determinant of cash outflows [6].

Finally, as previously explained and implied in most parts of this analysis, the implementation of such a transformation usually starts after several months, sometimes even multiple, before the actual outcome can be assessed. This is why these explanatory variables, such as DT intensity, are lagged by one year [2, 7]. Moreover, to address the influence of outliers and skewed distribution caused by variables like CCC or its elements, it winsorizes and takes the log for the estimation robustness enhancement.

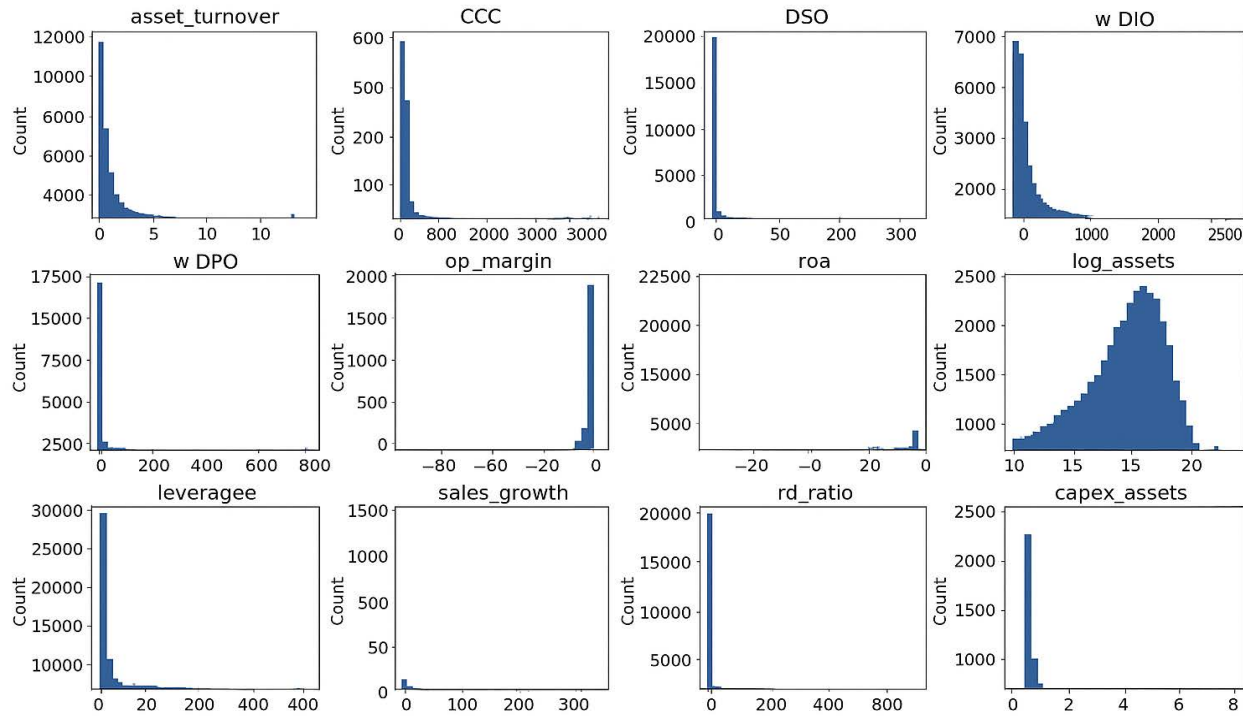## Figure 2. Distributions of key variables

Fig. 1 Main financial and operational variables employed in the empirical analysis (Photo/Picture credit: Original).

Fig. 1 presents the distribution patterns of the main financial and operational variables employed in the empirical analysis.

The baseline empirical specification adopts a two-way fixed-effects framework:

$$Y_{i,t} = \alpha + \beta Ratio_{i,t-1} + \gamma X_{i,t-1} + \mu_i + \tau_t + \epsilon_{i,t} \quad (1)$$

Where $Y_{i,t}$ denotes the outcome variable for firm i in year t; $Ratio_{i,t-1}$ is the lagged DT intensity; $X_{i,t-1}$ is the control-variable vector; μ_i and τ_t are firm and year fixed effects; and is the idiosyncratic error term. The model identifies within-firm variations while controlling for macroeconomic disturbances and long-term structural trends. Standard errors are clustered at the firm level, and coefficients are interpreted both per unit and per standard deviation of the digital-transformation ratio to assess their economic relevance [3, 7].

Three elements ensure identification consistency:
(1) Firm fixed effects remove time-invariant heterogeneity such as managerial quality and long-run capabilities;
(2) The one-year lag of the ratio isolates the forward-looking disclosure component and mitigates simultaneity; and

(3) Year effects absorb macro events, including the pandemic. Industry-by-year effects are added as robustness checks. The correlation matrix confirms limited multicollinearity and conceptual coherence of constructs [3].
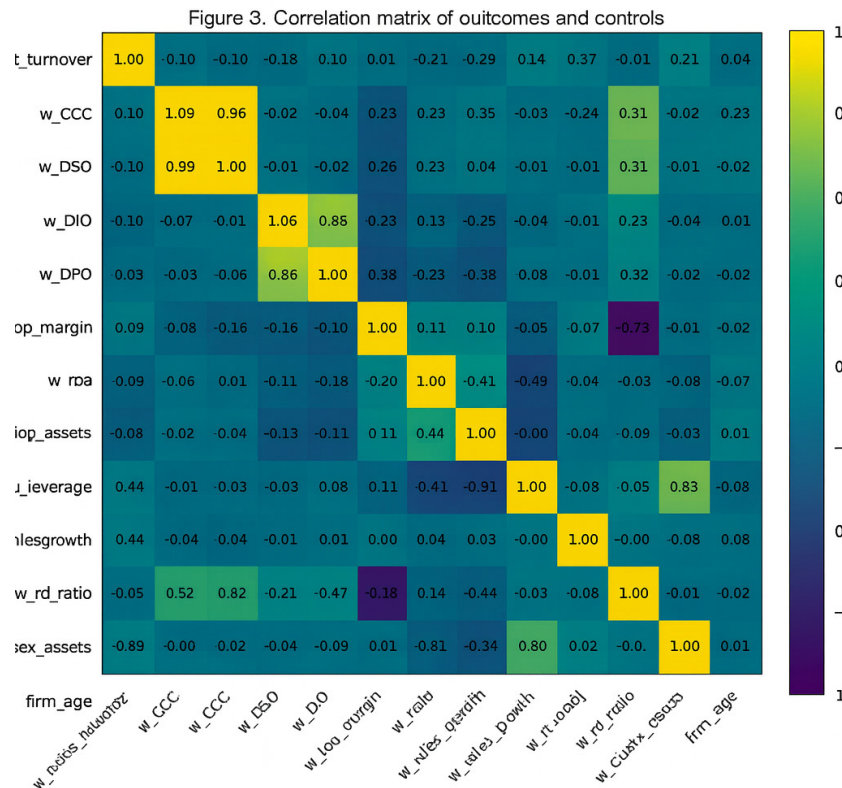

Fig. 2 Correlation matrix (Photo/Picture credit: Original).

Fig. 2 displays the correlation matrix of outcomes and control variables. To clarify the mechanism through which DT affects performance, I re-estimate models using DSO, DIO, and DPO as dependent variables, testing whether the ratio predicts faster collections, leaner inventories, and more strategic payables management [2,5,8]. Subsequently, I examine heterogeneity by interacting the ratio with proxies for competitive intensity, firm size, and initial digital maturity, and by conducting split-sample analyses around the pandemic period [9]. Timing effects are assessed through distributed lags of the ratio to capture delayed realization consistent with a productivity J-curve. Robustness checks include alternative winsorization cut-offs, inverse-hyperbolic-sine transformations for skewed variables, narrower and broader digital dictionaries, exclusion of the top 10 percent of disclosure length, and inclusion of industry-by-year fixed effects. All regressions report firm-clustered robust errors, within-R^2 values, and observation counts. Where helpful, coefficients are standardized for comparability across outcomes.

3. Enterprise Efficiency

It aims to evaluate enterprise efficiency along two main dimensions: asset utilization, captured by the asset turnover ratio, and working-capital efficiency, measured through the cash conversion cycle (CCC). As well as its components, days sales outstanding (DSO), days inventory outstanding (DIO), and days payables outstanding (DPO). Digital transformation strengthens efficiency through three interconnected channels.

First one is to enhance demand forecasting and real-time inventory visibility, lower safety-stock needs, and reduce DIO by supporting predictive restocking and continuous monitoring [2,5]. Secondly, digital tools such as e-invoicing, automated reconciliation, and algorithmic credit scoring speed up collections, cutting DSO and improving liquidity control [1,4]. The last one is workflow automation, and supplier portals make payment scheduling more strategic, allowing firms to extend DPO when feasible without damaging supplier relationships [9].

Taken together, these mechanisms shorten the overall cash

conversion cycle and raise asset turnover by increasing throughput per unit of assets [2,5]. Meanwhile, digital transformation fosters stronger organizational backbones and platform infrastructures that merge separate technological efforts into integrated system-wide efficiencies. Then, converting operational digitalization into lasting performance improvements [3,6].

4. Industry Competition

Industry rivalry reduces how effectively digital capabilities translate into performance. If competition is fierce and environmental change is rapid, the agility value will be large, and transformational returns will be relatively higher [8]. In this situation, it will take less time for firms that own digitally flexible infrastructures to facilitate a reset and maintain a leading position in the market. However, under the uncertain and fluctuating markets, an abnormal phenomenon of digitalization shows that more investments in technology lead to fewer benefits or even adverse benefits happening as coordination hardens, resources are scarce, and conflicts with conflicting goals [8]. It corresponds with the similar opinion between the RBV approach and DCTC that they both emphasize more on a firm's inner assets and business skills as well as external opportunities [3, 6].

5. Opportunities and Development

Digital transformation (DT) creates lasting sources of competitive advantage by embedding digital capabilities into firms' operational routines and strategic decision frameworks. Data governance and interoperability mechanisms further improve efficiency by enabling closed-loop optimization that connects forecasting, replenishment, and settlement within a continuous feedback system [3]. Building upon these foundations, deeper analytics help connect individual process improvements into a coordinated system, allowing firms to respond faster and operate with greater accuracy across their value networks.

In addition, firms with platform-based and ecosystem-driven approaches create network effects that strengthen their sales and growth cycles, producing compounding gains in performance over time [3]. This form of digital integration helps improve coordination and encourage innovation by using shared data systems to support collaborative value creation. Prior evidence also shows that productivity and innovation play huge roles in explaining how DT enhances firm outcomes. Similarly, studies on family businesses point out that combining a long-term strategic outlook with digital agility is vital for maintaining transformation success in the long run [10].

6. Discussion

This research examines whether the intensity of firms' digital transformation (DT), as reflected in 10-K narrative disclosures, predicts their future performance. Drawing on a firm-year panel spanning 2016–2025 and employing a two-way fixed-effects model with lagged regressors, the analysis reveals that greater DT intensity is associated with more efficient asset utilization and a shorter cash conversion cycle. These improvements are primarily driven by reductions in days sales outstanding (DSO) and days inventory outstanding (DIO), along with better-timed payables management when feasible. These operational improvements translate into significant gains in operating margin and return on assets, and the findings remain robust to different DT indicators, variable transformations, and alternative fixed effects.

Mechanism analysis reveals that working-capital components directly impact DT. At the same time, heterogeneity tests show stronger effects among firms operating in more competitive or volatile environments, as well as among those firms with more advanced digital infrastructures [8]. Timing results indicate that the full benefits of DT emerge over longer horizons, consistent with organizational learning effects and the gradual development of digital capabilities [7].

From both theoretical and practical views, these findings show that DT is a systemic capability framework rather than a stand-alone technological investment. By linking data governance, transparency, and automation to operational improvements and sustainable profitability, DT offers a foundation for long-term value creation [3, 5]. For managers, the greatest advantages come from integrating digital tools with disciplined working-capital management across payables, inventories, and receivables. Then, for policymakers and stakeholders, narrative-based DT metrics may serve as early indicators of firms' evolving strategic and operational maturity.

5. Conclusion

Digital transformation (DT) has important effects on firm profitability and performance. Based on 10-year data on US public firms, the result shows that higher adoption rates of digital technologies by firms lead to increases in asset turnover, net days sales outstanding, and payables. All these effects lead to higher income and better ROI results. The paper aims to demonstrate how firm performance improves by showing that an increasing pressure of competitiveness within an industry, a movement between economic regimes, is positively related to DT. Additionally, we examine the influence of integration, which moderates outcomes for companies that have to face a broader range of more complicated environments. Then, results in-

dicate that investing in technology can not be sufficient to capture persistent value unless these choices are matched to management activities ensuring sustained firm advantage.

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