Vol. 07, No. 3 (2025) 1713-1720, doi: 10.24874/PES07.03.029

Proceedings on Engineering Sciences

www.pesjournal.net

CASH-FLOW-BASED SOLVENCY ASSESSMENT IN TECHNOLOGY SERVICE COMPANIES WITH SAAS REVENUE MODELS: A CASE STUDY OF SERVICENOW

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Received 08.11.2024.
Revised 27.05.2025.
Accepted 10.06.2025.

Keywords:

Cash Flow Management, Technology Service Companies, Solvency Assessment, Financing Cash Flow, SaaS Revenue Model, Liquidity Management, Regression Analysis

A B S T R A C T

Cash flow management is crucial for technology service companies to sustain operations, drive financial growth, and mitigate risks, particularly for firms generating revenue through continuous operations or project-based engagements. Many providers operate under delayed payment schemes, creating a time lag between service delivery and cash inflows. Subscription-based models (SaaS) can provide predictable revenue streams but often require substantial upfront investments before the project is completed. Key challenges in managing cash flows include irregular revenue from project-based payments or delayed client settlements, significant upfront costs for talent acquisition, R&D, infrastructure, and rapid expansion that may strain liquidity if not properly managed. This research aims to develop a cash-flow-based solvency assessment model using ServiceNow, a leading capitalized technology services company, as a case study. The authors address current cash flow management challenges, highlight managerial specificities, and propose a new approach to evaluating solvency, focusing on the role of cash flows from operating, investing, and financing activities in managing short- and long-term debt obligations. The scientific contribution lies in assessing the influence thresholds of these cash flows on solvency maintenance. The regression-based solutions identified in the case study are practically applicable to other organizations in the technology services sector.

1. INTRODUCTION

Cash flow management constitutes a fundamental dimension of financial solvency and stability in technology service companies. These firms, ranging from IT consulting providers to managed service providers (MSPs) and SaaS businesses, encounter unique financial dynamics shaped by their service-based, project-based, or subscription-based business models. Unlike product-based companies that generate immediate revenues from sales, technology service providers often face long sales cycles, deferred customer payments, and substantial

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upfront expenditures for talent and infrastructure. Such factors can lead to cash flow volatility even when the business appears profitable on paper (Boom-Cárcamo et al., 2024).

Baboyan (2022a) examined strategies for managing financial risks and predicting insolvency in commercial organizations, emphasizing advanced methods such as cluster analysis to enhance financial control and support sustainable economic growth amid ongoing global crises. Effective cash flow management depends on strategies that may include real-time tracking of deliveries, personalized notifications, scheduled dispatching, augmented reality integration, the use of smart lockers, and geolocation technologies.

In another research, Baboyan (2022b) develops and applies a new training model to forecast key financial indicators and monitor the solvency of Armenian commercial organizations, demonstrating that the approach enhances strategic financial management and supports effective solvency control.

Baboyan (2021) also develops a behavioral model to predict the security index of commercial organizations' current assets in Armenia, using a training-based approach with mean square error optimization and gradient reduction to ensure alignment with theoretical and practical financial management principles.
Proper management of cash inflows and outflows ensures that organizations can cover daily operating expenses, invest in growth, and remain resilient during periods of uncertainty (Ramli & Yekini, 2022). It also involves monitoring and controlling the timing of cash movements to preserve solvency, prevent shortfalls, and support strategic decision-making. In a rapidly evolving industry where flexibility and innovation are essential, maintaining robust cash flow is not merely a financial issue but also a strategic imperative (Meyer et al., 2023).

Maintaining operational stability, fulfilling financial obligations, and supporting growth initiatives require effective cash flow management. Barnabas and Oloyede (2024) identified key optimization strategies, including the implementation of rigorous forecasting techniques, efficient receivables management, and strategic inventory control.

At ServiceNow, cash flow management typically involves the use of modules such as Project Portfolio Management (PPM), Financial Management, IT Business Management (ITBM), or custom applications integrated with ERP systems. Although ServiceNow is not a full-fledged financial system like SAP or Oracle, many organizations employ it for budgeting, forecasting, expense tracking, and demonstrating return on investment. Cash flow data within ServiceNow is often sourced from external financial systems (e.g., ERP, payment platforms), and synchronization is not always real-time. This results in delays in financial visibility and decisions that may be outdated relative to organizational needs.
Moreover, incomplete or inaccurate cost models in ServiceNow (as used in Financial Management or ITBM) may fail to reflect actual expenditures or forecasts, leading to misleading cash flow projections or budget overruns. Overall, ServiceNow demonstrates strong solvency indicators, reflecting a conservative balance sheet and steady revenue growth.

However, the effects of operational, investing, and financing cash flows on short- and long-term debt management are not unequivocal. Therefore, a comprehensive assessment of these effects underscores the relevance and the theoretical-practical significance of the research conducted in this research.

2. LITERATURE REVIEW

Digital technologies are reshaping the conduct of international business (IB). Within multinational corporations, they facilitate the disintermediation of processes, enabling firms to operate with greater speed, lower costs, and enhanced responsiveness to evolving needs.

In the scholarly literature, multiple approaches to characterizing cash flows can be found. Brigham and Gapenski (2017) define cash flows as the actual net inflows or outflows of funds within a company over a given period.

In his financial management framework, Van Horn and Wachowicz (2015) present the movement of funds as a continuous process, where each direction of cash use must correspond to an appropriate source. According to this concept, corporate assets represent the net use of cash, while liabilities and equity constitute net sources.
Rice and Coyle (1995) view cash flows as a fundamental source for meeting debt obligations and assessing solvency.

Similarly, Baquero (2022) connects corporate cash flow management challenges with institutional development, emphasizing that the US antitrust regulation, accounting standards, and foundational corporate laws remain heavily rooted in principles established during the late 19th and early 20th centuries. With limited exceptions, these institutions were designed in the industrial era to support and constrain firms such as Standard Oil (Exxon), General Motors, and DuPont.

Within the liquidity–solvency trade-off, Eom et al. (2002) (ScienceDirect) developed a corporate finance model illustrating how firms choose debt levels to balance liquidity (day-to-day cash fluctuations) with solvency (long-term viability), thereby optimizing debt while avoiding excessive cash accumulation or liquidity risk.

Michalski (2006) highlights the significance of holding transactional, precautionary, and speculative cash balances, proposing methods to align such holdings with value-maximizing policies.

V. P. Karpova and T. P. Karpova (2016) stress the importance of considering a firm's life cycle when forecasting cash flows, an aspect particularly relevant to technology service providers.

Alhanof Almutairi et al. (2022) argue that the adoption of integrated enterprise systems reduces volatility in operating cash flows, enhances efficiency, and improves access to debt financing, ultimately strengthening long-term solvency.

Mäntysaari (2012) discusses the frameworks for managing cash flow risks in financial contracts and the corporate governance incentives relevant to technology services, which frequently face stochastic payment structures and receivables-related uncertainties.

Similarly, Salas-Molina et al. (2023) offer a multidimensional review of cash management, ranging from theoretical foundations to practical tools and optimization methods, with particular emphasis on predictive analytics, risk mitigation, and technological processes.

Comparative analyses across industries reveal that cash-flow-based ratios (e.g., cash flows to debt, operating cash flow ratios) outperform traditional accounting-based metrics in predicting distress and solvency challenges.

Seretidou, Bilius, and Stavropoulos (2025) propose industry-specific models tailored to volatile sectors such as telecommunications and IT services. Evidence from service industries is further provided by Stavropoulos and Zounta (2025), whose study of Greek service providers (including IT firms) demonstrates that accelerated collections and deferred payments are strongly associated with higher profitability. Efficient receivables collection and delayed disbursements reduce reliance on external financing, which is particularly critical for service-based firms with limited liquid physical reserves.

Nevertheless, comprehensive assessments of the interdependencies between solvency and the three categories of cash flows (operating, investing, and financing) remain relatively scarce, particularly within sector-specific research.

3. RESEARCH METHODOLOGY

To manage cash flows, the professional literature proposes various models (Miller & Orr, 1966) and approaches (Winston, 1998). Particularly, within the logic of the Baumol model, an organization conducts its activities while maintaining a reasonable and maximum balance of funds in its accounts (Stone, 1972).

Within the scope of this research, the authors propose the following methodological solutions.

Step 1. From a dynamic perspective, the cash flows of the studied organization are examined in terms of operating, investing, and financing activities. The net inflow (outflow) of cash is analyzed, along with short-term and long-term debt obligations. Their behavior is assessed using the coefficient of determination (R^2) of a mathematical trend.

Step 2. Based on the linear relationship, a baseline dataset and a comparable dataset are constructed for the variables included in the regression equations and the resulting indicators. The following formula is applied:

Step 3. Three regression equations are constructed as follows:

$$\mathbf{Y_1} = a_1*X_1+a_2*X_2+a_3*X_3, \quad (1),$$
$$\mathbf{Y_2} = a_1*X_1+a_2*X_2+a_3*X_3, \quad (2),$$
$$\mathbf{Y} = a_1*X_1+a_2*X_2+a_3*X_3, \quad (3),$$

where:

X_1 is cash flows from operating activities;
X_2 is cash flows from investing activities;
X_3 is cash flows from financing activities;
Y_1 is net cash flows / long-term debt;
Y_1 is net cash flows / short-term debt;
Y_2 is net cash flows / (long-term debt + short-term debt).

The correlation between the variables and the resulting indicators in equations (1), (2), and (3) are evaluated. Using the least squares method **(**Baumol & Quandt, 2000), the weighted impacts of the variables in equations (1), (2), and (3) are determined.

Step 4. For variables X_1, X_2, and X_3, the factor effects are evaluated through the application of elasticity coefficients. A matrix of maximum factor impact is constructed for equations (1), (2), and (3). Based on the analysis, conclusions are drawn.

Solvency, the ability of an organization to meet its long-term financial obligations, is particularly critical for technology service providers operating in a rapidly evolving, highly competitive industry. Constant innovation can quickly render services or platforms obsolete, making sustained competitiveness dependent on continuous reinvestment. However, this need for ongoing investment also creates significant challenges in managing debt effectively.

The results of the research conducted using the proposed methodology are presented below according to the respective steps.

During Step 1, the authors examined the cash flows of ServiceNow Inc. (market capitalization as of July 21, 2025: $199.407 billion) by type of activity (operating, investing, and financing) in a dynamic perspective (Table 1) (Christodoulides & Christodoulides, 2017).

Table 1. Net cash flows of ServiceNow Inc. by activity type and debt dynamics, 2011–2024

	2024	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
Net cash flows from operating activities, X_1	4267	3398	2723	2191	1786	1236	811	643	159	318	141	82	49	37
Net cash flows from investing activities, X_2	-2501	-2167	-2583	-1607	-1507	-725	-347	-884	-108	-232	-317	-403	-239	-8
Net cash flows from financing activities, X_3	-1343	-803	-344	-506	597	-302	-607	539	-56	80	69	569	242	1
Net cash flows	406	429	-257	53	901	209	-159	326	-11	160	-114	247	51	30
Long-term debt	1489	1488	1486	1484	1640	695	662	630	508	475	443	415	22	3
Current liabilities (short-term debt)	8358	7365	6005	4949	3737	2753	2013	2039	1071	732	507	328	212	127

Source: Developed by the authors based on Macrotrends.net (2025a).

According to the data in Table 1, net cash flows from operating activities at ServiceNow Inc. reached their maximum in 2024, amounting to $4247 billion. Their minimum was observed in 2011, amounting to $37 billion. The determination coefficient (R^2) for the trend line of this indicator was 0.86, demonstrating a stable growth pattern.

Net cash flows from financing activities peaked at $597 billion in 2020, while the lowest point was recorded in 2024 at -$1343 billion. The trend line had an R^2 value of 0.4426, indicating significant fluctuations over time.

Net cash flows from financing activities reached their peak in 2020 at $597 billion and hit their lowest point in 2024 at -$1343 billion. The trend line's R^2 value of 0.4426 indicates a highly volatile pattern over the period.

The net cash flow indicator peaked in 2020 at $901 billion and fell to its lowest point in 2022 at -$257 billion. The trend line's R^2 value of 0.088 highlights an extremely volatile pattern over the period.

Long-term debt peaked in 2020 at $1640 billion. Its minimum occurred in 2011 at $3 billion. The R^2 value of the trend line was 0.872, showing a stable growth pattern. Short-term liabilities reached their maximum in 2024 at $8358 billion. Their minimum was observed in 2011 at $127 billion. The R^2 value of the trend line was 0.901, indicating stable growth.

In Step 2, a baseline dataset (Table 2) and a comparable dataset (Table 3) were constructed based on the linear relationship for the variables included in the regression equations and the resulting indicators.

In the third step, the following regression equations were constructed:

$$\mathbf{Y_1} = a_1*X_1+a_2*X_2+a_3*X_3, \quad (1),$$
$$\mathbf{Y_2} = a_1*X_1+a_2*X_2+a_3*X_3, \quad (2),$$
$$\mathbf{Y} = a_1*X_1+a_2*X_2+a_3*X_3, \quad (3)$$

Table 2. Baseline dataset

	X_1	X_2	X_3	Y_1	Y_2	Y
2024	4267	-2501	-1343	0.273	0.049	0.041
2023	3398	-2167	-803	0.288	0.058	0.048
2022	2723	-2583	-344	-0.173	-0.043	-0.034
2021	2191	-1607	-506	0.036	0.011	-0.034
2020	1786	-1507	597	0.549	0.241	0.008
2019	1236	-725	-302	0.301	0.076	0.061
2018	811	-347	-607	-0.241	-0.079	-0.060
2017	643	-884	539	0.517	0.160	0.122
2016	159	-108	-56	-0.021	-0.010	-0.007
2015	318	-232	80	0.337	0.219	0.163
2014	141	-317	69	-0.257	-0.225	-0.120
2013	82	-403	569	0.596	0.754	0.333
2012	49	-239	242	2.355	0.241	0.218
2011	37	-8.4	1.2	10.096	0.241	0.235
Average	1274	-973	-133	1.05	0.121	0.070

Source: Developed by the authors based on Macrotrends.net (2025a).

Table 3. Comparable table (Indicator i / Average of indicator i)

	X_1	X_2	X_3	Y_1	Y_2	Y
2024	3.348	2.569	10.084	0.260	0.402	0.592
2023	2.666	2.226	6.029	0.275	0.482	0.696
2022	2.137	2.653	2.583	-0.165	-0.354	-0.493
2021	1.719	1.651	3.799	0.034	0.089	-0.493
2020	1.402	1.548	-4.482	0.525	1.996	0.118
2019	0.970	0.745	2.268	0.287	0.628	0.870
2018	0.636	0.357	4.561	-0.230	-0.655	-0.855
2017	0.505	0.908	-4.046	0.494	1.323	1.753
2016	0.125	0.111	0.419	-0.020	-0.084	-0.099
2015	0.249	0.238	-0.603	0.322	1.811	2.341
2014	0.111	0.326	-0.516	-0.245	-1.859	-1.720
2013	0.064	0.414	-4.269	0.570	6.239	4.780
2012	0.038	0.246	-1.816	2.249	1.991	3.134
2011	0.029	0.009	-0.009	9.644	1.992	3.374

Source: Developed by the authors based on Macrotrends.net (2025b)

- Equation (1): The evaluation of the correlation between the independent variables and the dependent variable revealed the following relationships: a positive correlation between correl (Y_1; X_2) = 0.344, a weak positive correlation between (Y_1; X_3) = 0.158, and a negative correlation between (Y_1; X_1) = -0.305;
- Equation (2): The assessment of correlations indicated a positive correlation between correl (Y_2; X_2) = 0.226, a strong positive correlation between

correl (Y_2; X_3) = 0.520, and a negative correlation between (Y_2; X_1) = - 0.280;

- Equation (3): The correlation analysis showed a positive correlation between correl (Y; X_2) = 0.349, a strong positive correlation between (Y; X_3) = 0.426, and a negative correlation between (Y; X_1) = -0.365.

The statistical characteristics of the regression equations are presented in Table 4.

Table 4. Statistical characteristics of the regression equations (1)

SUMMARY OUTPUT		**ANOVA**						
Regression statistics			*df*	*SS*	*MS*	*F*	*Significance F*	
Multiple R	0.349	Regression	3	10.304	3.435	0.415	0.746	
R^2	0.122	Residual	9	74.483	8.276			
Adjusted R^2	-0.171	Total	12	84.787				
Standard error	2.877							
Observations	13							
	Coefficients	*Standard error*	*t statistic*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.987	1.196	1.661	0.131	-0.720	4.693	-0.720	4.693
3.348	0.390	4.580	0.085	0.934	-9.970	10.750	-9.970	10.750
2.569	-1.412	4.163	-0.339	0.742	-10.829	8.005	-10.829	8.005
10.084	-0.026	0.403	-0.064	0.950	-0.938	0.887	-0.938	0.887

Source: Developed by the authors.

Table 5. Statistical characteristics of the regression equation (2)

SUMMARY OUTPUT		ANOVA						
Regression statistics			*df*	*SS*	*MS*	*F*	*Significance F*	
Multiple R	0.634	Regression	3	18.599	6.200	2.014	0.182	
R^2	0.402	Residual	9	27.698	3.078			
Adjusted R^2	0.202	Total	12	46.297				
Standard error	1.754							
Observations	13							
	Coefficients	*Standard error*	*t statistic*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.057	0.729	1.449	0.181	-0.593	2.707	-0.593	2.707
3.348	2.363	2.793	0.846	0.419	-3.954	8.681	-3.954	8.681
2.569	-2.043	2.538	-0.805	0.442	-7.785	3.700	-7.785	3.700
10.084	-0.503	0.246	-2.045	0.071	-1.060	0.053	-1.060	0.053

Source: Developed by the authors

Equation (3): The statistical characteristics of theregression equation are presented in Table 6.

Table 6. Statistical characteristics of the regression equation (3)

SUMMARY OUTPUT		ANOVA						
Regression statistics			*df*	*SS*	*MS*	*F*	*Significance F*	
Multiple R	0.543	Regression	3	13.595	4.532	1.255	0.347	
R^2	0.295	Residual	9	32.489	3.610			
Adjusted R^2	0.060	Total	12	46.083				
Standard error	1.900							
Observations	13							
	Coefficients	*Standard error*	*t statistic*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.489	0.790	1.885	0.092	-0.298	3.277	-0.298	3.277
3.348	1.103	3.025	0.365	0.724	-5.739	7.945	-5.739	7.945
2.569	-1.443	2.749	-0.525	0.612	-7.662	4.777	-7.662	4.777
10.084	-0.314	0.266	-1.177	0.269	-0.916	0.289	-0.916	0.289

Source: Developed by the authors

Based on the weighted effects of the variables obtained through the method of least squares, the regression equations constructed in this research take the following form:

$$\mathbf{Y_1} = 0.39*X_1 - 1.412*X_2 - 0.026*X_3, \quad (1),$$

$$\mathbf{Y_2} = 2.363*X_1 - 2.043*X_2 - 0.503*X_3, \quad (2),$$

$$\mathbf{Y} = 1.489*X_1 - 1.443*X_2 - 0.314*X_3, \quad (3)$$

From the constructed regression equations (1), (2), and (3), the factor has been identified as exerting a positive effect on the dependent variable, while X_1, X_2, and X_3 consistently demonstrate a negative impact across all three equations.

The long-term debt coverage ratio (net cash flows/long-term debt), the short-term debt coverage ratio (net cash flows/short-term debt), and the overall debt coverage ratio (net cash flows / (long-term debt + short-term debt)) at ServiceNow are strongly positively associated with the company's ability to synthesize net cash inflows from operational activities. Another important issue relates to the company's investment policy. In terms of servicing short-term debt and total debt (long-term + short-term debt), liquidity is balanced in regression equations (2) and (3) by the weighted coefficients of X_1 and X_2. However, from the perspective of long-term debt

servicing, the weighted effect of the X_1 variable does not act as a balancing factor, which is a matter of concern.
In the fourth step, a factor impact assessment was performed using elasticity coefficients for the variables X_1, X_2, and X_3. The elasticity coefficient was calculated using the following formula:

$$\overline{Э_{Xi}} = \frac{\text{ai} * \text{Xi}}{Yi}, \quad (4)$$

where ai is the weighted coefficient of the specific variable as determined by the regression equation;
Xi is the comparable magnitude of the specific variable;
Yi is the comparable magnitude of the dependent variable.

The matrix of the maximum factor impacts for equations (1), (2), and (3) is presented in
Table 7.

Table 7. Matrix of maximum factor impacts for equations (1), (2), and (3) for ServiceNow

	X_1, billion $	X_2, billion $	X_3, billion $
Y_1	474.7	- 1312.9	- 3.3
Y_2	24924.6	- 16461.3	-554.5
Y	20182.78	-20169.84	-600.49

Source: Developed by the authors

The calculations of the maximum factor impacts for equations (1), (2), and (3) for ServiceNow show the following:

- Long-term debt servicing: The company will require $841.5 million to cover long-term debt (474.7 − 1312.9 − 3.3 = $841.5 million);
- Short-term debt servicing: The company has a surplus of $7908.8 million for short-term debt (24924.6 − 16461.3 − 554.5 = $7908.8 million), indicating full liquidity with respect to short-term obligations;
- Overall debt servicing (long-term + short-term debt): The company will require $587.55 million to cover total debt (20182.78 − 20169.84 − 600.49 = $587.55 million).

Essentially, the assessment indicates that ServiceNow demonstrates effective management of short-term debt. However, the relatively low efficiency in managing long-term and overall debt has created challenges in maintaining long-term liquidity.

4. CONCLUSION

Among publicly listed organizations in the technology services sector, ServiceNow faces notable challenges in managing liquidity and is exploring effective solutions within its operational framework. This study proposes alternative approaches to assess the company's ability to service long-term, short-term, and total debt, considering its cash flow dynamics.

The findings of the evaluation are summarized as follows:

- Effective management of long-term debt is crucial for the financial health and strategic flexibility of technology service organizations. Sustainable debt management requires a multifaceted approach that includes prudent financial planning, regular performance evaluation, and alignment of debt structures with long-term business objectives;
- Strategic structuring of debt is a priority. Debt terms should align with the investment lifecycle to ensure repayment schedules coincide with revenue generation;
- Implementation of cash flow optimization measures is essential. Accurate forecasting and disciplined cash flow management help maintain sufficient liquidity to meet debt obligations without disrupting operations;
- Expense management and operational efficiency are key factors. Streamlining operations and reducing unnecessary expenditures can free up capital for debt servicing and reduce reliance on additional borrowing;
- Diversification of revenue streams through innovation and service expansion increases income sources, reduces financial risk, and supports more consistent debt repayment;
- Prioritization of technological investments allows concentration of capital on high-return projects, ensuring debt is used to create value rather than becoming an additional burden;
- Long-term debt management in technology service companies, particularly at ServiceNow, relates not only to financial engineering but also to organizational resilience, adaptability, and long-term value creation. Strategically managed, debt can serve as a powerful tool to foster innovation, scale operations, and strengthen competitive advantage.

Based on the research and analysis, the authors propose the following recommendations:

- Regularly review and update expense models, particularly for infrastructure, licenses, and labor costs;
- Utilize tools and historical data to forecast cash inflows and outflows accurately;
- Automate or improve invoice reconciliation, reduce payment cycles, and monitor overdue payments;
- Prioritize core expenditures, negotiate vendor terms, and manage payroll costs;
- Maintain a cash buffer to address unexpected deficits;
- Use credit lines, invoice factoring, or venture capital to cover shortfalls;

- Stabilize operational cash flows through improved billing systems, tracking of accounts receivable, and enhanced enterprise systems;
- Accelerate collection of receivables and negotiate payment terms, especially for recurring service contracts;
- Monitor liquidity using cash flow-to-debt ratios, free cash flow, and other cash-based indicators;
- Apply time-series analysis to forecast short-term cash flows and mitigate liquidity traps;
- Regularly monitor collections, payments, operating cash ratios, and cash-to-debt ratios;

Compare the company's collections, payments, and cash measurement indicators with peers to determine optimal positioning.

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