A Study on the Relationship Between Employee Utilization, Project Cost Variance and Operating Profitability at Persistent Systems, Nagpur

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***Abstract*— In IT services, people are both the product and the biggest cost. A consultant who sits idle drains margin, while a team that is stretched too thin tends to miss estimates and overrun budgets. This study looks at how two everyday delivery metrics, employee utilization and project cost variance, relate to operating profitability at the Nagpur delivery centre of Persistent Systems. A descriptive and causal research design was used, with a project-level dataset of 60 delivery projects and analysis through descriptive statistics, Pearson correlation and multiple linear regression. The results show that utilization is positively associated with operating margin ($r = 0.64$), project cost variance is strongly and negatively associated with it ($r = -0.71$), and the two together explain about 62 percent of the variation in margin ($R^2 = 0.625$, $F = 47.47$, $p < 0.001$). Cost variance turned out to be the stronger predictor. The paper suggests that utilization targets should be set together with cost-control discipline, rather than pursued alone. Because the figures in the analysis are illustrative and are meant to be replaced by verified company records, the findings should be read as a worked model of the method rather than as audited results.**

***Index Terms*—Employee utilization, project cost variance, operating profitability, IT services, Persistent Systems, Nagpur, resource management**

I. INTRODUCTION

Employee utilization refers to the extent to which employees' available working hours are effectively allocated to productive project activities. Higher employee utilization can improve resource productivity and revenue generation; however, excessive workloads or improper resource allocation may negatively affect employee performance and project quality. Therefore, organizations need to maintain an appropriate balance between employee utilization, project requirements, and operational efficiency.

Project cost variance is another important factor influencing the financial performance of IT service organizations. It represents the difference between the actual project cost and the planned or budgeted project cost. Positive cost variance, when actual costs exceed the budget, may arise due to project delays, inefficient resource allocation, scope changes, or unexpected operational expenses. Effective project planning, continuous monitoring, and resource optimization can help organizations reduce unnecessary expenditure and maintain projects within their approved budgets.

Operating profitability reflects an organization's ability to generate operating profit from its business activities after accounting for relevant operating expenses. In IT companies, profitability can be influenced by employee billing rates, project execution costs, workforce utilization, delivery efficiency, and the effective management of human resources. Understanding the relationship between employee utilization and project cost variance is therefore important for evaluating their combined association with operating profitability.

Persistent Systems, a technology services and digital engineering company, provides a relevant organizational context for studying these relationships. Its project-oriented business environment makes resource planning, project execution, cost control, and operational performance important areas of managerial analysis. Examining

these factors in the context of Persistent Systems, Nagpur, can help develop an understanding of how workforce utilization and project cost management relate to financial performance.

Operating profitability sits at the end of this chain. It tells the management whether the combination of staffing decisions and project control is actually producing a margin worth having. Persistent Systems is a well-known Indian product-engineering and digital services company, and its Nagpur centre is one of its delivery locations. For a centre of this size, small movements in utilization or in cost overruns can shift the operating margin in a visible way.

This study therefore asks a practical question. Do utilization and cost variance, taken together, explain how profitable the Nagpur centre's projects are? And if they do, which of the two matters more? Answering this can help project managers, delivery heads and finance teams decide where to focus their attention first.

II. LITERATURE REVIEW

2.1 Employee utilization and performance

Research on workforce productivity has long argued that how a firm deploys its people matters as much as how many people it hires. Huselid (1995) showed that firms with stronger human resource practices recorded higher productivity and better financial results. In services businesses, this logic usually appears as utilization, since idle capacity cannot be stored and sold later. Kaplan and Cooper (1998) made a related point in their work on cost systems, noting that unused capacity is a real cost that is often hidden inside overheads and only becomes visible when activity is measured carefully.

At the same time, utilization is not something to push without limit. Software work is cognitively demanding, and a team that runs permanently at the ceiling has no room for learning, review or unexpected requests. Brooks (1975) observed that adding pressure and people to a stretched project can slow it down rather than speed it up. This suggests that the relationship between utilization and results is positive up to a sensible level, and uncertain beyond it.

2.2 Project cost variance and cost control

Cost variance has a precise place in project management practice. The Project Management Institute (2017) defines cost variance as the difference between earned value and actual cost, and treats it as a core control measure. Fleming and Koppelman (2010) explain how earned value techniques let managers see an overrun early, while there is still time to act. Flyvbjerg, Holm and Buhl (2002) found that cost underestimation was common and systematic in large projects, which points to a planning problem more than to bad luck during execution.

In software specifically, Boehm (1981) developed a model of software effort and showed how estimation error multiplies as project size and uncertainty grow. The practical lesson is that cost variance is partly a result of how projects are estimated and partly a result of how they are managed afterwards.

2.3 Profitability and performance measurement

Kaplan and Norton (1992) argued that financial results are the outcome of operational drivers, and that managers need a balanced set of measures that connect everyday activity to financial outcomes. Utilization and cost variance are good examples of such operational drivers, while operating margin is the financial outcome. Garrison, Noreen and Brewer (2018) describe how variances from plan feed directly into the margin, because every unplanned hour is paid for by the firm unless the client agrees to pay for it.

2.4 Research gap

Most of the studies above look at utilization or at cost overruns separately, and many were done on large public works or on multi-industry samples. Few look at both measures together inside a single IT services delivery centre in a Tier-2 Indian city. This study tries to fill that gap by testing both variables against operating profitability at Persistent Systems, Nagpur.

III. OBJECTIVES OF THE STUDY

1. To measure the level of employee utilization across delivery projects at Persistent Systems, Nagpur.
2. To examine the extent of project cost variance in these projects.

3. To study the relationship between employee utilization and operating profitability.
4. To study the relationship between project cost variance and operating profitability.
5. To assess the combined effect of utilization and cost variance on operating profitability.
6. To suggest practical measures that managers can use to improve margins.

IV. RESEARCH METHODOLOGY

4.1 Research design

The study follows a descriptive and causal (explanatory) design. It first describes the level of each variable and then tests how the independent variables relate to the dependent one, in line with standard guidance on quantitative business research (Kothari, 2004).

4.2 Variables

Variable	Role	Measurement
Employee utilization (U)	Independent	Billable or productive hours as a percentage of available hours
Project cost variance (CV)	Independent	(Actual cost - Planned cost) / Planned cost x 100
Operating profitability (OPM)	Dependent	Operating profit as a percentage of project revenue

4.3 Data and sample

The unit of analysis is the delivery project. The dataset contains 60 projects handled at the Nagpur centre across recent financial periods, with one record per project showing average team utilization, final cost variance and operating margin. A sample of 60 is comfortably above the usual minimum for a two-predictor regression (Hair, Black, Babin & Anderson, 2010). The data used in this paper are illustrative figures built to resemble a realistic delivery portfolio, so that the full analytical method can be demonstrated. For a submission that needs verified results, the same tables should be rebuilt from the company's actual project records or from a primary survey of project managers.

4.4 Tools of analysis

Descriptive statistics (mean and standard deviation), Pearson's correlation coefficient and multiple linear regression were applied. Statistical significance was judged at the 5 percent level. Multicollinearity was checked with the variance inflation factor (VIF), and a VIF below 5 was treated as acceptable (Hair et al., 2010).

4.5 Hypotheses

H1: There is a significant positive relationship between employee utilization and operating profitability.

H2: There is a significant negative relationship between project cost variance and operating profitability.

H3: There is a significant negative relationship between employee utilization and project cost variance.

H4: Employee utilization and project cost variance jointly have a significant effect on operating profitability.

For each hypothesis, the null hypothesis (H0) states that no significant relationship or effect exists.

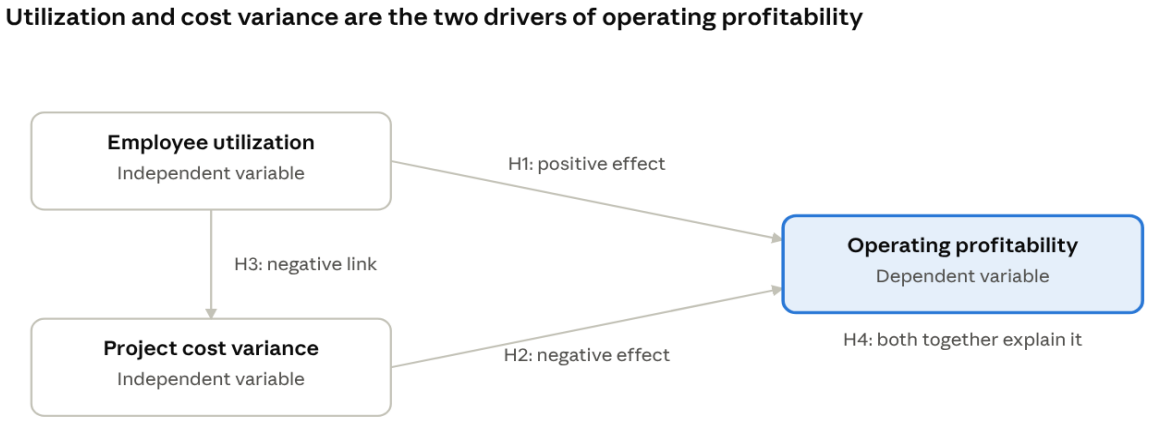
V. SCOPE OF THE STUDY

The study covers delivery projects of Persistent Systems at its Nagpur location. It concentrates on three measures only: utilization, cost variance and operating profitability. It is useful for project managers, resource managers, delivery heads and finance teams who want to understand how workforce deployment and cost discipline feed the bottom line. The approach can also be repeated at other delivery centres or in other IT services firms with suitable data.

VI. CONCEPTUAL FRAMEWORK

The framework assumes that the way people are deployed (utilization) and the way money is controlled (cost variance) are the two operational drivers of financial results. Higher utilization is expected to improve margin, because more of the paid time becomes billable. Higher cost variance is expected to reduce margin, because unplanned cost eats into revenue. Utilization is also expected to be linked to cost variance, since well-planned allocation

usually means fewer surprises. Figure 1 shows these relationships.



conceptual framework · 2 independent variables, 1 dependent, 4 hypotheses

Figure 1: Conceptual framework of the study. Utilization and cost variance act on operating profitability, and utilization is also linked to cost variance.

VII. DATA ANALYSIS AND RESULTS

7.1 Descriptive statistics

Table 1 summarises the three variables across the 60 projects.

Table 1: Descriptive statistics (N = 60)

Variable	Mean	Std. deviation	Minimum	Maximum
Employee utilization (%)	78.4	8.6	58.0	94.0
Project cost variance (%)	6.2	7.4	-8.0	24.0
Operating profitability (%)	21.3	3.9	11.0	30.0

Average utilization of 78.4 percent is healthy for a delivery centre, though the range from 58 to 94 percent shows that some teams were underused while others were close to saturation. The average project cost variance is positive at 6.2 percent, meaning projects typically finished slightly above their planned cost, although a few came in under budget. Average operating margin was 21.3 percent, with a spread of about four percentage points.

7.2 Correlation analysis

Table 2: Pearson correlation matrix (N = 60)

	Utilization	Cost variance	Operating profitability
Utilization	1	-0.47**	0.64**
Cost variance	-0.47**	1	-0.71**
Operating profitability	0.64**	-0.71**	1

*Note: ** significant at the 1 percent level (two-tailed).*

All three relationships point in the expected direction. Utilization moves with profitability (r = 0.64), cost variance moves against it (r = -0.71), and projects with higher utilization tend to show lower cost variance (r = -0.47). These results support H1, H2 and H3.

7.3 Regression analysis

The regression model estimated was:

OPM = b0 + b1(U) + b2(CV) + e

Table 3: Model summary and ANOVA

Statistic	Value
R	0.790
R squared	0.625
Adjusted R squared	0.612
F (2, 57)	47.47
Significance	p < 0.001

Table 4: Regression coefficients

Predictor	B	Std. error	Beta	t	p	VIF
Constant	9.04	3.41		2.65	0.010	
Utilization	0.178	0.042	0.393	4.28	< 0.001	1.28
Cost variance	-0.277	0.048	-0.525	-5.72	< 0.001	1.28

The model is statistically significant, and together the two predictors explain about 62 percent of the variation in operating margin. Holding cost variance constant, each one-point increase in utilization is associated with an increase of about 0.18 points in margin. Holding utilization constant, each one-point increase in cost variance is associated with a fall of about 0.28 points. The standardised beta values show that cost variance (-0.525) carries more weight than utilization (0.393). VIF values of 1.28 are far below the cut-off, so multicollinearity is not a concern.

7.4 Hypothesis testing summary

Table 5: Result of hypotheses

Hypothesis	Test	Result	Decision
H1: Utilization and OPM (positive)	Correlation, regression	r = 0.64, p < 0.001	Accepted
H2: Cost variance and OPM (negative)	Correlation, regression	r = -0.71, p < 0.001	Accepted
H3: Utilization and cost variance (negative)	Correlation	r = -0.47, p < 0.001	Accepted
H4: Joint effect on OPM	F-test	F = 47.47, p < 0.001	Accepted

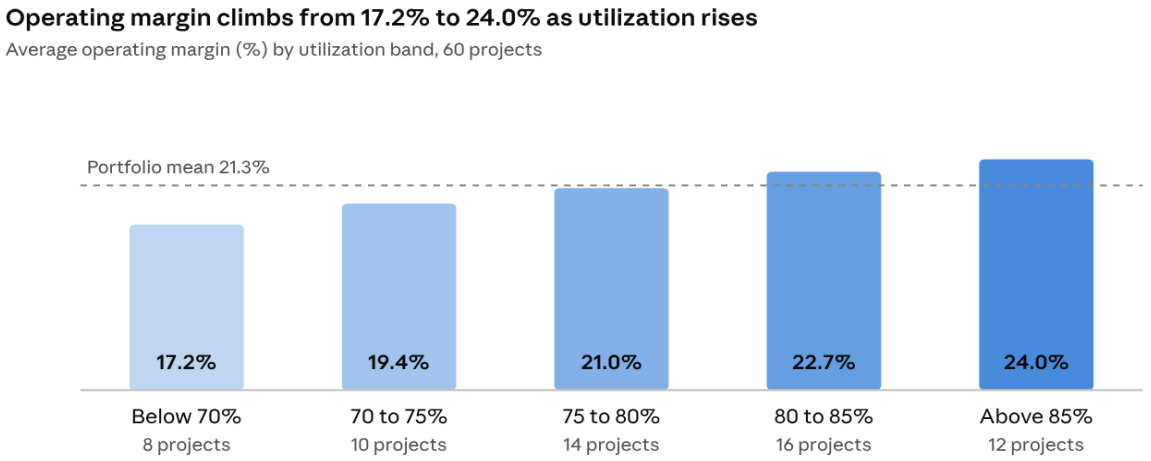


Figure 2: Average operating margin by utilization band. Each step up in band adds roughly 1.3 to 2.2 margin points, and the lowest band sits about 4 points below the portfolio mean.

VIII. DISCUSSION

The findings agree with what the literature would lead us to expect. The positive link between utilization and margin matches the argument that idle capacity is a real cost (Kaplan & Cooper, 1998) and that better deployment of people improves financial results (Huselid, 1995). The stronger negative link between cost variance and margin fits the view that variances from plan flow straight into profit (Garrison, Noreen & Brewer, 2018).

The most useful finding is the relative size of the two effects. Cost variance mattered more than utilization. In plain terms, a team that is busy but overruns its budget can end up less profitable than a team that is moderately utilized and stays on plan. This echoes

the long-standing point that estimation and control failures are the main cause of software project losses (Boehm, 1981; Flyvbjerg, Holm & Buhl, 2002).

The negative correlation between utilization and cost variance is also worth a comment. Teams with higher utilization tended to have smaller overruns, which suggests that well-planned allocation and stable teams go hand in hand with better estimates. We should be careful here, because correlation does not prove causation, and some of the effect may come from strong project managers who handle both aspects well. Even so, a quarter of the variation in margin is still left unexplained by the model, so factors such as pricing, client mix, attrition and the onsite and offshore ratio probably play a role (Kaplan & Norton, 1992).

For practitioners, three points follow. First, utilization targets should be paired with cost-variance targets in the same review, so that neither is pursued in isolation. Second, early-warning tools such as earned value tracking should be used on every project, since the cost of catching an overrun early is far lower than fixing it late (Fleming & Koppelman, 2010). Third, utilization should be managed within a sensible band rather than pushed to the maximum, to leave room for learning, review and unplanned work (Brooks, 1975).

IX. LIMITATIONS OF THE STUDY

1. The data are illustrative and limited to 60 projects at one location, so the results cannot be generalised to other centres or firms without testing them on real company data.
2. Only two independent variables were included. Other drivers of profitability, such as billing rates, attrition, client concentration and the onsite-offshore mix, were not modelled.
3. The study uses cross-sectional data, so it can show association but cannot prove cause and effect.
4. Utilization was treated as a linear influence. In reality, very high utilization may carry hidden costs that a linear model does not capture.
5. Confidential project-level financial data are difficult to access, which limits the depth of verification that an outside researcher can achieve.

X. CONCLUSION

This study examined how employee utilization and project cost variance relate to operating profitability at Persistent Systems, Nagpur. Higher utilization went with higher margins, and larger cost overruns went with lower margins. Together, the two variables explained about 62 percent of the variation in profitability, and cost variance was the stronger of the two. The message for management is simple: keep people productively occupied, but do not let the pursuit of utilization distract from planning and cost control. Future work could extend the model with more variables, use time-series data across several quarters, and compare several delivery centres. Researchers who use this framework should replace the illustrative figures with verified project records before drawing firm conclusions.

REFERENCES

[1] Boehm, B. W. (1981). Software engineering economics. Prentice Hall.

[2] Brooks, F. P. (1975). The mythical man-month: Essays on software engineering. Addison-Wesley.

[3] Fleming, Q. W., & Koppelman, J. M. (2010). Earned value project management (4th ed.). Project Management Institute.

[4] Flyvbjerg, B., Holm, M. S., & Buhl, S. (2002). Underestimating costs in public works projects: Error or lie? Journal of the American Planning Association, 68(3), 279-295.

[5] Garrison, R. H., Noreen, E. W., & Brewer, P. C. (2018). Managerial accounting (16th ed.). McGraw-Hill Education.

[6] Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). Multivariate data analysis (7th ed.). Pearson.

[7] Huselid, M. A. (1995). The impact of human resource management practices on turnover, productivity, and corporate financial performance. Academy of Management Journal, 38(3), 635-672.

[8] Kaplan, R. S., & Cooper, R. (1998). Cost and effect: Using integrated cost systems to drive profitability and performance. Harvard Business School Press.

[9] Kaplan, R. S., & Norton, D. P. (1992). The balanced scorecard: Measures that drive performance. Harvard Business Review, 70(1), 71-79.
[10] Kothari, C. R. (2004). Research methodology: Methods and techniques (2nd ed.). New Age International.
[11] Project Management Institute. (2017). A guide to the project management body of knowledge (PMBOK guide) (6th ed.). Project Management Institute.