To Study the Effect of Knowledge Diversity on Individual Performance Working in Teams in Manufacturing Industry.

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ABSTRACT

In the contemporary manufacturing sector, organizations rely extensively on teams comprising members with diverse knowledge, skills, and experiences. While knowledge diversity has been strongly associated with enhanced team-level outcomes such as creativity and innovation, its impact at the individual performance level is still to be explored in depth. This study explores as to how knowledge diversity within the team-members influences individual employee performance in manufacturing organizations. Data was collected from 120 employees across 3 manufacturing firms in Pune working in 10 teams, with knowledge diversity assessed using Blau's Index and performance evaluated through supervisor ratings. Statistical analysis, including descriptive measures, correlations, and regression modeling, revealed that higher levels of knowledge diversity within teams were significantly associated with improved individual performance. The findings suggest that exposure to heterogeneous expertise fosters learning, problem-solving, and adaptability at the individual level, though excessive diversity may introduce communication challenges. The study underscores the importance of strategically managing team composition to balance diversity and cohesion in order to maximize individual performance outcomes.

Keywords: knowledge diversity, Blau's Scale, individual performance.

INTRODUCTION

The manufacturing industry operates in an environment characterized by rapid technological advancement, competitive pressures, and demand for continuous process improvements. Within this context, organizations increasingly rely on teams as the primary work unit, bringing together employees with varied knowledge domains to solve problems and drive innovation. This phenomenon, referred to as knowledge diversity, involves differences in educational backgrounds, functional expertise, and professional experiences amongst team-members (Harrison et al, 2007; Bell, 2007).

Much of the prior literature remains concentrated on the impact of knowledge diversity on team level performance, demonstrating its role in enhancing innovation, and decision making (Joshi et al, 2009; Van Knippenberg et al, 2007). However, individual-level consequences of working with diverse teams remain relatively underexplored. In manufacturing contexts, where individual productivity, skill application, and adaptability are critical, understanding how knowledge diversity affects individual performance is essential.

Individual performance is not only influenced by technical capabilities but also by exposure to different perspectives and opportunities for learning within teams. Working in knowledge-diverse teams can encourage individuals to adopt new approaches, develop broader problem-solving skills, and improve adaptability. Conversely, it may also create challenges such as role ambiguity, misunderstandings, or communication barriers (Jehn et al, 1999).

The study is focussed on examining direct relation amongst knowledge diversity and individual employee performance within manufacturing teams. By focusing on individual outcomes, this research provides deeper insights into how team composition translates into employee-level contributions in the manufacturing sector.

LITERATURE SURVEY

Knowledge diversity refers to the variation in skills, expertise, and functional experience among team members. Blau's Index (1977) is a widely used metric to quantify such categorical diversity. Empirical studies suggest that diverse teams outperform homogeneous ones when tasks require innovation, creativity, and problem-solving (Bell, 2007). However, the impact of diversity is contingent upon context—diverse teams may also face coordination difficulties and interpersonal conflicts (Jehn et al., 1999).

A central theoretical lens explaining when diversity helps is the Categorization Elaboration Model (CEM), which argues diversity may boost performance via information elaboration while simultaneously triggering social categorization risks; outcomes hinge on task demands and climate (e.g., leadership, norms) that enable elaboration and curb bias (Van Knippenberg, et al, 2004). Building on CEM, work on information elaboration shows that functionally diverse teams translate their broader knowledge base into better solutions when they engage in rich exchange and integration of viewpoints especially on complex work (Resick C J et al, 2014).

Regarding measurement, Blau's Index remains the standard for categorical heterogeneity in organizational research and board/committee studies and is frequently recommended in diversity heterogeneity designs (Harrison, D. A., et al, 2007). Recent quantitative syntheses also underscore that context matters a 2024 meta-analysis finds small average main effects of demography, job specific, and cognitive diversity on team performance, but more significant effects under high task complexity or creativity and in lower power distance settings conditions typical of engineering or manufacturing problem solving cells.

While team level benefits of diversity are well-documented, individual level effects are less examined. Employees embedded in diverse teams often gain access to a wider pool of knowledge resources, which can enhance personal learning, skill acquisition, and adaptability. Research indicates that knowledge heterogeneity facilitates the development of cognitive flexibility and ability to solve problems as competence for the individuals (van Knippenberg et al, 2007). However, if unmanaged, diversity may overwhelm individuals with conflicting perspectives, reducing clarity in roles and negatively affecting performance (Joshi et al, 2009).

At the individual level, cognitive/knowledge diversity fosters learning by exposing employees to discrepant perspectives that "catch blind spots" and reduce confirmation bias, improving implicit learning and adaptability (Picazo et al., 2023). Empirical and theoretical work on knowledge elaboration indicates that when teams exchange and integrate information deeply, individuals expand domain knowledge and decision accuracy. Micro-evidence from matched employer employee data shows sizable learning from coworker effects within production teams, implying that heterogeneity in coworkers' knowledge capital can raise individual wages and productivity through on-the-job learning spillovers (Rossi-Hansberg, E. et al., 2021). Individual outcomes are, however, climate sensitive. A large-sample study finds that team climate can dampen the positive pathway from cognitive diversity to knowledge sharing, the very mechanism that benefits individuals. Studies of social diversity also link diverse networks to higher innovative work behavior at the individual level, reinforcing the idea that access to varied knowledge sources fuels personal creativity and output quality (Nicola Cangialosi et al, 2023).

In manufacturing organizations, individual performance is often measured in terms of productivity, efficiency, quality of output, and contribution to team goals (Spector, 1988). Employees who effectively utilize diverse team knowledge may demonstrate higher innovation and decision-making accuracy, directly impacting manufacturing performance.

In manufacturing and engineering contexts, cross-functional teamwork is a primary vehicle for individual upskilling: classic and contemporary evidence shows that the right mix of expertise plus active knowledge exchange improves personal problem solving, quality, and innovation metrics. Field and review work on functional diversity points to stronger benefits where tasks are complex and interdependent conditions matching many manufacturing improvement projects (Picazo et al, 2023). Multi-level and quasi-experimental evidence also document knowledge spillovers in production pr classroom team analogs, linking diverse peer groups to improved individual performance provided coordination costs and role ambiguity are managed. Finally, research on organizing knowledge-production teams inside firms shows that how organizations structure and locate diverse expertise shapes both learning opportunities and downstream performance for the individuals embedded in those teams.

RESEARCH METHODOLOGY.

This study adopted an exploratory quantitative design to deep dive in the relationship between knowledge diversity and individual employee performs in the manufacturing sector. The research was conducted across three medium-to-large manufacturing firms located in Pune, representing diverse sub-sectors of the industry. The final sample comprised 113 employees from ten cross-functional teams, each ranging between 8 and 14 members. The teams were engaged in a variety of functions, including design, operations, quality, and maintenance, thereby offering sufficient variation for analyzing knowledge diversity.

Primary data was taken from assessment of employee performance carried out by immediate supervisors in consultation with the Human Resource department. Performance was evaluated using a standardized rating instrument on a 100-point scale, reflecting four dimensions that is productivity, quality of output, innovation, and achievement of individual goals (Bell,

2007). Information regarding functional role and background of employees was also obtained to classify knowledge categories. The source of secondary data were books, peer-reviewed journals, magazines and online databases to provide theoretical grounding and to supplement primary findings with existing literature.

For Measurement of Variables to quantify the degree of knowledge heterogeneity within each team, Blau's Index (1977) was employed. The index calculates the probability of team members belonging to diverse functional categories. Values closer to zero indicate homogeneity, whereas values closer to one indicate higher diversity. In this study, categories included design, operations, quality, and maintenance.

Individual Performance scores were derived from supervisor evaluations. The evaluation framework emphasized measurable outcomes in productivity and quality, as well as subjective aspects such as problem-solving, creativity, and attainment of set objectives. The research objectives are outlined as:

1. To examine the relationship between knowledge diversity and individual employee performance in manufacturing teams.
2. To provide empirical evidence supporting the influence of heterogeneous team composition on individual outcomes.
3. To propose practical recommendations for leveraging knowledge diversity to enhance individual productivity and growth.

Data Analysis & Data Interpretation
The dataset was digitized and coded systematically for analysis. Statistical analysis was conducted by SPSS and Excel. Descriptive statistics were used to summarize key variables and Pearson correlation coefficients to test association between knowledge diversity and individual performance. Regression analysis determines the predictive impact of knowledge diversity on individual performance outcomes.

A summary of the data obtained from respondent employees has been reported as below,

Table 1: Descriptive Statistics for Performance Score and Blau Index

Metric	Performance Score	Blau Index
Count	113	113
Mean	75.28	0.56
Standard Dev.	4.43	0.12
Min	65	0.34
25th Percentile	72	0.44
Median (50%)	76	0.6
75th Percentile	79	0.67
Max	85	0.75

Table 1, the descriptive statistics indicate that the average individual performance score among employees was 75.28, with scores ranging between 65 and 85. This suggests that overall performance levels were relatively high, with modest variation across the sample. The mean Blau Index value of 0.56 reflects a moderate level of knowledge diversity across teams, with some teams being relatively homogeneous and others highly diverse.

Table 2: Distribution of Knowledge Categories

Knowledge Category	Frequency	Percentage
A	59	59%
B	33	29%
C	16	14%
D	5	4%

Table 2, the largest proportion of employees (59%), belonged to category A, while category B comprised 29% of the workforce. This distribution highlights a unbalanced balanced representation of knowledge areas of knowledge present in majority across teams, which is actual diversity analysis as in most of the teams.

The descriptive findings suggest that teams exhibit moderate diversity levels (Blau Index between 0.34 and 0.75), with corresponding variations in individual performance. Employees working in more diverse teams (higher Blau Index values) tended to show higher performance scores in preliminary inspection. However, this relationship requires confirmation through correlation and regression analyses, which will be used to statistically validate the impact of knowledge diversity on individual performance.

Table 3: Correlation Matrix

Variable	Blau Index	Performance Score
Blau Index	1	0.52

Performance Score	0.52	1

Table 3 shows a moderate positive correlation (r = 0.52) was observed between Blau's Index and individual performance. This implies that employees in teams with higher knowledge diversity tend to achieve better performance ratings. The strength of the correlation suggests a moderately strong relationship, consistent with theoretical expectations that diverse teams foster individual learning and adaptability.

To further validate the predictive effect of knowledge diversity on performance, a simple linear regression model was applied with Blau Index as the independent variable and Performance Score as dependent variable.

Table 4: Regression Analysis

Regression Values	
Multiple R	0.52
R Square	0.27
Adjusted R Square	0.26
Standard Error	3.81
Observations	113

ANOVA	df	SS	MS	F	Significance F
Regression	1	586.96	586.96	40.52	0.00
Residual	111	1607.98	14.49		
Total	112	2194.94			

	Coefficients	Standard Error	t Stat	P-value
Intercept	64.56	1.72	37.47	0.00
Blau Index	19.03	2.99	6.37	0.00

Table 4 represent regression analysis, the regression results indicate that Blau's Index is a statistically significant predictor of individual performance (p < 0.00). The model explains approximately 27% of the variance in performance scores, suggesting that knowledge diversity makes a substantial contribution to individual outcomes. The positive coefficient (coefficient = 19.03) implies that as knowledge diversity increases, individual performance also improves.

The findings provide clear empirical support for the hypothesis that knowledge diversity enhances individual employee performance. Employees working in teams with greater heterogeneity of expertise reported higher performance ratings, likely due to increased opportunities for knowledge sharing, skill acquisition, and innovative problem-solving. Importantly, while diversity contributes positively, managerial mechanisms are required to prevent potential drawbacks such as miscommunication or role ambiguity in highly diverse teams.

Key Findings of the Research
1. The analysis revealed a significant positive relationship between knowledge diversity (Blau's Index) and individual performance. Employees in teams with higher levels of functional heterogeneity consistently demonstrated stronger performance outcomes. This finding confirms that exposure to diverse perspectives and expertise enhances learning, adaptability, and problem-solving ability at the individual level.

2. Regression analysis indicated that knowledge diversity explained nearly 27% of the variance in individual performance. This is a considerable effect size, highlighting that team composition is a critical determinant of how employees perform in manufacturing contexts.

3. The workforce was distributed in moreover two categories comparatively with sparse in the other two categories across the four knowledge categories (A = 52%, B = 29%, C = 14%, D = 4%). This balance ensured meaningful diversity within teams and facilitated opportunities for cross-learning.

4. While the overall relationship was positive, preliminary observations suggested that teams at the highest diversity levels sometimes faced challenges related to communication and coordination. This indicates that knowledge diversity yields the strongest benefits when balanced with effective management practices.

CONCLUSION
This study focusses on the impact of knowledge diversity on individual performance in the manufacturing industry. Drawing on data from 113 employees across three firms in Pune, the findings provide robust empirical evidence that diverse knowledge amongst teams has a significant positive effect on individual employee outcomes.

The results show that employees embedded in more diverse teams achieve higher performance ratings. The

mechanism behind this relationship lies in the increased opportunities for knowledge sharing, skill acquisition, and exposure to multiple perspectives, all of which strengthen problem-solving and innovation. Importantly, the regression analysis demonstrated that nearly 27% of the variation in performance can be attributed to differences in knowledge diversity, underscoring the practical significance of team composition.

However, the study also highlights the need for balance. While moderate to high diversity fosters performance improvements, excessively heterogeneous teams may experience inefficiencies due to miscommunication, role ambiguity, or conflict. Thus, organizations must actively manage diversity by fostering open communication channels, defining clear roles, and promoting collaborative norms.

In conclusion, knowledge diversity is not merely a team level advantage but also a powerful driver of individual productivity and growth in manufacturing. By strategically structuring cross-functional teams and enabling effective knowledge exchange, firms can leverage diversity.

Limitations of the Research
This study was limited to organizations located within the Pune region and included a sample of 113 employees. The relatively small sample size restricts the extent to which the findings can be generalized to the broader manufacturing sector or to other geographic areas beyond Pune. Additionally, because the research focused solely on the manufacturing industry, its relevance to other industries or sectors is limited.

Recommendations
1. Strategic Team Design: Form cross-functional teams with a deliberate mix of employees from different knowledge categories. Moderate levels of diversity should be targeted to optimize learning and performance while avoiding excessive complexity.
2. Facilitate Knowledge Sharing: Implement formal mechanisms such as cross-departmental meetings, structured problem-solving sessions, and digital collaboration platforms to ensure that diverse expertise is shared and applied effectively.
3. Training and Development Programs: Provide employees with training in communication, conflict management, and collaborative problem-solving to maximize the benefits of diversity. This ensures that individuals can effectively leverage the knowledge of peers.
4. Integrate Diversity into Performance Management: Incorporate knowledge diversity metrics (e.g., Blau's Index) into HR analytics to guide team formation and monitor performance outcomes. Performance appraisals should consider both individual results and contributions to collaborative knowledge exchange.
By adopting these recommendations, organizations can build work place that harmonizes individual initiative and adaptability with the collaborative advantages of knowledge diversity, thereby enhancing performance at both the individual and team levels.

REFERENCES
1. Bell, S. T. (2007). Deep-level composition variables as predictors of team performance. Journal of Applied Psychology, 92(3), 595–615.
2. Blau, P. M. (1977). Inequality and heterogeneity. Free Press.
3. Contractor, N. S., & Monge, P. (2019). Organizing knowledge production teams within firms: Multilevel influences on innovation. Science and Technology Studies, 32(2), 29–45.
4. Harrison, D. A., & Klein, K. J. (2007). What's the difference? Diversity constructs as separation, variety, or disparity in organizations. Academy of Management Review, 32(4), 1199–1228.
5. Hülsheger, U. R., Anderson, N., & Salgado, J. F. (2009). Team-level predictors of innovation at work: A comprehensive meta-analysis spanning three decades of research. Journal of Applied Psychology, 94(5), 1128–1145.
6. Jehn, K. A., Northcraft, G. B., & Neale, M. A. (1999). Why differences make a difference: A field study of diversity, conflict, and performance in workgroups. Administrative Science Quarterly, 44(4), 741–763.
7. Joshi, A., & Roh, H. (2009). The role of context in work team diversity: A meta-analytic review. Academy of Management Journal, 52(3), 599–627.
8. Li, X., & Wang, J. (2023). Diversity of social ties and employee innovation: The mediating role of knowledge sharing. Journal of Work and Organizational Psychology, 39(2), 89–100.
9. Picazo, C., Gamero, N., & Peiró, J. M. (2023). Functional diversity and innovation in primary care teams: The role of knowledge integration. Journal of Health Organization and Management, 37(3), 379–395.
10. Resick, C. J., Murase, T., Randall, K. R., & DeChurch, L. A. (2014). Information elaboration and team performance: Toward a multilevel process model. Research in Organizational Behavior, 34, 1–24.
11. Rossi-Hansberg, E., Sarte, P.-D., & Trachter, N. (2021). Learning from coworkers. NBER Working Paper No. 29394. National Bureau of Economic Research.
12. Spector, P. E. (1988). Development of the work locus of control scale. Journal of Occupational Psychology, 61(4), 335–340.
13. Van Knippenberg, D., De Dreu, C. K. W., & Homan, A. C. (2004). Work group diversity and group performance: An integrative model of the categorization–elaboration framework. Academy of Management Review, 29(2), 207–224.
14. Van Knippenberg, D., & Schippers, M. C. (2007). Workgroup diversity and performance: An integrative framework and future research agenda. Journal of Organizational Behavior, 28(2), 195–218.
15. Wang, L., et al. (2024). The relationship between team diversity and team performance: A meta-

analysis. Journal of Organizational Behavior, 45(1), 23–47.

16. Wu, J., & Palacios, S. (2019). The impact of cognitive style diversity on implicit learning in teams. Frontiers in Psychology, 10, 1804.