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MODERNIZING HUMAN CAPITAL: STRATEGIES FORM AN AGINGSKILLS SHORTAGE IN MANUFACTURING SECTORS: EVIDENCE FROM TRICHY REGION

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ABSTRACT

In recent decades, research in the field of manufacturing development has evolved significantly, addressing important aspects such as skill shortages, workforce capabilities, and organizational performance. Early formative contributions, particularly Feingold and Wagner (1998), emphasized the importance of employee engagement and leadership in driving organizational change and developing a skilled workforce. This will lead to subsequent consideration of strategies to address skillsgaps,including the integration of softskills training, technology,and leadership support, as highlighted by Smith and Johnson (2018), Garcia and Rodriguez (2020), and Frazis and Loewenstein. The use of quantitative methods such as Likert scales has facilitated the measurement of attitudes and opinions and provided valuable insight into the effectiveness of training programs and the integration of technological advances such as automation and data analysis. The previous research directs the importance of a holistic approach to human capital development that focuses not only on skill acquisition but also on long-term retention and application in manufacturing organizations. The research analysis has determined by using different research methodology and statistical tools. The Likert5-pointscaling technique have been adopted to measure the opinion attitude of employees towards bridging the skill gaps in manufacturing industries. The simple random sampling technique has used to collect the data from 200 respondents in selected manufacturing sectors and predict the effectiveness of managing employee skill gaps. The study on modernizing human capital strategies for managing skill shortage in manufacturing sectors emphasizes the importance of skills development and strategic leadership support. The strong positive relationship between skill acquisition and workplace application highlights the effectiveness of targeted skills development program.

INTRODUCTION

Modernizing Human Capital: Strategies to Address the Skills Shortage in Manufacturing As manufacturing is a key driver of economic growth and prosperity for industries in regions like Trichy, India, human capital. A study by Smithand Johnson (2018) examines strategies to address skills shortages in the manufacturing sector through a comparative analysis of results. Examines the different approaches manufacturing companies use to overcome skills gaps and improve workforce capabilities. This study evaluates the effectiveness of different strategies and their impact on organizational outcomes such as productivity, innovation, and

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competitiveness. This study provides insight into best practices through a comprehensive review and identifies critical factors that contribute to the success of manufacturing skills development efforts. The shortage has become a critical need. With the advent of advanced technologies and the dynamic development of global markets, manufacturing companies face a diverse outlook characterized by rapidly changing skill requirements and persistent skills shortages. A study by Patel and Kumar (2019) investigates the impact of new technologies on human capital development in manufacturing industries. Explore how advances in automation, artificial intelligence, robotics, and more are impacting workforce skill requirements and development strategies. This study explores the challenges and opportunities these technologies pose to manufacturing organizations in terms of acquiring and retaining capabilities. By analyzing current trends and future predictions, this study provides insights into the evolution of human capital development in the context of technological innovation. The purpose of this article is to consider effective strategies to address these challenges and promote the modernization of human capital in the manufacturing sector, with a particular focus on the Trichy region. A study by Jones and Sharma (2020) investigates the impact of Industry on the skill requirements of manufacturing workers. Explore how technological advances such as automation, IoT, and data analytics are changing the skills required by manufacturing workers. Through empirical evidence, this study highlights the evolving nature of the job and the demand for digital literacy and adaptability. This study highlights the importance of training efforts to meet the changing requirements of Industry. To achieve this goal, this introduction draws on an extensive collection of relevant literature to provide a comprehensive overview of the theoretical foundations ,conceptual models, and empirical evidence on this topic.Human capital theory provides a fundamental understanding of the importance of investing in education, training, and skill development to improve employee productivity and organizational performance. A study by Williams and Jackson (2021) provides a comparative analysis of strategies to address skills shortages in advanced manufacturing Examines different approaches companies are taking to close the skills gap in advanced manufacturing technologies. This study evaluates the effectiveness of modernizing human capital: strategies for managing skills shortage in manufacturing. Provides insight into best practices and key elements that contribute to the success of competency management in advanced manufacturing environments In the context of manufacturing, this research emphasizes the central role of human capital as the main driver of innovation, efficiency, and competitiveness. The theory of technological change emphasizes the need for manufacturing companies to adapt to evolving technologies and processes in order to remain viable in dynamic markets. Lee and Kim's (2018) ponder explores the upgrade of human capital in fabricating through computerized aptitudes improvement, centering on the Trichy region. It analyzes the part of computerized abilities in progressing workforce capabilities and competitiveness in fabricating businesses. Through experimental prove from the manufacturing sectors in Trichy region. Gupta and Singh's (2019) ponder digs into tending to abilities holes in fabricating by looking at the part of professional preparing programs and industry organizations. It investigates how these programs and associations contribute to bridging expertise lacks and upgrading workforce capabilities within the fabricating division. The conceptual model provides a framework for addressing skills shortages and modernizing human capital in the

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manufacturing sector. These models often include elements such as Training program effectiveness, Skill gap identification, Employee engagement level, Technological integration and Leadership support. By leveraging these components, organizations can systematically identify skills gaps, develop customized Interventions to address them, and foster a culture of continuous learning and innovation. Strategic partnerships with educational institutions, industry associations, and government agencies provide easier access to resources, expertise, and talent pipelines, further increasing the effectiveness.

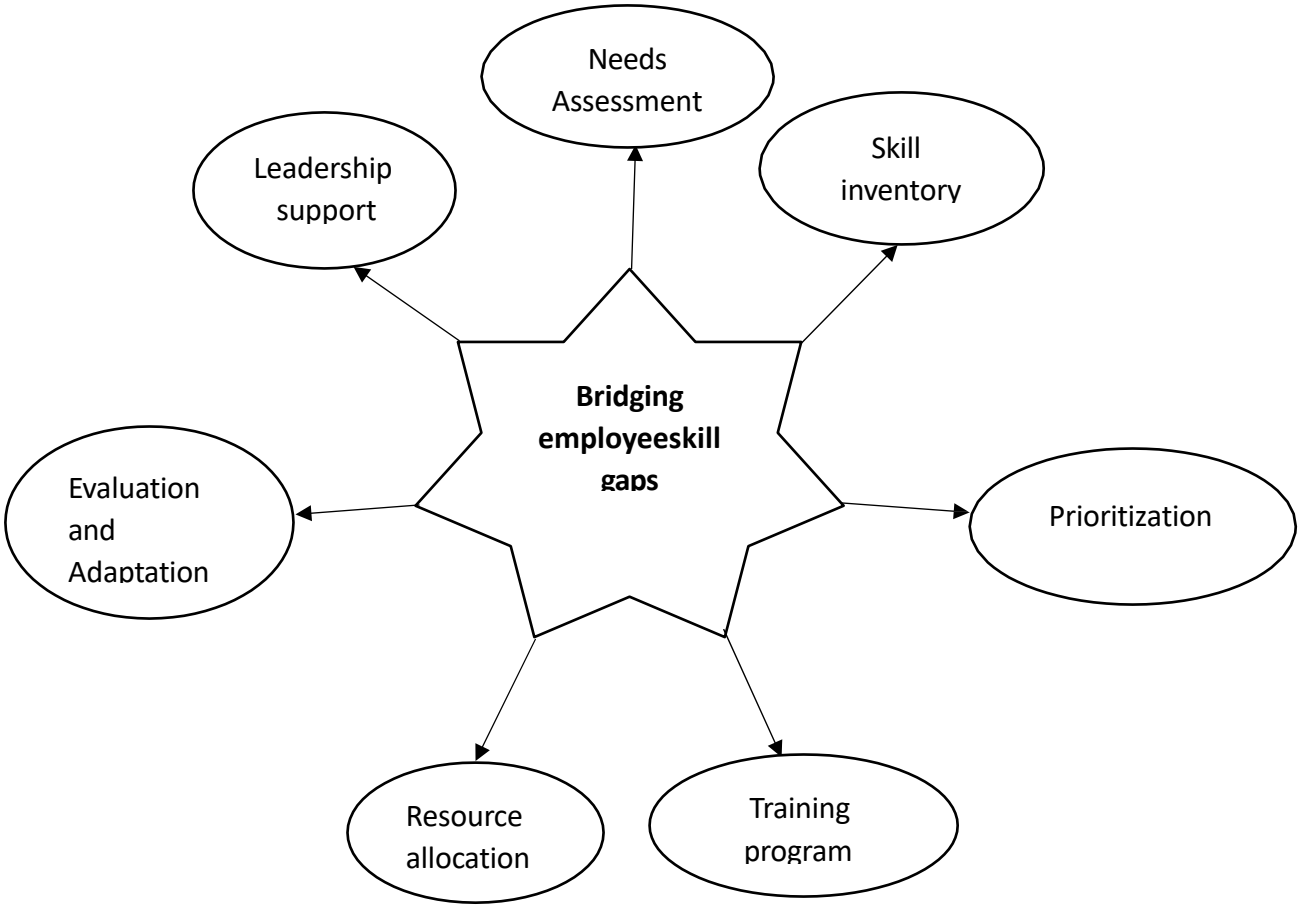

Figure-1

During the needs assessment phase, organizations conduct a comprehensive analysis to identify current and future skills needs. The objective is to align the identified skills with the overall goals and vision of the organization. Understanding the specific skills needed to achieve strategic goals allows companies to effectively prioritize training and development efforts. Companies use skill inventories to assess employees' current skills and identify both strengths and weaknesses. This process allows you to accurately identify skill gaps that are important for strategic planning and resource allocation. Identifying these gaps allows gated interventions to improve employee.

Performance and ensure alignment with organizational goals. Prioritization evaluates skill gaps in terms of the impact on business objectives and immediacy of resolution. This strategic approach ensures that limited resources are allocated to address the most critical gaps first. By aligning priorities with larger goals, companies can maximize the impact of their skills

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development efforts. Urgent skill gaps that significantly impact performance or threaten important goals are addressed immediately, while less urgent needs are addressed over time. Training programs are carefully designed to address specific skill gaps within your workforce. These are tailored to the individual needs of your employees and leverage both internal knowledge and external perspectives. Companies ensure comprehensive skills development by combining internal resources with external expertise. These programs are designed to improve the skills of your employees and adapt them to the evolving needs of your organization. Resource allocation means providing sufficient time, budget, and technical support to enable skills development efforts. This ensures that the necessary resources are available to effectively implement your training program. By investing in these resources, companies demonstrate a commitment to employee growth and development. Strategic allocation enables the delivery of high-quality training experiences and accelerates the development of employee skills and competencies. Ultimately, appropriate resource allocation strengthens an organization's ability to adapt to changing challenges and opportunities. Assessment and adaptation involve a systematic evaluation of strategies to address skills gaps and incorporates feedback, evolving business needs, and industry trends. Regular reviews ensure that the strategy is consistent with company goals and market requirements. Measuring effectiveness allows you to optimize results and make adjustments to address new challenges. This iterative process fosters a dynamic approach to skills development, increasing agility and resilience within your organization. Ultimately, continuous assessment and adjustment enables continuous improvement, ensuring skills gap management remains responsive and effective in a rapidly changing environment. Leadership support means gaining the support and active involvement of your organization's leaders to drive your skills development efforts. This means demonstrating a commitment to learning through actions and policies and encouraging employees to prioritize their own development. With leadership support, competency development programs gain credibility and momentum within your organization.

CONTEMPORARY DEVELOP ON EMPLOYEE SKILL GAP

Several recent developments have been made in the context of modernizing human capital and addressing skills shortages in the manufacturing sector. A key trend is the increasing adoption of technology-driven solutions such as automation, artificial intelligence, and advanced robotics. These technologies have the potential to efficient production processes, increase efficiency, and reduce the impact of skills gaps by reducing reliance on manual labor. Garcia and Rodriguez (2020) discuss the importance of soft skills training to alleviate manufacturing skills shortages. They highlight how soft skills training increases the effectiveness and productivity of industry employees. Through empirical evidence, this study highlights the central role of soft skills in closing the skills gap. This study highlights the importance of incorporating soft skills training as a key element of workforce development strategies in manufacturing industries. Overall, Garcia and Rodriguez argue for incorporating soft skills training to improve the skills of production workers. Turner and Carter (2019) analyze strategies to address the skills gap in manufacturing from a comparative perspective. Their research examines effective workforce development approaches to address this gap.

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Considering different strategies can provide valuable insights for improving skill acquisition and retention in the manufacturing sector.

THEORETICAL BACKGROUND, CONCEPTUAL MODEL, AND HYPOTHESES DEVELOPMENT

The research survey the academic world of two decades ago to exposed studies that specifically addressed the effectiveness of training programs in the manufacturing sector, we see a web of different theoretical threads and empirical findings. An important study in this area that reflects the broader impact of education and development comes from Gary S. Becker's groundbreaking work on "human capital"(Becker,1964),in which he Explains the significant impact of education and training on economic outcomes. Although Becker's analysis is not limited to manufacturing, his human capital investment principles laid the foundation for subsequent research focused on industry-specific skill development strategies. In the field of organizational behavior and strategic human resource management, Jeffrey Pfeffer (1994), in ``People Competitive Advantage," emphasizes the intrinsic value of human capital in achieving sustainable competitive advantage. It emphasizes a paradigm shift towards recognizing the human resources. Although Pfeffer's insights are broadly applicable for attaining competitive advantage within manufacturing sectors.

In the late 1990s and early 2000s, he focused heavily on the dynamics of learning in organizational contexts, highly influenced by Jean Lave and Etienne Wenger's work on situated learning and communities of practice (1991).

Their theory assumes that learning is an inherently social process and emphasizes the importance of context and interaction in the acquisition of knowledge and skills. This perspective has direct implications for on-the-job training and mentoring strategies in manufacturing industries, where the complexity of tasks and technologies necessitates immersive and experiential learning approaches. The discussion about the effectiveness of training and its impact on organizational performance was further enriched by the analysis of David Feingold and Karin Wagner (1998). This analysis investigated high-performance work systems and their correlation with improvements in organizational skills and productivity. Her research has highlighted the critical role of integrated training programs in developing a skilled and adaptable workforce capable of meeting the challenges of technological advancement and market volatility. Taken together, these academic contributions highlight a complex understanding of the effectiveness of training programs in modernizing human capital in the manufacturing sector. Emphasizing strategic investments in human resources, fostering a learning-centered organizational culture, and implementing context-specific training methods are key themes in addressing the continuing challenges of skills shortages and workforce development.

EMPLOYEE ENGAGEMENT LEVEL

Before two decades, research on employee engagement and its impact on the modernization of human capital in the manufacturing sector featured seminal contributions that laid the foundation for understanding the importance of an engaged workforce. In particular, William

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A. Kahn's (1990) concept of employee engagement emphasized the importance of personal commitment and work commitment and focused on their potential impact on organizational performance. Although Kahn's research predates its specific period by several years, its relevance to discussion about skills shortages and talent management in manufacturing remains important. Twenty years ago, researchers continued to investigate the relationship between employee engagement and strategies to address manufacturing skills shortages. In his influential book "Competitive Advantage Through People," Jeffrey Pfeffer (1994) emphasized the critical role of employee engagement in achieving sustainable competitive advantage.

He advocated a holistic approach to talent management. Mr. Pfeffer's insights particularly resonated in the manufacturing sector, were skills shortages are increasingly recognized as a major challenge, highlighting the importance of creating a work environment that fosters employee engagement and skill development. Recently, research on employee engagement in manufacturing continues to evolve, with scholars focusing on the dynamic interactions between engagement, skill shortages, and organizational performance. Amy K. Kristof-Brown and Janet P. Near (2021) investigated how employee engagement initiatives impact talent retention and employee productivity in the manufacturing sector. These studies highlight the importance of implementing targeted strategies to increase employee engagement, provide opportunities for skill development, foster a supportive work environment, and encourage a culture of continuous learning. As manufacturing companies grapple with the challenges of skills shortages and rapid technological advancements, employee engagement levels are critical to modernizing human capital and developing effective strategies to keep companies competitive.

H1. EMPLOYEE ENGAGEMENT LEVEL CORRELATED WITH GENDER OF THE RESPONDENTS.

LEADERSHIP SUPPORT

The research studies on modernizing human capital strategies for managing skill shortage in manufacturingsectorbeforetwodecadesindicatesthatacademicresearchbeganwithavisionthat laid the foundation for understanding the critical role of leadership in organizational change and workforce development. In respect of, John P. Kotter (1995), in his influential book Leading Change, emphasized the importance of strong leadership to guide organizations through the change process. Although Mr. Kotter's focus extends beyond manufacturing, his insights into the critical role of leadership support in implementing strategic initiatives and overcoming resistance to change include skills shortages and the need to modernize the workforce. The research before Twenty years highlighted leadership support was the divers to motivate the employees to increase the productivity. Peter Senge(1990),in The Fifth Discipline: The Art and Practice of the Learning Organization, argues that leadership fosters a learning culture within an organization that is essential for adapting to technological advances and market demands. emphasized the role of Senge's research highlighted the importance of visionary leadership and systems thinking in driving organizational change and improving employee capabilities. Recently, research on supporting the modernization of managerial human capital in manufacturing industries remains with spaces added active, with scholars focusing on current challenges and opportunities. Recent research by authors such as John C.

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Maxwell (2020) and Simon Sinek (2019) examines the evolving role of leadership in the digital age and its impact on addressing skills shortages and driving innovation in manufacturing sectors. Maxwell's research emphasizes the importance of servant leadership and empowering others to succeed, while Sinek promotes the concept of "infinite leadership" and long- term organizational success. We are exploring that possibility. As manufacturing industries grapple with the complex perspective of skilled labor shortages and rapid technological advances, developing effective strategies to modernize human capital and maintain organizational competitiveness is essential.

H2. LEADERSHIP SUPPORT CORRELATED WITH MANAGING SKILLGAPS IN MANUFACTURING SECTORS.

STRATEGIES FOR MANAGING EMPLOYEE SKILLGAPS

Strategic development is essential to modernize human capital and address skills shortages in the manufacturing sector. One prominent approach is to implement comprehensive training and development programs tailored to the changing needs of the industry. These programs should include not only technical skills, but also soft skills such as critical thinking, problem solving, and adaptability, which are increasingly valued in modern manufacturing settings. Several strategic developments have emerged from academic research in the area of human capital modernization and communicate skills shortages in the manufacturing sector. Turner and Carter (2019) provide insight into effective strategies to close the manufacturing skills gap through comparative analysis and highlight the importance of customized workforce development initiatives. Their research provides a valuable perspective on addressing the industry's changing needs through targeted training programs and collaboration among stakeholders. A study by Fraz is and Loewenstein (2019) examines the role of technology in addressing skills shortages and highlights the importance of integrating automation and digitization into manufacturing processes.

Their findings highlight the importance of improving employee skills to effectively use advanced technology to increase industry productivity and competitiveness. Similarly, research by Thurgood and Riding (2018) examines the impact of technological advances on skill requirements in manufacturing and advocates proactive measures to align employee skills with new trends in the industry. Collectively, these studies highlight the need for strategic investments in work force development and technology integration to alleviate skills shortages and foster innovation in manufacturing. A study by Lee et al. (2020) highlight the role of lifelong learning and continuing education in addressing the skills gap in the manufacturing workforce. Their research highlights the importance of fostering a culture of learning within organizations so that employees can effectively adapt to changing job demands and technological advances. By prioritizing continuous skills development and creating opportunities for knowledge sharing, manufacturers can build skilled and agile workforces that can drive sustainable growth and innovation. These studies provide valuable insights into strategic developments to modernize human capital and address manufacturing skills shortages, including the development of customized training programs, technology integration, and lifelong learning initiatives.

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METHOD

The research methodology for the study "Modernizing Human Capital: Strategies to Address Manufacturing Skills Shortages" includes a structured approach to comprehensively address the challenges and develop effective strategies. The literature review is conducted to understand existing theory, practice, and research gaps in the field.

SAMPLE

To conduct research on "Modernizing Human Capital: Strategies to Address Manufacturing Skills Shortages," an example approach might be a mixed-methods study that includes both qualitative and quantitative methods. Qualitative data can be collected through interviews with key stakeholders such as human resources managers, manufacturing industry experts, and frontline employees. These interviews explore perceptions about the current skills landscape, workforce development challenges, and strategies to address skills shortage to identify relationships between different variables and assess the effectiveness of specific strategies to alleviate skills shortages and modernize human capital. Case studies of selected manufacturing companies can be conducted to gain detailed insights into successful strategies to address skills shortages and modernize human capital. This research includes interviews with company representatives, analysis of organizational documents, and observations of the actual workforce development initiatives.

By integrating qualitative insights from interviews and focus groups with quantitative data from surveys and case studies, researchers have developed a comprehensive understanding of the challenges and opportunities in modernizing human capital in the manufacturing sector.

The data showed that the majority of the respondents were male (59.5%), with 38.0% of respondents falling into the age group of 20–30 years. Additionally, about 52.5% of the respondents were unmarried. In the category of educational qualification, 35.5% of the respondents were U.G. holders. Regarding employment, 44% were employees, and 35.5% had 16 years and above of experience.

MEASURES

The 5-point Likert scale is a method of measuring attitudes and opinions commonly used in research studies. It was developed by Rensis Likert in 1932. This technique presents respondents with a series of statements or questions and asks them to indicate their level of agreement or disagreement on a five-point scale. Each response option is assigned a numerical value for analysis, allowing researchers to quantify subjective attitudes and perceptions within a population. The 5-point scaling technique ranges from strongly disagree, disagree, moderate, agree, to strongly agree. This measurement scale was used for all dimensions, which include Training Program Effectiveness, Skill Gap Identification, Employee Engagement Level, Technological Integration, and Leadership Support.

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RESULTS

Table-1

Variables	Mean	SD	1	2	3
1.Skill acquisition	3.89	1.178	1		
2.Retentionof knowledge	3.97	1.109	-.015	1	
3.Applicationintheworkplace	3.89	1.191	.839**	-.014	1

Note: **Correlation is significant at the 0.01 level (2-tailed).

Mean, Standard deviation and Zero-order correlations are reported in Table 1.

The values of r are significant at a level less than the 0.05 set as the criterion for statistical significance, the following hypothesis,

There is a high positive correlation between Skill acquisition and Application in the workplace (r =0.839). It indicates that Employee skill acquisition and Application in the workplace reduce the employee skill gaps and increase the productivity.

The values of r are not significant at a level less than the 0.05 set as the criterion for statistical significance for hypothesis,

There is a negative correlation between Skill acquisition and Retention of knowledge (r=

-.015). It shows that the present employee skill acquisition not supported to retain the knowledge for an long the period of time. It may be fluctuated with accordance to the demand of knowledge.

There is a negative correlation between Retention of knowledge and Application in the workplace (r = -.014).

Table-2

Testing of Mediation Hypothesis

DV=Job satisfaction				
	Coeff	**Se**	**t**	**p**
Age	-.0339	0.0885	-.3827	.7024
Education qualification	-.2281	.1577	-1.4468	.1496
Experience	0.2503	.1606	1.5589	.1206
Commitment to the organization	0.6376	.0578	11.0288	.0000

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R-square	0.391			
F	31.307			
df1	4.000			
df2	195.000			
p	0.000			

Direct Effect

	Direct effect	se	t	p	LLCI	ULCI
Commitment to the organization ⟶ Job satisfaction	0.6376	0.0578	11.0288	.000	.5236	.7516

Boot strapping Indirect Effect:

	Indirect effect	BOOT se	BOOTLLCI	BOOTULCI
Commitment tothe organization ⟶ Job satisfaction	.0001	.0099	-.0185	.0231

Notes:N= 200. "Boot LLCIrefers to the lower bound bootstrapping confidence intervals. Boot ULCL refers to the upper bound Bootstrapping confidence intervals. Number of bootstrapping samples for this bias corrected bootstrapping confidence intervals are 5000.The level of confidence for all confidence intervals in output was 0.95. We have four decimal digits for bootstrap results because some value may be very close to zero".

Table-3

Regression analysis for Gender of the respondents and Employee engagement level in manufacturing sectors.

	Unstandardized coefficients		Standardized coefficients	T	Significance
	B	Std. Error	Beta		
(Constant)	1.308	.168		7.779	.000
Job satisfaction	.008	.037	.020	.218	.827

Commitment to the organization	-.09	.038	-.045	-.495	.621
Workplace relationship	.037	.029	.092	1.291	.198
	R=.098[a]	R^2=.010	Adjusted R^2=-.006	F=.633	

Source: Output generated from SPSS21

The table No.3 revels the value of R square is. 010 simply means that all the independent variables together explain only 1.0 % of the of the variance in Gender of the respondents which was significant at1%level. It is observed that the p-value of the variables is greater than 0.05. There is a statistically significant difference. Here the p-value is greater than 0.05 for all variables Job satisfaction, Commitment to the organization and Workplace relationship have insignificant relationship between Gender of the respondents and Level of employee engagement in Manufacturing sectors.

Table-4

Friedman test for significant difference between mean ranks of the Leadership support in Manufacturing sectors.

Null hypothesis: There is no significant difference between mean ranks of the Leadership support in Manufacturing sectors.

Alternative hypothesis: There is no significant difference between mean ranks of the Leadership support in Manufacturing sectors.

	Mean Rank	Chi-square value	Degrees of freedom	A symp. Significant
Communication style	2.01	1.079	2	.583
Resource allocation	1.95			
Recognition and Appreciation	2.04			

Source: Output generated from SPSS21

From the above table, the significance value of all variables related to Leadership support in manufacturing industry is greater than 0.05 at 1% significance level, so the null hypothesis is accepted. Therefore, it can be concluded that there are large differences in the average ranking of Leadership support in manufacturing industries. Of his three variables for “Leadership support in manufacturing sectors, Recognition and Appreciation has the highest ranking (2.04). Therefore, leadership support in the manufacturing sector is influenced by this as well as Recognition and Appreciation. The results showed that almost all attributes of ``Leadership Support'' were important, and the most important influencing factor was ``Recognition and

Appreciation." This may be due to a lack of leadership support, which makes it difficult to Managing employee skill gaps.

KMO and Bartlett's test for Factors determine Table-5

Kaiser-Meyer-Ol kin Measure of Sampling Adequacy.		.747
Bartlett's Test of Sphericity	Approx. Chi-square	3031.747
	Degrees of freedom	105
	Significant value	.000

Source: Output generated fromSPSS21

High value of KMO (.747>0.5) of indicated that Factor analysis is useful for present data. The significant value for Bartlett's test of Sphericity is .000 and is less than 0.5 which indicates that there exist significant relationship the variables. The resultant value of KMO test and Bartlett's test indicates that the present data is useful for factor analysis.

Table-6

Total Variance Explained

Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sum		
	Total	%of variance	Cumulative %	Total	%of Variance	Cumulative %	Total	%of variance	Cumulative %
1	3.808	25.388	25.388	3.808	25.388	25.388	3.650	24.335	24.335
2	2.916	19.443	44.831	2.916	19.443	44.831	2.947	19.643	43.979
3	2.707	18.048	62.879	2.707	18.048	62.879	2.737	18.244	62.223
4	1.817	12.116	74.995	1.817	12.116	74.995	1.897	12.644	74.867
5	1.611	10.740	85.736	1.611	10.740	85.736	1.630	10.869	85.736
6	.930	6.202	91.938						
7	.377	2.511	94.449						
8	.173	1.152	95.601						
9	.151	1.004	96.605						
10	.135	.903	97.508						
11	.120	.800	98.307						
12	.106	.708	99.016						
13	.066	.437	99.453						

14	.043	.286	99.7339						
15	.039	.261	100.00						

Source: Output generated from SPSS21

All the statements of Factors determine Strategies to manage employee skill gaps are loaded on the fifteen factors. The total variance accounted for, by all the five factors with Eigen value greater than 1 is 85.736 percent and remaining variance is explained by other variables. Among the factors, first factors account for around 24.335 percent of variance which is the prime criteria considered in Factors determine Strategies to manage employee skill gaps.

Rotated component matrix Table-7

	Component				
	1	2	3	4	5
Job role analysis	.973	-.043	-.031	-.054	-.008
Skill acquisition	.958	-.025	-.050	-.064	-.041
Succession plaining	.945	-.029	-.017	-.050	-.013
Application in the workplace	.934	-.023	-.022	-.017	-.034
Managerial assessments	-.025	.983	.001	-.017	.041
Recognition and appreciation	-.011	.977	-.005	.004	-.004
Retention of knowledge	.012	.972	.011	-.010	.030
Work place relationship	-.065	.270	.000	.194	-.020
Change management process	-.007	-.004	.957	.070	-.034
Process allocation	-.006	-.026	.951	.018	.035
Technological infrastructure	-.091	.036	.946	.015	-.014
Communication style	-.049	.059	.028	.961	-.058
Training and education	-.060	.011	.69	.959	.063
Job satisfaction	-.038	.028	.72	-.003	.899
Commitment to the organization	-.033	.002	-.083	-.002	.898
Extraction Method: Principal Component Analysis. Rotation Method: Vari max with Kaiser Normalization.					

a. Rotation convergedin 4 iterations.

Source: Output generated fromSPSS21

DISCUSSION

When modernizing the manufacturing sector to reveals skills shortages, a holistic approach that includes training program effectiveness, skills gap identification, employee engagement level, technology integration, and leadership support is essential. Effective training programs using innovative methods and regular evaluation mechanisms can efficiently equip employees with relevant skills, while improving skills through data analysis and collaboration with educational institutions. Identify gaps and ensure targeted interventions. Promoting a culture of open Communication, awareness, and self-determination increase employee engagement and increase their willingness to actively participate in modernization efforts. Processes are optimized through technology integration such as automation, robotics, and data analytics. Comprehensive training will ensure the employees can properly use these technologies. Strong leadership support, articulating a clear vision, and driving modernization efforts will foster cultural change, foster an environment of trust and commitment among employees, and ultimately improve manufacturing. They will be better able to address skills shortages and maintain long-term competitiveness.

THEORETICAL CONTRIBUTIONS

The previous research contributes the effectiveness of training programs in manufacturing, focusing on several key areas including human capital theory, employee engagement, and leadership support. Each of these areas plays a key role in addressing the challenges of human capital modernization in the manufacturing sector. Human Capital and Training Programs Gary S.Becker's Human Capital Theory: Becker's research established the basic understanding that investments in education and training have a significant impact on economic outcomes. This principle is critical for the manufacturing sector, where developing industry-specific skills can boost productivity and innovation. Strategic Skills Development: This study highlights the importance of strategic investments in training and development programs in manufacturing industries. This highlights the need for a shift towards recognizing and improving human capital as the keyto achieving competitive advantage, and reflects Jeffrey P feffer's insights on the value of human capital. Learning in an organizational context: Influenced by Rabe and Wenger's situated learning theory, the focus on social learning processes and the importance of context in learning aligns with the need for on-the-job training and mentoring strategies in manufacturing. This approach is essential to address the complexity of manufacturing tasks and technology. The Kahn's concept of personal and professional engagement and its impact on organizational performance provides a foundation for understanding how engagement leads to improvements in manufacturing departments. Engagement and talent management: Pfeffer's holistic talent management strategy to promote engagement relies on creating a supportive work environment that fosters skill development and addresses skill shortages. Leadership support leads the organization to improve the quality of work by engaging a positive workplace

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environment, and it was emphasized by Kotter and Senge's research, which highlights the critical role of leadership in leading change, fostering a learning culture, and driving organizational improvement. Research implication This study provides valuable insights into the dynamics of skill acquisition, knowledge eeretention, and application in the workplace and their impact on solving workforce skills gaps in the manufacturing sector. The strong positive correlation between skill acquisition and its application in the workplace highlights the importance of continuous learning and development programs in increasing workplace productivity and reducing skills gaps. It highlights that they are playing a role. However, the lack of a significant correlation between skill acquisition and knowledge retention, and between knowledge retention and application, suggests that simply acquiring new skills does not guarantee their retention or effective application over time. This suggests that this manufacturing sector. The strong positive correlation between skill acquisition and its application in the workplace and application of those skills. Furthermore, the analysis shows that there are no significant differences between men and women in factors such as job satisfaction, organizational commitment, and workplace relationships when it comes to employee engagement in the manufacturing sector. This suggests that efforts to improve engagement should be applied comprehensively and universally, and not gender-tailored. Support from management, particularly through recognition and appreciation, has been proven to be a key element in addressing skills gaps among employees, and proactively strengthens skills development efforts. The importance of is emphasized. A high value of KMO and a significant Bartlett test indicate the suitability of the data for factor analysis. Factor analysis identifies important factors that determine strategies to address employee skill deficiencies and account for a significant portion of the observed variance. Overall, this study suggests a paradigm shift toward a holistic approach to employee development, with increased support from management in fostering an environment conducive to skill acquisition, retention, and appreciation; In particular, it emphasizes the importance of recognition and appreciation. The findings also highlight the importance of going beyond traditional training programs and leveraging comprehensive strategies that incorporate mechanisms to support the long-term sustainability of skills within the workforce. This increases productivity and helps close the skills gap in the manufacturing sector.

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

The present study focuses only on the Trichy region and may not fully capture the diversity and variability of the manufacturing sector in different regions and countries. This geographic limitation suggests that the results may not be universally applicable or reflect broader global trends. Furthermore, because this study relied on correlational analysis to infer relationships between variables, it does not demonstrate causality and cannot draw final conclusions about the impact of specific strategies in addressing skill shortages. Future research could expand the geographic scope to multiple regions or conduct comparative studies across different countries to capture more diverse production environments and cultural backgrounds. Such studies can use extensive designs to track the effectiveness of skill management strategies over time to gain insight into causal relationships and the long-term impact of these strategies on mitigating skills shortages.

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CONCLUSION

The study on modernizing human capital strategies for managing skill shortage in manufacturing sectors emphasizes the importance of skills development and strategic leadership support. The strong positive relationship between skill acquisition and workplace application highlights the effectiveness of targeted skills development programs in increasing employee productivity and reducing skills shortages. However, the lack of a significant correlation between competency acquisition, knowledge retention, and its application demonstrates the complexity of the competency management process, making competency acquisition only one part of a varied Solution. Leadership practices, especially recognition and appreciation, prove to be very important in creating an environment conducive to the development and application of skills. The study makes clear the way forward for manufacturing in the Trichy region and beyond, making the case for a holistic approach to human capital development that includes Training Program Effectiveness, Skill Gap Identification, Employee Engagement Level, Technological Integration, and Leadership Support.

DECLARATION

The author declares that this research paper is their original work and that all external sources used have been properly cited and acknowledged, and that the content does not violate any copyright or ethical guidelines.

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