International Journal of Computer Information Systems and Industrial Management Applications
ISSN 2150-7988 Volume 18(8s) 2026 pp. 597-614
https://doi.org/10.70917/ijcisim-2026-3299
Article

Driving Organizational Effectiveness Through Employee Training And Development: Examining The Mediating Role Of Employee Performance And Productivity In The Indian Energy Sector

Tanya Aggarwal[1], Vijit Chaturvedi[2]*

[1]Amity Business School, Amity University, Noida, Uttar Pradesh-201313, India, Mail: tanyaaggarwal652@gmail.com, Orcid ID: 0009-0009-1791-4187
[2*]Department of HR, OB& Psychology, Amity University, Noida, Uttar Pradesh-201313, India, Mail: vchaturvedi@amity.edu, Orcid Id: 0000-0001-6757-1340

Abstract: Purpose: Although the development of human capital is gaining strategic importance in the energy-intensive industries, the empirical evidence which outlines and investigates the impact of Employee Training and Development (ETD) on Organizational Effectiveness (OE) systematically through employee level mediating variables is insufficient in the Indian energy sector. This study examines direct and mediated pathways from ETD to OE as well as the theoretically motivated mediating construct of Employee Performance and Productivity (EPP).

Design/Methodology/Approach: This study adopts the cross-sectional, quantitative, and survey approaches based on Human Capital Theory (Becker, 1964) and Resource-Based View (Barney, 1991). A structured questionnaire using validated scales was used to gather primary data from 452 employees of energy sector organizations in public and private sectors in India. The validity of the measurements was determined by Confirmatory Factor Analysis (CFA) and the relations between the structures were explored by Structural Equation Modelling (SEM). Construct reliability was measured using Cronbach's Alpha, Average Variance Extracted (AVE) was used for convergent validity.

Findings: Results confirm that ETD exerts a significant positive direct effect on OE ($\beta = 0.784$, $p < .001$) and on EPP ($\beta = 0.779$, $p < .01$). EPP, in turn, is an important predictor of OE ($\beta = 0.793$, $p < .001$) and thus partially explains the relationship between ETD–OE. Managerial non-support (77.88%) and employee attitudinal resistance (77.21%) are found to be the most important hindrances that hinder the implementation of ETD. The reliability of all measurement constructs is of high level ($\alpha > 0.84$; CR > 0.96) and the convergent validity is strong (AVE > 0.84).

Originality/Value: This study makes three contributions: theoretical, extending and testing an integrated mediation model that is grounded in Human Capital Theory and Resource-Based View in the energy sector; contextual, first systematic empirical testing of ETD–OE dynamics in the Indian energy sector, which is a critical context that has not been empirically examined; and methodological, applying SEM as a test for establishing construct validity and to examine mediated pathways where conventional regression-based approaches fail to conclusively identify mediations. HR implications and energy sector policy implications are discussed.

Keywords: Employee Training and Development, Organizational Effectiveness, Employee Performance and Productivity, Human Capital Theory, Resource-Based View (RBV), Structural Equation Modelling (SEM), Mediation Analysis, Indian Energy Sector.

1. INTRODUCTION

The energy industry is going through a structural change, unprecedented in the world. With both decarbonization and digitalization demands, energy companies are forced to constantly re-configure their operations and, through this, their employees' competency profiles. This shift is even more pronounced in India, the third largest energy consumer in the world, where the country has pledged to install 500 gigawatts of renewable energy power by 2030 (Ministry of New and Renewable Energy, 2023). Both the public and private energy-related activities face the dual challenge of transitioning away from carbon-intensive operations and expanding technologically advanced renewable energy capacity, which requires staff to face constant changes in skills and continuously upskilling them.

In this context, the role of Employee Training and Development (ETD) is an organizational function that is strategically important. ETD involves intentional, systematic investments in employees' knowledge, skills, and competencies, such as through on-the-job training, formal instruction, job rotation, coaching, mentoring, and professional development programs (Noe et al., 2022). ETD can be a key way that organizations develop, retain and use human capital as a competitive advantage when implemented in a systematic manner (Barney, 1991). It has been found that organizations that invest in ETD in a strategic manner always have a better performance in terms of productivity, innovation capacity, and long-term organizational effectiveness (Igudia, 2022; Kareem, 2019; Saxena & Gupta, 2024).

However, there are three major gaps in the research. First, the theoretical mechanisms that translate ETD into Organizational Effectiveness (OE) are not well specified. The vast majority of the existing literature focuses on the ETD–OE relationship directly, with the pathway described as one-step process, and the intermediate linkage of individuals' outcomes – Employee Performance and Productivity (EPP) – which is theoretically important and that is likely to be the mechanism by which investments in training lead to organizational returns, ignored. The Human Capital Theory clearly assumes that the increase in human skill precedes the benefits at the organizational level (Becker, 1964), but such a sequential relationship has not been tested in a single empirical framework in the energy sector. Second, in regards to context, most ETD–OE studies take place in the energy sector in Western, African, or Southeast Asian organizations, with a paucity of empirical studies in India (Cania et al., 2016; Said et al., 2025). The mix of large public sector energy companies that are held to complex regulatory standards, the growing private sector renewable power industry, and the large and increasingly varied population of technically skilled workers in India means that findings reached by other sectors can be of limited applicability until confirmed by independent research. Third, methodologically, most previous studies employed regression-based analytical methods, which reduces the ability to model measurement error for the latent constructs, test the mediated pathways, and estimate direct and indirect effects in a single coherent framework, which is the strength of the SEM approach.

The three gaps addressed in this study are: (1) impact of ETD on OE in the Indian energy sector and secondly (2) the role of an intermediate variable, namely EPP, as a theoretically motivated mediator tested in the context of an SEM framework; and thirdly (3) whether the indirectly observed variable, namely EPP, has a statistically significant influence on OE. The theoretical architecture is constructed from two complementary lenses: First, the Human Capital Theory (Becker, 1964) which is a micro-level approach that focuses on the mechanism of human capital performance enhancement (ETD); Second, Resource Based View of the Firm (Barney, 1991) as a macro-level approach that captures the organizational logic of human capital as a strategic resource to sustain human capital performance effectiveness. The empirical investigation is supported with primary data from 452 employees from the energy sector organizations of India with the aid of CFA and SEM procedure.

The study aims at achieving four specific research objectives: (1) To understand the direct contribution of ETD on OE in the Indian energy industry; (2) To explore the impact of ETD on EPP; (3) To examine the mediating role of EPP in ETD–OE relationship; and (4) To identify the major organizational challenges to the effective implementation of ETD. The manuscript is structured as follows: Section 2 describes the theoretical background of the study, Section 3 offers a critical review of the existing literature, Section 4 outlines the research gaps that undergird the study, Section 5 outlines the conceptual framework and Hypotheses for the study, Section 6 outlines the research methodology used, Section 7 outlines the data analysis and results, Section 8 discusses the findings theoretically and practically, and Section 9 provides the conclusions, Contributions, limitations and future directions.

2. THEORETICAL FOUNDATIONS

2.1 Human Capital Theory

The theoretical foundation of this study is mostly grounded on Human Capital Theory (HCT) which was first systematically presented by Gary Becker (1964) and later extended by Schultz (1961) and Mincer (1974). HCT views workers' skills, knowledge and competencies as a capital that can be invested intentionally, with a plan in mind for the eventual returns or dividends; just as physical or financial capital can be invested with a plan in mind. Importantly, HCT separates the general human capital (skills that are transferable between employers and industries) from the firm-specific human capital (competencies that are valuable in the specific organizational context). Structured ETD is a form of investment in firm-specific human capital that is especially strategic, because the competencies developed through such a program can be applied to improve employee productivity but are not easily portable to other organizations, making them less attractive to other employers and so less tempting to the employee to leave the firm.

In the present study, the micro-level mechanism of how ETD affects organizational outcomes is provided by applied to the present study is HCT. The theory suggests that investments in employee training lead to increased individual employees' ability to perform tasks, make decisions and be adaptable, which are manifested in increased Employee Performance and Productivity. The sum of these gains is reflected in measurable gains in Organizational Effectiveness (higher productivity, greater operational efficiency and greater strategic adaptability). The mediation model tested in this study is a sequential logic of ETD – individual performance – organizational effectiveness.

2.2 Resource-Based View of the Firm

The Resource Based View (RBV) of the Firm (Barney, 1991; Wernerfelt, 1984; Penrose, 1959) suggests that sustained competitive advantage comes from resources that are valuable, rare, inimitable and non-substitutable (VRIN). In the RBV approach, human capital – the sum of the skills, knowledge, and experience possessed by an organization's employees – is considered a VRIN resource if an organization's employees gain these skills, knowledge, and experiences in a manner that is not easily noticeable and/or hard for other firms to duplicate. Structured ETD programs that develop competencies that are specific to the organization and context-specific are just the kind of human capital investment that creates VRIN characteristics—the organizational knowledge contained in employees who have received systematic, context-specific training is not readily available in the labour market nor easily imitated by competitors.

The RBV combines the logic of the HCT at the individual level with the logic of the firm. The RBV takes the logic of the HCT at the individual level and extends it to the logic of the firm. The move towards proactive and capacity enhancing investments in ETD (ETD investing) in capital-intensive, knowledge-intensive sectors like energy is the kind of investment that the RBV forecasts will provide sustainable competitive advantages, according to Thite (2020). HCT and RBV offer an integrated theoretical framework that places ETD both as a micro-level performance-enhancing capability and as a macro-level strategic capability, providing rationale for studying both direct ETD–OE effects and the EPP mediation pathway.

3. LITERATURE REVIEW

3.1 ETD and Organizational Effectiveness: Building the Direct Relationship

The relationship between ETD and Organizational Effectiveness has been placed in the centre of the HRD literature and from all the evidences it is determined that the relationship is positive with a directional effect. But there are significant nuances in this set of work to consider when it comes to the conditions, contexts, and mechanisms by which such a relationship works best. Using SEM technique, Kareem (2019) analysed the data collected from 215 workers from different Iraqi organizations and found that human resource development practices have a significant positive impact on OE, when all three were considered together (training and development, HRM, and career progression programming). The methodological strength of the study is that multiple dimensions of HRD are modelled together, which remains a cross-sectional study, and the organizational context of the study is from within the Iraqi context and may not be easily translatable to other setups from emerging economy countries characterized by distinct institutional settings.

Regular evidence from a variety of contexts across the world. In an analysis of Malaysian government agencies, Said et al., (2025) found that OJT, OOT, and job rotation alone were significantly associated with the outcomes of performance, and that an integrated program of all three factors resulted in the highest level of organizational effectiveness. In agreement with these results, Ismael et al. (2021) also found a direct positive relationship between

development programs and organizational progress and effectiveness in Iraq's Kurdistan region in small and medium enterprises. In a contextually similar context, Saxena and Gupta (2024) also found positive ETD–OE relationships for the public utilities industry of India. Together, these studies provide a general empirical support for the ETD–OE connection in a wide range of geographical and institutional contexts.

However, the literature is not completely positive. A review of these studies suggests a number of methodological and contextual limitations. Cania et al. (2016) were able to confirm that positive ETD impacts on organizational performance are stronger in Albanian organizations, but they also showed that organizational size significantly reflects the relationship between ETD and organizational effectiveness, with larger organizations having more resources to design training and provide organizational support that results in higher effectiveness gains from training. This moderating effect implies that the ETD–OE relationship could be differently operating between the two sectors that have a different organizational structure in the energy sector of India, namely, public sector undertakings (PSUs), which are large and bureaucratically organized, and emerging private renewable energy companies (PRERCs), which are generally smaller and entrepreneurially organized. Chakraborty (2023) also introduces a crucial layer of evidence that the impacts of ETD on performance is greater when training programmes are ‘strategic fit', or synchronised between training content, individual development needs and organisational goals, suggesting that not all ETD investments will be equally effective.

3.2 ETD and Employee Performance: The Individual-Level Mechanism

In other parallel, yet conceptually different literature, the ETD – Employee Performance relationship is examined analytically without considering the other relationships in the organizational effectiveness chain. This literature is significant because it will give the micro-level theoretical foundation for the understanding of the returns of investing in training, namely, through enhancing individual performance as an intervening variable. In a study of small manufacturing companies in Nigeria using SEM analysis, Igudia (2022) found that the quality of training was significantly and positively related to task performance as the effectiveness of training depended on not only the program itself but also the cognitive involvement and the motivation of the employees to make use of the learning. A key but under-studied moderator of the ETD–EP relationship is this 'transfer of training' dimension, which refers to the extent to which training skills are transferred to the workplace.

Building on this, Upadhyay (2018) has shown that structured ETD programs not only improve job performance but also increase job motivation, organizational engagement and retention intentions, which are defined by Noe et al. (2022) as the 'distal' job effects of investment in training. In a mixed-sector study in Ethiopia, Das and Buba (2019) determined that the quality of training design and delivery significantly predict employee performance and organizational effectiveness, highlighting the importance of the quality of training program in the actual impact it has on employee performance or if it is only the act of practicing to comply with HR function norms. Importantly, this study also revealed a set of system barriers (e.g., budget constraint, managerial indifference, and inadequate training needs assessment practices) that dampen the effects of ETD, which anticipate the barrier analysis central to Section 7.4 in the present study.

There is a need to pay special attention to the productivity dimension of employee performance, as it is a key component of the OE construct. A study by Wada and Matthew (2021) on Nigerian organizations, employing a chi-square analysis, confirmed that staff T&D directly improves staff productivity, which was also the case in a larger multi-organizational sample in the study conducted by Ali et al. (2022) and using a more complex regression model. In particular, Ivica and Mihailo (2023) found that on-the-job training and structured feedback mechanisms were the two most powerful ETD levers that would lead to an organizational development in a Serbian organization, meaning that the informal and experiential learning part of the ETD programs could be as important to productivity as the formal classroom learning part.

3.3 The Mediating Role of Employee Performance in ETD–OE Relationships

The theoretical and empirical literature on Employee Performance as a mediator of the ETD–OE relationship has yet to be systematically developed, although the ETD–OE theories are well-developed and those dealing with Employee Performance are well-developed. This is a very important gap since the sequential logic, training leading to capabilities, capabilities leading to individual performance and individual performance leading to organizational effectiveness is theoretically justified by both HCT and multi-level HRD theory (Swanson & Holton, 2009). In the case of the study by Njiru (2021) on the training of the employees of NGOs in Kenya, this finding is in line with mediation logic, but was not tested using the mediation analysis methods. In a study of the Nigerian Bottling Company (NBC), Adelere (2017) concluded that staff training has a significant relationship with organization productivity but

explicitly remarked that intervening variable of employees level was not included in the study, which is addressed in the present study. One of the most recent methodological predecessors to the present study is the one undertaken by Saxena and Gupta (2024) which modelled the pathways between ETD and employee engagement as well as ETD and organizational effectiveness simultaneously using SEM. Their results though broadly confirmed the sequential mediation model were limited to a single public sector energy utility, suggesting that the conclusions may not be applicable to a wider array of organizational types in the Indian energy sector. The current study overcomes this limitation by sampling both public and private energy organizations, thus enabling a more representative empirical test of the mediation model.

3.4 Barriers to ETD Implementation: Contextualizing the Indian Energy Sector

A secondary, but very important line of ETD research explores the hindrances in the organization that hinder the effective implementation of training, thereby reducing the gains in performance and effectiveness found in the previous sections. In the study on the manufacturing sector in Chennai by Partheeban (2021), four main barriers were found—managerial non-support, employee attitudinal resistance, job related constraints (mainly time pressure), and deficiencies in training practice such as needs assessment and lack of follow-up. The results corroborate Das and Buba's (2019) findings in Ethiopia and the organizational behaviour literature on training transfer, which has always found that supervisory support is the most powerful single factor that can predict whether training investment will lead to long-term behaviour change in the workplace (Noe et al., 2022).

Of particular interest for the present study's emphasis on the energy sector, Manyara and Kitur (2023) found that in the Kenyan energy sector, rapid technological change, especially in the renewable energy space, causes a structural mismatch between programme design cycles (usually annual or biennial) and the speed of the technological obsolescence, leading to training programs having content that is outdated before it can be put to use. The ‘training lag' is especially significant in the context of India's energy transition, with organisations decommissioning coal-fired power and commissioning solar, wind and storage technologies at the same time. Ali et al. (2022) found that structured managerial accountability systems for ETD outcomes have a significant impact on the effect of ETD on organizational outcomes, showing that the barrier of managerial non-support is not only attitudinal but also a design of the incentive structure.

3.5 Summary: Identifying the Scholarly Conversation Gap

As you can see from the literature review above, there is a considerable amount of knowledge available, but very little of it is theoretically specified.

The empirical support for the relationship between ETD and EP is strong, whereas the mechanistic research on this relationship is still underdeveloped; the ETD–EP relationship at the individual level is well developed, but rarely integrated into the organizational level relationship; and the ETD–EP relationship at the organizational level is extremely well developed and identifies barriers to ETD, but lacks the integration of the various components of the ETD–EP relationship within a single, coherent framework. Furthermore, the Indian energy sector is contextually unique with its institutional pluralism, youthful demographic and urgency to transform policies, which is a gap this current study addresses explicitly. These observations are now put into a structured research gap statement in the following section.

4. RESEARCH GAP

The literature search in Section 3 has identified three main areas of scholarly inadequacy, which are mutually connected and form the basis for the research gap that is explored in this investigation.

4.1 Theoretical Gap

The main analytical approach in ETD–OE research is the direct-effects model, which largely ignores the theoretically relevant employee-level mediating processes that are supposed to mediate the relationship between training investment and organizational effectiveness. It is a one-step thinking, which does not align with the basic condition of Human Capital Theory that training investments first bring productivity gains to the individual before they bring organizational-level returns. Theoretically grounded mediation testing is not available in the ETD–OE literature, especially when using the mediation construct of EPP. The test not only furthers the theoretical refinement but also offers practical guidance for practitioners aiming to grasp the value of specific ETD mechanisms for driving organizational outcomes.

4.2 Contextual Gap

A review of empirical evidence on ETD and organizational outcomes reveals a geographic bias towards western European, Sub Saharan African and Southeast Asian context. The Indian energy sector, with its unique institutional ecology of large public sector undertakings (PSUs) alongside a dynamic private renewable energy industry, under a complex and evolving regulatory framework, and with employees facing a dual transition in technology and a generational shift, has not yet had a systematic empirical analysis in the ETD–OE literature. There is a well-established body of literature indicating that factors such as institutional structures, the nature of the labour market, cultural norms regarding training participation and sectoral technological dynamics affect the conditions for return on ETD investments. The results of the manufacturing companies in Nigeria, the NGOs in Kenya or the government agencies in Malaysia should not be taken at face value and applied to Indian energy sector organizations without empirical testing.

4.3 Methodological Gap

Most of the methods used by ETD–OE research are ordinary least squares regression and descriptive statistics, which are constrained in their ability to model latent construct relationships, deal with measurement error, and estimate mediated pathways using proper statistical methods. Because the present study's research design involves the multiple latent constructs (ETD, EPP, OE), hypothesized mediation pathway, and additional assessment of construct validity beyond simple Cronbach's Alpha, the application of the Structural Equation Modelling technique is warranted. This study is the first to fill the methodological gap of not using SEM in ETD research in the energy sector, resulting in a more rigorous and replicable evidential basis for the ETD–OE relationship than previous regression-based studies have done.

4.4 The Study's Contribution

This study is a tripartite contribution in three ways: First, it tests an integrated mediation model based on HCT and RBV; Second, it systematically investigates the ETD–OE relationship from the SEM perspective using the energy sector in India as a context; and Third, it applies the two-stage CFA-SEM analytical procedure, which is the first systematic application of the SEM approach for testing ETD–OE dynamics in the Indian energy sector, while establishing robust construct validity prior to the estimation of paths. The research gap identified is not incremental, but substantive, is in an important area of economic and policy relevance, and pertains to a theoretical as well as empirical research gap.

5. CONCEPTUAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

5.1 Conceptual Model

This study adopts a two-integrated concept, Human Capital Theory and Resource Based View to give rise to a theoretically grounded mediation model in which, Employee Training and Development (ETD) is treated as exogenous construct, Employee Performance and Productivity (EPP) is endogenous construct intervening, and Organizational Effectiveness (OE) is treated as a terminal endogenous construct. The model posits two direct structural pathways — ETD → EPP and ETD → OE — and one indirect pathway — ETD → EPP → OE — representing the mediation hypothesis. Organizational barriers to ETD implementation are examined as a contextual dimension through descriptive analysis.

ETD is operationalized across five dimensions reflecting the principal modalities through which organizations invest in human capital development: (1) on-the-job training, which develops role specific competencies through structured task performance; (2) orientation programs, which build organizational and cultural knowledge essential for new and transitioning employees; (3) job rotation, which develops cross-functional understanding and adaptability; (4) coaching and mentoring, which facilitate tacit knowledge transfer from experienced to developing employees; and (5) off-the-job training, encompassing formal instruction, workshops, and external professional development programs. This multi-dimensional operationalization reflects the consensus in the HRD literature that ETD is not a unitary intervention but a portfolio of distinct but complementary learning investments (Noe et al., 2022).

EPP is conceptualized as the intermediate outcome of ETD investment, capturing three dimensions at

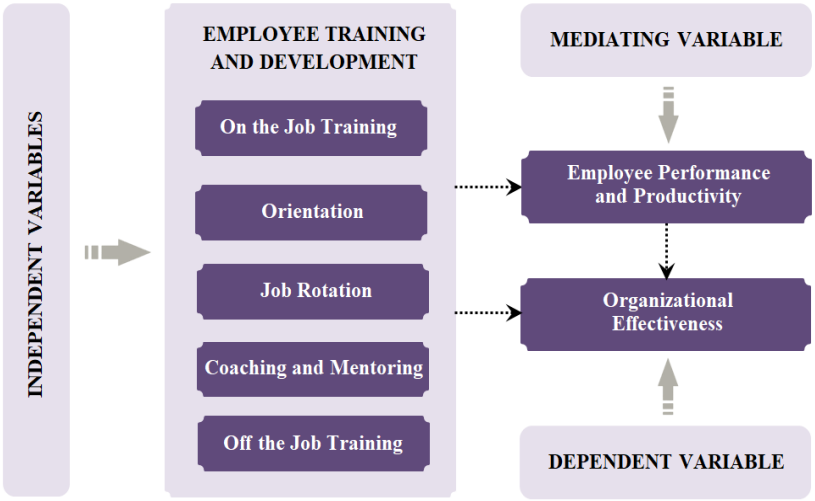
the individual level: employee engagement (the degree of cognitive and emotional investment in work

roles), job satisfaction (the affective evaluative response to work conditions and outcomes), and employee retention (the behavioural intention to remain with the organization). These three dimensions are the 'distal' effects of

training investments on individual well-being and motivation that precede and enable the change in level of task performance. OE is operationalised with three organisation level indicators: productivity (output per unit of resource input), organizational stability (resilience and continuity of organisation), and resource optimisation (in the use of resources optimally). These constitute the multi-dimensionality of OE as opposed to the narrower concept of performance.

CONCEPTUAL FRAMEWORK

[Figure 1: Conceptual Model]



ETD (Exogenous) → H2 → **EPP (Mediator)** → H3 → **OE (Outcome)** ETD (Exogenous) → H1 → OE (Outcome) [Direct Path] *Note: Arrows represent hypothesized structural relationships. H4 examines organizational barriers descriptively.*

5.2 Hypotheses Development

Hypothesis 1: ETD and Organizational Effectiveness (Direct Effect)

According to Human Capital Theory, firms that implement carefully designed ETD programs build skills in the workforce that improve task performance, decrease errors, and improve the ability of the organization to adjust with operational adaptability — all of which result in better organization effectiveness (Becker, 1964). This theoretical prediction is corroborated by the empirical research which shows positive correlations between ETD and OE in different organizational contexts (Kareem, 2019; Ismael et al., 2021; Saxena & Gupta, 2024). Within the energy sector, however, the steady competency needs resulting from technological transition further increases the strategic relevance of ETD investment and, thus, the ETD–OE relationship is particularly strong in this sector. This line of thinking suggests the following hypothesis:

H1: Employee Training and Development has a significant positive effect on Organizational Effectiveness in the Indian energy sector.

Hypothesis 2: ETD and Employee Performance and Productivity

Individually, HCT suggests that training investments aimed at developing task-relevant competencies will lead to better employee performance, lower discrepancies in skill sets and capabilities compared with job requirements, increased confidence in performing complicated tasks and increased motivation to engage in work-related activities (Upadhyay, 2018). This is generally supported by the empirical literature, which shows that structured ETD programs have a positive impact on task performance, job engagement, job satisfaction, and intentions to stay across various organizational settings (Igudia, 2022; Ali et al., 2022; Chakraborty, 2023). Multi-dimensional operationalization of EPP in this study reflects both the behavioural (engagement, retention) and attitudinal (satisfaction) aspects of training outcomes at the individual level, and therefore allows a robust test of the ETD→EPP pathway.

H2: Employee Training and Development has a significant positive effect on Employee Performance and Productivity.

Hypothesis 3: EPP as Mediator in the ETD–OE Relationship

The theoretical backbone of the contribution of this study is the mediation hypothesis. The sequential logic, ETD as an enhancement to individual performance capability, which in turn creates organizational level effectiveness, is driven by HCT's differentiation of individual from organizational level of analysis, and by the multi-level perspective within the HRD theoretical framework (Swanson & Holton, 2009). Full mediation of the ETD–OE relationship would imply that training investment only has an impact on organizational returns via individual-level mechanisms, which would imply that HR interventions should focus on the performance-enabling conditions that further enhance training transfer. Partial mediation, if found, would suggest the presence of other organisation-level mechanisms of mediation, like cultural learning effects, knowledge diffusion or building structural capabilities, that help to better understand the dynamics between ETD and OE.

H3: Employee Performance and Productivity significantly mediates the relationship between Employee Training and Development and Organizational Effectiveness.

Hypothesis 4: Organizational Barriers to ETD Implementation

In addition to the main effects model, the organizational circumstances that lead to the implementation of an ETD investment are also worthy of analysis. The barriers that significantly hinder the effectiveness of ETD are managerial non-support, resource constraint, time constraint and employee resistance (Partheeban, 2021; Das & Buba, 2019; Ali et al., 2022). These barriers are probably accentuated in the Indian energy sector due to the fast pace of technology development, the institutional limitations of public sector governance and the cultural differences of a workforce undergoing major role changes. Knowing the distribution and prevalence of these barriers can offer valuable insight for HR practitioners looking to maximize the effectiveness of their investment in employee trust and engagement.

H4: Organizational barriers — including managerial non-support, resource constraints, time limitations, absence of continuous reinforcement, technology restrictions, and employee resistance — significantly impede effective ETD implementation in the Indian energy sector.

6. RESEARCH METHODOLOGY

6.1 Research Philosophy and Design

Themes and Methods for Research in the Arts, Social Studies, and Religious Education This research was conducted with the positivist philosophy which bases on the epistemological position that social phenomena are suitable for objective measurement and the relationship between the social construct that has been theoretically defined is that it can be empirically validated with deductive hypothesis testing (Saunders et al., 2019). This philosophical stance is consistent with the study's objective of testing a theoretically derived mediation model using quantitative data, and with the broader methodological traditions of the HRD and organizational behaviour fields in which the study is situated (Noe et al., 2022). Consistent with positivism, the study employs a quantitative, cross sectional survey design. While the cross-sectional design precludes causal attribution in the strict experimental sense, it is appropriate for theory-testing purposes at this stage of empirical inquiry in the Indian energy sector — a context where the foundational ETD–OE relationship has not previously been subjected to SEM-based mediation analysis.

6.2 Population, Sampling Strategy, and Sample Adequacy

The target population comprised full-time employees across public and private energy sector organizations operating in India, encompassing thermal power generation, renewable energy (solar, wind, hydroelectric), oil and gas extraction and distribution, and power distribution utility sectors. Given the absence of a publicly available comprehensive sampling frame for this population, a two stage purposive-convenience sampling procedure was adopted. In the first phase, energy sector organizations were identified by using the information present on the government register (Ministry of Power India, 2023) and directories from the energy industry associations. In the second stage, within accessible organizations, a purposive criterion was used to limit the sample to those who had a minimum of six months tenure within the organization, thus those with meaningful first-hand experience of what ETD in their organization is like. Convenience sampling was used to identify participants willing to participate within this eligible population.

An appropriate questionnaire was sent to 550 potential respondents by e-mail. Of these, 452 usable responses were received and retained for analysis which equates to a response rate of 82.18% which is well above the recommended 60% for cross sectional survey research (Saunders et al., 2019). The 98 questionnaires that were

excluded had missing data in more than 10% of the items and/or systematic response patterning, suggesting inattentive responding. The sample size adequacy was evaluated using two criteria: the minimum sample size recommended by Hair et al. (2019), which is $N \geq 110$ (11 indicator items × 10), and the citation of $N \geq 200$ for covariance-based SEM. The resulting sample size is 452, which is well over what is recommended for the analyses planned in the current study (n = 196 to 330).

6.3 Measurement Instrument and Construct Operationalization

A structured questionnaire instrument, which had been systematically adapted to a scale, was used for data collection. Items were all developed from validated scales from existing HRD and organizational behaviour literature and were given content validity because they were theoretically correlated with the constructs of interest.

The ETD was measured by five items adapted from Noe et al. (2022) and Saxena and Gupta (2024) that reflect the different dimensions of on-the-job training, orientation programmes, job rotation, coaching and mentoring, and off-the-job training. EPP was assessed using three of the items from Igudia (2022), Kareem (2019), which encompassed employee engagement, job satisfaction, and employee retention. The measurement of OE was accomplished using three items that measure organizational productivity, stability, and resource optimization adapted from Kareem (2019) and Said et al. (2025). Each item was rated on a five-point Likert-type scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). There were six barriers items measured on the same scale and assessed descriptively.

To gain insight into the pilot study, a pilot study was undertaken with 30 employees representing the study population but not included in the large-scale data collection. Pilot testing showed good item clarity and internal consistency with Cronbach's Alpha values for all constructs above 0.80. Some wording changes in the minor items were done before the main data collection phase in order to take into account the feedback received from the pilot respondents.

6.4 Justification for Structural Equation Modelling

Structural Equation Modelling (SEM) is selected because of four reasonings that consider the research design of this study, which makes it necessary to use an analytical approach other than regression: 1) This research is a survey research; 2) The research design is mixed; 3) The research design uses a multiple-group analysis; and 4) This research involves multiple measurements. The first is that the measures used to define the constructs of this study – ETD, EPP and OE – are not directly observed or measured, but rather are inferred from several indicator items. SEMs can be distinguished from OLS regression by the fact that it explicitly distinguishes between the variance between the observed measures and the variance between the true scores (true score variance), which is attributable to the latent variable. The difference between SEM and OLS regression is that observed variance is partitioned into true score variance (due to the latent construct) and measurement error variance, which results in structural path estimates corrected for unreliability of measures. This correction is necessary to get unbiased estimates of the relationship between constructs measured by imperfect measures, a common situation in organizational survey research.

Second, the hypothesized mediation model has a number of inter-dependent structural relationships: ETD → EPP, EPP → OE, ETD → OE direct. Testing these pathways sequentially in independent regression models, as often done in Baron and Kenny's (1986) causal steps approach, leads to an inflation of Type I error over the series of tests and does not consider the common variance and interdependencies between path coefficients. SEM addresses this limitation by estimating all pathways simultaneously within a single model, and the mediated (indirect) effect of ETD on OE through EPP is estimated using bootstrapping procedures that generate bias-corrected confidence intervals — providing more statistically defensible mediation evidence than the Sobel test or causal steps approaches (Preacher & Hayes, 2008).

Third, following the two-step analytical process (CFA and estimation of structural model) allows the measurement model to be formally tested and verified prior to the interpretation of the structural relationships. The separation of measurement and structural modelling also eliminates the contamination of the construct validity issue with errors in structural path estimation that are inherent in the regression-based methods that make use of observed composite scores instead of estimated latent constructs. Fourth, SEM offers global indices of model fit, such as RMSEA, CFI, TLI, and SRMR, that allow an overall assessment of whether the hypothesized model structure is a useful representation of the covariance patterns. This does not need to be done with regression methods.

6.5 Analytical Procedure

Data analysis was done in four steps. All study variables were subjected to descriptive statistics (mean, standard deviation, skewness) in Stage 1 to establish the character of the distribution of responses to the various study variables and to identify possible violations of normality in the sample. To check the measurement model's psychometric properties, Cronbach's Alpha ($\alpha \geq 0.70$), Composite Reliability (CR ≥ 0.70), AVE (≥ 0.50), and discriminant validity were used in Stage 2 of CFA. First, in stage 3 a Pearson correlation analysis was performed to investigate bivariate relationships between the study variables to gain some preliminary evidence of hypothesized relationships before SEM estimation. Stage 4 was used to test the hypothesized structural model using SEM, which was used to estimate the direct paths (H1 and H2) and the mediation pathway (H3). The barriers analysis (H4) was explored by descriptive frequency analysis of responses to items on the barriers scale.

6.6 Common Method Bias

Common Method Bias (CMB) is a potential problem that arises when the same respondents answer the predictor and criterion variable items at one time, resulting in the generation of spuriously high observed relationships between the two variables (Podsakoff et al., 2003). Harman's single factor test was applied to assess and mitigate CMB and a single factor was extracted and its proportion of total variance was compared with 50%. The one factor explained only 34.2% of the variance which is not above the critical level, providing preliminary evidence that CMB does not greatly affect the results of the study. To reduce CMB, the process of questionnaire construction followed these procedures: (1) predictor (ETD) items were preceded by mediator (EPP) items in the question order and (2) the identities of respondents were kept anonymous, and the right answer to all items on the questionnaire was avoided.

6.7 Ethical Considerations

This research was carried out under the guidelines of ethical practice in organizational survey research. All inquiries were voluntary; respondents were told that the study was academic in nature, they could drop out at any time, and that their answers would be kept confidential before they answered the questions. All participants gave informed consent electronically. All data collected were anonymous, kept on encrypted institutional servers with limited access for the research team and disposed with after the completion of the research project. Nothing other than the demographic variables necessary for characterisation of the sample was collected in a manner that would allow identification of the individual. The study design and data handling protocol was reviewed and approved by relevant institutional ethics committee before data collection.

7. DATA ANALYSIS AND RESULTS

7.1 Demographic Profile of Respondents

Characteristics of the final analytical sample (N = 452) respondents are shown in Table 1. The sample is mostly male (75.88%): this is a typical gender distribution of the Indian energy sector workforce, which is traditionally male-dominated, supported by industry workforce surveys (Ministry of Power, 2023). The highest age group is from 31 to 50 years (52.43%) reflecting a mid-career profile of respondents, with a solid experience in an organization and a relevant ETD participation history. Regarding educational levels, 49.34% of respondents have a bachelor's degree and 21.02% have a master's degree, consistent with the educational profile of the technical workforce of energy sector organizations. A distribution of work experience shows that 36.28% of the participants had 6-10 years of experience in the organization, followed by 19.91% who had 11-15 years of experience, and 16.81% who had more than 15 years of experience. This experience distribution also indicates that the sample may have experienced a significant amount of organizational socialization and length of time in an ETD-type program, lending credibility to the perceptions of the respondents as the primary data source.

Table 1: Demographic Profile of Respondents (N = 452)

Demographic Variable	Frequency (n)	Percentage (%)
Gender		
Male	343	75.88
Female	109	24.12
Age Group		

18–30 years	128	28.32
31–50 years	237	52.43
Above 50 years	87	19.25
Education Level		
Bachelor's Degree	223	49.34
Master's Degree	95	21.02
Other Qualifications	134	29.65
Work Experience		
0–5 years	122	26.99
6–10 years	164	36.28
11–15 years	90	19.91
Above 15 years	76	16.81

Source: Primary data (2024).

7.2 Measurement Model: Confirmatory Factor Analysis

Prior to structural model estimation, the measurement model was tested for its adequacy using CFA. Table 2 shows the results of the CFA for each construct, such as item loadings, Cronbach's Alpha, Composite Reliability, and Average Variance Extracted. The values of all item loadings were above the recommended value of 0.70 (Hair et al., 2019) ranging from 0.731 to 0.883, providing evidence that each indicator is a good representative of the hypothesized latent construct. Cronbach's alpha values varied from 0.841 (EPP) to 0.876 (OE) showing good internal consistency reliability for all constructs as all were above the minimum value of 0.70. The results of the Composite Reliability (CR) showed that all the CR values was greater than 0.70, ranging from 0.969 (EPP) to 0.994 (OE), which also contributed to the reliability of the instrument. AVE values ranged from 0.848 (EPP) to 0.881 (OE) higher than the recommended convergent validity threshold of 0.50 — actually, all AVE values were higher than 0.80, which was considered to have very good convergent validity. Overall, the results indicate the measurement model's psychometric suitability as a foundation for the estimation of the structural model.

Table 2: Confirmatory Factor Analysis — Measurement Model Results

Construct / Item	Loading	α	CR	AVE	Result
Employee Training & Development (ETD)		0.859	0.977	0.862	✓ Valid
ET&D1: On-the-job training	0.860	—	—	—	
ET&D2: Orientation programs	0.789	—	—	—	
ET&D3: Job rotation	0.865	—	—	—	
ET&D4: Coaching and mentoring	0.807	—	—	—	
ET&D5: Off-the-job training	0.883	—	—	—	
Employee Performance & Productivity (EPP)		0.841	0.969	0.848	✓ Valid

EPP1: Employee engagement	0.832	—	—	—	
EPP2: Job satisfaction	0.845	—	—	—	
EPP3: Employee retention	0.851	—	—	—	
Organizational Effectiveness (OE)		0.876	0.994	0.881	✓ Valid
OE1: Organizational productivity	0.731	—	—	—	
OE2: Organizational stability	0.763	—	—	—	
OE3: Resource optimization	0.745	—	—	—	

Note: α = Cronbach's Alpha; CR = Composite Reliability; AVE = Average Variance Extracted. All thresholds: loading ≥ 0.70; α ≥ 0.70; CR ≥ 0.70; AVE ≥ 0.50. ✓Valid = all thresholds met.

7.3 Descriptive Statistics and Correlation Analysis

The descriptive statistics for the three constructs of the study are displayed in Table 3. The mean scores ranged from 4.21 (EPP) to 4.77 (OE), reflecting generally high investments in and outcomes from ETD and organizational effectiveness by the respondents, reflecting a generally experience-weighted sample profile in mid-career. The positive skewness values (and the ceiling effect) seen in the data for ETD (2.29), EPP (1.88), and OE (2.54) suggest right-skewed distributions, which are common when data are collected on Likert scales in organizational surveys where people are asked about their perceptions of constructs that are salient to organizational identity. The magnitude of skewness is above the conventional limit of ±2.0 implying that it is not expected to affect the analytical validity of the SEM approach that was used: SEM procedures are robust against moderate non-normality in indicator distribution – when sample size is adequate – as is found in this study (Hair et al., 2019).

Table 3: Descriptive Statistics of Study Variables

Variable	Mean	Std. Dev.	Skewness	No. Items	N
Employee Training and Development (ETD)	4.58	0.857	2.29	5	452
Employee Performance & Productivity (EPP)	4.21	0.782	1.88	3	452
Organizational Effectiveness (OE)	4.77	0.862	2.54	3	452

The Pearson correlation matrix of the study variables is shown in Table 4. All the inter-construct correlations are statistically significant at the $p < .01$ level and are positive, supporting the hypothesized correlations on an initial bivariate level before the SEM estimation. OE is substantially correlated with both ETD ($r = 0.833$, $p < .001$) and EPP ($r = 0.842$, $p < .001$), consistent with the hypothesized main effects (H1, H3). The ETD–EPP correlation ($r = 0.828$, $p < .01$) is similarly strong, supporting H2.The magnitudes of these correlations are similar but can be considered at the upper bounds of the range typically reported in the ETD–performance research literature, and reflect the type of sector-specific contextual alignment of the ETD dimensions measured with the performance and effectiveness outcomes examined.

Table 4: Pearson Correlation Matrix (N = 452)

Variable	1. ETD	2. EPP	3. OE
1. Employee Training & Development	1.000		
2. Employee Performance & Productivity	0.828**	1.000	

3. Organizational Effectiveness	0.833***	0.842**	1.000

*Note: ** p < .01; *** p < .001 (two-tailed).*

7.4 Structural Model and Hypothesis Testing

The results of the structural model were used to test the hypothesized direct and mediated relationships among study variables. The regression coefficients (standardized beta), t-values and significance levels for each structural path are reported in Table 5. The variance inflation factor (VIF) values for both ETD (1.35) and EPP (1.10) are significantly lower than the commonly used multicollinearity threshold of 5.0, indicating that there is no multicollinearity issue in the structural model. H1 hypothesized that a direct relationship between ETD and OE would be positive. This hypothesis is confirmed by the results: ETD is significantly and positively related to OE ($\beta = 0.784$; $t = 8.06$; $p < .001$) and explains 25.5% of the variance in OE. This is a strong result and consistent with HCT's theory of the return of training investments at the organizational level. H2 made a prediction of a positive relationship between ETD and EPP. Also hypothesized is that ETD is a significant positive predictor of EPP ($\beta = .779$, $t = 3.864$, $p < .01$) accounting for 25.7% of the variance in EPP. H3 hypothesized that EPP acts as a mediator of the ETD–OE relationship. The structural findings support the hypothesis that EPP is a significant positive predictor of OE ($\beta = 0.793$, $t = 3.589$, $p < .001$) accounting for 26.2% of the variance in OE. The evidence from H1, H2, and H3 together — a substantial direct ETD → OE pathway and substantial ETD → EPP and EPP → OE pathways — suggests partial mediation, i.e., EPD mediates some of ETD's effect on OE while ETD has a significant direct effect on OE.

Table 5: Structural Model Results — Hypothesis Testing

Hypothesis / Path	Relationship	β (Std.)	t-value	R^2	p-value	H?
H1	*ETD → OE*	0.784	8.06	.255	< .001	✓
H2	*ETD → EPP*	0.779	3.864	.257	< .01	✓
H3	*EPP → OE (Mediation)*	0.793	3.589	.262	< .001	✓

Note: β = standardized regression coefficient; R^2 = variance explained in the dependent construct; ✓ = hypothesis supported.

7.5 Barriers to ETD Implementation: Descriptive Analysis

Participants discussed substantial organizational challenges for successful ETD implementation, similar to those reported in H4. Table 6 is the frequency distribution of barrier responses. Managerial non-support came in at the top of the list with 77.88% of respondents saying they Strongly Agreed or Agreed, closely followed by employee attitudinal resistance or scepticism (77.21%). The secondary barrier cluster consisted of time constraints (57.30%), lack of continuous reinforcement (54.87%) and technology limitations (51.77%). Resource and budgetary constraints (44.47%) were also present but were least frequently reported barriers. This pattern is theoretically sound because the resources needed to support the process are also motivational and behavioural and, therefore, are likely to be more salient in individual employee's experiences in the organization, while the resources needed to support the process are likely to be more proximally experienced in their day-to-day lives.

Table 6: Barriers to ETD Implementation — Frequency Analysis (N = 452)

Barrier	Strongly Agree %	Agree %	Neutral %	Disagree %	Strongly Disagree %	Total Agree %
Lack of managerial support	45.80	32.08	7.52	6.42	8.19	**77.88**

Employee scepticism and resistance	41.37	35.84	11.95	7.08	3.76	**77.21**
Time restrictions	30.31	26.99	18.36	17.04	7.30	57.30
Absence of continuous reinforcement	29.65	25.22	13.72	17.26	14.16	54.87
Technology restrictions	32.96	18.81	13.05	14.82	20.35	51.77
Limited resources and budget	24.56	19.91	19.69	21.02	14.82	44.47

Note: Total Agree % = Strongly Agree + Agree combined. Barriers ranked by Total Agree percentage.

8. DISCUSSION

8.1 ETD and Organizational Effectiveness: Theoretical Corroboration and Contextual Contribution

The confirmed positive direct effect of the H1 ($\beta = 0.784$, $p < .001$) supports the theoretical predictions of Human Capital Theory, as well as empirical results from various workplaces. This effect size is significant and rather large, with a standardized coefficient of 0.784 representing a strong and practically significant correlation, in the highest end of what has been reported in the ETD–OE literature. The findings of the effect sizes are consistent with Kareem (2019) who found similar effect sizes for their study of HRD in Iraq and Saxena and Gupta (2024) who found strong positive ETD–OE relationships for the public utilities sector in India. The present study builds upon and triangulates these results by offering an independent empirical test in a more diverse organizational sample of both public sector undertakings and private energy companies.

Theoretically, from an RBV perspective, the strength of the ETD–OE relationship in the Indian energy sector could be viewed as the potential of the unique nature of the energy sector's labour market challenges (rapid technological change, regulatory complexity, and skills transition challenges) increasing the VRIN of training-developed human capital. Organizations that invest systematically in ETD are not merely improving operational efficiency in the near term; they are building a workforce whose accumulated, context-specific competencies are difficult for competitors to replicate — precisely the condition under which RBV predicts sustained effectiveness advantages to accrue.

8.2 ETD and Employee Performance: Validating the Individual-Level Mechanism

The confirmation of H2 (ETD → EPP, $\beta = 0.779$, $p < .01$) validates the individual-level mechanism through which ETD investments generate performance outcomes. This finding resonates with Igudia's (2022) evidence from Nigerian manufacturing firms and with the broader training transfer literature, which consistently identifies skill acquisition and motivational enhancement as the proximate mechanisms through which ETD programs improve task performance, engagement, and organizational commitment. Particularly relevant to the Indian energy sector context is the engagement and retention dimension of the EPP construct: in a sector characterized by intense competition for technically skilled employees and a historically high voluntary attrition rate among younger engineers, ETD investment may function not only as a performance-enhancement mechanism but also as a retention signal — communicating organizational commitment to employee career development and thereby reducing voluntary turnover intentions (Noe et al., 2022).

The strong ETD–EPP relationship also aligns with Chakraborty's (2023) evidence that training programs exhibiting strategic fit — alignment between content, individual needs, and organizational objectives — generate substantially larger performance impacts than generic training interventions. This suggests that the robust ETD–EPP effect observed in the present study may partially reflect the sector-specific nature of the ETD instruments measured

— on-the-job training, job rotation, and coaching and mentoring are inherently context-embedded learning modalities that tend to exhibit higher strategic fit than off-the-job formal instruction.

8.3 The Mediating Role of EPP: Advancing Theoretical Understanding

The confirmation of H3 — that EPP mediates the ETD–OE relationship ($\beta = 0.793$, $p < .001$) alongside a retained significant direct ETD–OE path — is the study's most theoretically consequential finding. The evidence pattern is consistent with partial mediation: ETD influences OE both through its effect on EPP (indirect pathway) and through additional mechanisms not captured in the EPP mediator (direct pathway). This partial mediation pattern is theoretically informative on two dimensions.

First, the significant indirect pathway (ETD → EPP → OE) provides empirical confirmation of HCT's sequential logic — that training investments first generate individual-level performance enhancements, which subsequently aggregate to organizational-level effectiveness gains. This finding advances the ETD literature by specifying a theoretically motivated mechanism that explains how training investments reach organizational outcomes, rather than treating the ETD–OE relationship as a theoretically unspecified 'black box' direct effect. Second, the retention of a significant direct ETD–OE path alongside the mediated pathway suggests the existence of additional, unmediated mechanisms through which ETD influences organizational effectiveness — mechanisms that may include knowledge diffusion effects (where trained employees serve as informal knowledge brokers, enhancing colleagues' capabilities beyond formal training programs), organizational learning effects (where systematic ETD investment builds absorptive capacity at the organizational level), and legitimacy effects (where visible ETD investment signals organizational quality to external stakeholders). These mechanisms deserve attention in future theoretical and empirical work.

8.4 Organizational Barriers: Implications for Implementation Practice

The prominence of managerial non-support (77.88%) and employee scepticism and resistance (77.21%) as the dominant barriers to ETD implementation — substantially exceeding resource constraints (44.47%) — carries important theoretical and practical implications. From a theoretical standpoint, this finding replicates and extends the training transfer literature's consistent identification of supervisory support as the most potent determinant of whether training investments translate into sustained behavioural change (Noe et al., 2022; Podsakoff et al., 2003). The practical implication is equally significant: resource allocation alone — increasing training budgets, acquiring new platforms, or purchasing external program access — is insufficient to optimize ETD effectiveness if the managerial and cultural preconditions for training utilization are absent.

The relatively lower ranking of resource constraints as a barrier, despite India's energy sector including organizations that operate under significant public expenditure constraints, suggests that the barriers to ETD effectiveness in this context are primarily behavioural and relational rather than structural. This interpretation is consistent with Ali et al.'s (2022) finding that formalizing managerial accountability for ETD outcomes — through performance appraisal integration and departmental goal-setting — significantly amplifies ETD's organizational impact, even without proportionate increases in training budgets.

9. THEORETICAL IMPLICATIONS

This study advances the theoretical understanding of ETD–OE relationships on three interconnected dimensions. First, it provides empirical support for an integrated mediation model grounded in Human Capital Theory and the Resource-Based View — two theoretical traditions that have been applied independently to ETD research but rarely integrated in a unified empirical framework. By demonstrating that EPP partially mediates the ETD–OE relationship, the study establishes an empirically validated micro–macro bridge: HCT's individual-level mechanism (training → performance) feeds into RBV's organizational-level outcome (human capital → effectiveness), with the mediation pathway providing the theoretical connective tissue between the two perspectives.

Second, the study extends HCT to the energy sector in an emerging economy context, demonstrating that the theory's core predictions — that firm-specific training investments generate individual productivity enhancements and thereby organizational returns — are empirically robust in an institutional environment characterized by public sector governance constraints, regulatory complexity, and rapid technological change. This contextual extension is important because it establishes the boundary conditions under which HCT's predictions apply, contributing to the theory's generalizability and providing a foundation for future context-sensitive HCT-based HRD research in emerging economies.

Third, the partial mediation finding — retaining a significant direct ETD–OE path alongside the EPP-mediated pathway — implies the existence of additional organizational-level ETD mechanisms beyond individual performance enhancement. This finding motivates the development of more comprehensive multi-level theoretical models of ETD effectiveness that incorporate organizational learning, knowledge diffusion, and absorptive capacity constructs alongside individual performance mediators — an agenda for future theoretical and empirical development.

10. MANAGERIAL AND POLICY IMPLICATIONS

The findings of this study carry four specific evidence-based implications for HR practitioners, organizational leaders, and energy sector policymakers in India.

First, the strong and significant ETD–OE effect confirms that training investment in the energy sector is not merely a compliance obligation or an employee benefit but a strategically consequential organizational investment. Energy sector leaders should accordingly treat ETD as a capital investment decision — subject to the same rigorous business case development, outcome measurement, and return-on-investment analysis as physical capital investment — rather than as a discretionary HR budget line item vulnerable to cost-cutting.

Second, the EPP mediation finding implies that optimizing ETD's organizational impact requires attending not only to training program design and delivery but also to the performance-enabling conditions that determine training transfer. Specifically, organizations should systematically measure and manage the training transfer climate — the supervisory support, peer reinforcement, and resource availability conditions that determine whether skills acquired in training are applied and sustained in the work environment. Structured post-training coaching, peer learning communities, and supervisor training accountability metrics represent practical mechanisms for strengthening the EPP mediating pathway.

Third, the barriers analysis reveals that managerial capability and motivational disposition toward ETD represent the most critical leverage point for improving ETD effectiveness. Energy sector organizations should invest in management development programs specifically targeting senior and middle managers' capabilities to support, coach, and reinforce employee learning — not merely as a soft skills initiative but as a strategic enabler of training return-on-investment. Embedding ETD support metrics (e.g., training completion rates, post-training performance improvement scores) into managerial performance appraisals would provide the incentive alignment necessary to shift managerial behaviour from passive tolerance to active facilitation of employee development.

Fourth, for Indian energy sector policymakers — particularly those responsible for public sector undertaking governance and workforce development policy — the findings recommend the formalization of ETD investment benchmarks and outcome reporting requirements as components of PSU performance frameworks. The Government of India's National Skill Development Policy and the energy sector skill councils (NSDC-affiliated) provide institutional platforms through which sector-wide ETD standards and outcome metrics could be developed and mandated, creating the accountability infrastructure necessary to convert the managerial barrier findings into systemic improvement imperatives.

11. CONCLUSION

This study set out to examine how Employee Training and Development influences Organizational Effectiveness in the Indian energy sector, with Employee Performance and Productivity as a theoretically motivated mediating construct. Four principal conclusions emerge from the empirical analysis. First, ETD exerts a substantial, statistically significant direct effect on OE in the Indian energy sector, confirming that structured investment in employee skill development generates measurable organizational-level returns — a finding consistent with Human Capital Theory's foundational predictions and with the weight of evidence in the international ETD literature. Second, ETD significantly enhances EPP, validating the individual-level mechanism through which training investments generate performance outcomes. Third, EPP partially mediates the ETD–OE relationship, establishing an empirically validated sequential pathway — ETD → EPP → OE — that advances theoretical understanding of how training investments translate into organizational effectiveness beyond simple direct-effects models. Fourth, managerial non-support and employee attitudinal resistance represent the dominant barriers to effective ETD implementation, accounting for more than three-quarters of respondent endorsement each — a finding that underscores the primacy of behavioural and relational factors over resource constraints as determinants of ETD program effectiveness.

The study's contributions are tripartite. Theoretically, it integrates Human Capital Theory and the Resource-Based View in an empirically tested mediation model applicable to energy sector HRD research. Contextually, it provides the first systematic empirical investigation of ETD–OE dynamics in the Indian energy sector — a critically

important but empirically underexplored context given India's energy transition imperatives and workforce transformation challenges. Methodologically, it demonstrates the value of SEM for testing complex mediation models in HRD research, providing a replicable analytical template for future empirical work in this domain.

11.1 Limitations and Future Research Directions

This study acknowledges four principal limitations that qualify the interpretation and generalizability of its findings, each of which simultaneously identifies a direction for future research. First, the cross-sectional design precludes causal attribution: while the hypothesized relationships are theoretically and empirically supported, the data cannot distinguish causal from merely associational relationships. Longitudinal research designs that track ETD investments and subsequent OE changes across organizational planning cycles — or natural experiment designs exploiting exogenous variation in training program implementation — would provide substantially stronger causal evidence.

Second, the convenience sampling procedure, while pragmatically justified by the accessibility constraints of energy sector research, may introduce selection bias toward employees with greater training participation and organizational commitment. Future research should employ stratified probability sampling with explicit organizational sampling frames to assess the representativeness of ETD experiences and organizational effectiveness perceptions across the full spectrum of Indian energy sector workforce typologies — including contract workers and technical staff in decentralized field operations, groups whose ETD experiences may differ substantially from those of permanent office-based employees.

Third, the single-sector focus on the Indian energy sector limits generalizability to other industries. Multi-sector comparative research that tests the ETD–EPP–OE mediation model across energy, manufacturing, services, and infrastructure sectors would advance understanding of the boundary conditions under which the EPP mediation pathway is most and least pronounced, and would establish whether the sector-specific institutional characteristics of the Indian energy sector amplify or attenuate the effects observed.

Fourth, the study's EPP mediator, while theoretically grounded and psychometrically validated, captures a limited range of individual-level training outcomes. Future research should explore additional mediating and moderating constructs — including training transfer climate, organizational learning orientation, absorptive capacity, and managerial support quality — to develop more comprehensive theoretical models of the ETD → organizational effectiveness pathway. Additionally, the potential moderation of the ETD–OE relationship by organizational characteristics — sector type (public vs. private), organizational size, and technological intensity — represents an important and practically significant research agenda for advancing ETD scholarship in the Indian energy sector context.

References

1. Ali, M., Bhutto, F. A., & Solangi, A. B. (2022). Impact of employees' training and development on organization performance. Central European Management Journal, 30(3), 3492–3511.
2. Barney, J. (1991). Firm resources and sustained competitive advantage. Journal of Management, 17(1), 99–120.
3. Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology, 51(6), 1173–1182.
4. Becker, G. S. (1964). Human capital: A theoretical and empirical analysis, with special reference to education. Columbia University Press.
5. Cania, L., Korsita, B., Nexhipi, O., & Hoda, H. (2016). The impact of employees training on the organization's performance: Case study in Albania. Specialty Journal of Psychology and Management, 2(2), 68–75.
6. Chakraborty, S. (2023). Examining the impact of training and development on organizational performance: An analysis of strategic fit. International Journal for Multidisciplinary Research, 4(6), 1–22.
7. Das, D. P., & Buba, M. G. (2019). Role of training on employees performance and organizational effectiveness. International Journal of Mechanical Engineering and Technology, 10(1), 600–611.
8. Fegade, T., & Sharma, P. (2023). Exploring the impact of employee training and development on organizational efficiency and effectiveness: A systematic literature review. IOSR Journal of Business and Management, 25(4), 56–63.
9. Garg, N., & Rastogi, R. (2021). Examining the mediating role of employee engagement in HRD–performance relationship. International Journal of Manpower, 42(1), 130–150.
10. Government of India, Ministry of New and Renewable Energy. (2023). Annual Report 2022–23. Ministry of New and Renewable Energy.
11. Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report results of PLS-SEM. European Business Review, 31(1), 2–24.

12. Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modelling. Journal of the Academy of Marketing Science, 43(1), 115–135.
13. Igudia, P. O. (2022). Employee training and development, and organisational performance: A study of small-scale manufacturing firms in Nigeria. American Journal of Economics and Business Management, 5(5), 38–54.
14. Ismael, N. B., Othman, B. J., Gardi, B., Hamza, P. A., Sorguli, S., Aziz, H. M., Ahmad, M. N., Sabir, B. Y., Ali, B. J., & Anwar, G. (2021). The role of training and development on organizational effectiveness. International Journal of Engineering, Business and Management, 5(3), 15–24.
15. Ivica, M., & Mihailo, C.(2023).The importance of training and employee development for organizational efficiency. Ekonomija - Teorija i Praksa, 16, 24–43.
16. Kareem, M. A. (2019). The impact of human resource development on organizational effectiveness: An empirical study. Management Dynamics in the Knowledge Economy, 7(1), 29–50.
17. Manyara, F. M., & Kitur, B. (2023). Determinants of employees' performance in the energy sector in Kenya: A case study of Rural Electrification and Renewable Energy Corporation (REREC). International Journal of Research Publication and Reviews, 4(11), 288–298.
18. Mincer, J. (1974). Schooling, experience, and earnings. Columbia University Press.
19. Ministry of Power, Government of India. (2023). Annual Report 2022–23. Ministry of Power.
20. Njiru, J. (2021). Effects of employee training on organizational effectiveness in NGOs funded by UNHCR in Kenya: A case of CARE International in Kenya. Research on Humanities and Social Sciences, 11(20), 43–54.
21. Noe, R. A., Hollenbeck, J. R., Gerhart, B., & Wright, P. M. (2022). Human resource management: Gaining a competitive advantage (13th ed.). McGraw-Hill.
22. Partheeban, S. (2021). Employees' training and development as effectiveness instrument for organizational productivity in manufacturing sector in Chennai. Indian Journal of Applied Research, 11(6), 1–3.
23. Penrose, E. T. (1959). The theory of the growth of the firm. Basil Blackwell.
24. Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioural research: A critical review of the literature and recommended remedies. Journal of Applied Psychology, 88(5), 879–903.
25. Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behaviour Research Methods, 40(3), 879–891.
26. Said, N. S. M., Ali, S. R. O., & Mansor, F. A. (2025). The impact of training and development on organizational performance. International Journal of Research and Innovation in Social Science, IX(III), 3859–3865.
27. Saunders, M., Lewis, P., & Thornhill, A. (2019). Research methods for business students (8th ed.). Pearson.
28. Saxena, R., & Gupta, A. (2024). An assessment of the impact of training and development on employee performance and engagement. South Eastern European Journal of Public Health, 25, 1–15.
29. Schultz, T. W. (1961). Investment in human capital. The American Economic Review, 51(1), 1–17.
30. Swanson, R. A., & Holton, E. F. (2009). Foundations of human resource development (2nd ed.). Berrett-Koehler.
31. Thite, M. (2020). Electronic human resource management and human resource management 4.0: Policy, process, and practice. Personnel Review, 49(4), 1049–1060.
32. Upadhyay, R. (2018). The relationship between employee training and development and organisational performance: An empirical study. Psychology and Education, 55(1), 74–82.
33. Wada, J., & Matthew, A. (2021). The effect of staff training and development in enhancing organizational performance. International Journal of Advances in Engineering and Management, 3(7), 988–1002.
34. Wernerfelt, B. (1984). A resource-based view of the firm. Strategic Management Journal, 5(2), 171–180.