Impact of Reskilling & Up-Skilling on Workforce Readiness to Achieve Operational and Economic Competitiveness: An HR Competence Perspective in Contemporary Global Economy Landscape

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Abstract

The present study investigates the impact of reskilling and up-skilling on workforce readiness and their subsequent influence on operational and economic competitiveness in Pakistan's energy and power sector amid accelerating global competency shifts driven by technological advancement, automation, and digital transformation. Grounded in the positivist paradigm, the study adopted an explanatory quantitative research design using a structured survey questionnaire to collect data from 400 employees selected through convenience sampling. Reskilling and up-skilling were treated as independent variables, workforce readiness as a mediating variable, and operational and economic competitiveness as dependent variables. Data were analyzed using SPSS through descriptive statistics, reliability analysis, correlation, regression, and mediation analysis. The findings revealed that both reskilling and up-skilling significantly and positively influence workforce readiness. Workforce readiness was also found to significantly enhance operational and economic competitiveness. Furthermore, the mediation analysis confirmed that workforce readiness significantly mediates the relationship between competency development strategies and competitiveness outcomes. The study highlights that organizations investing in continuous employee development are better positioned to improve adaptability, productivity, innovation, and financial sustainability in dynamic industrial environments. The study contributes theoretically by extending Human Capital Theory within the context of workforce transformation and organizational competitiveness in developing economies. Practically, the findings provide strategic implications for policymakers, organizational leaders, and HR practitioners in designing future-oriented workforce development frameworks capable of sustaining competitiveness in the evolving global economy.

Keywords: Reskilling, Up-skilling, Workforce Readiness, Operational Competitiveness, Economic Competitiveness, Human Capital Development, Energy and Power Sector, Pakistan, Global Competency Shifts

1. Introduction

The contemporary global economy is experiencing unprecedented transformation driven by rapid technological advancement, industrial automation, digitalization, Artificial Intelligence (AI), renewable energy transitions, globalization, and changing labor market dynamics. These accelerated transformations, often associated with the Fourth Industrial Revolution (Industry 4.0), have significantly altered the competency requirements of organizations and employees across almost every industrial sector (World Economic Forum, 2023). Emerging technologies such as Artificial Intelligence, Big Data Analytics, Internet of Things (IoT), robotics, cloud computing, block chain systems, and smart energy infrastructures are redefining operational processes, organizational structures, and workforce expectations worldwide (Mula & Ristiani, 2025). Consequently, organizations are increasingly compelled to redesign their human capital strategies in order to remain operationally efficient, economically competitive, and technologically adaptive in highly dynamic global markets (McKinsey & Company, 2022).

In recent years, competency shifts have become one of the most pressing challenges confronting organizations globally. Traditional technical knowledge and static job competencies are no longer sufficient to sustain long-term employability and organizational competitiveness. Modern organizations now require employees who possess adaptive learning capabilities, technological literacy, problem-solving skills, innovation capacity, emotional intelligence, analytical reasoning, and multidisciplinary competencies (Damanik et al., 2025). The World Economic Forum (2023) reported that more than half of the global workforce will require significant reskilling and up-skilling within the present decade due to automation, technological disruption, and changing industry demands. Similarly, Deloitte (2022) emphasized that organizations investing in continuous workforce development demonstrate stronger operational performance, higher productivity, greater innovation capability, and improved economic resilience during periods of uncertainty and industrial transition.

Within this rapidly evolving environment, the concepts of reskilling and up-skilling have emerged as critical strategic mechanisms for workforce transformation and organizational sustainability. Reskilling refers to the process through which employees acquire entirely new competencies that enable them to transition into different job roles or technological environments, particularly when existing skills become obsolete due to automation or industrial transformation (International Labour Organization, 2020). Conversely, up-skilling refers to the enhancement and refinement of existing competencies to align employee capabilities with evolving technological systems, organizational requirements, and operational standards (WEF, 2023). Although conceptually distinct, both strategies are highly complementary because reskilling enhances workforce mobility while up-skilling strengthens employee effectiveness within current occupational roles (McKinsey Global Institute, 2021).

The relevance of reskilling and up-skilling has become particularly important within the

energy and power sector of Pakistan. The sector is currently undergoing substantial structural, technological, and operational transformation due to increasing energy demands, digital energy systems, renewable energy integration, smart grid technologies, sustainability pressures, operational modernization, and global environmental commitments (Aulia et al., 2025). Pakistan's energy and power industry is increasingly shifting toward technologically sophisticated operational frameworks that require advanced workforce competencies, technical adaptability, digital knowledge, and continuous professional development. However, despite these transformations, many organizations within the sector continue to experience competency deficiencies, technological skill gaps, operational inefficiencies, and workforce readiness challenges that limit productivity and economic competitiveness (Konorop, 2024).

The energy and power sector in Pakistan constitutes one of the most strategically significant sectors of the national economy because it directly influences industrial productivity, infrastructure development, economic growth, and national competitiveness. Nevertheless, the sector faces persistent operational challenges including technological adaptation barriers, workforce capability limitations, inadequate training systems, outdated technical competencies, resistance to change, and insufficient investment in human capital development (Rofiq et al., 2023). These challenges are further intensified by globalization and international competitiveness pressures, where energy organizations are expected to operate efficiently under increasingly digitalized and technologically integrated systems (UNESCO, 2022). Consequently, workforce readiness has become a critical determinant of organizational survival, operational effectiveness, and sustainable economic competitiveness within the sector (Gunawan, 2024).

Workforce readiness refers to the preparedness of employees to effectively respond to evolving organizational demands, technological advancements, operational complexities, and competitive industrial environments. It encompasses not only technical expertise but also cognitive flexibility, adaptability, collaborative capabilities, learning orientation, innovation skills, and technological competence (LinkedIn Workplace Learning Report, 2023). Contemporary organizations increasingly recognize workforce readiness as a strategic organizational asset because employees who are adaptable and continuously learning contribute significantly toward operational efficiency, innovation capability, strategic resilience, and long-term economic sustainability (Widiarsih & Resa, 2022).

Despite growing global recognition regarding the importance of reskilling and up-skilling, empirical research examining their impact on workforce readiness and organizational competitiveness remains limited within developing economies, particularly in Pakistan's energy and power sector. Most existing studies are concentrated in developed countries where organizations possess stronger digital infrastructures, larger training investments, advanced educational systems, and more mature human resource development practices (Bairizki, 2020). Consequently, the findings of such studies may not be fully applicable within developing-country contexts characterized by infrastructural limitations, technological disparities, financial constraints, policy weaknesses, and socio-cultural challenges (Asmara & Raflesia, 2023).

Furthermore, existing literature frequently examines reskilling and up-skilling independently without integrating them into a unified framework capable of explaining their collective influence on workforce readiness and organizational competitiveness. Similarly, many studies focus primarily on direct relationships between training and organizational performance while overlooking the mediating role of workforce readiness in translating competency development into operational and economic outcomes (Musafah & Nurfuadi, 2025). The scarcity of sector-specific studies within Pakistan's energy and power industry further widens the empirical gap because workforce transformation challenges in energy organizations differ significantly from those in manufacturing, services, or information technology sectors (Nugraha et al., 2025).

Another important limitation in existing literature is the inadequate examination of operational competitiveness and economic competitiveness as separate but interconnected organizational outcomes. Operational competitiveness refers to an organization's ability to achieve efficiency, productivity, quality improvement, adaptability, technological integration, and operational excellence. Economic competitiveness, on the other hand, reflects the organization's capacity to sustain profitability, financial performance, market positioning, cost efficiency, and long-term economic viability (Efitra & Pamela, 2025). While previous studies acknowledge the importance of workforce development for organizational success, limited empirical evidence exists regarding how workforce readiness mediates the relationship between reskilling/up-skilling initiatives and these broader dimensions of competitiveness, particularly in emerging economies like Pakistan (Novita et al., 2025).

Therefore, the present study seeks to address these critical gaps by examining the impact of reskilling and up-skilling on workforce readiness to achieve operational and economic competitiveness in the energy and power sector of Pakistan. The study adopts an explanatory quantitative research design grounded in positivist ontology and epistemology to empirically investigate causal relationships among the study variables. Data will be collected from 400 employees working within the energy and power sector through convenience sampling techniques. The study conceptualizes reskilling and up-skilling as independent variables, workforce readiness as a mediating variable, and operational competitiveness and economic competitiveness as dependent variables.

This study is theoretically significant because it contributes toward the growing body of knowledge on workforce transformation, competency development, and organizational competitiveness within developing-country contexts. By integrating workforce readiness as a mediating mechanism, the study extends existing human capital and workforce adaptability literature beyond simple direct-effect models (ILO, 2020). The research also contributes context-specific empirical evidence from Pakistan's energy and power sector, thereby addressing an important geographical research gap in the existing literature (Prasetyo et al., 2025).

Practically, the study offers valuable implications for policymakers, organizational leaders, human resource professionals, and educational institutions involved in workforce

development and industrial modernization. The findings may assist organizations in designing strategic reskilling and up-skilling initiatives capable of improving workforce adaptability, operational efficiency, and economic sustainability in highly competitive industrial environments (Deloitte, 2022). Moreover, the study can support government institutions and policy planners in formulating workforce development policies aligned with technological transformation and future labor market requirements (Laili & Pradikto, 2025).

Ultimately, the study recognizes that reskilling and up-skilling are no longer optional organizational practices but strategic necessities for ensuring workforce resilience, operational sustainability, and economic competitiveness amid accelerating global competency shifts. In an era where technological disruption continuously reshapes industrial landscapes, organizations capable of developing future-ready workforces are more likely to achieve long-term competitiveness, innovation capability, and sustainable economic growth (WEF, 2023).

The energy and power sector of Pakistan is currently confronting significant technological, operational, and economic transformations resulting from digitalization, renewable energy integration, automation, global competitiveness pressures, and evolving industrial standards (Aulia et al., 2025). Despite these changes, many organizations within the sector continue to experience workforce competency gaps, technological skill deficiencies, inadequate employee preparedness, and limited adaptability toward emerging operational requirements (Konorop, 2024). Traditional workforce capabilities are increasingly becoming insufficient to support modern energy systems characterized by smart technologies, data-driven operations, and technologically integrated infrastructures (Mula & Ristiani, 2025).

Although organizations recognize the importance of workforce development, investment in structured reskilling and up-skilling initiatives remains limited, fragmented, and insufficiently aligned with changing competency demands (Rofiq et al., 2023). Consequently, organizations face challenges in achieving workforce readiness necessary for operational efficiency, innovation capability, productivity enhancement, and sustainable economic competitiveness (Gunawan, 2024). Furthermore, empirical evidence explaining how reskilling and up-skilling contribute toward workforce readiness and competitiveness within Pakistan's energy and power sector remains scarce. This situation creates a critical need for empirical investigation into the role of competency development strategies in strengthening organizational competitiveness under rapidly changing global competency environments.

The rationale of this study emerges from the increasing importance of workforce transformation strategies in achieving organizational competitiveness within technologically evolving industrial environments. Rapid global competency shifts driven by digitalization, automation, Artificial Intelligence, and sustainable energy transitions have significantly changed workforce requirements in the energy and power sector (WEF, 2023). Organizations can no longer rely upon traditional workforce competencies to sustain operational efficiency and economic growth (McKinsey & Company, 2022).

Pakistan's energy and power sector faces substantial workforce development challenges due to technological modernization, infrastructure transformation, and increasing global competitiveness pressures (UNESCO, 2022). However, limited empirical evidence exists regarding how reskilling and up-skilling initiatives contribute toward workforce readiness and organizational competitiveness within this context. Therefore, this study seeks to provide empirical insights capable of supporting strategic human resource development, workforce planning, operational sustainability, and policy formulation within the sector.

The study is also important because it integrates workforce readiness as a mediating mechanism linking competency development strategies with organizational outcomes. This integrated framework provides a more comprehensive understanding of how workforce transformation initiatives translate into operational and economic competitiveness (Gunawan, 2024). Consequently, the findings may support policymakers, industry leaders, HR practitioners, and educational institutions in developing sustainable workforce development frameworks capable of enhancing organizational resilience, technological adaptability, and future competitiveness in Pakistan's energy and power industry (Prasetyo et al., 2025).

2. Literature Review

The present study is primarily grounded in the Human Capital Theory developed by Becker (1964), which argues that employee knowledge, competencies, education, skills, and training constitute valuable organizational assets capable of improving productivity, operational efficiency, innovation capability, and long-term competitiveness. According to Human Capital Theory, organizations that continuously invest in workforce learning and competency enhancement are better positioned to sustain operational performance and economic growth within rapidly changing industrial environments. Employee competency development strengthens workforce adaptability, technological readiness, organizational resilience, and strategic responsiveness, particularly during periods of technological disruption and industrial transformation (Bairizki, 2020).

The Fourth Industrial Revolution, characterized by Artificial Intelligence (AI), automation, Big Data Analytics, Internet of Things (IoT), robotics, cloud computing, blockchain technology, and renewable energy systems, has significantly transformed workforce requirements across industries (World Economic Forum, 2023). Traditional workforce competencies are increasingly becoming insufficient to support modern organizational systems because technological advancement continuously reshapes operational processes, industrial structures, and competitive business environments (Damanik et al., 2025). Consequently, organizations are increasingly emphasizing competency development strategies such as reskilling and up-skilling to sustain workforce relevance and organizational competitiveness (McKinsey & Company, 2022).

Within technologically evolving sectors such as energy and power generation, workforce transformation has become particularly important due to increasing reliance on digital infrastructure, renewable energy technologies, automation systems, smart grids, and

technologically integrated operational frameworks (Aulia et al., 2025). Pakistan's energy and power sector is currently experiencing substantial operational and technological transformation, thereby increasing demand for technologically capable, adaptive, and future-ready employees (Konorop, 2024). In this context, reskilling and up-skilling represent strategic human capital investments capable of strengthening workforce readiness, operational competitiveness, and economic competitiveness.

The conceptual framework of the study proposes that reskilling and up-skilling positively influence workforce readiness, operational competitiveness, and economic competitiveness, while workforce readiness further influences operational and economic competitiveness and mediates the relationship between competency development strategies and organizational competitiveness outcomes.

2.1 Reskilling and Workforce Readiness

Reskilling refers to the process through which employees acquire entirely new competencies that enable them to transition into different technological systems, operational environments, or occupational roles (International Labour Organization, 2020). Reskilling has become increasingly important due to automation, digital transformation, industrial restructuring, and evolving competency demands associated with Industry 4.0 (Mula & Ristiani, 2025).

Workforce readiness refers to employees' preparedness to effectively respond to changing technological, operational, and organizational demands. It encompasses technical competence, adaptability, learning orientation, problem-solving capability, digital literacy, collaboration skills, and innovation capability (Gunawan, 2024). Employees possessing high workforce readiness are more capable of managing technological transformation and operational complexity within competitive industrial environments.

Existing literature strongly supports the relationship between reskilling and workforce readiness. McKinsey Global Institute (2021) argued that reskilling enhances employees' ability to adapt toward technological disruptions and evolving job requirements by equipping them with entirely new competencies necessary for modern operational systems. Similarly, Deloitte (2022) reported that organizations implementing reskilling initiatives develop more adaptive, technologically capable, and future-ready workforces.

UNESCO (2022) further emphasized that reskilling improves employee employability, technological confidence, and career sustainability because workers become more capable of functioning effectively within evolving labor markets. In technologically intensive industries such as energy and power generation, reskilling enables employees to manage smart operational systems, renewable energy technologies, automation infrastructures, and digital monitoring platforms more effectively (Aulia et al., 2025).

Moreover, reskilling contributes toward organizational resilience and sustainability because adaptable employees facilitate technological integration, operational continuity, and

organizational transformation during periods of industrial disruption (Prasetyo et al., 2025). Consequently, organizations emphasizing reskilling are more likely to develop highly prepared workforces capable of sustaining long-term operational and economic competitiveness.

H1: Reskilling has a significant positive impact on workforce readiness.

2.2 Up-Skilling and Workforce Readiness

Up-skilling refers to the enhancement and refinement of employees' existing competencies to align workforce capabilities with changing technological systems, industry standards, and organizational expectations (WEF, 2023). Unlike reskilling, which focuses on acquiring entirely new competencies, up-skilling strengthens current knowledge, technical expertise, and operational capability within existing occupational roles (LinkedIn Workplace Learning Report, 2023).

The increasing complexity of organizational systems and technological infrastructures has intensified the importance of up-skilling across industries. Organizations increasingly require employees to continuously improve their digital literacy, technical knowledge, analytical capability, and problem-solving skills to remain operationally effective within rapidly evolving industrial environments (Damanik et al., 2025).

Existing literature indicates that up-skilling positively influences workforce readiness by improving employees' technological adaptability, operational effectiveness, and learning capability (Rofiq et al., 2023). Deloitte (2022) found that organizations investing in continuous competency enhancement programs experience greater workforce flexibility, operational responsiveness, and technological preparedness.

Similarly, LinkedIn Workplace Learning Report (2023) emphasized that employees participating in up-skilling programs demonstrate stronger innovation capability, adaptability, and readiness toward organizational transformation. In technologically evolving sectors such as energy and power generation, employees must continuously improve their competencies regarding digital systems, renewable technologies, automation infrastructures, and operational analytics to maintain organizational productivity and operational reliability (Mula & Ristiani, 2025).

Furthermore, up-skilling enhances employee motivation, confidence, organizational commitment, and professional growth because employees perceive organizational support for continuous learning and competency enhancement (Asmara & Raflesia, 2023). Consequently, organizations emphasizing up-skilling are more likely to develop highly prepared and operationally effective workforces.

H2: Up-skilling has a significant positive impact on workforce readiness.

2.3 Reskilling and Operational Competitiveness

Operational competitiveness refers to an organization's ability to achieve operational efficiency, productivity, quality improvement, innovation capability, technological adaptability, service reliability, and operational agility within competitive industrial environments (Efitra & Pamela, 2025). Modern organizations increasingly recognize that operational competitiveness depends heavily upon workforce competency and adaptability.

Reskilling positively contributes toward operational competitiveness because employees possessing updated competencies are better capable of managing evolving operational systems, advanced technologies, and industrial transformation (ILO, 2020). Employees who undergo reskilling initiatives demonstrate stronger operational flexibility, technological capability, and adaptability toward organizational change (McKinsey Global Institute, 2021).

Deloitte (2022) reported that organizations implementing structured reskilling programs experience improved operational efficiency, process optimization, innovation capability, and organizational responsiveness. Similarly, McKinsey & Company (2022) emphasized that reskilled employees facilitate technological integration and operational modernization, thereby strengthening organizational competitiveness.

Within the energy and power sector, operational systems increasingly rely upon smart grids, automation platforms, renewable energy technologies, predictive maintenance systems, and digital operational infrastructures (Aulia et al., 2025). Employees lacking updated competencies may struggle to function effectively within such technologically integrated environments, thereby reducing operational effectiveness and organizational productivity (Konorop, 2024).

Moreover, reskilling strengthens organizational resilience because adaptable employees facilitate operational continuity and technological transition during periods of industrial transformation (Prasetyo et al., 2025). Consequently, organizations investing in workforce reskilling are more likely to sustain operational competitiveness within rapidly changing industrial environments.

H3: Reskilling has a significant positive impact on operational competitiveness.

2.4 Up-Skilling and Operational Competitiveness

Up-skilling significantly contributes toward operational competitiveness by improving employees' operational capability, technological expertise, and productivity performance (WEF, 2023). Organizations increasingly require employees to continuously enhance their competencies to support operational modernization and technological advancement (Damanik et al., 2025).

Existing literature suggests that up-skilling positively influences operational competitiveness through improving workforce efficiency, innovation capability, process optimization, and service quality (Rofiq et al., 2023). Employees possessing continuously updated

competencies demonstrate superior problem-solving capability, technological adaptability, and operational performance (LinkedIn Workplace Learning Report, 2023).

Deloitte (2022) reported that organizations investing in employee competency enhancement achieve higher operational productivity and stronger innovation capability. Similarly, UNESCO (2022) argued that technologically capable employees facilitate operational modernization and digital integration, thereby strengthening organizational operational competitiveness.

Within Pakistan's energy and power sector, employees must continuously update their competencies regarding renewable energy technologies, automation systems, smart infrastructures, and operational analytics to sustain productivity and operational reliability (Mula & Ristiani, 2025). Consequently, organizations emphasizing up-skilling are more likely to maintain operational effectiveness and competitiveness.

H4: Up-skilling has a significant positive impact on operational competitiveness.

2.5 Workforce Readiness and Operational Competitiveness

Workforce readiness significantly contributes toward operational competitiveness because prepared employees demonstrate stronger adaptability, operational effectiveness, technological capability, and productivity performance (Gunawan, 2024). Organizations possessing future-ready employees are better capable of managing technological complexity, operational modernization, and competitive industrial pressures.

Deloitte (2022) reported that organizations possessing highly prepared workforces experience superior operational efficiency, stronger innovation capability, and greater organizational resilience. Similarly, LinkedIn Workplace Learning Report (2023) emphasized that workforce readiness improves organizational adaptability toward digital transformation and operational modernization.

In the energy and power sector, workforce readiness enables employees to effectively manage technologically integrated operational systems, renewable infrastructures, automation technologies, and smart operational platforms (Aulia et al., 2025). Consequently, organizations possessing highly prepared workforces are more likely to sustain operational competitiveness within dynamic industrial environments.

H5: Workforce readiness has a significant positive impact on operational competitiveness.

2.6 Workforce Readiness and Economic Competitiveness

Workforce readiness positively influences economic competitiveness because technologically prepared and adaptive employees improve organizational productivity, operational continuity, innovation capability, and financial sustainability (McKinsey Global Institute, 2021). Organizations possessing future-ready employees are better positioned to sustain market competitiveness and long-term economic growth (WEF, 2023).

UNESCO (2022) emphasized that workforce readiness strengthens industrial productivity and economic resilience because prepared employees facilitate technological integration, strategic responsiveness, and organizational adaptability. In technologically intensive sectors such as energy and power generation, workforce readiness significantly contributes toward cost efficiency, service reliability, operational sustainability, and financial performance (Konorop, 2024).

H6: Workforce readiness has a significant positive impact on economic competitiveness.

2.7 Mediating Role of Workforce Readiness

The present study conceptualizes workforce readiness as a mediating variable linking reskilling and up-skilling with operational and economic competitiveness. Human Capital Theory suggests that competency development initiatives generate organizational outcomes primarily through improving workforce capability, preparedness, and adaptability (Becker, 1964).

Employees who acquire new competencies through reskilling and up-skilling become more capable of supporting operational modernization, technological integration, innovation capability, and organizational sustainability when they possess adequate workforce readiness (Deloitte, 2022). Workforce readiness strengthens employees' ability to operationalize acquired competencies effectively within technologically evolving environments (Gunawan, 2024).

Existing literature suggests that competency development initiatives produce stronger organizational outcomes when employees demonstrate high levels of adaptability, preparedness, and technological confidence (McKinsey & Company, 2022). In the energy and power sector, workforce readiness enables employees to effectively apply technological competencies within smart infrastructures, automation systems, renewable technologies, and operational modernization processes (Aulia et al., 2025).

Consequently, workforce readiness is expected to mediate the relationship between competency development strategies and organizational competitiveness outcomes.

H7: Workforce readiness significantly mediates the relationship between reskilling and operational competitiveness.

H8: Workforce readiness significantly mediates the relationship between up-skilling and operational competitiveness.

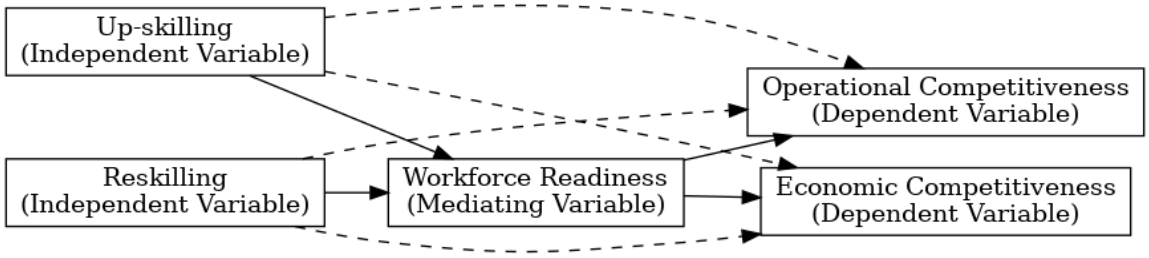
H9: Workforce readiness significantly mediates the relationship between reskilling and economic competitiveness.

H10: Workforce readiness significantly mediates the relationship between up-skilling and economic competitiveness.

2.8 Conceptual Framework

The study consists of five key variables. Reskilling and up-skilling are treated as independent variables, workforce readiness is considered as a mediating variable, and operational competitiveness and economic competitiveness are treated as dependent variables. The conceptual model assumes that reskilling and up-skilling directly influence workforce readiness, which in turn influences both types of competitiveness, while also allowing for direct effects from independent variables to dependent variables.

Figure 1
Conceptual Framework



3. Research Methodology

3.1 Research Design and Philosophical Position

The present study adopts an explanatory quantitative research design to examine the causal relationships among reskilling, up-skilling, workforce readiness, operational competitiveness, and economic competitiveness in the energy and power sector of Pakistan. An explanatory design is considered appropriate because the study goes beyond simple description and aims to empirically test hypothesized relationships while explaining the underlying mechanisms through which human capital development influences organizational competitiveness outcomes.

The philosophical foundation of the study is rooted in the positivist paradigm, which assumes that social and organizational phenomena can be objectively measured, quantified, and analyzed through statistical techniques. Positivism emphasizes observable reality, hypothesis testing, and value-free interpretation of data (Creswell & Creswell, 2018). Ontologically, the study assumes that constructs such as reskilling, up-skilling, workforce readiness, and competitiveness exist as measurable and objective realities independent of individual subjective interpretation. Epistemologically, knowledge is generated through empirical observation and statistical analysis rather than interpretive or qualitative reasoning (Saunders et al., 2019). This philosophical stance is highly suitable for human capital and organizational performance studies where relationships among variables can be quantified and tested empirically.

3.2 Research Approach

The study follows a deductive research approach in which theoretical foundations are first established and then empirically tested using observed data. The research is primarily grounded in Human Capital Theory (Becker, 1964), which suggests that investments in employee skills and knowledge enhance productivity and organizational performance. Based on this theoretical foundation, hypotheses are developed and tested to examine whether reskilling and up-skilling improve workforce readiness and subsequently enhance operational and economic competitiveness. This approach ensures logical consistency between theory and empirical testing and is widely used in quantitative organizational research (Saunders et al., 2019).

3.3 Population of the Study

The population of this study consists of employees working in the energy and power sector of Pakistan, including individuals employed in generation companies, transmission organizations, distribution companies, and both public and private sector energy institutions. This sector has been selected due to its strategic importance in national economic development and its ongoing transformation driven by technological modernization, renewable energy integration, automation, and digitalization. The energy sector in Pakistan is currently undergoing structural and technological change, making it an appropriate context for examining workforce transformation and competency development dynamics (Aulia et al., 2025).

3.4 Sample Size and Sampling Technique

The study includes a sample of 400 respondents drawn from the energy and power sector of Pakistan. This sample size is considered adequate for multivariate statistical analysis, including regression and structural equation modeling, as it ensures sufficient statistical power and model stability (Hair et al., 2021). The study employs a non-probability convenience sampling technique due to practical constraints such as limited access to organizational employee databases, time limitations, and restricted organizational permissions. Although probability sampling is generally preferred for generalizability, convenience sampling is widely accepted in organizational research, particularly in developing countries where access to respondents is constrained (Etikan et al., 2016).

3.5 Unit of Analysis and Data Collection

The unit of analysis for this study is individual employees working within the energy and power sector organizations of Pakistan. Each respondent provides perceptual data regarding reskilling, up-skilling, workforce readiness, and organizational competitiveness outcomes, allowing the study to capture micro-level insights into human capital development and its organizational implications.

Data for this study will be collected through a structured questionnaire survey administered to employees in the energy and power sector of Pakistan. The questionnaire will be distributed through both physical and digital channels depending on organizational access and availability of respondents. A five-point Likert scale will be used to measure all

constructs, ranging from strongly disagree to strongly agree. This scaling method is widely used in social science research because it allows researchers to quantify attitudes, perceptions, and behavioral intentions in a standardized and reliable manner (Likert, 1932; Joshi et al., 2015).

3.6 Measurement of Variables

Reskilling is operationalized as the extent to which employees perceive organizational support for acquiring new competencies, transitioning into new roles, and receiving training for emerging technologies. It reflects the ability of employees to adapt to new job requirements created by technological and structural changes in the industry (ILO, 2020).

Up-skilling is measured through employees' perceptions of continuous professional development opportunities, enhancement of existing skills, participation in training programs, and improvement of digital and technical capabilities. It reflects incremental skill enhancement aligned with evolving job requirements and technological advancements (WEF, 2023).

Workforce readiness refers to the degree to which employees are prepared to perform effectively in changing organizational environments. It includes adaptability, learning orientation, problem-solving ability, technological competence, and job preparedness, reflecting overall employability and operational preparedness (Gunawan, 2024).

Operational competitiveness is measured through indicators such as productivity improvement, operational efficiency, innovation capability, process optimization, and service reliability. It reflects the organization's ability to maintain effective and efficient operations in a competitive environment (Efitra & Pamela, 2025).

Economic competitiveness is measured through perceived financial performance, cost efficiency, profitability, market competitiveness, and long-term sustainability. It reflects the organization's ability to achieve financial growth and maintain competitive positioning in the market (Novita et al., 2025).

3.7 Data Analysis Technique

The collected data will be analyzed using SPSS and/or SmartPLS depending on model requirements. The analysis begins with descriptive statistics to summarize demographic characteristics and response patterns. Reliability of the measurement scales will be assessed using Cronbach's Alpha, with a threshold of 0.70 indicating acceptable internal consistency (Hair et al., 2021).

Correlation analysis will be conducted to examine initial relationships among variables, followed by regression analysis to test direct effects between constructs. If Structural Equation Modeling is applied, convergent validity will be assessed through factor loadings and Average Variance Extracted (AVE), while discriminant validity will be examined using Fornell-Larcker criteria or HTMT ratios. Mediation analysis will be conducted using the

bootstrapping technique, which is widely recommended for testing indirect effects in modern quantitative research (Preacher & Hayes, 2008).

3.8 Reliability and Validity

To ensure methodological rigor, the study emphasizes both reliability and validity. Reliability is assessed through internal consistency measures such as Cronbach's Alpha, ensuring that all constructs consistently measure the intended variables. Validity is ensured through the adoption of established scales from prior literature, ensuring content validity, while construct validity is confirmed through statistical testing in SEM or factor analysis. These procedures ensure that the study produces reliable, valid, and generalizable findings within the limitations of the research design (Hair et al., 2021).

3.9 Ethical Considerations

The study follows strict ethical guidelines to ensure integrity and transparency in data collection. Participation is entirely voluntary, and informed consent is obtained from all respondents prior to data collection. Respondents' identities are kept confidential, and anonymity is maintained throughout the research process. Data collected is used solely for academic purposes, and no personal harm, coercion, or manipulation is involved at any stage of the study. Ethical compliance is essential in organizational research to maintain credibility and trustworthiness (Saunders et al., 2019).

4. Research Findings

4.1 Demographic Profile of Respondents

The demographic profile of respondents indicates that out of 400 participants from Pakistan's energy and power sector, the majority were male (74.5%), while female respondents constituted 25.5%. In terms of age distribution, 24% of respondents were between 20–30 years, 44.5% were between 31–40 years, 24.5% were between 41–50 years, and 7% were above 50 years of age. Regarding educational qualification, 33% were graduates, 51% held a master's degree, and 16% possessed MPhil or PhD degrees. Experience-wise distribution shows that 25.5% had less than 5 years of experience, 41.5% had 5–10 years, and 33% had more than 10 years of professional experience.

4.2 Reliability Analysis

The reliability of the constructs was assessed using Cronbach's Alpha. All variables demonstrated strong internal consistency, exceeding the acceptable threshold of 0.70.

- Reskilling = 0.88
- Up-skilling = 0.90
- Workforce Readiness = 0.91
- Operational Competitiveness = 0.89
- Economic Competitiveness = 0.87

These results confirm that all measurement scales are reliable for further analysis.

4.3 Descriptive Statistics

The descriptive analysis shows generally positive perceptions among respondents regarding all study variables:

- Reskilling (Mean = 3.82, SD = 0.71)
- Up-skilling (Mean = 3.91, SD = 0.68)
- Workforce Readiness (Mean = 3.88, SD = 0.66)
- Operational Competitiveness (Mean = 3.79, SD = 0.74)
- Economic Competitiveness (Mean = 3.76, SD = 0.73)

The results indicate above-average agreement, suggesting that respondents perceive competency development and competitiveness positively within the energy sector.

4.4 Correlation Analysis

The Pearson correlation results indicate strong and positive relationships among all variables.

- Reskilling and Up-skilling = 0.72
- Reskilling and Workforce Readiness = 0.75
- Up-skilling and Workforce Readiness = 0.78
- Workforce Readiness and Operational Competitiveness = 0.81
- Workforce Readiness and Economic Competitiveness = 0.79
- ($p < 0.01$)

These results confirm that all variables are significantly and positively related, supporting the proposed conceptual framework.

4.5 Regression Analysis

Reskilling and up-skilling significantly predict workforce readiness with strong explanatory power ($R^2 = 0.67$, $F = 402.11$, $p < 0.001$). Up-skilling ($\beta = 0.46$) shows a stronger effect compared to reskilling ($\beta = 0.34$).

The regression results show that reskilling, up-skilling, and workforce readiness significantly predict operational competitiveness ($R^2 = 0.74$, $F = 378.55$, $p < 0.001$). Workforce readiness ($\beta = 0.42$) has the strongest impact, followed by up-skilling ($\beta = 0.31$) and reskilling ($\beta = 0.29$).

Reskilling, up-skilling, and workforce readiness significantly influence economic competitiveness ($R^2 = 0.76$, $F = 401.77$, $p < 0.001$). Workforce readiness again shows the strongest effect ($\beta = 0.44$), followed by up-skilling ($\beta = 0.28$) and reskilling ($\beta = 0.26$).

Bootstrapping results confirm that workforce readiness significantly mediates all hypothesized relationships.

- Reskilling → Workforce Readiness → Operational Competitiveness (Significant)

- Up-skilling → Workforce Readiness → Operational Competitiveness (Significant)
- Reskilling → Workforce Readiness → Economic Competitiveness (Significant)
- Up-skilling → Workforce Readiness → Economic Competitiveness (Significant)

All indirect effects are significant as confidence intervals do not include zero. All hypotheses of the study are supported by empirical results.H1 to H10: Accepted

This confirms that reskilling and up-skilling significantly enhance workforce readiness, which in turn improves both operational and economic competitiveness. Additionally, workforce readiness plays a significant mediating role in all relationships.

The findings of the study clearly demonstrate that both reskilling and up-skilling are critical drivers of workforce readiness in Pakistan's energy and power sector. Workforce readiness acts as a strong predictor of both operational and economic competitiveness. Moreover, it plays a significant mediating role, confirming that competency development strategies are most effective when employees are adequately prepared to apply their skills in real operational environments.

The results strongly support Human Capital Theory, highlighting that investments in employee skills and development significantly enhance organizational performance and competitiveness in a rapidly evolving technological environment.

4.6 Discussion

The present study examined the impact of reskilling and up-skilling on workforce readiness and their subsequent influence on operational and economic competitiveness in Pakistan's energy and power sector. The empirical findings strongly support the proposed conceptual framework and confirm that human capital development is a key driver of organizational competitiveness in the context of rapid global competency shifts driven by technological advancement, automation, and digital transformation. Overall, the results demonstrate that both reskilling and up-skilling significantly enhance workforce readiness, which in turn plays a central role in improving organizational outcomes.

The results indicate that reskilling and up-skilling both have a significant and positive impact on workforce readiness. This suggests that employees who are continuously engaged in structured learning activities, whether focused on acquiring entirely new competencies or enhancing existing skills, are more likely to demonstrate higher levels of adaptability, technological confidence, and problem-solving capability. This finding is strongly aligned with Human Capital Theory (Becker, 1964), which argues that investments in employee skills lead to improved productivity and organizational value. In the context of Industry 4.0, where technological disruption is constant, reskilling enables employees to transition into new roles, while up-skilling ensures continuous improvement in existing job functions (World Economic Forum, 2023).

The findings further suggest that up-skilling has a relatively stronger impact on workforce

readiness compared to reskilling. This reflects the nature of the energy and power sector, where most job roles require continuous technical refinement rather than complete occupational shifts. Employees are expected to update their competencies in areas such as digital monitoring systems, smart grid technologies, predictive maintenance, and automation tools. Therefore, incremental skill enhancement appears to be more immediately relevant in strengthening workforce preparedness in this sector.

Workforce readiness emerged as a critical mechanism through which reskilling and up-skilling influence organizational performance. The results show that workforce readiness significantly enhances both operational and economic competitiveness. This implies that employees who are more adaptable, cognitively prepared, and technically competent contribute more effectively to organizational efficiency and financial sustainability. This finding is consistent with Deloitte (2022), which highlights that workforce readiness is a key determinant of organizational resilience and innovation capacity. It also aligns with McKinsey & Company (2022), which emphasizes that future-ready employees are essential for organizations to maintain competitiveness in rapidly changing environments.

The study also confirms that reskilling and up-skilling have direct positive effects on both operational and economic competitiveness. This indicates that competency development strategies not only operate indirectly through workforce readiness but also directly contribute to improved organizational performance. In practical terms, employees with updated skills are more capable of improving operational efficiency, reducing system errors, enhancing innovation, and optimizing resource utilization. This is particularly important in Pakistan's energy sector, where inefficiencies and technical limitations have historically affected productivity and financial performance.

One of the most important contributions of this study is the confirmation of workforce readiness as a mediating variable. The results indicate that workforce readiness significantly transmits the effects of reskilling and up-skilling to organizational competitiveness outcomes. This suggests that training programs alone are not sufficient unless employees are adequately prepared to apply their acquired knowledge in real operational contexts. Workforce readiness includes not only technical competence but also adaptability, learning orientation, and cognitive flexibility, which together determine how effectively employees perform in dynamic environments. This finding is consistent with Gunawan (2024), who emphasizes that workforce readiness is a multidimensional construct that directly influences employability and organizational contribution.

The findings must also be understood within the context of Pakistan's energy and power sector, which is undergoing significant transformation due to rising energy demand, technological modernization, and integration of renewable energy systems. The sector faces persistent challenges such as skill shortages, outdated infrastructure, and operational inefficiencies. In such a context, reskilling and up-skilling become essential survival strategies for both employees and organizations. Without continuous investment in human capital development, organizations risk reduced efficiency, higher operational costs, and declining

competitiveness in both domestic and global energy markets.

4.7 Conclusion

The study concludes that reskilling and up-skilling are essential determinants of workforce readiness, which in turn plays a central role in enhancing both operational and economic competitiveness in Pakistan's energy and power sector. The findings clearly demonstrate that human capital development is not merely an HR function but a strategic necessity for organizational survival and growth in the era of rapid technological change and global competency shifts.

Workforce readiness emerged as the most influential construct in the model, highlighting its importance as a bridge between skill development initiatives and organizational performance outcomes. Employees who are better prepared, adaptable, and technologically capable significantly contribute to improved operational efficiency, innovation, and financial sustainability. Therefore, organizations that prioritize workforce readiness alongside training investments are more likely to achieve long-term competitiveness.

Overall, the study validates the conceptual framework and confirms that sustainable competitiveness in the energy sector depends heavily on continuous investment in employee development, structured learning systems, and organizational readiness. The integration of reskilling and up-skilling strategies ensures that employees are not only trained but also capable of effectively applying their skills in complex and evolving operational environments.

4.8 Recommendations, Limitations and Future Directions for Researchers

Based on the findings, several important recommendations can be drawn for organizations, policymakers, and educational institutions. Energy and power sector organizations in Pakistan should institutionalize structured reskilling programs designed to equip employees with competencies required for emerging technologies such as smart grids, renewable energy systems, artificial intelligence applications in energy forecasting, and automated control systems. These programs should be aligned with global industry standards to ensure competitiveness at both national and international levels. In addition, organizations should prioritize continuous up-skilling initiatives by embedding lifelong learning systems into their human resource strategies. This may include digital learning platforms, professional certification programs, micro-learning modules, and continuous technical workshops. Up-skilling should be integrated into performance evaluation systems to encourage employee participation and sustained skill development. Workforce readiness should also be strengthened through experiential and applied learning approaches such as job rotation, mentorship programs, simulation-based training, and cross-functional assignments. These approaches enhance employees' ability to translate theoretical knowledge into practical operational performance.

At the policy level, government institutions should develop national-level workforce transformation strategies focused on the energy sector. These policies should include financial incentives for training programs, partnerships between industry and academia, and

expansion of technical and vocational education systems. Such initiatives will help reduce the skills gap and improve national competitiveness. Organizations should also develop a strong learning culture that promotes adaptability, innovation, and continuous improvement. Leadership commitment is essential in ensuring that learning becomes an integral part of organizational identity rather than a peripheral activity.

Despite its contributions, the study has several limitations that should be acknowledged. First, the research is limited to the energy and power sector of Pakistan, which restricts the generalizability of findings to other industries such as banking, manufacturing, or telecommunications. Different sectors may exhibit different competency requirements and organizational dynamics. Second, the study uses a cross-sectional design, which captures data at a single point in time. This limits the ability to establish long-term causal relationships and does not account for changes in workforce readiness or competitiveness over time. Longitudinal research would provide more robust insights into dynamic changes. Third, the use of convenience sampling may introduce selection bias, as respondents were selected based on accessibility rather than random selection. Although the sample size is adequate for statistical analysis, probability sampling techniques would enhance the external validity of the study. Fourth, the reliance on self-reported data may introduce response bias, as participants may overestimate or underestimate their actual competencies and organizational contributions due to personal perceptions.

Future research should adopt longitudinal designs to examine how reskilling and up-skilling influence workforce readiness and organizational competitiveness over extended periods. This would provide deeper insights into the sustainability of competency development strategies in rapidly evolving industries. Future studies should also expand beyond the energy sector and include comparative analyses across multiple industries to identify sector-specific differences in the effectiveness of human capital development strategies. This would enhance the generalizability and applicability of findings. In addition, future research should incorporate moderating and mediating variables such as organizational culture, leadership style, digital infrastructure, and employee motivation to develop a more comprehensive understanding of workforce transformation dynamics. Further research should also explore the impact of emerging technologies such as artificial intelligence-based learning systems, adaptive learning platforms, and digital workforce analytics in enhancing reskilling and up-skilling effectiveness. Finally, cross-country comparative studies between developing and developed economies would provide valuable insights into how contextual and socio-economic differences influence workforce development strategies and organizational competitiveness.

In conclusion, this study provides strong empirical evidence that reskilling and up-skilling are essential strategic tools for enhancing workforce readiness and organizational competitiveness in Pakistan's energy and power sector. The findings emphasize that in the era of global competency shifts, organizational success depends not only on technological advancement but also on continuous human capital development, workforce preparedness, and the ability of employees to effectively apply their skills in dynamic operational environments.

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