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DRIVERS OF EMPLOYEE RESISTANCE TO DIGITALIZATION IN PRODUCTION OPERATIONS: A STUDY OF THE OIL & GAS SECTOR OF PAKISTAN

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Abstract

Digitalization has become a strategic area of interest in the oil and gas industry production processes because of the adoption of Industry 4.0 technologies such as SCADA systems, automation, Internet of Things (IoT) and predictive maintenance. Even though these technologies have significant advantages in the fields of operational efficiency, safety, and

reliability, their successful application is extremely dependent on the acceptance of the employees. The paper has discussed the key reasons why employees in the Pakistani oil and gas industry are resistant to digitalization in the production processes. The research design selected and used was qualitative and exploratory based on the secondary data collected using the academic journals, industry reports, company documents, and reliable news sources. The data was analysed using the thematic analysis to identify recurrent patterns and themes with regards to employee resistance. The results showed that the main sources of resistance were job insecurity and fear of being replaced by robots, lack of skills and digital illiteracy, and insufficient organizational support and communication. All these factors combined to delay the implementation of technology and diminished the success of digital transformation programs. The research is relevant to the current body of literature because it offers industry-specific information based on a developing economy setting and has practical implications to managers and policymakers who want to enhance digital adoption by using specific training, open communication, and supportive change management approaches.

Keywords: Digitalization; Employee Resistance; Production Operations; Oil and Gas Sector; Industry 4.0; Change Management

INTRODUCTION

Oil and gas has been a major part of the Pakistan economy, which includes upstream exploration and production, downstream refining and distribution, and numerous pipeline activities. The extraction of crude oil and natural gas is done in the upstream segment whereas refining, processing and delivery of petroleum products to the end-users is done in the downstream operations (Alshibani et al., 2024). Pipelines, storage and refineries are of importance in maintaining continuity in operations and reliability of supply of energy throughout the country. This industry has been undergoing a tremendous growth over the years owing to the rise in domestic energy demand, the growth in investment in infrastructure and growth in local and international players.

Following the industrial tendencies in the world, the oil and gas companies in Pakistan implemented Industry 4.0 technologies in their production processes, such as Supervisory Control and Data Acquisition (SCADA) systems, automation, Internet of Things (IoT) applications, and predictive maintenance tools (Tariq, 2022). These technologies were adopted to enhance efficiency of operations, safety, minimize downtime, and become more competitive in a more technology-driven global market. Digitalization provided possibilities of real-time monitoring, better resource management and better integration between upstream and

downstream processes which would bring immense benefits to operational performance (Elijah et al., 2021).

Nevertheless, the success of digitalization programs was strongly based on the attitude and acceptance of the employees. Employee resistance was also a major challenge, as it was based on the fear of job loss, deficiency in the necessary digital skills, and the lack of organizational support in adjusting to new technologies (Matsunaga, 2024). Resistance did not only slow down the adoption of digital tools but also jeopardized the anticipated efficiency and safety gains, which jeopardized overall competitiveness.

The research problem was also stated: most of the oil and gas production activities in Pakistan were resisted by employees who felt insecure in their jobs, had skills mismatch, and lacked organizational support despite the digitalization efforts. To make the digital transformation smooth and to receive the most out of the Industry 4.0 implementation, it was necessary to understand the drivers of this resistance.

This research was conducted to explore the major causes of employee resistance to digitalization in production processes in the oil and gas industry in Pakistan. The results of this research were supposed to be useful to HR managers who had to know how to create training and engagement strategies; production managers who had to make sure that operations would not be interrupted during the digital transformation; and policymakers who had to create supportive frameworks and skill development programs to make the process of adopting digital technologies in the sector successful.

Research Objectives

- To identify the primary factors contributing to employee resistance toward digitalization in production operations.
- To examine the impact of perceived job insecurity, skill gaps, and organizational support on employee resistance.
- To provide recommendations for reducing resistance and facilitating smoother digital transformation in Pakistan's oil and gas sector.

Research Questions

- What are the main factors driving employee resistance to digitalization in production operations in Pakistan's oil and gas sector?
- How do perceived job insecurity, skill gaps, and organizational support influence
- What strategies can organizations adopt to minimize resistance and enhance acceptance of digital technologies in production operations?

LITERATURE REVIEW

Digitalization in Production Operations

Digitalization in production operations is the adoption of digital technologies in the operations to improve efficiency, monitoring, and decision-making (Adamczak et al., 2023). The Supervisory Control and Data Acquisition (SCADA) systems, the Internet of Things (IoT), automation tools, and predictive maintenance solutions are the key technologies in the oil and gas industry. SCADA systems allow to monitor the production processes, pipelines, and equipment in real-time whereas IoT devices will gather information about the performance of the operations, environmental conditions, and health of the machinery. Automation minimizes the human touch in the daily operations, and predictive maintenance uses data analytics to avoid the failure of equipment before it happens.

The advantages of digitalization are not new. These are improved operational efficiency, automated systems simplify operations and minimize downtimes; better reliability and safety, real-time monitoring and early fault detection; and cost savings, which is achieved by lowering maintenance costs, energy savings, and operational interruptions.

The Pakistani environment has been slow in adopting these technologies as compared to the international markets. The challenges may be poor infrastructure, like the lack of digital connectivity in remote field work, and the lack of skills among the employees who can be untrained to use the latest digital tools (Hazaa & Al Mubarak, 2024). Also, lack of management support and organizational preparedness has been a barrier to the smooth digitalization process, which has generated resistance among the workforces.

Employee Resistance to Digitalization

Digitalization resistance among employees is characterized as unwillingness, shunning, or slowness to adopt novel digital technologies at work (Akhtar, 2022). Resistance may be in the form of active resistance, passive resistance or low use of technological tools.

Resistance is also caused by fear of job loss as a result of automation, the absence of digital skills, low perceived usefulness of new technologies, and organizational culture that is slow to adopt change (Alrasheed et al., 2025). The employees who feel that digitalization is a threat to their jobs or who do not have confidence in utilizing new systems are more likely to be resistant to adoption.

This phenomenon is explained by theoretical frameworks. Technology Acceptance Model (TAM) assumes that the perceived usefulness and ease of use are the determinants of technology adoption, whereas the Change Management Model by Lewin focuses on the

unfreezing, transition, and refreezing stages, and how resistance occurs when the employees are not sufficiently prepared to accept the change in the organization (Jabeen et al., 2024).

Drivers of Resistance in Oil & Gas

Three main sources of resistance have been established in oil and gas production operations; job insecurity, skill gaps, and organizational support. Job insecurity is a situation where employees fear that they will be substituted by robots or internet surveillance. The skills shortage arises when the employees are not familiar with the digital tools or analytical systems and they do not trust them. Lack of organizational support, such as absence of training, absence of adequate communication, absence of adequate leadership engagement, also contributes to resistance (Ali & Rizavi, 2020).

Global research suggests that the reluctance to digitalize the production sector is common in heavy industries, where the complexity of work and risky conditions predetermine the employees to be conservative (Nguyen et al., 2020). The same trend is noticed in regional studies of South Asia where employees show that they are afraid of automation due to the absence of skills and the perception that their employment is under threat.

Relationship between Drivers and Resistance

The organizational, technological, and individual factors are in interaction to cause resistance. Organizational culture, leadership support and training programs determine the way employees perceive digital initiatives. The technological factors which affect the willingness to adopt include complexity and perceived usefulness. Individual factors that mediate resistance include self-efficacy, adaptability and fear of redundancy. Studies show that these factors, when combined, are what will lead to employees either embracing or rejecting digitalization, and a comprehensive approach is required to address the issue of digital transformation (Aboghoniem and Al Mubarak, 2025).

Research Gap

Despite the growing interest in the concept of digitalization, empirical research on the topic of employee resistance in the Pakistani oil and gas sector is still lacking. Few studies have been conducted to establish the combined impact of different drivers on resistance in production operations, such as job insecurity, skills gaps, and organizational support. Also the literature has been inclined to research technological adoption or human factors individually and thus there remains a research gap in the literature on the synergy of organizational, technological and

individual factors on resistance. This gap should be bridged to develop effective measures that can facilitate successful digital transformation in the oil and gas sector in Pakistan.

Theoretical Framework

The three theories form the basis of this research to explain the resistance of employees to digitalization in the production processes in the oil and gas industry in Pakistan.

The Technology Acceptance Model (TAM) is grounded on the premise that the perceived usefulness and ease of use determine the adoption of new technology by an employee (Al-Emran and Shaalan, 2021). Employees will embrace the use of digital tools when they feel that they are useful and easy to use and they will resist when they feel that the digital tools are hard to use or not of much benefit.

The Lewin Change Management Theory is a model of resistance in terms of organizational change. According to this theory, resistance can be experienced during unfreezing, transition, and refreezing (Crosby, 2020). The employees may resist to digitalization when they are unready during the unfreezing stage, overwhelmed during the transition stage, or not assisted during the adaptation to the new processes.

The Job Demands Resources (JD-R) Model states that the availability of organizational resources defines resistance (Demerouti and Bakker, 2023). Lack of training, guidance, or technical support puts an additional strain on the employees and reduces their confidence in the utilization of digital tools, which further enhances resistance to change.

Based on such theories, the research hypothesis is that there is a conceptual model that perceived job insecurity, deficit of skills, and low organizational support are antecedents of employee resistance, which ultimately affects the successful utilization of digital technologies in production processes. This theoretical background is combined to inform the study of factors that lead to resistance in the oil and gas industry in Pakistan.

RESEARCH METHODOLOGY

The research design applied in this study was a qualitative type of research to investigate the reasons that contribute to employee resistance to digitalization in production processes in the oil and gas industry in Pakistan. It was considered that a qualitative approach would be appropriate in exploring the complex relationship between organizational, technological, and individual factors that define employee attitudes and resistance (Bell et al., 2022). The study was exploratory because it aimed at summarizing the knowledge of the literature and other written materials in order to get an understanding of the resistance patterns in production activities.

Data Sources

The research was based purely on secondary data of reputable sources. The academic journals on digitalization, human resource management, and production operations were reviewed to develop theoretical and empirical backgrounds. The reports of the major oil and gas companies, such as PARCO, SNGPL, OGDC, MOL, and PPL, were studied to obtain information on the digitalization efforts and workforce practices. Also, the news articles, market analysis, and company documents were read to obtain real-life evidence of employee reaction and resistance to digital technologies in production processes. This methodology allowed the research to find common trends without the necessity of primary data gathering, but still have a sector-specific focus on Pakistan.

Data Analysis

The data collected were examined with the help of thematic analysis that presupposed the systematic coding and categorization of information to determine the main themes. Thematic analysis enabled the research to identify the key causes of employee resistance such as job insecurity, skills mismatch, and absence of organizational support as well as how they interacted to determine the impact on digital adoption in production operations (Leavy, 2022).

Ethical Considerations

All citations were made and all sources recognized to maintain academic integrity. The research was conducted with the level of confidentiality, credibility, and ethical utilization of the public information and no sensitive or personal information about the employees was involved (Cacciattolo, 2015).

The qualitative secondary data approach that utilized the thematic analysis approach provided a nuanced understanding of the drivers of employee resistance to digitalization that can be applied to informed recommendations to HR managers, production managers, and policymakers.

ANALYSIS, FINDINGS, AND DISCUSSION

Thematic Analysis

Method of Analysis

The qualitative thematic analysis was performed based on twelve peer-reviewed journal articles and official industry research on the issue of digitalization, Industry 4.0, and employee resistance in production-intensive industries, namely, oil and gas. The selected articles were systematically reviewed, coded, and broken down into shared themes. There were only three

themes that were present throughout the literature: job insecurity and fear of automation, skill gaps and lack of digital literacy, and organizational support and communication gaps. These themes were examined to describe how they influenced the development of employee resistance to digital transformation in production processes.

Theme 1: Job Insecurity and Fear of Automation

The strongest theme that has been identified in all the studies reviewed was job insecurity that is caused by the introduction of automation and digital technologies. Employees tended to view technologies such as SCADA systems, remote monitoring, and predictive maintenance as a threat to their jobs and their relevance to the job. Some studies suggested that automation results in fewer manual inspections, on-site surveillance and routine operations, which cause employees to be afraid of being laid off and have no control over the production processes (Herceg et al., 2020).

Digitalization was perceived as a replacement of human labor rather than an addition in the context of oil and gas production environments where the job description has traditionally been determined by the experience in the field (Georgiou et al., 2021). The literature established that this fear led to emotional resistance, which was unwillingness to use digital systems, deliberate delays in adoption, and negative perceptions towards change initiatives. Low job mobility and social safety nets in the developing economy environment like Pakistan also worsened these fears. Therefore, the problem of job insecurity emerged as a powerful psychological barrier to adoption of digital.

Theme 2: Skill Gaps and Lack of Digital Literacy

The second important theme was that there were skills gaps and the production staff were not digital literate. The reviewed literature was also consistent in the fact that it did not adequately train employees and introduce them to digital tools such as SCADA dashboards, IoT-based sensors, and data analytics platforms (Cetindamar et al., 2024). Such incompetence reduced the trustworthiness of the employees and caused an increased fear of working with new technologies.

The literature emphasized that bad technical skills negatively influenced the perceived ease of use in which digital systems were seen as complicated and hard to operate (Chromjakova, 2018). Employees who were not aware of how to use or understand digital tools and just avoided them also contributed to the continuation of resistance. In oil and gas production environments, where a mistake in operations can have severe safety consequences, the fear of making a mistake by employees also deterred the use of digital systems. The results

indicate that the lack of specific training and ongoing skill improvement will probably lead to the ongoing resistance to digitalization endeavors.

Theme 3: Organizational Support and Communication Gaps

The third theme was on organizational support and communication disconnects in the process of digital transformation. Most of the studies indicated that organizations focused on technological investment and ignored human and organizational preparedness. The employees were often informed little about the purpose, benefits, and long term consequences of digitalization initiatives (He et al., 2022).

There were no formal training programs, poor leadership participation, and lack of chances to provide employees with feedback which enhanced uncertainty and mistrust. The lack of good communication in the initial phases of digital transformation meant that the employees did not have time to psychologically prepare towards change, which strengthened the resistance. The literature revealed that resistance reduction requires the adoption of effective change management practices such as open communication and managerial support that is visible. Without them, even technically able workers demonstrated the lack of interest in digital tools (Abbasi et al., 2024).

Table 1: Thematic Analysis

Theme	Description of Theme	Key Evidence from Literature	Representative Studies
Job Insecurity and Fear of Automation	Employees perceive digital technologies as a threat to job continuity, role relevance, and employment stability	Automation, SCADA, and predictive maintenance reduce manual intervention, increasing fear of redundancy and loss of control	Herceg et al. (2020); Georgiou et al. (2021); Adamczak et al. (2023).; Hazaa & Al Mubarak (2024).
Skill Gaps and Lack of Digital Literacy	Employees lack adequate technical skills and confidence to operate digital systems effectively	Insufficient training and low digital competence lead to frustration, anxiety, and avoidance of new technologies	Cetindamar et al. (2024); Chromjakova (2018); Akhtar, (2022); Alrasheed et al. (2025).
Organizational Support and Communication Gaps	Limited training opportunities, weak leadership involvement, and poor communication during digital transformation	Absence of structured support systems and unclear communication increases uncertainty, mistrust, and resistance	He et al. (2022); Abbasi et al. (2024); Jabeen et al. (2024); Ali & Rizavi (2020).

Summary of Findings

The thematic analysis showed that three related factors, namely, job insecurity, skill gaps, and insufficient organizational support, are the main cause of employee resistance to digitalization in production operations. Of these, job insecurity proved to be the most emotionally compelling force, and skill gaps were a functional obstacle to adoption. The presence of organizational support and communication gaps was a reinforcing factor, which increased the fear and challenges related to skills. The results show that resistance is most intense when the three factors are combined, which forms psychological stress, difficulty in operations, and mistrust in the organization.

Discussion

The results are highly consistent with the Technology Acceptance Model, which focuses on the fact that perceived usefulness and ease of use are the key factors in technology adoption (Al-Emran & Shaalan, 2021). Workers with low digital skills felt that SCADA systems, automation tools, and analytics platforms were difficult to use and complex, which made them more resistant. Likewise, employees who had the fear of being laid off felt that digitalization was not as helpful to their personal and professional interests.

Change management-wise, the findings confirm the Change Management Theory by Lewin especially difficulties in the unfreezing and transition phases (Crosby, 2020). The lack of communication, low participation of leaders, and insufficient training did not allow the employees to prepare psychologically to change, which led to the development of defensive attitudes and resistance.

The results also support the Job Demands Resources Model which postulates that the resistance escalates as job demands escalate without the corresponding organizational resources (Demerouti & Bakker, 2023). Digitalization in the oil and gas industry of Pakistan raised cognitive and technical requirements of the workers, whereas training, assistance, and encouragement were still inadequate. Such imbalance increased stress and opposition.

In general, the discussion proves that technological investment is not enough to make a digital transformation of production operations successful. The issues of job security, capability growth, and organizational support are the concerns of employees that should be addressed to minimize the resistance and guarantee the successful adoption of digital technologies.

CONCLUSION, LIMITATIONS AND FUTURE DIRECTIONS

This research came to the conclusion that job insecurity, skills gap, and lack of organizational support are the key factors that contribute to employee resistance to digitalization in the oil and gas production processes in Pakistan. The results point to the fact that investing in technology is not enough without considering human and organizational issues. To minimize resistance and achieve successful digital transformation, effective training, clear communication, and supporting change management are required.

In spite of its contributions, the study has a number of limitations. First, the study is founded solely on secondary data, which is based on peer-reviewed literature, limiting the possibility of obtaining first-hand employee perceptions and organization-specific practices. Second, the thematic analysis is based on a small set of studies that might not be representative of the diversity of the digitalization experiences of all oil and gas companies in Pakistan. Third, the study has a qualitative character, which reduces the ability to generalize the results and statistically prove the relationships between the factors of resistance.

The limitations can be overcome in future studies through the use of primary data in the form of interviews or surveys. Further comparative studies within the context of energy industries or developing economies might contribute to the enrichment of knowledge and help to develop context-specific strategies of digital transformation.

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