

THE ADKAR MODEL AND DIGITALIZATION IN PAKISTAN'S MANUFACTURING SECTOR: A CASE STUDY OF LUCKY CEMENT

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Abstract

This study investigates the impact of Green Human Resource Management (GHRM) practices on organizational sustainability in Pakistani manufacturing firms, focusing on the mediating roles of employee engagement and motivation. Drawing on the Resource-Based View (RBV) and Social Exchange Theory (SET), a quantitative PLS-SEM analysis was conducted using survey data from 250 managerial respondents in Sindh Province's textile sector. Results reveal a stark divide in GHRM efficacy: green recruitment ($\beta=0.472$, $T=10.241$) and green training ($\beta=0.272$, $T=3.794$) significantly enhance employee motivation and engagement, indirectly driving sustainability ($R^2=0.568$). Conversely, green performance appraisal (mean=2.90) and green reward systems (mean=4.20) show non-significant paths, indicating implementation failures and decoupled rewards. Mediation analysis confirms strong indirect effects via front-end practices, explaining 56.8% variance in sustainability outcomes. The study addresses literature gaps by empirically validating psychological mechanisms over direct effects, highlighting "fluffy rewards" and appraisal deficiencies in developing contexts. Theoretical implications refine RBV and SET for GHRM bundles; practical recommendations urge prioritizing recruitment/training investments and overhauling back-end systems. Limitations include cross-sectional design and conceptual mismatches with proposed green innovation mediation. Future research should adopt longitudinal, multi-source approaches to test innovation pathways.

INTRODUCTION

Digital transformation in manufacturing has been described as the introduction of modern technologies in the manufacturing process in order to increase efficiency, productivity, and flexibility. It has ceased to be an option but a requirement for companies that desire to compete favorably in the global market. With the advent of new technologies, such as Enterprise Resource Planning (ERP), Internet of Things (IoT), and Big Data, the method of manufacturing operations has been transformed. As Jabeen, Aakif, and

Afridi (2024) argue, digital transformation will enable firms to automate their production, improve the decision-making process with the assistance of data analytics, and work in real-time, which will ultimately raise the efficiency of the process. The increasing tendencies of digitalization of manufacturing industries in different regions of the world are a pointer to a global shift towards a greater integration of technological aspects. Those economies that have developed, such as the companies in Europe and

North America, have been the most front-runners of this development, yet the developing ones, such as Pakistan, are also beginning to realize the necessity of adopting such innovations (Batool et al., 2024).

However, the trends observed in the global arena suggest that a lot of positive changes have already been made, yet the manufacturing industries prevalent in Pakistan continue to face serious challenges, such as insufficient infrastructure, capital, and unskilled workers, which make it more difficult to accomplish the digitalization process (Nadeem et al., 2024). Lucky Cement is one of the manufacturing sectors in Pakistan that is the first to introduce digital changes, although it is under considerable pressure. A problem of financial constraint arises, and the technological infrastructure in the manufacturing sector in Pakistan, specifically the small and medium-sized enterprises (SMEs), makes it difficult to adopt digital technology (Siddique et al., 2022). Despite these challenges, the opportunities the digital transformation will present, such as the higher production efficiency, the higher quality control, and reduced cost of operation, are the directions that should be taken by businesses. The examples of the digital tools implemented by Lucky Cement, such as the IoT systems and the ERP systems, demonstrate the ways in which Pakistani companies manage to avoid these challenges and improve the functioning (Malik et al., 2024). However, as such a migration will require significant changes in both the technology process and the human exercise, it will require an adequate change management practice to be effective.

The management of change plays a crucial role in the smooth adoption of digital technologies, particularly in industries that have been quite hostile to change. Change management can be described as a methodological process of guiding people, the workforce, and organizations between their current state and a desired state in the future. Nasereddin (2025) mentions that the human factor of the digital transformation is the most difficult in many cases, and the employees are afraid of losing their jobs, not knowing how to use the new technologies, or simply because these

systems seem complicated. Consequently, it is essential to ensure this resistance is handled by effective communication, training, and engagement. One of the most popular models that is used to assist organizations in the process is the ADKAR model, which was created by Hiatt (2006). The model concentrates on five main stages, namely Awareness, Desire, Knowledge, Ability, and Reinforcement, which are critical in ensuring that the employees are not only willing to adopt new technologies but also in making sure that the employees are able to use the technologies to benefit. The model focuses on the need to match the attitudes and behavior of employees with the strategic goals of the organization, which is why it is extremely applicable to manufacturing companies, especially in such a country as Pakistan, where the workers might not be familiar with digital technologies (Darcy, 2021).

The applicability of the ADKAR model in the digital transformation process, particularly in manufacturing sectors, has been a well-known fact. The model can be used by companies to overcome human resistance by making the employees realize the necessity of the change, encouraging them to learn and use new technologies, and providing them with the skills needed to operate them (Mazikana, 2023). With the manufacturing sector in Pakistan having a low level of technological preparedness, the ADKAR model offers a systematic approach, the use of which helps companies organize the process of digital transformation of the workforce and prepare them to meet the new requirements. This is particularly in the case of firms that are in the process of a digital transformation, such as Lucky Cement, which have technological, financial, and organizational limitations, even though they are undertaking the digital transformation process. The model not only facilitates overcoming resistance but also contributes to strengthening the change in the long run, which will make digital technologies become adopted successfully and sustainably. The ADKAR model implementation in Lucky Cement began with the establishment of awareness of the necessity to be digitalized. Batool et al. (2024) also mention that awareness should be created among the staff, especially in areas

where employees may not know about the benefits of using digital tools in the beginning. Lucky Cement reacted to this by telling them of the benefits of digitalization in the long term, such as employment security, as it will be efficient in running its operations and will not require a lot of manual work. This was followed by the establishment of a need to embrace digital change amongst the employees. Connecting the idea of digitalization with the personal and organizational development prospects, Lucky Cement could encourage its staff to be active participants in the change process (Malik & Imran, 2022). The firm then concentrated on imparting knowledge and skill through carrying out intensive training to its employees. The purpose of this training was not only to introduce technical skills but to make sure that the employees were able to learn how to use new tools with the least amount of impact on production (Soomro et al., 2024).

Literature Review:

The digital transformation can be characterized as the introduction of new modern technologies in the production process in order to make it more efficient, cost-effective, and flexible (Jones et al., 2021). It also involves the application of digital technology such as Enterprise Resource Planning (ERP), Internet of Things (IoT), Artificial Intelligence (AI), and Big Data that are applied in one way or another in the manufacturing process. ERP systems help in the coordination of various operations of manufacturing firms and can plan resources more easily and make decisions on the spot (Duraivelu, 2022). The IoT devices, including them, enable predictive maintenance and real-time monitoring, which is important to minimize downtime and optimize the operation (Chirumalla et al., 2025). AI and Big Data can also enhance manufacturing by providing hints that may be utilized to improve manufacturing operations, personalize manufacturing, and control the supply chain effectively (Zhang et al., 2023).

These technologies also enact work automation in addition to generating action information to enable firms to remain competitive in an increasingly globalized market. Digital

transformation is not an easy process. Ghobakhloo and Iranmanesh (2021) state that the development of manufacturing organizations and, in particular, SMEs has significant challenges, they are financial limitations, the lack of professional staff, and aversion to changing the situation. Advanced countries in the world have embraced the aspect of digitalization as businesses are embracing high-tech technologies to increase their efficiency when it comes to operations. On the other hand, there are still challenges related to digital infrastructure and the readiness of human resources in the developing countries, including Pakistan. But there are companies in the country, such as Lucky Cement, that are beginning to embrace such technologies, and this will provide a good case study to overcome such hurdles.

According to Abdallah et al. (2021), digital transformation success in the manufacturing industry depends not only on the technological readiness but also on the organization's ability to cope with the human factor of change. Continuing on the aspect of transition to digitalization, Roblek et al. (2021) mark the place of digital transformation as a disruptive innovation in small and medium-sized businesses (SMEs). These businesses tend to hesitate to adopt new technologies because they feel that they are too expensive and dangerous. Nonetheless, the adoption of Industry 4.0 technologies is perceived as a requirement for long-term competitiveness. This correlates with the results of Abdallah et al. (2021), who also state that SMEs have to be digitally prepared in order to survive and prosper in the digital era.

2.2.2 CHANGE MANAGEMENT AND ITS IMPORTANCE.

Change management refers to a process that assists organizations in coping with the process of transitioning between two states. It concentrates on training and assisting people in the organization to fit into the new modes of operation. This has been of utmost importance in the light of digital transformation, where employees may develop disruption, resistance, and uncertainty with the introduction of new technologies. Two of these models are Kotter's 8-

Step Process (Kotter, 1996) and the Change Management Model by Lewin (Lewin, 1947), which are two of the most popular change management models in organizations. These models underline the significance of establishing a sense of urgency, engaging the employees in the change process, and solidifying the change through constant support. Another common change management model, which pays attention to the human element of change, is called the ADKAR model and was developed by Hiatt (2006). ADKAR is an abbreviation that means Awareness, Desire, Knowledge, Ability, and Reinforcement, and its stages are the stages that the individuals pass through in order to accept and effectively adopt change.

As stated by Jones et al. (2021), the ADKAR model will be effective in the context of digital transformation as it can help employees deal with the emotional and cognitive stages of technological adoption. The Awareness level informs employees about the necessity to change. During the Desire stage, they are inspired to help the transformation. Knowledge and Ability are concerned with skill formation, as it is necessary to make sure that the employees are able to operate the new technologies properly. Lastly, to make the change long-term, there is the element of Reinforcement. Human factor is considered to be the most difficult part of the digital transformation. Duraivelu (2022) states that the sources of resistance to change include fear of job loss, distrust of new technologies, and the discomfort of new systems. This is a major threat to the use of digital tools in the manufacturing setting. According to Abdallah et al. (2021), such models of change management as ADKAR can alleviate such problems by influencing the emotional and psychological obstacles that employees experience when switching to digital transformations.

CURRENT STATE OF DIGITALIZATION IN PAKISTAN

The implementation of digital transformation in the manufacturing industry in Pakistan has encountered many obstacles that make the scale of deploying the advanced technology difficult to

achieve. Mushtaq et al. (2023) indicate that financial constraints are among the biggest impediments since most small and medium-sized enterprises (SMEs) do not have the money to allocate to the costly digital tools like an ERP system and the internet of things (IoT). The expensive nature of these technologies, together with the low returns in the short term, makes it hard to justify the investment on the part of manufacturers. Moreover, another problem is that the lack of adequate infrastructure, like a stable internet connection and electricity, complicates the implementation of digital solutions (Sultan & Tabassam, 2023). The manufacturing industry in Pakistan is also overly dependent on the use of outdated machinery and manual operations, which complicates the process of switching to digitalization further (Annan et al., 2024).

THE ROLE OF TECHNOLOGY IN MANUFACTURING

The technologies that are at the core of transforming the production processes in Pakistan include ERP systems, IoT, and automation. According to Nureen et al. (2023), ERP systems are significant in integrating various business operations, such as procurement, inventory control, and production planning (Sajjad et al., 2023). The IoT technology is another important driver of digital transformation in the manufacturing industry. Connected machines, along with other devices, which make part of an IoT, enable real-time monitoring of equipment and production lines, and lead to predictive maintenance and reduced downtime, as well as increased efficiency (Annan et al., 2024). The use of IoT in Pakistan is at an infantile stage, and the potential of streamlining operations by means of these technologies is immense. Pakistani manufacturers can also improve their quality control, visibility of the supply chain, and energy utilization with the assistance of IoT (Shoukat et al., 2023).

Large-scale manufacturers are also increasingly adopting automation and robotics in Pakistan. These technologies can facilitate accuracy, speed, and consistency in production and avoid the use of human labor, as well as human error. In spite

of this, the importance of technology in improving the performance of manufacturing companies in Pakistan is gaining popularity. Kanwal et al. (2024) observe that to enhance the global competitiveness of Pakistani manufacturers, digital transformation is necessary, especially with the industries in the world shifting towards Industry 4.0 technologies.

ADKAR MODEL: OVERVIEW AND THEORETICAL FOUNDATIONS.

The ADKAR model is one of the most popular change management models that was developed by Hiatt (2006) to help individuals and organizations go through the process of transformation. ADKAR is an acronym signifying the five most crucial components of the model, which are Awareness, Desire, Knowledge, Ability, and Reinforcement. The first phase of the ADKAR model is awareness, in which individuals have to be made aware of the necessity of change. Ali et al. (2021) state that the creation of awareness entails informing employees, who need to understand the rationale behind the necessity of the transformation and how it contributes to the strategic goals of the organization. This is an important phase, which will assist in clearing confusion or ambiguity regarding the aim of the change. After creating awareness among employees, the second process is to create Desire—the process where individuals get personal drive to contribute and participate in the change. According to Hiatt (2006), employees need to perceive that the change will benefit them either in terms of career advancement, job security, or increased productivity.

The third level, Knowledge, is concerned with the provision of information and training needed to enable the employees to appreciate how the change will take place. Employees must also be given skillsets and knowledge to apply the new technologies or adjust to the new processes (Kaminski, 2022). The next stage is Ability, during which one is supposed to apply his/her new knowledge in actual real-life situations. The focus of this stage is on practical training and practice to make sure that employees are able to translate what they have been taught into their work. Lastly, the Reinforcement makes sure that the change is

maintained in the long run. As pointed out by Osolase et al. (2022), the reinforcement is to acknowledge achievements, give feedback, and support employees all the time to adapt to the new systems or processes.

ADKAR IN THE CONTEXT OF PAKISTAN'S MANUFACTURING SECTOR

The ADKAR model of change management is a human-based model of change management that is particularly relevant in situations involving the manufacturing sector in Pakistan, where the country expects to embrace the digital transformation. The ADKAR model is convenient as a possible remedy to the resistance to digital transformation in Pakistan, where the traditional manufacturing processes are still the leading ones. Ali et al. (2021) state that the attitudes of the employees to change are heavily impacted by the cultural factors, such as the high degree of the hierarchical organization structure and the significance of job security. The creation of awareness will require educating the employees on the importance of digital transformation, not only to the company but to them as individuals in pursuing their career development and job security. It supports the findings of Batool et al. (2024), who also underline the importance of determining the organizational interests and aligning them with the interests of the employees in order to facilitate a positive attitude towards change.

The applicability of ADKAR is also supported by the fact that this framework is culture and organization-specific to Pakistan. According to Siddiqui et al. (2022), the manufacturing industry of Pakistan is mainly dominated by SMEs that are resource-constrained and unwilling to invest in digital technologies. The issue that has become common with such companies is the absence of infrastructure, lack of financial resources, and a workforce that is not well-skilled in digital solutions. The ADKAR model in this type of environment provides an organized manner in which the management and the employees undergo the process of change. The model can help in addressing the human resistance to novel

technologies, which is typically the key impediment to digital adoption in the sector. Moreover, the problem of an unskilled labor force is usually forced upon manufacturing companies in Pakistan, and the implementation of complex digital technologies, such as ERP systems, IoT, and automation devices, is difficult. As stated by Quiroz-Flores et al. (2023), the possibility of ensuring that the workforce possesses the necessary knowledge and skills to successfully use the new technologies is one of the biggest problems within the framework of digital transformation. This issue is directly conscious of ADKAR, and it provides a straight path to knowledge acquisition. The knowledge step of the ADKAR model is particularly relevant in this case, as it offers the degree of satisfaction that the staff is trained to use the new systems and tools in the right manner. This is necessary in a nation such as Pakistan, where workers in the traditional manufacturing jobs are not digitally literate.

RESEARCH OBJECTIVES

1. Assess the application of the ADKAR model in Lucky Cement's digital transformation.
2. Evaluate the impact of the ADKAR model on operational efficiency and employee adaptability.
3. Provide recommendations for other manufacturing companies in Pakistan

PROBLEM STATEMENT

The manufacturing industries in Pakistan have been struggling with the implementation of digital technologies, which are very significant in enhancing efficiency and competitiveness. Digitalization does not necessarily apply to the manufacturing companies in Pakistan because there are myriad impediments to digitalization, such as inappropriate infrastructure, funds, and unskilled labor. It is also noticed by Nadeem et al. (2024), and can result in a digitalization barrier in developing countries such as Pakistan because of a lack of technological preparedness and the right training programs. Specifically, manufacturing companies are not predisposed to spending on new technologies due to the high initial costs and the risk of destabilizing established processes

(Siddique et al., 2022). According to Malik et al. (2024), despite the introduction of digital technology, such as Enterprise Resource Planning (ERP) and Internet of Things (IoT), the gap in skills between employees is quite considerable, and therefore, employees are quite resistant. This issue is also increased by the lack of awareness about the positive aspects of digitalization, as there is a possibility that the employees themselves will not be able to perceive the merits of using the new technologies (Batool et al., 2024).

These problems are aggravated by the absence of a systematic change management approach. In Pakistan, companies that are involved in the manufacturing sector tend to be very keen on technological aspects of the digital transformation and neglect the human aspect of the latter. Batool et al. (2024) state that digitalization efforts cannot succeed unless the need to prepare and attract employees is taken into account. The staff will also not understand the need to change without guidance and encouragement, and they will lack the competencies to utilize and embrace the new technologies. This lack of efficiency of change management strategies was proven by the example of Lucky Cement, one of the largest Pakistani manufacturers, as the company had to face some major problems connected with the implementation of digital technologies, such as Enterprise Resource Planning (ERP) and Internet of Things (IoT) systems (Malik & Imran, 2022). As the company attempted to invest in technology, the employees had high resistance since they were not adequately prepared to adapt to the digital transition, leading to delays in implementation and poor usage of the novel systems.

GAPS IN LITERATURE

Despite the fact that the theme of change management models, including the ADKAR application in the digital transformation within various industries, is becoming increasingly popular, the literature gap is significant, with the manufacturing industry in Pakistan being left out. A significant gap to be filled is the underutilization of the ADKAR model in the digital transformation of manufacturing companies in Pakistan. The model has been effectively applied

in other sectors around the world, but little has been applied to its use within the framework of the manufacturing sector in Pakistan. According to Ali et al. (2021), ADKAR has been successful in making change happen within an organization that has gone through the digital transformation, but it has not been widely used in manufacturing, particularly in developing nations like Pakistan. This is an opportunity to conduct more studies on how ADKAR can be implemented in the manufacturing industry in Pakistan to facilitate digital transformation, especially since the industry has its own set of challenges.

Hypotheses:

H1: The application of the ADKAR model at Lucky Cement improved employee readiness for digital transformation.

H2: Digitalization has positively impacted operational efficiency at Lucky Cement.

H3: Awareness: Increased awareness of the need for change leads to greater acceptance among employees.

METHODOLOGY

This study utilized an exploratory and descriptive research design because the two methods are especially adequate when exploring a phenomenon that has not been researched thoroughly with reference to the particular sector of manufacturing in Pakistan. The study was intended to investigate and explain the application of the ADKAR model in the digital transformation process in Pakistani manufacturing companies. The adoption of digital transformation in the manufacturing industry is a relatively new and complex process in Pakistan, and there is a lack of empirical studies regarding how the change management models, namely ADKAR, can be used to address the challenges related to digitalization.

A qualitative and quantitative approach was the secret underlying the more in-depth insights into the complex process of digital transformation and change management in the manufacturing industry. Since the qualitative methods provided sufficient information on the human and organizational dynamics of the change, the

quantitative methods aided in establishing the information that was provided by the qualitative methods using statistical data. The qualitative data provided a voice to both the employees and the managers, as it recorded their experiences with the ADKAR model and how it has influenced them to overcome resistance, engage the employees, and make digital transformation initiatives successful. The philosophical research approach was pragmatism. Pragmatism refers to a school of thought that stresses the practical resolutions, and it is concerned with the application of research in solving real-world problems. Pragmatism was selected in the context of this research as it enables the use of both qualitative and quantitative methods since there are various perspectives and approaches that could offer crucial information to the research problem.

POPULATION AND SAMPLING

This study was targeted at the employees and management of manufacturing companies in Pakistan, namely those who have experienced or are experiencing the process of digital transformation. It prioritized both the small and medium-sized enterprises (SMEs) and large manufacturing businesses because Pakistan is usually different in its digital transformation journey based on the size, resource, and type of industry of the business. The presence of both kinds of firms helped to make sure that the scope of experiences and challenges associated with implementing the ADKAR model under the impact of digitalization was observed. Pakistan has a very varied manufacturing industry with various types of industries like textiles, cement, chemicals, and metalworking, among others.

Sampling Method

The sampling method used in this study was purposive sampling since the research question was a specific one. Purposive sampling will enable the researcher to select subject participants who are well informed on the topic of study and will give detailed information on the research objective. Because the research was aimed at the exploration of the role of the ADKAR model in the digital transformation of manufacturing

companies, it was necessary to find individuals directly engaged in the implementation process of digital tools or familiar with the change management process in their companies.

The participants selected for the study included key stakeholders such as:

Management personnel: Senior managers, HR managers, IT managers, and change agents responsible for overseeing digital transformation and change management efforts.

Employees: Operational workers, supervisors, and team leaders who have been involved in the day-to-day use of new digital tools and systems.

Industry Type: The study included manufacturing firms across various industries such as cement, textiles, chemicals, and metalworking, reflecting the diversity within Pakistan's manufacturing sector.

Readiness for Digital Transformation: Firms were selected based on their current or recent efforts to implement digital transformation initiatives. This included firms that had either completed or were in the process of adopting ERP systems, IoT, automation technologies, or similar digital tools.

The questionnaires were distributed among employees who were employed in production, maintenance, IT and administration departments of Lucky Cement (350 in total). Of these 312 were validated to have been returned, which is an 89.14% response rate. Following the elimination of missing values and repetitive answers, 298 responses were selected as viable to analyse and this provided an effective response rate of 85.14%. This response rate shows that there was high participation of employees and that makes the findings reliable.

Table 1: Survey Distribution and Response Rate

Category	Frequency	Percentage
Distributed questionnaires	350	100%
Returned questionnaires	312	89.14%
Usable questionnaires	298	85.14%

Note. Percentages are based on total distributed questionnaires

Table 2 Demographic Characteristics of Respondents

Variable	Category	Frequency	Percentage
Gender	Male	256	85.9%
	Female	42	14.1%
Age	20-25 years	38	12.8%
	26-30 years	79	26.5%
	31-35 years	92	30.9%
	36-40 years	52	17.4%
	Above 40	37	12.4%
Education	Intermediate	34	11.4%
	Bachelor's	158	53.0%
	Master's	97	32.6%
	Other (Diploma/Technical)	9	3.0%
Department	Production	104	34.9%
	Maintenance	79	26.5%

Variable	Category	Frequency	Percentage
	IT & Digital Systems	47	15.8%
	Administration	68	22.8%

NORMALITY ASSESSMENT

Skew and kurtosis were used to measure the normality of constructs.

PLS-SEM does not assume normally distributed data, but normality tests give an idea of how the data behave. **Skewness values were found to lie between -1.10 and +0.98. Kurtosis values were found to lie between -1.35 and + 1.22.**

COMMON METHOD BIAS (CMB)

The Harman Single Factor Test was done since all the data were self-reported. The first factor explained **36.2 percent of variance**, which is less than 50 percent, meaning that there was not a significant concern with common method bias.

Construct Reliability and Convergent Validity

Construct	Cronbach's α	CR (rho_a)	CR (rho_c)	AVE
ADKAR Model	0.915	0.917	0.932	0.663
Digitalization	0.799	0.799	0.869	0.625
Employee Readiness	0.862	0.871	0.906	0.707
Operational Efficiency	0.747	0.756	0.840	0.568

Note. CR = Composite Reliability; AVE = Average Variance Extracted.

All constructs achieved AVE values above 0.50, confirming **convergent validity**.

Internal consistency reliability was assessed using **Cronbach's Alpha** and **Composite Reliability (CR)**. All constructs demonstrated excellent reliability, with Cronbach's Alpha values above 0.70 and CR values above 0.80, meeting the criteria established by Hair et al. (2021). These results confirm that the items consistently measure their respective constructs.

5 Outer Loadings of Constructs

Indicator	Loading	T-value	p-value
ADKAR1	0.751	26.06	.000
ADKAR2	0.794	33.42	.000
ADKAR3	0.834	54.35	.000
ADKAR4	0.850	52.90	.000
ADKAR5	0.853	66.60	.000
ADKAR6	0.752	31.59	.000
ADKAR7	0.859	59.41	.000
D1	0.720	22.95	.000
D2	0.811	31.45	.000
D3	0.841	48.52	.000
D4	0.786	32.73	.000
ER1	0.818	44.30	.000

Indicator	Loading	T-value	p-value
ER2	0.815	36.85	.000
ER3	0.848	56.74	.000
ER4	0.880	77.01	.000
OE1	0.794	39.49	.000
OE2	0.768	25.12	.000
OE3	0.770	26.63	.000
OE4	0.677	17.87	.000

Note. All loadings exceed the acceptable threshold of 0.70 except OE4, which was retained due to acceptable AVE and CR

DISCRIMINANT VALIDITY

Discriminant validity was assessed using the **Heterotrait-Monotrait Ratio (HTMT)**. All HTMT values were below 0.85, confirming that each construct is empirically distinct.

Table 6 HTMT Discriminant Validity Matrix

Construct	ADKAR	Digitalization	Employee Readiness	Operational Efficiency
ADKAR	–	0.481	0.560	0.677
Digitalization	–	–	0.473	0.540
Employee Readiness	–	–	–	0.748
Operational Efficiency	–	–	–	–

Note. All HTMT values < 0.85, satisfying discriminant validity.

R² and Adjusted R² Values

Construct	R ²	Adjusted R ²
Digitalization	0.574	0.573
Employee Readiness	0.557	0.555
Operational Efficiency	0.483	0.479

Note. R² values of 0.25 = weak, 0.50 = moderate, 0.75 = substantial (Hair et al., 2021).

The ADKAR model explains **57.4%** of the variance in Digitalization – a **moderate to strong** effect. The ADKAR model explains **55.7%** of Employee Readiness – again **moderate to strong**. Together, ADKAR, Digitalization, and Employee Readiness explain **48.3%** of the variance in Operational Efficiency – a **moderate** effect. These results confirm that the ADKAR model significantly contributes to enhancing digitalization and employee readiness, both of which subsequently improve operational efficiency.

Model Fit Summary

Fit Index	Saturated Model	Estimated Model
SRMR	0.066	0.074
Chi-square	677.001	687.129
NFI	0.864	0.862

- **SRMR = 0.074**, demonstrating a good fit between the theoretical and empirical models.
- **NFI = 0.862**, above the recommended threshold of 0.80, supporting model adequacy.

- Chi-square values are acceptable and expected to be higher in large-sample SEM. Overall, the model demonstrates a strong and theoretically consistent fit.
- **Path Coefficients (Direct Effects)**

Relationship	β (Original Sample)	t-value	p-value
ADKAR → Digitalization	0.418	9.658	.000
ADKAR → Employee Readiness	0.506	12.763	.000
ADKAR → Operational Efficiency	0.306	6.378	.000
Digitalization → Operational Efficiency	0.140	3.109	.002
Employee Readiness → Operational Efficiency	0.404	8.150	.000

Specific Indirect Effects

Mediation Path	β	t-value	p-value
ADKAR → Employee Readiness → Operational Efficiency	0.205	6.424	.000
ADKAR → Digitalization → Operational Efficiency	0.058	2.991	.003

Note. All indirect effects significant at $p < .05$.

HYPOTHESIS TESTING

Based on the significance of the direct and indirect effects, all hypotheses proposed in the conceptual framework were tested. The criteria for accepting a hypothesis were: $p\text{-value} < .05$, $t\text{-value} > 1.96$, standardized coefficient in expected direction.

Table 12 Summary of Hypothesis Testing

Hypothesis	Statement	Supported?
H1	ADKAR → Digitalization	Yes
H2	ADKAR → Employee Readiness	Yes
H3	ADKAR → Operational Efficiency	Yes
H4	Digitalization → Operational Efficiency	Yes
H5	Employee Readiness → Operational Efficiency	Yes
H6	ADKAR → OE (mediated by Employee Readiness)	Yes
H7	ADKAR → OE (mediated by Digitalization)	Yes

Interpretation

All hypotheses were supported, demonstrating the strong influence of the ADKAR model on enhancing digital transformation, boosting employee readiness, and ultimately improving operational efficiency at Lucky Cement.

Conclusions:

The main research results prove that the ADKAR model of change management plays a crucial role in the achievement of the results of digital transformation in Lucky Cement. The findings of the empirical analysis indicate the usefulness of the model to promote the preparedness of employees, digital adoption, and operational

efficiency. These results are good evidence of the conceptual model of change management with organizational performance within the digitally developing manufacturing environment.

The research concluded that the statistically significant and strong influence of the ADKAR model on digitalization in Lucky Cement exists. Having a path coefficient ($\beta = 0.418$) and a large t-value, the relationship proves that structured change management has a positive effect on the process of adopting and integrating digital technologies. This can also be related to the theoretical basis of the literature review, as scholars like Malik and Imran (2022) and Batool et al. (2024) have highlighted that companies in

developing nations find it difficult to digitalize, mostly because of resistance to change and the unawareness factor. These arguments, combined with the empirical evidence that awareness, desire, knowledge, ability, and reinforcement, which are the fundamental foundations of the ADKAR framework, play a critical role in determining technological adoption.

The establishment of awareness made employees realize the need for digitalization, and the desire aspect inspired employees to embrace digital programs. Knowledge and ability provided them with the ability to acquire the required skills to use digital tools, and reinforcement brought about sustainability. These results prove the idea that only technology does not work, as it needs to be integrated into a human-based change management concept. It is found in accordance with the international literature in which change management is regarded as a vital success factor in the implementation of digital transformation (Nasereddin, 2025; Darcy, 2021). The relevance of the ADKAR model to Lucky Cement demonstrates that, even in a situation characterized by financial limitations, lack of skills, and poor technological readiness, a thorough approach to the change process can make the digital transformation much faster.

Conclusively, the research confirms that the ADKAR model is a very effective model that can be used to facilitate digital transformation in the manufacturing organization. It contributes greatly to digitalization and employee preparedness, which consequently optimizes the working performance. The results highlight the value of the holistic approach to the digital transformation that is not limited to the technological investments but also the profound sense of human-centered change management. Since organizations in Pakistan and other developing economies are still adopting digital technologies, the incorporation of formalized models of change management, such as ADKAR, will be instrumental in achieving long-term success.

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