

The Moderating Effect of Digital Leadership on The Factors Affecting Organizational Sustainability in The Engineering, Electrical and Information Technology Industry

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Abstract: The purpose of this study is to examine factors that impact the sustainability of the organizations in the engineering, electrical and information technology in Jordan and examine the moderating role of digital leadership. The data of 396 leaders were collected and analyzed using the quantitative approach and PLS-SEM. The results reveal that the factors of technology, organization, and environment have significant effects on organizational sustainability, with AI complexity being the one that does not show any significant direct effect. They are most important organizational factors with internal ability being the most important. Digital leadership has a significant moderating effect on most relationships, strengthening positive relationships, and weakening or even turning negative relationships positive, but not having an impact on the relationship between regulatory pressure and sustainability. The model explains 79.8% of the variation in organizational sustainability ($R^2 = 0.798$).

Key-Words: - Organizational Sustainability, Artificial Intelligence, Digital Leadership, TOE Framework, PLS-SEM, Jordan

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1 Introduction

Organizational sustainability helps an organization sustain its activities, attain strategic goals, and be successful in the long run. It is more than just about short-term performance, it is about long-term value, operation, satisfaction and adaptation to changing market and environmental conditions [1]. In an era of rapidly evolving markets, technological advancements and regulatory changes, firms that integrate sustainability into their business models are more likely to be competitive, viewed positively by stakeholders, and to have long-term growth and resilience [2], [3].

Jordan's Engineering, Electrical and Information Technology (EIWTS) Industry Sector plays a key role in the economic development of the Kingdom, contributing significantly to GDP, employment and infrastructure development. This sector is comprised of industries vital to Jordan's export potential and industrial growth -manufacturing, construction, chemicals, and engineering services [4]. Despite this, the industry continues to confront persistent challenges which include expensive process costs, inability to access cutting-edge technologies and the overreliance on imported forms of energy. These obstacles limit the efficiency of operations and long-

term competitiveness of the industry and place greater emphasis on the need for industry participants to become more environmentally and socially responsible with their operations to maintain their competitive position in a very competitive industry [5].

According to the Jordan Chamber of Industry (2025), Jordan's Engineering, Electrical, and Information Technology Industries Sector has continued to make a distinguished mark in local and international markets in recent years and has made a significant and clear contribution to the national economy. The sector encompasses a wide range of advanced industries, most notably household electrical appliances, air conditioning and refrigeration, motors and lifting equipment, wires and cables, technological and electronic products, metal forming, metal structures, industrial machinery and equipment, as well as jewelry [6]. According to [7] report, the sector represents around 12 per cent of the Kingdom's total manufacturing output and contributes about 1.6 per cent to the gross domestic product (GDP), while providing over 35,000 direct job opportunities through around 4,800 industrial facilities, while the sector witnesses diversification in its export markets, led by the US with 45 per cent of exports, followed by Iraq at 11.3 per cent, Saudi

Arabia at 7.8 per cent, and the United Arab Emirates at 3.8 per cent.

2 Literature Review

Although strategically important, the Jordanian Engineering, Electrical and Information Technology Industry Sector has been reluctant to incorporate sustainability in its mainstream practices. Despite the rise of these new sustainability business models, many organizations do not have a clear and common sustainability framework, regularly track performance, and have the digital infrastructure to drive and support innovation and long-term planning [8].

Artificial Intelligence (AI) is a revolutionary force to improve efficiency, innovation, and decision-making in organizations. AI can be used in the Jordanian Engineering, Electrical, and Information Technology Industry sector to streamline processes, optimize resources, and support evidence-based initiatives that contribute to the sustainability of the organizations [9]. While these are all advantages of AI, there are also limitations because of factors including system complexity, incompatibility with existing systems, and technical authorization. These are important to address and mitigate in order to optimize the use of AI in an organization and achieve long-term sustainability [10].

AI Compatibility is the degree to which the AI systems are able to interface with an organization's processes and systems. The compatibility of AI in Engineering, Electrical, and IT sector is the answer to the reduction of resistance and efficiency gains in the long haul of sustainable development. Businesses with more aligned AI systems are the ones that will result in a better environmental, economic, and operational future. However, if compatibility is not high, it may become a barrier to adoption and hinder the achievement of sustainable targets [11].

AI Complexity refers to the relative complexity in understanding, incorporating, and leveraging AI technologies. High complexity, in the Engineering, Electrical, and IT industries in Jordan, can discourage adoption, pose implementation challenges, and burden organizations' resources, resulting in unsustainable practices. With complex AI implementations, an organization can end up delayed, over budget, or facing user resistance, all of which can impede an organization's ability to innovate or provide services to its customers. This will increase the efficiency of integration and will make the organizations more sustainable, as the complexity will decrease [12].

Top Management Support indicates the willingness of the senior leadership team to take up AI efforts. Jordan's Engineering, Electrical, and IT sectors have had strong involvement with the strategy orientation, the distribution of resources, and a supporting culture, the three pillars of sustainability. AI's adoption is more likely to be successful when top management actively supports the technology, which can drive innovation and help companies maintain their performance in highly dynamic environments [13].

Organizational readiness is defined as the ability of an organization to deploy an AI system in terms of resources, infrastructure, and capability. In fact, having a high level of awareness in the Jordanian Engineering, Electrical and IT industry makes the process of adopting the technology easier and less disruptive to operations, which means continuous progress, a key requirement for the technology's longevity. Well-prepared organizations are able to better adapt to technological developments and have a long-term competitive edge [14].

Innovation Culture is the openness to new ideas, freedom to experiment, and the culture of continuous innovation. A strong innovation culture is driving fast uptake of AI, problem-solving, and adaptation in Jordan's Engineering, Electrical, and IT sector, which are essential elements for a sustainable future. Employees who are empowered to innovate can help the organization adapt to changing circumstances, streamline processes, and ensure continued success [15].

Regulatory Pressure is the pressure to adopt sustainability through technologies as a result of government policies, industry standards, and laws. In Jordan's Engineering, Electrical, and IT sectors, regulatory requirements around data privacy and environmental impact are growing [16].

Social Influence is determined by the effect of actors on an organization's adoption of AI. There is significant social pressure in Jordan for innovation and sustainability, which may impel organizations to behave responsibly [17].

The engineering, electrical, and IT industries in Jordan are so competitive that companies are racing to employ AI and streamline processes to keep up. Organizations that adopt AI to meet market demands are more prone to take the lead with innovative projects, resource optimization, and prolonged sustainability [18].

By contrast, Digital Leadership encompasses the ability to shape digitalization through a vision, strategic steering and momentum for innovation. They use their influence to help organizations harness this potential and capabilities during times of

change to reshape their businesses and produce long-term, sustainable results [19], [20], and [21].

In terms of the workforce, AI systems can help personnel by taking over repetitive tasks and enabling them to perform more valuable duties, which in turn can enhance job satisfaction rates and improve employee retention [22]. These effects are strongly consistent with the author's view of organizational sustainability, which emphasizes sustaining and improving operations to attain strategic objectives that also promote societal and environmental value creation. To achieve AI's potential of more performance and greater profitability, one must give priority to repeatability in operations, which is how AI facilitates innovation, agility, and resilience [23]. Through the lens of long-term sustainability, AI is a tool to improve operations and a strategic infrastructure that enables organizations to grow rationally and competitively in a world that's becoming ever more complex and resource-constrained [12].

AI is of great relevance for the Jordanian Engineering, Electrical and Information Technology industries, as it transforms operations, strategy and innovation. These industries are built to be data-driven, require quick response, and are prone to fierce competition, which means AI is a strong enabler to improve efficiency, accuracy, and adaptability, which are really needed to be improved in Jordan.

In the engineering field, it facilitates predictive maintenance, optimal design, and product quality, thus helping to reduce downtime and improve product reliability [24]. AI technology is finding applications in the power and electricity sector, for example, to manage a smart grid, forecast electricity loads, and help reduce energy consumption, thereby fostering more sustainable use of energy and infrastructure [25]. In the IT industry, AI has shown value in cybersecurity, automation of repetitive tasks, fostering innovation in software development, scaling up operations, and quick response to customer needs. These technologies can make enterprises in these sectors more agile, data-driven, innovative, and customize services at a fraction of the cost and ecological footprint [26]. Amid the global drive for digital transformation and sustainability, AI has become a necessary component for companies in these industries to compete, be future-ready, and stay in line with the global opportunities for efficiency and sustainability. It is a key enabler for the Engineering, Electrical and IT industry to continue to grow and be successful in the long run, by facilitating technological and talent development optimally [27].

In the context of achieving strategic sustainability goals, it is seen as an enabling force

that steers organizations through technological transformation and helps identify and align digital initiatives with sustainable goals [19], [28]. Good digital leadership is essential to drive a culture of innovation, to help staff embrace change, and for the effective investment in digital technologies such as AI to be realized and put into practice. Digital-savvy leaders can help bridge the gap between strategy and execution, build intra- and inter-functional working, and build capabilities that will help the business to perform in the long term. Without digital leadership, directions on sustainability could be ineffective [29].

Organizational sustainability is influenced by a set of internal and external dynamic factors which jointly determine its ability to function and to adapt in the long run. Internally, top management support, organizational readiness, and innovation culture are important for fostering sustainable actions by leveraging resources, capabilities, and strategic direction [30]. Outward forces- regulatory pressures, societal demands, competition- drive organizations to practice more responsible, effective, and prescient ways of doing business. Meanwhile, in the context of Jordan's industrial engineering sector, which continues to experience both constraining resources and technological voids, the balance and synergy between such internal forces within the organization and external impetuses are quite powerful. Effectively mitigating these influences calls for end-to-end approaches to encourage flexibility, sustain compliance and long-term performance, and ensure adherence to industry norms and stakeholder expectations [31].

This study is important because there still lacks a comprehensive explanation of how the external and internal factors collectively impact organizational sustainability in the Jordanian Engineering, Electrical and Information Technology Industry Sector, particularly with respect to digitalization. Despite the international emphasis on the value of technologies (artificial intelligence) and the role of leadership in successfully instigating sustainable change, little is known empirically about this in the Jordanian context. For many companies in this industry, adopting sustainability into their business model has not been fully developed, and the adoption of technology, particularly in support of operational objectives, has not been fully explored. In addition, the moderating effect of digital leadership on the relationship has not been well-investigated in this context. This research provides a response by offering an extensive framework that integrates technological, organizational, and environmental factors with sustainability performance; thus, contributing to the knowledge of scholars and

practitioners willing to boost the Jordanian Engineering, Electrical and Information Technology Industry sector's long-term performance.

3 Research Framework

The research is grounded by one core theory, which is the Technology-Organization-Environment (TOE) Framework, and three sub-theories, which are Diffusion of Innovations (DOI), Resource-Based View (RBV) Theory, and Institutional Theory (INT), which were selected to provide theoretical rationale for the study's variables. The overall structure of the model is based on the TOE Framework, according to which technological factors (AI complexity and AI compatibility), organizational factors (top management support, organizational readiness, innovation culture), and environmental factors (regulatory pressure, social influence, competitive pressure) determine organizational sustainability in Jordan. This model motivates internal and external factors attending organizational consequences [32], [33], [34], [35], and [36].

DOI Theory is used to underpin AI complexity and AI compatibility as technological forces with complexity and compatibility of innovation driving the adoption, in addition to innovation culture [36], [37], and [38]. Thus, using the RBV Theory to support Digital Leadership, Organizational Readiness, and Organizational Sustainability, it can be shown that the exploitation of unique and valuable resources allows Engineering, Electrical, and Information Technology Industry organizations to react to external demands while preserving long-term competitive advantage and sustainability [39], [40]. While Institutional Theory (INT) was selected to justify the selection of Regulatory Pressure, Top Management Support, Competitive Pressure, and Social Influence [41], [42], [43], and [44].

This study will attempt to overcome these problems by highlighting the roles of Technological Factors (AI Complexity and AI Compatibility), Organizational Factors (Top management support, Organizational Readiness, and Innovation Culture), Environmental Factors (Regulatory Pressure, Social Influence, and Competitive Pressure) as independent variables, in addition to Digital Leadership as a moderating variable. All of these variables are associated with Organizational sustainability among the Engineering, Electrical, and Information Technology industry sectors in Jordan. The research framework is illustrated in Figure 1. Therefore, the following hypotheses are developed:

H1: Technological factors have a significant positive effect on Organizational Sustainability.

H1a: AI Compatibility has a significant positive effect on Organizational Sustainability.

H1b: AI Complexity has a significant negative effect on Organizational Sustainability.

H2: Organizational factors have a significant positive effect on Organizational Sustainability.

H2a: Top management support has a significant positive effect on Organizational Sustainability.

H2b: Organizational Readiness has a significant positive effect on Organizational Sustainability.

H2c: Innovation Culture has a significant positive effect on Organizational Sustainability.

H3: Environmental factors have a significant positive effect on Organizational Sustainability.

H3a: Regulatory Pressure has a significant positive effect on Organizational Sustainability.

H3b: Social Influence has a significant positive effect on Organizational Sustainability.

H3c: Competitive Pressure has a significant positive effect on Organizational Sustainability.

H4: Digital Leadership moderates the relationship between Technological Factors and Organizational Sustainability.

H4a: Digital Leadership moderates the negative relationship between AI complexity and Organizational Sustainability.

H4b: Digital Leadership moderates the relationship between AI compatibility and Organizational Sustainability.

H5: Digital Leadership moderates the relationship between Organizational Factors and Organizational Sustainability.

H5a: Digital Leadership moderates the relationship between Top management support and Organizational Sustainability.

H5b: Digital Leadership moderates the relationship between Organizational Readiness and Organizational Sustainability.

H5c: Digital Leadership moderates the relationship between Innovation Culture and Organizational Sustainability.

H6: Digital Leadership moderates the relationship between Environmental Factors and Organizational Sustainability.

H6a: Digital Leadership moderates the relationship between Regulatory Pressure and Organizational Sustainability.

H6b: Digital Leadership moderates the relationship between Social Influence and Organizational Sustainability.

H6c: Digital Leadership moderates the relationship between Competitive Pressure and Organizational Sustainability.

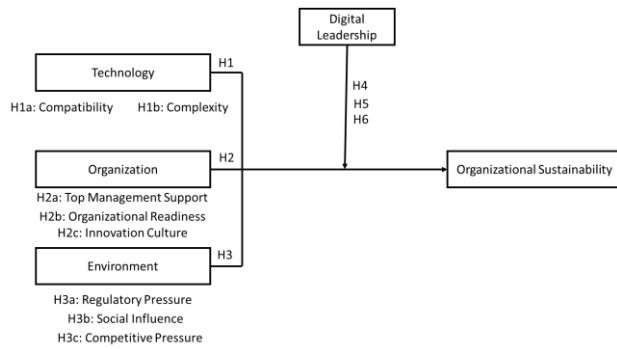


Fig. 1: The Study Framework

Source: Created by Author

4 Research Methodology

The research design used in this research was a quantitative research design. The population for the study consists of all 5154 establishments of the Engineering, Electrical, and Information Technology Industry Sector (ITI) in Jordan, as reported by the Jordan Chamber of Industry (JCI) [6]. This is a key industry sector in Jordan's industrial and technological development and is therefore a context of great strategic importance for exploring the factors driving organizational sustainability.

It is expected that a systematic random sampling method will be used to ensure that each organization will have an equal chance of being selected to participate in the study, thus increasing the representativeness of the sample. All registered organizations in the sector will be used as the sampling frame (obtained from JCI). The desired sample size is 396 and the interval will be $n = 5154 / 396 = 13$. Therefore, each 13th company from the list will be targeted to answer the survey.

This method is similar to the standard sampling for systematic sampling and provides participants in a statistically unbiased way from throughout the sector. The questionnaire will be answered only by those who hold a leadership position, for example, CEOs, general managers, departmental heads, or senior executives. These individuals will be identified by their participation in strategic decision-making, especially in relation to sustainability within their organizations.

The results of the 396 valid responses were analyzed using descriptive analysis and preliminary analysis in SPSS 30 and Smart PLS 4, which were used for the evaluation of the hypothesized relationships in this study. The items that make up the questionnaire were created by adapting items from available studies to align with the context of IT SMEs in Jordan, as presented in Table 1. Care was taken to review each item for clarity and relevance and to make minor modifications to ensure that each item

was appropriate for the study objectives for each construct.

Table 1. Instrument Development

Variable	Construct	References
AI Compatibility	4	[45], [46]
AI Complexity	6	[46]
Top management support	5	[47]
Organizational Readiness	4	[48]
Innovation Culture	4	[49]
Regulatory Pressure	4	[50]
Social Influence	4	[51], [52]
Competitive Pressure	5	[53], [54]
Digital Leadership	5	[55]
Organizational Sustainability	9	[56]

Source: Created by Author

5 Data Analysis

5.1 Respondent Profile

The first section of the instrument gathered data on the background profile of the respondents (Age, Gender, Educational Level, and Years of experience). Each of the demographic profiles is described below in Table 2.

Table 2. Demographic Characteristics of Respondents (n = 396)

Item	Selection	Frequencies	Percentage
Age	Less than 25 YO	45	11.36
	26-35 YO	135	34.09
	36-45 YO	110	27.78
	46-55 YO	64	16.16
	56 YO and older	42	10.61
Gender	Male	265	66.92
	Female	131	33.08
Educational Level	Bachelor	203	51.26
	Master	106	26.77
	PhD	87	21.97
Years of Experience	less than 2 years	34	8.59
	2-4 years	127	32.07
	4-6 years	143	36.11
	More than 6 years	92	23.23

Source: Created by Author

The demographic profile of the respondents suggested a mature, professionally experienced, and well-educated sample suitable for studying digital leadership and organizational sustainability in the Engineering, Electrical, and Information Technology sectors in Jordan.

As far as age is concerned, the highest percentage (61.87%) was in the age group 26-35 and 36-45, which make up half of the sample. This implies that the majority of the respondents are in their prime working and decision-influencing years, which is a

good age to assess the organizational technology adoption and sustainability efforts. The remaining young and experienced practitioners (ages 46-55, 10.61%, and 56 years and older, 16.16%) lend credibility to the sample and provide the voice of the experienced and senior practitioner.

As far as gender is concerned, the majority of the respondents are male (66.92%) and 33.08% are females. This distribution is representative of the region as a whole, and of the gender distribution of engineering, electronic and IT related occupations, which further increases the representativeness and external validity of the results.

In terms of education, over half of the respondents have a Bachelor's degree (51.26%), with a significant number having postgraduate qualifications: Master's degrees (26.77%) and PhDs (21.97%). A high level of education indicates that the respondents are likely to have a high level of technical and cognitive knowledge and understand and evaluate complex concepts such as AI compatibility, AI complexity, digital leadership and organizational sustainability.

Regarding their work experience, the majority of the respondents (36.11%) have 4-6 years of experience, followed by 2-4 years of work experience (32.07%) and over 6 years of work experience (23.23%). More than 91% of respondents have at least 2 years of professional experience, which means that the answers they provide are based on their professional experience in the organization, not only on theoretical knowledge. A small percentage of respondents have less than two years of experience (8.59%).

Overall, the profile of the respondents suggests that the sample is sufficiently diverse and yet experienced and educated enough to ensure reliable data and the testing of the proposed relationships between technological, organizational, and environmental factors, the role of digital leadership, and organizational sustainability.

5.2 Measurement Model

The analysis was carried out in two steps, first measurement model was examined to check the reliability and validity of the constructs; second the structural model was examined to test the hypothesized relationships. The Cronbach's Alpha values for CX and TMS were 0.692 and below the recommended value of 0.70 for reliability, respectively, while the Composite Reliability values were below 0.70, the recommended value for reliability, and the Average Variance Extracted (AVE) values were 0.492 and 0.496, respectively, and were below 0.50, which is the recommended

value for AVE [57]. Further, 2 factors (CX2 and TMS4) loaded below the acceptable value of 0.40. Hence, a change was made in the 2nd run, and also the removal of CX2 & TMS4 to get better the scale. The constructs were found to have acceptable reliability (Cronbach's alpha = 0.757 to 0.975, and Composite Reliability = 0.843 to 0.978) and convergent validity (AVE = 0.573 to 0.831) after the removal of the items. All constructs were then adjusted to meet the recommended measurement requirements (Table 3 and Figure 2).

Table 3. Convergent Validity Results

Items	Outer loadings	Cronbach's alpha	Composite reliability	AVE
CX1	0.767	0.758	0.843	0.573
CX3	0.748			
CX4	0.809			
CX5	0.702			
CX6	0.807	0.849	0.892	0.623
CP1	0.774			
CP2	0.803			
CP3	0.797			
CP4	0.763			
CP5	0.770	0.828	0.878	0.591
CMP1	0.790			
CMP2	0.779			
CMP3	0.732			
CMP4	0.771			
DL1	0.693	0.849	0.881	0.599
DL2	0.776			
DL3	0.781			
DL4	0.838			
DL5	0.774			
IC1	0.710	0.757	0.846	0.578
IC2	0.793			
IC3	0.744			
IC4	0.793			
ORE1	0.730	0.794	0.864	0.614
ORE2	0.797			
ORE3	0.818			
ORE4	0.788			
OS_EN1	0.913	0.975	0.978	0.831
OS_EN2	0.915			
OS_EN3	0.918			
OS_EV1	0.910			
OS_EV2	0.909			
OS_EV3	0.904			
OS_S1	0.908			
OS_S2	0.909			
OS_S3	0.919			
RP1	0.782	0.791	0.864	0.613
RP2	0.789			
RP3	0.764			
RP4	0.797			
SI1	0.740	0.795	0.864	0.613
SI2	0.840			
SI3	0.764			
SI4	0.786			
TMS1	0.767	0.796	0.867	0.619
TMS2	0.795			
TMS3	0.825			
TMS5	0.759			

Source: Created by Author

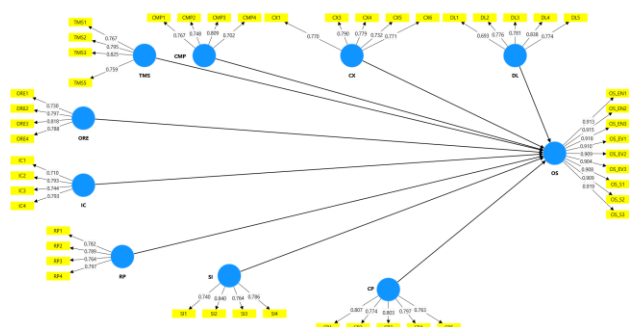


Fig. 2: PLS Algorithm Results (Second Run)

Source: Created by Author

A discriminant validity analysis was performed in the second stage of the process. This analysis was performed to determine the degree to which a certain construct is distinct from other constructs. A significant factor to consider in determining validity is the correlation between the variables. Measures of the correlations between constructs and the square root of the average variance extracted for a construct were used to evaluate the validity of the constructs [58], [59]. [59] reports that the model's estimate did not surpass 0.95 [59]. Moreover, the model did not provide any statistically significant results. Therefore, the results of the Fornell-Larcker Criterion are presented in Table 4 (Appendix), which reveals that none of the obtained results is greater than the recommended cutoff value of 0.95 [58].

Furthermore, if it is assumed that both constructs were entirely reliable or accurately assessed, the Heterotrait-Monotrait Ratio (HTMT) provides an estimate of the true correlation between them. The HTMT is the average of all correlations or cross-correlations between indicators that measure different constructs, relative to the geometric mean of the average correlations between indicators that measure the same construct. The HTMT may be used to assess discriminant validity. The level of HTMT that is deemed "acceptable" in the literature is 0.90. For further details, see Table 5 in the Appendix.

5.3 Structural Model

The structural model illustrates the theoretical or conceptual aspects of the path model. In PLS-SEM, the inner model is synonymous with the structural model, as stated by [57]. This model includes latent variables and the paths connecting them. The evaluation of the structural model occurs after the measurement model. In addition, [57] argues that to assess the structural model, four specific tasks must be performed. These stages involve evaluating the path coefficients (step 2), assessing collinearity (step 4), evaluating the coefficient f^2 , and determining the

effect size (R^2) [57]. Full results are shown in Table 6 and Figure 3 (Appendix).

5.3.1 Assessment of the Structural Model for Collinearity Issues

The first step in the structural model is assessing collinearity issues. It is vital to safeguard against collinearity issues between the constructs before performing a latent variable analysis in the structural model. Collinearity is measured by the VIF value. The threshold value for the assessment is 3.3, following [60]. In this study, as seen in Table 6, all the inner VIF values for the constructs are within 1.028 and 1.585, which are less than 3.3, thus indicating collinearity is not a concern in this study.

5.3.2 Assessing the Significance of Structural Model Relationships

The model's structural paths were evaluated to determine the significance of the path coefficients. The importance of these paths was assessed by examining the path coefficients and t-values. To test the hypothesis, PLS path modeling and bootstrapping were performed. The path coefficients and R^2 values were derived from the PLS analysis, while the t-values came from the bootstrapping process. As recommended [57], if the p-value is less than or equal to .05, the minimum acceptable t-value is 1.645. Additionally, the Beta value should be within -1 and +1; however, since the hypothesis in this study is positive, it should be positive. As shown in Table 6, all t-value scores meet the accepted level.

The analysis revealed several significant direct relationships, specifically, H1, H1a, H2, H2a, H2b, H2c, H3, H3a, H3b, and H3c, since p-value was less than 0.05 and t-value was larger than 1.645. However, H3b, specifically the relationship between CX and OS, was insignificant ($\beta = 0.015$, $t = 0.623$, $p = 0.267$) and was therefore rejected.

5.3.3 The Coefficient of Determination (R^2)

Furthermore, [57] stated that there are three types of R^2 scores found in the literature: .25 (weak predictive accuracy), .50 (moderate predictive accuracy), and .75 (substantial predictive accuracy). As shown in Table 7, the scores of R^2 for OS are considered at a substantial level.

Table 7. Coefficient of Determination (R^2)

Variable	R-square	R-square adjusted
OS	0.798	0.793

Source: Created by Author

5.3.4 Assessment of the Effect Size (f^2)

The summary and inference on the f^2 estimate for independent (exogenous) constructs across the model are presented in Table 6. As recommended [20], an f^2 value below 0.02 indicates no effect. An f^2 value of 0.02 or higher is considered a weak effect, while values above 0.15 and 0.35 indicate medium and substantial effects, respectively [61]. With this classification, no impact was observed in H1b (CX → OS) since the AI complexity does not meaningfully affect the change in organizational sustainability. By contrast, H1a (CMP → OS) revealed a weak to moderate effect size, indicating that variations in organizational sustainability can be explained by AI Compatibility to a noticeable degree.

Technological factors, overall, had a weak effect size (H1: TECH → OS), suggesting that technological factors, as a whole, are related to sustainability but to a lesser degree than the other dimensions of the technological construct.

Organizational factors (ORG → OS) had a moderate effect size, indicating the overall significance of organizational capabilities. Specifically, the effect sizes for specific items of the innovation culture, H2a (TMS → OS) and H2c (IC → OS), were quite large, highlighting the importance of top management support and innovation culture for organizational sustainability. H2b (ORE → OS) had a medium effect size, suggesting a moderate but significant impact of organizational readiness on sustainability outcomes.

In the case of environmental factors, the effect size value of H3 (ENV → OS) was moderate, thus supporting the overall significance of external pressures. At the individual level, H3a (RP → OS) and H3c (CP → OS) had significant impacts, reflecting the influence of regulatory pressure and competitive pressure as factors influencing organizational sustainability. For H3b (SI → OS), however, a medium effect size was found, indicating that social influence has a moderate influence on sustainability performance.

5.3.5 The Moderating Assessment

The moderation hypothesis is explored following the direct effect. A third construct, described as a moderator, can alter or influence the relationship between the independent and dependent variable [57], [62]. The organizations were added to the model as a continuous variable, namely structure. Product indicators for each interaction term were computed with the Orthogonalizing Approach [63] for the moderation analysis, which was conducted on the constructs [64]. This approach enabled the evaluation of the effect of Digital Leadership on the

relationships studied. The values of R^2 without moderation for the model with the interaction terms are presented in Table 8.

Table 8. R^2 Change for Moderation Model

R^2 included the moderator	R^2 excluded moderator
0.803	0.798

Source: Created by Author

The R^2 for the main model (no interaction) is 0.798 and for the model with the interaction is 0.803. This is a change in R^2 of 0.005. The effect size (f^2) can be calculated as follows with this increase:

The formula for f^2 is: $(R^2 \text{ included moderator} - R^2 \text{ excluded moderator}) / (1 - R^2 \text{ included moderator})$
 $f^2 = (0.803 - 0.798) / (1 - 0.803)$
 $f^2 = 0.005 / 0.197 \approx 0.025$

According to Kenny (2018), 0.005, 0.01, and 0.025 are small, medium, large effect sizes, respectively. Therefore, based on the f^2 value of 0.025, it can be concluded that the effect size is large [65].

As can be seen in Table 9 (Appendix), the relationship between digital leadership and overall technological factors is positive and significant ($\beta = 0.159$, $t = 2.743$, $p = 0.003$), meaning that the impact of technological capabilities on sustainability increases as digital leadership increases. Thus, leaders with a solid vision and skill in digital tools can successfully lead the technology adoption and integration, which leads to concrete sustainability results. The Contingency Theory view suggests that the effectiveness of technological resources depends on the quality of leadership in directing their implementation.

The moderation effect is positive and significant ($\beta = 0.172$, $t = 2.396$, $p = 0.008$), consistent with the finding that digital leadership enhances the impact of AI systems compatible with existing organizational processes on sustainability outcomes. In the real world, this means that digital leaders can harness the synergy between AI systems and their tasks to maximize efficiency and innovation. The findings are consistent with Diffusion of Innovation Theory, which highlights the importance of leadership in facilitating the diffusion of innovations that are appropriate to an organization.

The interaction is negative but significant ($\beta = -0.185$, $t = 2.553$, $p = 0.005$), and indicates that, for high-complexity AI systems, the direct effect of AI complexity decreases slightly in the presence of strong digital leadership. This could result in digital leaders facilitating organizations to navigate complex AI use with careful management, addressing cognitive workload or operational difficulties. The

discovery fits in with the Technology-Organization-Environment (TOE) Theory, which suggests that the affect of a intricate technology on outcomes could be moderated by the organizational context and leading.

In general, the moderation effect is positive and significant ($\beta = 0.129$, $t = 2.484$, $p = 0.007$), meaning that leadership improves the organization's resources and sustainability results. Leaders have a strong potential to ensure organizational readiness, support systems and strategic initiatives are more effective as a whole towards achieving sustainability.

The interaction is significant ($\beta = 0.134$, $t = 1.999$, $p = 0.023$) and it can be concluded that the impact of top management support is amplified by digital leadership. Leaders who proactively champion digital developments create an environment which promotes positive sustainability outcomes, through effective management resources and encouragement. This is due to Goal-Setting Theory, where leadership is tasked with setting and reinforcing organizational priorities.

Digital leadership positively and significantly improves the impact of organizational readiness on sustainability ($\beta = 0.137$, $t = 2.319$, and $p = 0.010$). The better developed the organization, the more they can take advantage of leadership guidance to ensure processes are used, skills are applied, and infrastructure is deployed to achieve sustainability objectives.

The influence of innovation culture is significant but less ($\beta = 0.069$; $t = 2.394$; $p = 0.009$), which shows that the leadership slightly affects the influence of innovation culture. Leaders promote an environment in which innovative practice can be promoted and supported, which in turn helps to promote sustainability. This discovery is consistent with the Resource-Based View (RBV), which explains that under good management, human resources and culture are increasingly valuable.

There is overall positive and significant moderation ($\beta = 0.128$, $t = 2.487$, $p = 0.006$), meaning that the environmental pressures (regulatory, social, and competitive) are better transformed into sustainability outcomes under strong digital leadership. This highlights the need for leadership in effectively maneuvering external pressures.

Compliance-driven pressures are less sensitive to leadership influence as the interaction is not significant ($\beta = 0.022$, $t = 0.499$, $p = 0.309$). In this case, digital leadership was a minor factor as rules must be adhered to irrespective of its leadership style.

Leadership strengthens the ability of social pressure (from stakeholders or industry trends) to affect the implementation of sustainability practices in a positive manner ($\beta = 0.084$, $t = 2.467$, $p = 0.007$).

This is a positive and significant interaction ($\beta = 0.088$, $t = 1.808$, $p = 0.036$), with digital leadership being more effective when applied in cases of competitive pressures. Leaders can identify threats and opportunities strategically, and turn them into opportunities for sustainable growth.

6 Discussion

The findings from this study offer many practical implications of a complex and rich nature to the organizations of the Engineering, Electrical and Information Technology industry sector in Jordan. The findings bring together the technological, organizational and environmental aspects of digital transformation, and demonstrate the role of digital leadership as a moderating factor, providing a comprehensive framework for organizations to improve their organizational sustainability through digital transformation. These implications are especially relevant in decision-making in complex technological environments where decisions are made in the face of internal capability and external pressures.

On the technological side, the results provide insightful details about the properties of AIs and their influence on sustainability. The results indicated that there was no direct relationship between AI compatibility and organizational sustainability, implying that AI compatibility alone is not enough to ensure sustainable results. The report suggests that the transition to AI systems compatible with existing structures can be a pathway to sustainable benefits for companies, but by no means is it guaranteed. But compatibility needs to be coupled with explicit adoption strategies, employee acceptance of the change, and organizational assimilation. The complexity of AI, however, does highlight the potential for harm by AI, if not handled properly, which could be detrimental to sustainability. On a more practical level, this underscores the need to anticipate complexity by trying to simplify systems, design for users, provide specific training programs, and develop strategies for implementing AI.

The organizational-level results highlight the importance of internal capacities and capabilities for sustainability actions. The high positive impact of the top management support, organizational readiness, and innovation culture on organizational sustainability suggests that the organizational digital transformation process of sustainability starts within the organization. But in practice, senior leaders must play an active role in supporting AI projects, providing leadership and vision, resources, and buy-in among organizations. The technical preparation of the organization (infra-structure, manpower, and

procedure) should be viewed as a strategic investment rather than merely a technical component. Moreover, having an innovation culture that encourages experimentation and learning enables organizations to continually adapt and optimize the use of AI technologies for sustainable success.

There are also practical implications for the environmental factors looked at in this study. The results show that regulatory pressure, social influence, and competitive pressure have significant positive influences on organizational sustainability, which means that external pressures play a constructive role in shaping sustainable organizational behavior. Regulatory requirements should thus not be seen only as compliance obligations but rather as motivators for implementing more efficient, transparent, and sustainable practices. Likewise, other social drivers, such as stakeholder pressure and competitive dynamics within the sector, can be significant drivers of transformation towards sustainability. Organizations are more likely to be legitimate, competitive, and viable if they actively monitor and respond to these environmental signals.

Digital leadership as a moderating role provides essential insights into organizational practice. The results highlight that digital leadership enhances positive relationships and reduces negative relationships in the majority of technological and organizational factors. More specifically, digital leadership helps to buffer against the negative influence of AI complexity and magnify the positive influence of AI compatibility, top management support, organizational readiness, and innovation culture on organizational sustainability. This highlights the need for developing leaders with digital vision, technological understanding, and change management skills. Therefore, potential leadership development initiatives should focus on both digital skills and strategic thinking around AI and sustainability should be emphasized.

Notably, the moderating role of digital leadership at the relationship between regulatory pressure and organizational sustainability was not supported, thus having implications for practice. The outcome suggests that management discretion is not a key factor for compliance with regulatory requirements, which in turn suggests that no digital mindset or strong management is required, in order for an organization to comply with regulatory needs. In practice this means it needs to be institutionalised – not simply based on influence of leaders – by having formal governance arrangements, compliance frameworks and organisational policies in place.

In contrast, the digital leadership that is moderating effects on social influence and

competitive pressure shows how important leadership is in the interpretation and response to external signals. A digitally competent leader can more effectively transform stakeholders' expectations and competition into proactive digital strategies to improve sustainability. This underscores the importance of leadership as a strategic and fundamental element in the way organizations respond to their external environment, specifically in dynamic and competitive environments.

The translation of AI investments to sustainability outcomes is more effective in firms with strong digital leadership, where the leaders ensure that digital investments are strategically integrated with organizational goals. In this case, executives focus on AI as a business change tool instead of technology. In this case, executives see AI as a business change tool, rather than technology. Yes, digital leaders make sure that everyone is educated, internal processes are reworked, and decision-making in the company is supported by data. This brings tangible outcomes such as reduced operating waste, more energy efficient, using less resources and improved service delivery. This means that AI investments can deliver meaningful sustainability benefits, with full use and strategic integration of AI technology driven by leadership.

By contrast, companies that don't have strong digital leadership are likely to fall short in translating AI investments into tangible sustainability results. AI systems can be purchased, but are often underutilized or utilized in a simple way without due coordination and strategic direction. Sometimes, employees may not be fully aware of how to use AI tools, while different departments may be working in silos and not connected. This means that AI is still being utilized as a technological solution, not a change agent. This leads to only minor improvements in efficiency, minimal improvements in sustainability, and decreased resources in some cases due to poor implementation. Other companies face a void between the investment of technology and the organizational benefit from it that is created by a lack of digital leadership.

The findings underscore that organizational sustainability does not solely stem from investing in AI, but from how organizations strategically deploy AI to align with business transformation goals — a focus especially relevant for CEOs. CEOs should look at AI not as a technology upgrade, but as a fundamental part of organizational redesign, and connect AI efforts to efficiency, innovation, and long-term sustainability objectives. This means that CEOs should actively champion AI initiatives, invest adequate financial and human resources, and foster

the integration of AI across different functions. The findings also show that digital leadership is a key executive competency; CEOs need to build or hire teams of digitally competent executives who can make the measurable difference in the operations, including cost reduction, resource optimization, and service enhancement, that AI can provide. If not for this strategic leadership position, AI may fall short of delivering sustainability value or become disorganized.

The results highlight for IT managers the need to take a holistic approach towards effective implementation over just system deployment. While AI compatibility is a key element, it is important to recognize that simply having an AI system that is technically compatible is not sufficient to ensure sustainability benefits; IT managers will need to make sure that the AI systems are technically incorporated but also operationally integrated into the daily workflow. User-centric system design to reduce complexity, ongoing technical support, and formal training to build employee skills and lessen concern about implementation are key areas of focus for managing AI complexity. The findings also show that the key pathway to achieving sustainability is the adoption of AI, which implies that IT managers should focus on usability, user acceptance and long-term usage of a system rather than on the successful installation. In addition, IT managers must be the digital leaders who can bring technical insights to bear in strategic decision making, and ensure that AI systems are scalable, secure, and integrated with sustainability goals for the organization.

The results offer "evidence" to Jordanian policy makers that external institutional pressures like regulatory, social, and competitive pressures are important determinants of encouraging digital transformation for sustainability. But because regulatory pressure was identified as an independent variable, policymakers should enhance formal institutional arrangements instead of the voluntary nature of managerial discretion to ensure compliance and sustainability results. This involves creating robust AI governance policies, sustainability reporting, and digital transformation strategies to help organizations navigate ethical and efficient adoption of AI. At the national level, also, policy makers should look to support broader efforts to increase digital leadership capacity in the national economy, through leadership development programmes, digital competency training, and incentivising innovative use of AI. The effective adoption of AI, coupled with strengthening national-level institutional enforcement and leadership capacity, will accelerate the sustainability of

organizations in the Engineering, Electrical and Information Technology fields in Jordan.

In conclusion, the findings of this study highlight the importance of aligning technological attributes, organizational capabilities, environmental pressures, AI adoption, and digital leadership to ensure organizational sustainability in technology-intensive industries. Establishing a supportive internal culture, proactively integrating AI technologies, and creating a strong digital leadership are key factors that can help organizations achieve sustainable results in the complex world of AI. The results give a clear direction for practitioners to follow when using AI-driven digital transformation as a strategic tool for the sustainability of the organization in the long term.

7 Conclusions and Future Research

Following the results and scope of this study, the following future research directions are recommended to further enhance the knowledge of the adoption of artificial intelligence and the sustainability of an organization. The proposed framework can be further developed in future studies to contribute to the theoretical understanding, methodological rigor, and empirical insights from various contexts and technological settings.

Following this study's results and drawbacks, this study recommends the following research directions to expand the understanding of the use of AI and organizational sustainability. The proposed framework can be expanded and deepened in future research to further theoretical understanding and methodological rigour and to be applied to a broader range of contexts and technological environments to further empirical insights.

Firstly, future studies are encouraged to use longitudinal research designs to study the relationship between the evolution of AI adoption and organizational sustainability over time. Longitudinal studies would enable researchers to document the changes in the organizational capabilities, leadership effectiveness, and environmental pressures, as these are mapped out through AI implementation and sustainability outcomes. These designs would help to establish more causal relationships and gain insights into the sustainability effects of adopting AI in the long term.

Second, future studies can broaden the scope of the context to other industries and national contexts. This study was conducted in the Engineering, Electrical, and Information Technology industry sector in Jordan, but the model could be replicated in other sectors like the healthcare, manufacturing, finance, education or public administration sectors to

increase the generalizability of the results. Comparative analysis with other developed and developing economies would also be useful in highlighting contextual variations in regulatory frameworks, level of technological development and cultural factors influencing adoption and sustainability.

Third, future studies could be based on a more comprehensive model that includes other technological and organizational factors. Data quality, AI adoption, ethical AI governance, cyber security readiness, organizational learning and digital maturity can offer further insights into the context in which the adoption of AI can be a positive force for sustainability. The addition of these variables might broaden the scope of explanatory power of the Technology–Organization–Environment framework and associated theories.

Finally, researchers are encouraged to look for "other" mediators and moderators beyond AI adoption and the digital leadership. For example, the mechanisms and boundary conditions affecting the sustainability of an organization can be further explained by other variables like organizational agility, digital capability, employee digital skills, innovation performance, or strategic alignment. An investigation of several mediators and moderated mediators may provide a more comprehensive picture of the complex process of digital transformation.

Fifth, future research might be conducted using a mixed-method or qualitative methodology along with quantitative results. In-depth interviews, case studies and focus group discussions may help to give more depth to the explanations about how these organizations cope with the complexity of AI, how they encourage an innovative culture and how they react to pressures in the environment. These methods would yield information that could not be obtained by simply administering surveys.

Sixth, considering the different results found about the moderating role of digital leadership, further studies could explore additional contingencies related to leadership. Scholars could examine various leadership styles, leadership levels, or digital leadership competencies and identify how leadership can affect AI adoption and sustainability across different institutional/or regulatory contexts. This would further develop leadership theory in the context of the digital transformation.

Last, future research could use more sophisticated methods, such as multi-group analysis, multilevel modeling, or configuration analytic methods, to examine inter-organizational differences. These methods could show unique routes

to sustainability and combinations of factors that can yield successful AI-driven outcomes.

To wrap up, the future research recommendations suggest a roadmap for further research and development on AI adoption and organizational sustainability. The theoretical contributions, methodological insights, and the examination of new contextual aspects set the stage for future research, which can continue to expand the knowledge base surrounding digital transformation in modern companies.

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APPENDIX

Table 4. Discriminant validity (Fornell and Larcker Criterion)

	AI	CX	CP	CMP	IC	ORE	OS	RP	SI	TMS
AI	0.884									
CX	0.336	0.769								
CP	0.262	0.005	0.789							
CMP	0.125	0.040	0.070	0.757						
IC	0.324	0.082	0.019	0.013	0.761					
ORE	0.317	0.048	0.041	0.037	0.005	0.784				
OS	0.874	0.353	0.291	0.123	0.327	0.302	0.812			
RP	0.240	0.039	0.013	0.021	0.058	0.046	0.285	0.783		
SI	0.276	0.032	0.003	0.022	0.083	0.102	0.158	0.024	0.783	
TMS	0.239	0.025	0.029	0.025	0.003	0.011	0.249	0.088	0.056	0.787

Source: Created by Author

Table 5. HTMT Discriminant validity

	AI	CX	CP	CMP	DL	IC	ORE	OS	RP	SI	TMS
AI											
CX	0.379										
CP	0.292	0.064									
CMP	0.139	0.061	0.100								
DL	0.057	0.063	0.077	0.095							
IC	0.384	0.110	0.085	0.075	0.053						
ORE	0.362	0.076	0.092	0.093	0.069	0.063					
OS	0.817	0.386	0.316	0.136	0.049	0.379	0.332				
RP	0.277	0.080	0.063	0.072	0.048	0.116	0.092	0.322			
SI	0.312	0.064	0.070	0.080	0.076	0.114	0.145	0.170	0.081		
TMS	0.276	0.073	0.087	0.081	0.069	0.057	0.068	0.281	0.114	0.075	

Source: Created by Author

Table 6. Structural Model Path Coefficients

H	Path	Beta	STD Error	T-value	P-values	Decision	Confidence Interval		f ²	Effect Size	VIF	R ²
							5.00%	95.00%				
H1	TECH -> OS	0.081	0.028	2.946	0.003	Supported	0.028	0.137	0.226	Medium	1.159	0.798
H1a	CMP -> OS	0.093	0.027	3.460	0.000	Supported	0.050	0.139	0.381	Substantial	1.188	
H1b	CX -> OS	0.015	0.024	0.623	0.267	Rejected	-0.023	0.055	0.001	No Effect	1.028	
H2	ORG -> OS	0.128	0.029	4.488	0.000	Supported	0.070	0.181	0.377	Substantial	1.585	
H2a	TMS -> OS	0.094	0.024	3.911	0.000	Supported	0.057	0.135	0.387	Substantial	1.169	
H2b	ORE -> OS	0.077	0.025	3.082	0.001	Supported	0.038	0.120	0.291	Medium	1.333	
H2c	IC -> OS	0.097	0.026	3.796	0.000	Supported	0.056	0.139	0.371	Substantial	1.228	
H3	ENV -> OS	0.111	0.032	3.442	0.001	Supported	0.047	0.173	0.380	Substantial	1.494	
H3a	RP -> OS	0.127	0.026	4.852	0.000	Supported	0.086	0.173	0.401	Substantial	1.228	
H3b	SI -> OS	0.045	0.025	1.808	0.035	Supported	0.002	0.084	0.189	Medium	1.207	
H3c	CP -> OS	0.107	0.025	4.357	0.000	Supported	0.068	0.149	0.429	Substantial	1.199	

Source: Created by Author

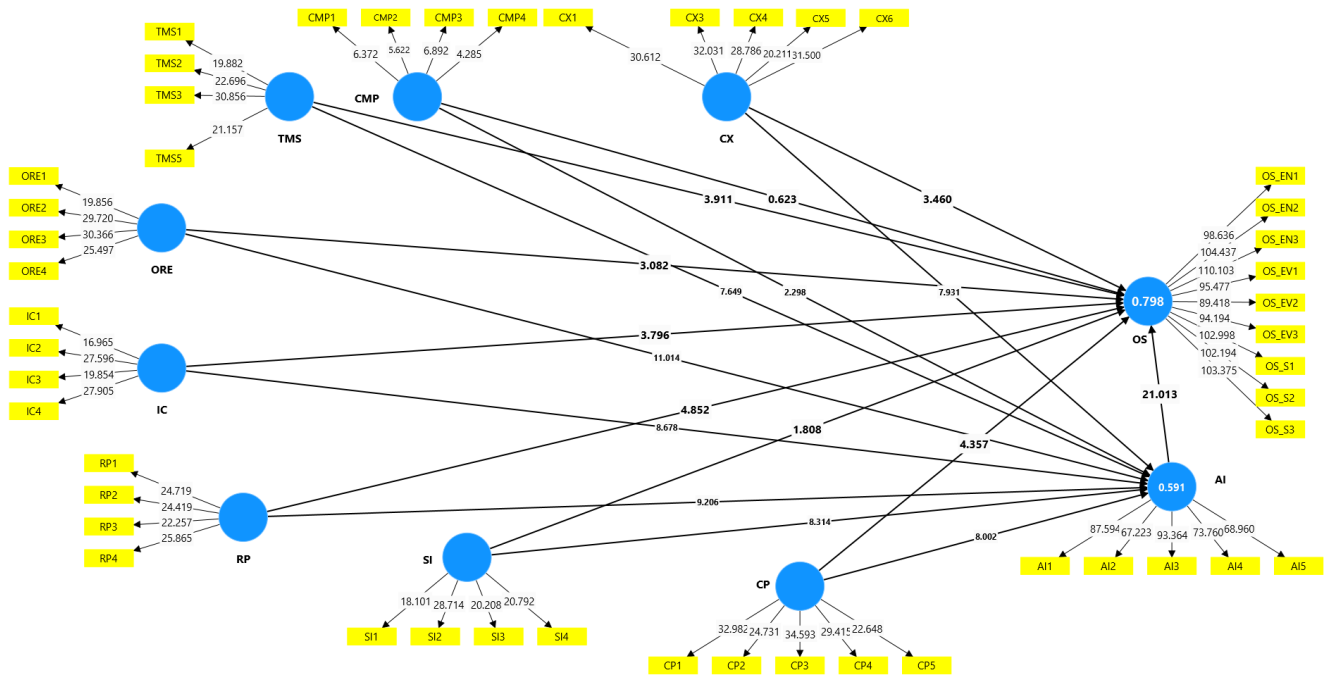


Fig. 3: PLS Bootstrapping Results
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Table 9. Significance Testing for Structural Paths

H	Path	Std. Beta	Std. Error	T-values	f ² (For the moderation)	P values	Decision
H4	DL x TECH -> OS	0.159	0.058	2.743	0.025	0.003	Supported
H4a	DL x CMP -> OS	0.172	0.072	2.396		0.008	Supported
H4b	DL x CX -> OS	-0.185	0.072	2.553		0.005	Supported
H5	DL x ORG -> OS	0.129	0.052	2.484		0.007	Supported
H5a	DL x TMS -> OS	0.134	0.067	1.999		0.023	Supported
H5b	DL x ORE -> OS	0.137	0.059	2.319		0.010	Supported
H5c	DL x IC -> OS	0.069	0.029	2.394		0.009	Supported
H6	DL x ENV -> OS	0.128	0.052	2.487		0.006	Supported
H6a	DL x RP -> OS	0.022	0.045	0.499		0.309	Rejected
H6b	DL x SI -> OS	0.084	0.034	2.467		0.007	Supported
H6c	DL x CP -> OS	0.088	0.049	1.808		0.036	Supported

Source: Created by Author