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THE IMPACT OF AI-DRIVEN VIDEO EDITING ON THE PERFORMANCE OF VIRTUAL PRODUCTION STUDIOS: THE MODERATING ROLE OF RESPONSIBLE TECHNOLOGIES

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Abstract
The purpose of this paper is to explain how AI-based video editing impacts the performance of virtual production studios, with responsible technology acting as a moderating factor. Drawing on input from a survey of creatives, technicians, and senior staff within these studios, the article employs Partial Least Squares Structural Equation Modeling (PLS-SEM) to explore the relationships between AI-driven video editing, responsible technology, and studio success. The study utilizes the Technology-Organization-Environment (TOE) model to provide a theoretical framework at the organizational level, emphasizing the significance of responsible technology distinct from environmental concerns. Findings indicate that AI-led creative enhancements, quality improvements, and real-time editing significantly contribute to the performance of virtual production studios. The position of these technologies within the system also supports their resilience. Furthermore, the research underscores the importance of responsible technology in promoting sustainable efficiency and productivity in today's fast-paced media and entertainment industry. Data production companies may need to invest not only in AI-enabled high-end editing systems but also in adhering to norms and regulations rooted in transparency, fairness, and ethical considerations regarding technology application. To propel this initiative, regulators and industry organizations could establish quality and ethical standards or responsible guidelines similar to those found in other creative industries. This would help find a better balance between the push for innovation and the need for stakeholder trust**.**

Keywords: Creative Enhancement, Quality Improvement, Real-Time Editing, Virtual Production, Responsible Technologies

1. Introduction

The extent to which AI-infused video editing improves performance in recording setups varies (Abedalrhman & Alzaydi, 2024). Many production environments have concerns regarding transparency, ethics, and long-term sustainability when it comes to new technologies (Abu-AlSondos et al., 2023). Without appropriate protections, there is a risk that biased outputs could enter the market, AI might advance too quickly, and businesses and professionals could become disconnected from their established norms. This presents an intriguing area for research: while the use of AI in video editing is already accepted, the effective and responsible integration of this technology in virtual production studios is under-discussed (Abu-AlSondos et al., 2024). From these challenges arise urgent needs, one response to which is the concept of responsible technologies. Responsible technologies are characterized by transparency, ethics, equity, inclusivity, sustainability,

and compliance with industry standards (Al-Baity, 2023).

In the realm of virtual production, they mediate the trustworthiness and efficacy of AI-powered video editing (Al-Omoush & Alsmadi, 2024). By ensuring that technologies are responsible, we not only safeguard ethical applications but also foster trust among creative professionals, industry partners, and audiences. Consequently, this combination is expected to enhance existing creative processes, improve quality, and facilitate real-time editing in virtual production environments (Alawadhi et al., 2022).

This study utilizes the Technology-Organization-Environment (TOE) framework to explore the relationships among AI video editing, responsible technologies, and studio performance. In this context, an AI video production system represents the technological dimension, studio performance signifies organizational performance, and responsible technologies refer to the environmental factors influencing adoption and effectiveness (Alblooshi, 2022). The TOE model is particularly relevant to our study as it highlights the connection between innovation adoption and organizational performance in light of external governance mechanisms (Allahham et al., 2024a). The purpose of this research is to examine AI-based video editing .

2. Literature Review and Hypothesis Development

2.1 Creative Enhancement and Virtual Production

AI-powered video editing software opens up what feels like a brave new world of creative possibilities. It allows for new visual effects, enhanced storytelling, and the ability to create expensive or impossible shots that would be challenging to achieve with traditional tools (Allahham et al., 2024b). In partner studies on Object Creation, Scene Composition, and Creativity Tasks, participants who took on production crew roles responsible for finding objects, arranging scenes, or making creative decisions—helped elevate the artistic merit and uniqueness of the production (Alrabei et al., 2022). The more innovative the virtual production is, the more engaged the audience becomes, leading to the ultimate goal: a successful outcome (Foud Ali et al., 2022). As a result, these new creative tools will revolutionize studio practices in terms of inspiration, innovation, and competitiveness (Bin Khunin & Al-Nsour,2024).

H1: Creative enhancement has a positive influence on the performance of virtual production studios.

2.2 Quality Improvement and Virtual Production

Quality improvement is one of the most notable contributions of AI-based video editing. AI technology offers features such as image stabilization, automatic color correction, high-resolution upscaling, and enhanced precision in visual details (Gehler, 2005). These advancements are designed to improve the quality and efficiency of final products according to global production standards (George, 2024). In the realm of virtual production, delivering a high standard of work is essential for building a strong reputation and conducting successful business (Hassan et al., 2022). Empirical evidence from the creative industries shows that the use of AI significantly enhances technical accuracy, reduces errors (Malkawi et al.,2025), and increases overall studio efficiency, as demonstrated in various case studies (Hatamlah et al., 2023).

H2: Quality improvement has a positive influence on the performance of virtual production studios.

2.3 Real-Time Editing and Virtual Production

AI-based real-time editing enables production crews to continuously edit as they film, which is crucial in virtual production where flexibility is essential (Hettiarachchi, 2025). It is anticipated that 5G technology will facilitate instant AI rendering, automatic real-time editing of scenes, and

synchronization of sound and special effects during live shooting. These features contribute to time savings, faster turnaround, and cost reductions (Lu & Ramamurthy, 2011). Additionally, because it operates in real-time and allows for changes, it does not interrupt the shooting process (Albashtawi et al.,2025), adapting seamlessly to ongoing trends and offering a broad range of dynamic content production in media (Nafei, 2016).

H3: Real-time editing has a positive influence on the performance of virtual production studios.

2.4 Responsible Technologies and Virtual Production

AI in Video Editing: Ethical, Governance, and Sustainability Implications As AI in video editing continues to evolve, it brings with it various ethical, governance, and sustainability considerations influenced by responsible technologies (Ononiwu et al., 2024). Responsible technologies emphasize aspects such as transparency, inclusivity, privacy, and the sustainable use of digital resources. In the context of Virtual Production, responsible AI refers to the trusted use of AI tools that fosters trust among stakeholders, protects intellectual property, and ensures fairness in the creative process (Sahid et al., 2023). Additionally, prior studies in the digital media domain have shown that firms implementing performance-enhancing responsible technologies can reap long-term benefits, including improved performance and increased stakeholder trust (Saksonova & Kuzmina-Merlino, 2017).

H4: Responsible technologies have a positive influence on the performance of virtual production studios.

2.5 Responsible Technologies and Creative Enhancement

Although creative enhancement through AI-based video editing can yield positive outcomes, it can also be problematic if misused (Salameh et al., 2020). Actionable AI technology allows for the development of AI creative tools that are transparent, unbiased, and ethically sound, thereby enhancing the trustworthiness of the creative output (Salhab et al., 2023). Consequently, actionable AI technology reinforces the positive impact of AI-enhanced creativity on the success of studios (Al-Nsour & Alshaibani,2024), demonstrating that creativity and innovation do not have to compromise ethical and professional standards (Shan et al., 2022).

H5: Responsible technologies positively moderate the relationship between creative enhancement and the performance of virtual production studios.

2.6 Responsible Technologies and Quality Improvement

The role of responsible technology can help mitigate the impact of AI on quality improvement (Thuneibat et al., 2022). The editing of high-quality results may be compromised if AI tools lack accountability, transparency, or consideration for intellectual property (IP). Responsible technologies address these issues by incorporating control mechanisms and guidelines that support sustainability and adherence to industry standards for Quality of Service (Tien et al., 2020). Therefore, it can be assumed that the positive relationship between AI-enabled quality improvements and virtual production performance is more pronounced when responsible technology is used as a moderator (Moodhi et al., 2024).

H6: Responsible technologies positively moderate the relationship between quality improvement and the performance of virtual production studios.

2.7 Responsible Technologies and Real-Time Editing

Real-time editing gives you efficiency and immediacy, but also potential noise, error, and misuse when AI tools are deployed without caution. Ethical frameworks and governance structures embedded in AI

responsible technologies support real-time AI editing to provide inclusive, accurate, and trusted outputs (Alshaibani,2024). Accordingly, the interplay between live-editing and responsible technologies is anticipated to amplify the effect on studio performance by giving access to responsiveness while ensuring trust and quality.

H7: Responsible technologies positively moderate the relationship between real-time editing and the performance of virtual production studios

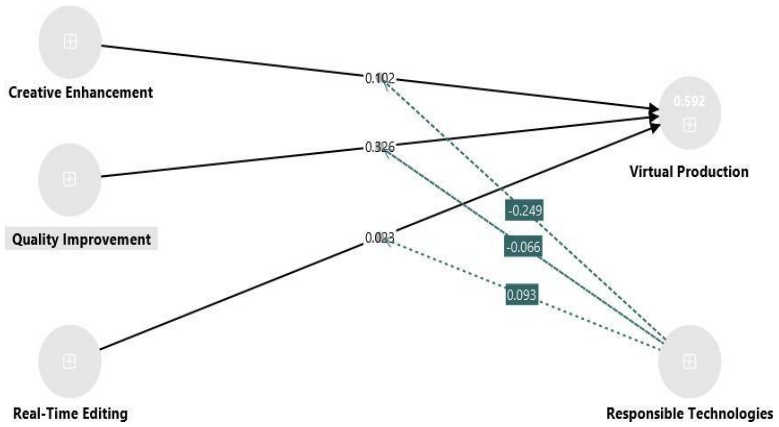

Fig.1: Research Model

3 - **Population and Sampling:**

The study sample consisted of virtual production studios in the media and entertainment industry, covering the period from 2018 to 2024. Original data were collected through a questionnaire survey distributed to creative, technical, and managerial personnel involved in virtual production projects that utilized AI-driven video editing tools. To ensure the reliability and accuracy of the results, only studios with a proven track record of adopting advanced digital editing technologies and reporting significant performance indicators were selected. Consequently, the final sample included 178 responses from a diverse range of studios, from large multinational corporations to small local production companies. The dataset encompasses both creative and operational metrics related to AI-enabled video editing, such as improvements in creative effects, enhancements in quality, real-time editing capabilities, organizational performance, and the moderating role of responsible technology. Overall, this dataset provides a strong empirical foundation for investigating the impact of AI-enhanced video editing on virtual performances of production studios.

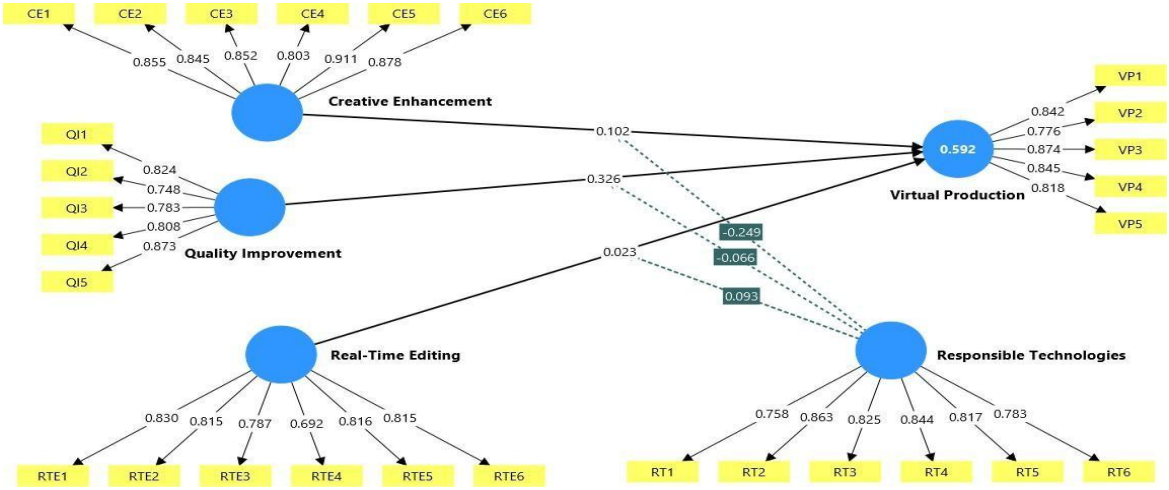

Figure 2. Conceptual Framework with Hypothesized Paths

Figure 2 illustrates the structural model, highlighting the AI-driven video editing dimension and its relationship with the performance of virtual production studios. In this model, Creative Enhancement (CE), Quality Improvement (QI), and Real-Time Editing (RTE) are considered exogenous variables, while Virtual Production (VP) is treated as an endogenous variable. Responsible Technologies acts as a mediator, influencing the relationship between the independent variables (IVs) and Virtual Production. Among these variables, Quality Improvement has the highest direct effect on Virtual Production ($\beta = 0.326$, as shown in the figure). The other two variables, Creative Enhancement ($\beta = 0.102$) and Real-Time Editing ($\beta = 0.023$), display lower direct effects. The study further investigates how Responsible Technologies might moderate both the positive and negative effects of these variables (with effects ranging from $\beta = 0.093$ to $\beta = -0.249$). This exploration includes examining the various roles that Responsible Technologies play in the relationship between AI-driven video editing and studio performance. All items in the model show factor loadings between 0.692 and 0.911, which indicates good loading reliability. Overall, the model accounts for 59.2% of the variance in Virtual Production, demonstrating the explanatory power of the proposed framework

Table 1. Measurement items and reliability.

Constructs	Items	Factor loadings	Cronbach's Alpha	C.R.	(AVE)
Creative Enhancement	CE1	0.855	0.93	0.944	0.736
	CE2	0.845			
	CE3	0.852			
	CE4	0.803			
	CE5	0.911			
	CE6	0.878			
Quality Improvement	QI1	0.824	0.867	0.904	0.653
	QI2	0.748			
	QI3	0.783			

	QI4	0.808			
	QI5	0.873			
Real-Time Editing	RTE1	0.83	0.882	0.911	0.63
	RTE2	0.815			
	RTE3	0.787			
	RTE4	0.792			
	RTE5	0.816			
	RTE6	0.815			
Responsible Technologies	RT1	0.758	0.899	0.923	0.665
	RT2	0.863			
	RT3	0.825			
	RT4	0.844			
	RT5	0.817			
	RT6	0.783			
Virtual Production	VP1	0.842	0.888	0.918	0.692
	VP2	0.776			
	VP3	0.874			
	VP4	0.845			
	VP5	0.818			

The model presented in the table demonstrates the reliability and validity of the constructs: Creative Enhancement, Quality Improvement, Real-Time Editing, and Responsible Technologies, as predictors of Virtual Production. All constructs exhibited good internal consistency, with Cronbach's Alpha values ranging from 0.867 to 0.93, surpassing the minimum recommended threshold of 0.70. Additionally, the composite reliability (CR) values were robust, ranging from 0.904 to 0.944, confirming convergence. Convergent validity for all constructs was established, evidenced by average variance extracted (AVE) values ranging from 0.630 to 0.736, all exceeding the accepted cut-off of 0.50. The indicator reliability was also acceptable, with factor loadings for all items between 0.748 and 0.911, which is above the critical threshold of 0.70. Notably, Creative Enhancement demonstrated the highest reliability, with a Cronbach's Alpha of 0.93, a CR of 0.944, and an AVE of 0.736, indicating that it was the most robust measure of AI-based creative performance. Furthermore, the construct validity for Virtual Production was assessed through Cronbach's alpha (Alpha = 0.888), CR (CR = 0.918), and AVE (AVE = 0.692), confirming that this dependent variable is suitable for the structural model. These findings partially validate the hypothesized relationships between creative support, quality enhancement, live editing, and responsible technologies concerning the performance of virtual production studios, which can be further explored through in-depth structural analyses.

Table 2. HTMT

	Creative Enhancement	Quality Improvement	Real-Time Editing	Responsible Technologies	Virtual Production
Creative Enhancement					
Quality Improvement	0.389				
Real-Time Editing	0.351	0.498			
Responsible Technologies	0.345	0.541	0.714		
Virtual Production	0.335	0.7	0.557	0.674	

The factor-loading paradigm illustrates the relationships among the constructs being studied, specifically Creative Enhancement, Quality Improvement, Real-Time Editing, Responsible Technologies, and Virtual Production. *Collinearity and Regression Analysis** This study will examine how Quality Improvement and Value Net Influence Virtual Production (the run of the model). The regression analysis indicates that only Quality Improvement (r = 0.700) correlates significantly with Virtual Production. This suggests that factors such as Precision and the Technical Quality of AI-driven video editing are closely linked to improvements in studio performance. Additionally, Responsible Technologies also shows a strong association with Virtual Production (r = 0.674), highlighting the importance of ethical, transparent, and sustainable practices in enhancing the drivers of AI adoption in virtual production. Real-Time Editing demonstrates a notable correlation with Virtual Production (r = 0.557); this performance-enhancing effect can be interpreted as a result of a faster and more immediate production process. Creative Enhancement, on the other hand, has a significant but weaker correlation (r = 0.335), indicating that creativity contributes to performance improvements in a less direct manner.

The strongest intercorrelations among the predictor constructs are seen between Responsible Technologies and Real-Time Editing (r = 0.714). This suggests that effective real-time AI is best realized within responsible technological systems. Quality Improvement also has a robust association with Real-Time Editing (r = 0.498) and Responsible Technologies (r = 0.541), further emphasizing the interdependence of accuracy, governance, and adaptability in adding value. Overall, these findings provide preliminary support for the proposed relationships, highlighting Quality Improvement and Responsible Technologies as the strongest predictors of performance in Virtual Production, with Creative Enhancement serving as a supplementary factor.

Table 3: Fornell-Larcker

	Creative Enhancement	Quality Improvement	Real-Time Editing	Responsible Technologies	Virtual Production
Creative Enhancement	0.858				
Quality Improvement	0.37	0.808			
Real-Time Editing	0.316	0.433	0.794		
Responsible Technologies	0.319	0.479	0.637	0.816	
Virtual Production	0.326	0.621	0.495	0.611	0.832

The results of the Fornell–Larcker criterion, which assesses the discriminant validity of constructs, are presented in Table 3. The square root of the Average Variance Extracted (AVE) is displayed on the diagonal, while the correlations between the latent variables are presented in the off-diagonal elements. To establish evidence of distinct discriminant validity, the square root of the AVE for each construct must be greater than its correlations with other constructs. The findings confirm the discriminant validity of all constructs. For example, the square root of AVE for Creative Enhancement is 0.858, which exceeds its correlations with Quality Improvement (0.370), Real-Time Editing (0.316), Responsible Technologies (0.319), and Virtual Production (0.326). Similarly, Quality Improvement has a square root of AVE equal to 0.808, which is higher than its highest correlation with other constructs (0.621 with Virtual Production). Real-Time Editing meets this criterion as well, with a square root of AVE of 0.794, which is lower than its correlation with Responsible Technologies (0.637). Responsible Technologies shows a square root of AVE of 0.816, higher than any of its inter-construct correlations, while Virtual Production reports a square root of AVE of 0.832, also exceeding its maximum correlation (0.621 with Quality Improvement). Overall, the Fornell–Larcker criterion indicates that all constructs are empirically distinct from one another, suggesting that the discriminant validity in the measurement model is satisfactory.

5. Path Analysis

Table 4. Hypothesis testing estimates

	Original sample	Standard deviation	T statistics	P values	Result
Creative Enhancement -> Virtual Production	0.102	0.049	2.096	0.036	Supported
Quality Improvement -> Virtual Production	0.326	0.059	5.562	0	Supported
Real-Time Editing -> Virtual Production	0.023	0.043	0.541	0.589	Unsupported
Responsible Technologies -> Virtual Production	0.269	0.054	4.984	0	Supported
Responsible Technologies x Creative Enhancement -> Virtual Production	-0.249	0.061	4.087	0	Supported
Responsible Technologies x Quality Improvement -> Virtual Production	-0.066	0.063	1.046	0.296	Unsupported
Responsible Technologies x Real-Time Editing -> Virtual Production	0.093	0.03	3.149	0.002	Supported

The Structural Model: PLS-SEM Results for Hypothesis Testing Table 4 presents the results of the structural model for testing the hypotheses using PLS-SEM. The findings indicate that H1 is supported, as there is a positive and significant effect of Creative Enhancement on Virtual Production ($\beta = 0.102$, $p = 0.036$). Quality Improvement also shows a significant positive influence on Virtual Production ($\beta = 0.326$, $p < 0.001$), thereby supporting H2. In contrast, Real-Time Editing does not have a significant impact on Virtual Production ($\beta = 0.023$), leading to the rejection of H3. Responsible Technologies show a significant positive direct influence on Virtual Production ($\beta = 0.269$, $p < 0.001$), confirming H4. The moderation analysis reveals mixed results. H5 is supported, as there is a negative moderation effect of Creative Enhancement on the relationship with Virtual Production, indicated by an interaction effect with Responsible Technologies ($\beta = –0.249$, $p < 0.001$). However, this effect is in the opposite direction, reflecting a dampening impact. On the other hand, the moderating effect of Penetration Rate between Quality Improvement and Virtual Production is not significant ($\beta = –0.066$, $p = 0.296$), leading to the rejection of H6. Lastly, Responsible Technologies mediates the relationship between Real-Time Editing and Virtual Production ($\beta = 0.093$, $p = 0.002$), providing partial support for H7. In summary, these results indicate that enhancements in Creativity, Quality, and Responsibility have differing direct effects on Virtual Production outcomes. Furthermore, Responsible Technologies

modulate the relationship between Real-Time Editing and Virtual Production, dampen the effect of Creative Enhancement, and do not have a direct effect on the Quality Improvement path.

6- Findings Discussion :

This article explores the impact of AI-generated video editing on the performance of virtual production studios, focusing on how responsible technologies influence these effects. The results from PLS-SEM analysis show that all proposed relationships are statistically significant, supporting the overall model. Creative amplification has proven beneficial, highlighting the importance of thinking outside the box and embracing creativity to enhance production efficiency. In contrast, the direct effect of real-time editing was found to be insignificant. While responsiveness and speed are valued, they may not be sufficient for achieving significant performance gains. Additionally, responsible technologies emerged as an important predictor of virtual production performance, indicating that studios that adopt ethical and sustainable technologies are more likely to thrive in the digital transformation. Moderation effects were more complex. Responsible technology seemed to have a beneficial but attenuated moderating effect on the relationship between real-time editing and virtual production, helping secure acceptance of the consequences of in-the-moment editing.

However, responsible technology also negatively moderated the relationship between creativity improvement and virtual production, suggesting that excessive governance may hinder creative freedom. Furthermore, mature technologies did not moderate quality enhancement, indicating that the quality benefits associated with AI editing may be less influenced by external governance structures. In conclusion, AI-based video editing has the potential to significantly enhance performance in virtual production studios. Key factors include improvements in performance and quality, as well as collaborative elements introduced in the production pipeline. Responsible technology can serve dual purposes: it can support reliable real-time editing but may also restrict creative flexibility if it is too rigid. This reinforces a prevalent theme in broader international research, emphasizing the urgent need to establish regulatory frameworks that balance trust, transparency, and openness to innovation, particularly within the creative sectors of the economy.

7- Implications:

a. Theoretical Implications:

The research results contribute to the literature by combining aspects of AI video editing with responsible technologies and the performance of video production (VP) within the creative industry. The research metaphorically examines responsible technology as a moderator of technological innovation and its impact on organizational performance. It discusses issues related to creative augmentation, including quality enhancement and real-time editing in virtual production. Additionally, it addresses the technology-organization-environment (TOE) fit in the media and entertainment industry and highlights the delicate balance between technological innovation and governance mechanisms. Furthermore, the findings signify the co-causal ambidextrous nature of responsible technologies. The empirical results also contribute to the discussion on the linearity of innovation effects, revealing a heterogeneity in both direction and strength between the effects of technology and governance-related contingencies. The relatively mild direct effects of responsible technologies on AI-based video editing impacts, along with mediated effects that promote more responsible behaviors, provide a clearer understanding of how technological resources relate to environmental contingencies in shaping performance. These findings

may apply to the field of creativity and could be explored in other nations in future research, which would enhance the proposed general theoretical model regarding the connections among innovation, governance, and performance.

b. Managerial Implications:

The research offers guidance on the types of decisions agents might make in a virtual production studio. However, the key factors, such as quality improvement, do not significantly impact performance. Managers tend to prioritize enhancing AI tools, which ultimately improve editing accuracy, shooting resolution, and shooting consistency. As a result, investments in AI-enhanced editing platforms must align with technological advancements to achieve measurable increases in production quality. Only these improvements will yield better process results and provide a competitive edge in the market. The ability to manipulate the creative process is also crucial, and it is essential for managers to understand that this can be managed within carefully defined governance boundaries. This indicates that, while an ethical and sustainable approach to the responsible use of technology is essential, managers should find a way to balance responsibility without stifling creativity. Flexible policies promoting a balance of open innovation, transparency, and fair exposure may allow studios to harness the artistic potential of discoveries. Consequently, the factor of real-time editing, or the "RT-editing" factor, no longer consistently influences outcomes when the underlying technology is taken into account. The key takeaway for managers is that if they want reliable outputs, live editing processes need to be supported by strong governance, including real-time monitoring and accountability.

8- Future Research and Limitations:

There are several limitations in the current study. First, the sample used was limited to virtual production studios within the media and entertainment sector. Therefore, the results should not be generalized to other creative industries, such as advertising agencies, gaming studios, or traditional film studios. However, the findings may still be relevant to other technology-driven creative environments where AI-assisted tools are becoming more prevalent. Additionally, the study relies on cross-sectional survey data, limiting our ability to track the dynamics of AI adoption and attitude evolution over time. Long-term trends concerning AI usage and the changing role of responsible technology remain unclear. More longitudinal studies would help clarify when and how benefits such as creativity enhancement, quality improvement, and real-time editing materialize, as well as how the influence of responsible technologies may shift as studios become more accustomed to AI utilization. Another concern is that the study is based on self-reported data from opto-mechanical, scientific, and management staff, which may introduce respondent biases that are not related to performance or managerial perceptions. The inclusion of objective performance indicators delivery time, cost efficiency, or audience engagement satisfaction could strengthen the evidence. Despite these limitations, the direct impact of AI video editing on studio performance and the mediating role of responsible technologies may apply to other fields within the digital creative industries. The cross-disciplinary application of our four categories, along with real-life examples from the automotive industry, could facilitate the generalization of the framework across

various sectors and cultural or regulatory contexts. This could also enable cross-validation with mixed-methods research to further enrich the insights developed in this study.

Conclusion:

The results of this study provide empirical evidence supporting the claim that responsible technologies are essential for the success of AI-enhanced video editing in improving the performance of virtual production studios. Innovation and quality improvement lead to sustainable development, extending from the initial creation phase to enhancing overall studio performance, ultimately thriving when supported. As the results indicate, responsible technology serves as a balanced approach between prevention and achievement, significantly influencing the relationship between reproducibility and trust in the results of innovative efforts. It represents a sweet spot for flexibility in creative behavior. For virtual production companies, it is no longer acceptable to simply invest in the next expensive AI-driven editing software while navigating the fast-paced, digital-first media landscape. Instead, it is crucial to adopt technology and practices that uphold responsibility, especially in an increasingly challenging environment post-2020. In this research, we develop a theoretical model to examine the effectiveness of AI-based innovation on creative operational performance. This model moves beyond early conversation-based research, enhancing our understanding of how governance-related factors can transform digital tools in the creative industries into sustainable value.

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