

A DEMATEL-Based Framework for Combating Digital Piracy in Media & Entertainment Industry through Blockchain: A Critical Success Factor Analysis

Mohit Mittal

Department of Computer Science and Engineering,
Banasthali Vidyapith, Banasthali, 304022, Rajasthan, India.
&
Galgotias College of Engineering, Greater Noida, 201310, Uttar Pradesh, India.
E-mail: mhtmittal03@gmail.com

Khandakar F. Rahman

Department of Computer Science,
Banasthali Vidyapith, Banasthali, 304022, Rajasthan, India.
E-mail: kfrahman@banasthali.in

C. K. Jha

Department of Computer Science,
Banasthali Vidyapith, Banasthali, 304022, Rajasthan, India.
E-mail: ckjha@banasthali.in

Shivani Bali

Department of Management,
Jaipuria Institute of Management, Noida, 201309, Uttar Pradesh, India.
E-mail: lbsshivani@gmail.com

Vikram Bali

Department of Computer Science and Engineering,
Galgotias College of Engineering, Greater Noida, 201310, Uttar Pradesh, India.
Corresponding author: vikramgcet@gmail.com

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Abstract

The media and entertainment sector remain under threat from digital piracy, with an estimated annual revenue loss of over USD 30 billion resulting from the illegal distribution and consumption of digital content. Blockchain technology (BT) has recently resolved numerous concerns addressing the protection of digital media rights. It can assist digital content creators and distributors in automating transactions and tracking the dissemination of digital material in the movie and music industries. This article aims to determine the critical success factors (CSFs) for BT adoption in the movie and entertainment industry. An extensive literature review was undertaken to discover success criteria. This resulted in discussions with experts to validate the CSFs needed to adopt BT in the movie and music industries. The 'Decision-Making Trial and Evaluation Laboratory (DEMATEL)' method was used to identify cause-effect link between essential success elements. The DEMATEL technique, which is well-suited for revealing the linkages between interdependent components. Based on the investigation, 14 CSFs were found and classified into five dimensions. With the DEMATEL technique, 10 factors were categorized in the causal group, and the remaining 4 in the effect group. The study highlights the essential interdependencies between key elements, including stakeholder preparation, technology infrastructure, digital rights management, and regulatory compliance, based on expert advice. The results provide governments and industry stakeholders with valuable insights to mitigate the risks of piracy and foster healthy digital ecosystems. Immutable Attribution, Decentralized Governance, and Decentralized Audience Insights were rated as the top three factors for BT adoption. Our findings can help legislators, technology integrators, and media and entertainment companies create blockchain-based anti-piracy plans. The DEMATEL analysis's actionable insights offer a prioritized roadmap for successfully integrating blockchain technology to guarantee safe and long-lasting digital content management.

Keywords- Digital media, Blockchain technology, MCDM, Critical success factors (CSFs), DEMATEL.

1. Introduction

India's digital media boom is undeniable, with internet penetration soaring and content consumption reaching new heights (Qian et al., 2022). However, this vibrant landscape suffers from a persistent shadow: rampant digital piracy. From Bollywood blockbusters to regional cinema, music, and literature, piracy drains billions from creators and stifles innovation (Chawla & Buch, 2023; Chen et al., 2022). India is one of the top five countries in terms of piracy traffic, with over 141 billion visits to pirated websites worldwide, according to a recent MUSO (2023) analysis. Digital piracy is estimated to cost the Indian M&E sector more than ₹20,000 crore (approximately USD 2.4 billion) annually, affecting live sports broadcasts, OTT platforms, and movie releases. Within hours of its theatrical debut, the popular film *Pathaan* was illegally distributed online, resulting in a significant loss of revenue. These illustrations underscore the pressing need for robust technology solutions to safeguard intellectual property rights, preserve digital assets, and foster the long-term sustainability of content-driven enterprises. This is where Blockchain, the revolutionary technology rewriting trust and transparency, emerges as a beacon of hope.

Traditionally, tackling piracy in India has been an uphill battle. Ineffective copyright laws, weak enforcement mechanisms, and the lure of free content create a perfect storm for illegal downloads and streaming (Greco, 2023). This deprives creators of their rightful dues and discourages investment in high-quality content, impacting the entire ecosystem. However, the decentralized and unchangeable nature of blockchain provides a powerful solution. Imagine a system where copyright content is safely stored on a blockchain and can be accessed using special digital tokens that belong to the original creators. Every transaction, from purchase to consumption, is transparently recorded on the Blockchain, making piracy virtually impossible to trace and monetize (Aldweesh, 2024). This would provide creators with robust legal protection and create a fair revenue model, incentivizing the production of diverse and engaging content. Although blockchain has been extensively researched in various fields, including supply chain, healthcare, and banking, its application in the media and entertainment (M&E) sector—especially in preventing digital piracy—has not received sufficient attention. The majority of existing literature focuses on the technical aspects of blockchain technology for digital rights management. Still, it lacks frameworks for strategic decision-making that would guide its application in industries vulnerable to piracy. By creating a DEMATEL-based framework to determine and examine the key success factors (CSFs) for blockchain adoption in the M&E industry, this study fills that knowledge vacuum.

The advantages extend beyond the creators. Blockchain-powered platforms can provide secure and convenient access to information to Indian audiences (Kaushik & Malik, 2022). Consider purchasing a music album through a blockchain platform and receiving a one-of-a-kind token that provides exclusive access to additional tracks, previously unheard material, or even backstage interactions with the artist. This direct link between producers and consumers develops loyalty and engagement, resulting in a dynamic content ecosystem in which everyone benefits.

The path forward, however, is not without its challenges. Building robust blockchain infrastructure, navigating regulatory hurdles, and educating creators and consumers about this transformative technology is crucial. However, the potential of Blockchain to reshape the Indian digital media landscape is too significant to ignore. This ground-breaking technology, founded on trust and openness, can change the norms of content consumption. However, utilizing it effectively necessitates careful consideration and strategic strategy. The CSFs are the key factors needed to unlock blockchain's full potential in combating digital piracy, must be carefully identified and understood. Only through comprehending these driving

forces can a healthy, piracy-free economy for Indian digital media be charted.

This research paper investigates the transformative potential of BT in reforming the digital media ecosystem by handling the challenges of piracy, royalty distribution, and lack of transparency. By examining the opportunities and challenges of BT, this study seeks to add to the existing knowledge base surrounding blockchain's application in Indian movies and music sector. This study attempts to find the answers to research questions:

RQ1. What are the 'critical success factors' of blockchain implementation in Media & Entertainment?

RQ2. How do the critical success factors influence each other regarding cause-and-effect relationships?

The study addresses the research questions across four distinct phases. A comprehensive literature review identified a preliminary set of critical success factors in the first phase. These CSFs were refined and finalized in the second phase through iterative consultations with industry experts. The third phase employed the DEMATEL technique to look into the hierarchy and interrelationships among the identified CSFs. DEMATEL enables the examination of complex causal relationships by categorizing factors into cause-effect groups, offering a profound insight into their relative influence within the system than other analytical techniques. In the final phase, the results were validated through expert feedback to ensure their relevance and robustness. Imagine if a filmmaker spent years producing unique material, only to have it leaked and circulated on pirated sites just hours after its premiere. With creators, platforms, and investors feeling the brunt of this, it is not a unique episode but rather a persistent reality that afflicts the worldwide M&E business. The sophistication of piracy networks is increasing alongside digital consumption, which raises a crucial question: How can we safeguard creative intellectual property in an era of unending digital duplication?

This article progresses as follows: Section 2 provides a literature survey of blockchain in the media and entertainment industry, focusing on digital piracy. Section 3 explains the approach followed in this work. Section 4 proposes the critical framework to answer the RQs formulated in the study. Section 5 reports the research findings and discusses the critical success factors under cause-and-effect groups. Section 6 gives the theoretical and managerial implications. Section 7 concludes the article.

2. Literature Review

The burgeoning digital media industry pulsates with a vibrant spectrum of content, from captivating music and spellbinding literature to enthralling movies and regional gems. Nevertheless, beneath this dazzling surface lurks a persistent foe: rampant piracy. Billions siphon from the pockets of creators, stifling innovation and dampening the spirit of this growing industry. Several Multi-Criteria Decision-Making (MCDM) approaches have been extensively employed to examine issues related to the adoption of technology. One of the most popular approaches, the Analytic Hierarchy Process (AHP), is praised for its ease of use and methodical pairwise comparison methodology; yet, it assumes that criteria are independent. Interdependence is addressed via the Analytic Network Process (ANP); however, it can be computationally demanding and less visually intuitive. VIKOR and TOPSIS do not disclose causal linkages; instead, they concentrate on finding optimal solutions based on proximity metrics.

2.1 Blockchain- A Multi-Domain Technology

Emerging from the realm of cryptocurrencies, Blockchain transcends its initial association with Bitcoin to offer a paradigm shift in content creation and consumption (Yang et al., 2022). It is a decentralized, tamper-proof digital ledger, a secure platform for recording and managing digital assets with unparalleled transparency. This transformative potential holds immense promise for the digital media industry (Shrestha

et al., 2020), paving the way for a future where creators are empowered, consumers are engaged, and trust reigns supreme (Liu et al., 2021). The applications of Blockchain Technology are discussed in **Table 1**.

Table 1. Applications of BT in several domains.

Authors	Domains with blockchain application	Use of BT	Real-life examples
Fanning & Centers (2016), Treleaven et al. (2017)	Financial Services (Smart Contract and Security)	Blockchain technology was once thought to be just starting in the financial services industry. However, it has become a valuable instrument for all sectors with time. Blockchains serve as safe, tamper-proof digital ledgers in the financial services industry, improving accuracy and privacy.	Ripple, Chain, Enigma
Chakrabarti & Chaudhuri (2017)	Retail Services (Traceability)	Blockchain technology proves highly beneficial in the retail industry. Numerous online retailers are investigating it, including Amazon, Walmart, Openbazaar, and Alibaba. Blockchain technology protects their vast records and transactions and reduces transaction costs.	Openbazaar, Alibaba
Albeanu (2017), Chen et al. (2018)	Education Services (Provenance)	Academic record recognition and verification are complex tasks. They might take time and entail monitoring on a case-to-case basis in universities.	Blockcerts Toolset
Swati & Prasad (2018), Yang et al. (2017)	Mobility and Travel Services (Smart Contract)	Blockchain technology offers an impartial, robust, and impenetrable method of storing tangible assets, such as auto components. Its purpose is to locate supply chain components.	SIMBA Chain, DocuSign, Ocean Protocol
Olmes & Jansen (2018)	Infrastructure Services (Regulatory Compliance)	The infrastructure sector involves many different trades, including intricate projects and transactions. Blockchain technology facilitates identity verification and tracking of multi-party work progress.	Ubitquity, HerenBouw
Chung et al. (2019), Kamilaris et al. (2019)	Agriculture and Mining Services (Licensing)	BT can protect product-specific logistics and contribute to the security of the agricultural supply chain. Creating a decentralized platform facilitates better transactions in farming industry.	Trace, Agri Digital
Kshetri & Voas (2018), Soni & Mahler (2020), Warkentin & Orgeron (2020)	Public Sector Services (Security)	It reduces paperwork and guards against vital records being tampered with.	Follow My Vote, Delaware

Firstly, Blockchain empowers creators by disrupting the traditional value chain. By enabling the tokenization of their work, creators unlock novel monetization models, including direct-to-fan microtransactions (Paduraru et al., 2022), fractional ownership (Cu et al., 2021; Vitelaru & Persia, 2023), and dynamic pricing-based on audience engagement. This paradigm shift disrupts the reliance on intermediaries, allowing creators to capture a more equitable share of the value they generate (Koçer, 2023).

Secondly, BT fosters transparency and trust within the digital media ecosystem. Its immutable timestamps and verifiable records offer a secure chain of custody for digital assets, combating piracy and intellectual property theft (Xu et al., 2017). Consumers gain confidence in their content, knowing its provenance and secure distribution. This fosters engagement and loyalty, strengthening the bond between creators and audiences.

Finally, Blockchain facilitates personalized content experiences and targeted advertising while prioritizing user privacy. Its capabilities extend beyond security, enabling the development of innovative platforms that recommend content based on individual preferences while ensuring responsible data handling. This empowers consumers to control their data and receive a personalized, enriching experience.

However, harnessing the full potential of Blockchain requires careful consideration of specific challenges. Building robust infrastructure, navigating evolving regulatory frameworks, and educating creators and consumers is crucial for widespread adoption. Collaborative efforts between technology providers, policymakers, content creators, and consumers are essential to addressing the barriers and unlocking the true impact of this technology.

2.2 Blockchain as a Solution to Curb Digital Piracy in the Media Industry

The papers collectively suggest that various approaches have been taken to curb digital piracy. Jütte & Olson (2022) found that piracy is frequently motivated by the profit-maximizing policies of major media license holders, which are seen as unjust and unfriendly to customers. Miocevic (2023) found that users' feelings about copyright enforcement regulations impact their decisions and intentions about digital piracy. Kaddu et al. (2022) examined the legal framework in Uganda for combating book piracy and discovered that the rules, as they are, are ineffective. Ling (2023) researched the factors that influence digital piracy practice in Malaysia and discovered that irregular peer relationships substantially impact a person's perspective toward digital infringement. Overall, a summary of the papers shown in **Table 2** suggests that combining customer-focused policies, adequate legal frameworks, and addressing emotional reactions and peer associations may curb digital piracy effectively.

Blockchain technology presents a paradigm shift for the digital media industry. Addressing the critical issues of creator empowerment, trust, and transparency can reshape how we create, distribute, and engage with content. While challenges remain, the collaborative pursuit of practical solutions and the continuous exploration of Blockchain's possibilities can lead to a thriving future where creators are valued, content is secure and engaging, and consumers enjoy a personalized, enriching experience. As researchers and stakeholders, we must seize this opportunity to rewrite the rules of the digital media game, embracing Blockchain as a transformative force for an equitable and sustainable future. According to the literature review, there is limited research on utilizing blockchain technology to combat digital piracy in the media and entertainment industry. Few studies discuss blockchain's role in protecting digital rights, despite its well-documented applications in the supply chain, healthcare, and banking sectors (Zhang & Li, 2021). By incorporating critical success factors (CSFs) from current research and utilizing the DEMATEL approach to rank them, this study helps to close the gap. A fresh interdependency-based methodology is highlighted in the updated review, which is backed by updated analytical tables.

DEMATEL (Decision-Making Trial and Evaluation Laboratory) is ideally suited for this investigation as it has the capacity to simulate causal linkages and interdependencies among components. In the media and entertainment industry, where success elements (such as stakeholder readiness, IT infrastructure, and regulatory alignment) are closely related, this is especially important.

In conclusion, the literature now in publication demonstrates that blockchain technology is gaining popularity in various fields; however, it does not sufficiently discuss how to strategically implement it to counter digital piracy in the media and entertainment industry. Although several crucial success factors (CSFs) have been examined separately, a structured, relationship-based analysis that considers the intricate relationships between these elements is lacking. The methodological framework used to operationalize this strategy and answer the research questions is described in the Section 3.

Table 2. Summary of work done to curb digital piracy.

S No.	Authors	Authors and titles	Year	Outcomes measured	Main findings
1.	Ling et al. (2023)	"The Determinants of Digital Piracy Behaviour in Malaysia"	2023	•Intention towards 'Digital Piracy' •Actual 'Digital Piracy' Behaviour	Intentional digital piracy has a significant association with real digital piracy behavior.
2.	Liu et al. (2023)	"Digital Piracy Case of Learning Materials in China: A Tough Challenge to Chinese Copyright Law"	2023	•Awareness & Attitude towards Digital Piracy •Ways To Safeguard the Copyright of under Chinese Law	By not collecting fees for educational resources available online, digital theft of educational resources can be adequately protected.
3.	Czetwertyński (2023)	"Digital piracy: the issue of knowledge of the institution of copyright law."	2023	•Understanding Copyright Law Awareness in Poland •Assessing the Heuristic Importance Index •Demographic Influences on Illegality Perceptions in Copying	Those with an academic degree are the social category that most sharply condemns specific forms of copying as illegal.
4.	Jütte & Olson (2022)	"A brand hegemony rejection explanation for digital piracy."	2022	•Digital Piracy Behavior and Motivations •Strategies for Profit by Major Media Copyright Holders •Legal Channels for Digital Content Acquisition •Concerns About Impact on Digital Content Creators	Piracy tends to be driven by the profit-maximizing policies of significant media publishers.
5.	Miocevic (2023)	"Deterrence and defiance as responses to copyright enforcement policies of digital content: appraisal tendency perspective."	2022	•Digital Piracy Related Judgments •Intention towards Continuous Usage of Illegal Streaming Services	Fear is a motivator for people to stop using unauthorized streaming services.
6.	Kaddu (2022)	"Examining Uganda's legal and institutional framework in curbing book piracy"	2022	•Types of Book Piracy •Legal Efforts to Combat Book Piracy •Awareness Of Book Printers and Its Impact •Counter-Piracy Enforcement and the Law •Challenges in Enforcing Anti-Piracy Regulations & Laws	Need for strict laws & regulations as at present these are ineffective.
7.	Humphreys (2022)	"Utopia in a Package? Digital Media Piracy and the Politics of Entertainment in Cuba"	2022	•"Paquete" Challenges Cuba's Media Landscape •Examines Cuba's Socialist History and Digital Piracy •Explores Cuban Cultural Responses to Socialism & Global Entertainment •Expands Media Archaeology's Perspective on Copyright and Modernity	The Cuban government nationalized and controlled the island's media outlets.

3. Research Approach

The research is structured into 4 distinct phases, which are illustrated in **Figure 1**.

3.1 Determining Success Factors

In the first phase, structured literature review was undertaken to find success factors for BT deployment in media & entertainment industry. Fourteen success criteria were discovered.

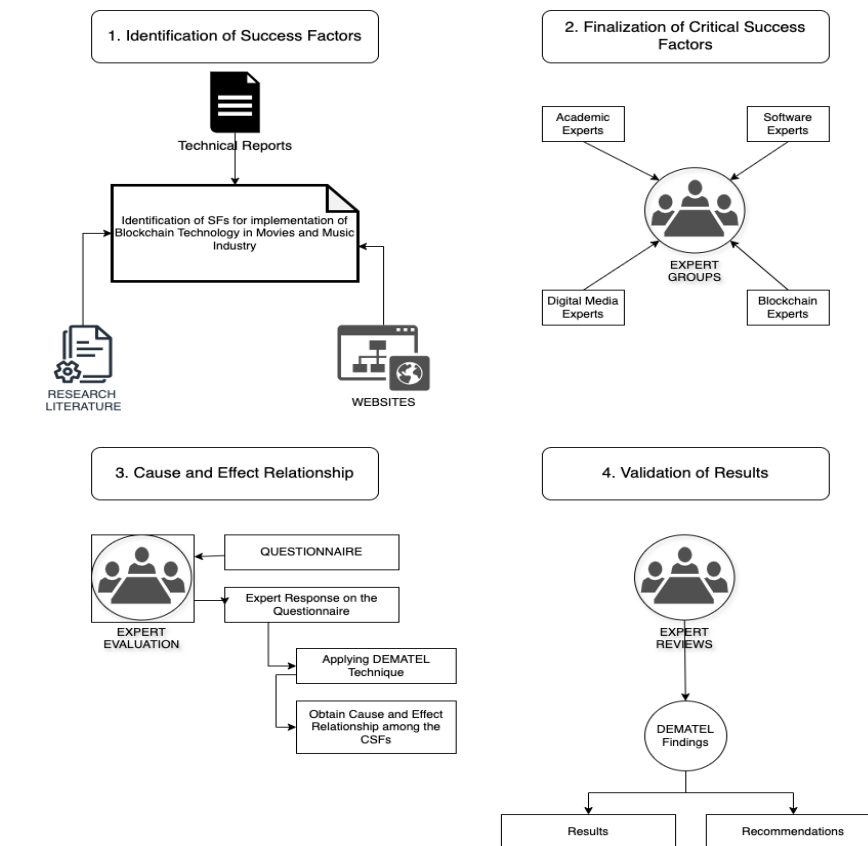


Figure 1. Phases of proposed research approach.

3.2 Consolidation of Final list of CSFs

A group discussion was held among blockchain professionals from the movies and music industry to determine CSFs. They include academics, music producers, movie producers, content distributors, content curators and editors, and blockchain technology consultants in the IT sector. Following long hours of deliberations, all 14 success elements were categorized into five dimensions: **Table 4** thoroughly lists CSFs, their categorical dimensions, and relevant reference literature.

3.3 DEMATEL based Causal Relationship Analysis

Employing appropriate methodologies is essential to ensure the success of this research. Identifying CSFs for implementing BT in digital content requires careful consideration of multiple criteria, solved using ‘multi-criteria decision-making problem’ (MCDM). Many researchers have employed the MCDM approach (Bali & Amin, 2017; Nemeth et al., 2019). Tan et al. (2021) applied MCDM in building information modeling to address difficulties in the architectural, engineering, and construction industries. We employed the DEMATEL strategy to solve the research problem, which involves specialists rather than the general population filling out questionnaires. DEMATEL identifies cause-and-effect relationships in complicated systems. This strategy involves creating a matrix to illustrate the relationships between various components. The graphical representation explains the complex relationship exist between numerous components. This technique generates a cause-and-effect diagram to identify the root cause of an issue and propose a remedy (Gabus & Fontela, 1973; Guo et al., 2015; Mangla et al., 2020).

The following section outlines the DEMATEL framework along with the complete computational procedure:

Step 1: Computation of Initial Matrix

The experts were asked to mention the degree of direct influence that each factor i have on every factor j , denoted by a_{ij} . An integer scale ranging between 0 to 4 is employed, where “0” represent no influence, “1” represent very low influence, “2” signify low influence, “3” is describes high influence, and “4” very high influence. Initial matrix $A = a_{ij}$ is in Equation (1), where, a_{ij} is mean of all the values obtained from the experts.

$$A = \begin{bmatrix} 0 & a_{12} & \cdots & a_{1j} & \cdots & a_{1n} \\ a_{21} & 0 & \cdots & a_{2j} & \cdots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ a_{i1} & a_{i2} & \cdots & a_{ij} & \cdots & a_{in} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nj} & \cdots & 0 \end{bmatrix} \quad (1)$$

Step 2: Compute Normalized Direct-Relationship Matrix

Equations (2) and (3) are used to normalize the initial matrix, which is indicated by "D"

$$D = kX \quad (2)$$

$$k = \frac{1}{\sum_{j=1}^n a_{ij}} \quad (3)$$

Step 3: Total Influencing Matrix

The total influencing matrix "T" is computed using Equation (4) with the help of Equation (2)

$$T = D + D^2 + \cdots + D^m = D(I - D)^{-1}, \text{ where } D^m = [0]_{n \times m} \quad (4)$$

Explanation,

$$\begin{aligned} T &= D + D^2 + \cdots + D^m \\ &= D(I + D + D^2 + \cdots + D^{m-1})(I - D)(I - D)^{-1} \\ &= D(I - D^m)(I - D)^{-1}. \end{aligned}$$

Identity matrix is represented by I

$$T = D(I - D)^{-1},$$

when $m \rightarrow \infty$

Step 4: Calculate the Rows and Columns Sums.

The Causal parameters "R" and "D" are computed using Equations (6) and (7)

$$T = [t_{ij}], \dots i, j = 1, 2, \& \dots, n, \quad (5)$$

$$R = [r_i]_{n \times 1} = \left[\sum_{j=1}^n t_{ij} \right]_{n \times 1} \quad (6)$$

$$D = [s_j]_{n \times 1} = \left[\sum_{i=1}^n t_{ij} \right]_{n \times 1} \quad (7)$$

Step 5: Draw Causal Diagram.

Let r_i represents the sum of the i^{th} row of T matrix. Hence r_i is the sum of factor i on the other factors. Let s_j is the column sum of the j^{th} column of T matrix. Hence, s_j is the sum of factor j on the other factors. With the assistance of " r_i " and " s_j " values the causal impact diagram is drawn (Rajesh & Ravi, 2015).

If $i = j$, then $(r_i + s_j)$ denotes the total influence given and received by factor i .

The factors are further grouped in cause-effect based on $(r_i - s_j)$ values. If $(r_i - s_j)$ is positive, it is a net cause for other CSFs; if this value is negative, it is the net effect of other CSFs (Bai & Sarkis, 2013). Thus, values of $R + D$, i.e. $(r_i + s_j)$, and $R - D$, i.e. $(r_i - s_j)$, given in **Table 10** is used to draw the causal diagram.

Step 6: Setting up the Threshold Value for the Building a Digraph

Since the factors are relatively large, a threshold value is set in the relation matrix T to filter out very small/insignificant causes or effects among success factors (Bai & Sarkis, 2013; Rajesh & Ravi, 2015; Yadav & Barve, 2018). This threshold value is calculated by adding one standard deviations to mean value in T matrix as shown in **Table 9**.

3.4 Phase 4: Validation of Findings

The findings from previous phase were subsequently presented to experts for validation and critical feedback.

4. Proposed Framework

To address the RQs, this section outlined the following steps:

4.1 Phase 1: Determining Success Factors

Comprehensive literature research used keywords such as CSFs in the movies and music industry, blockchain technology, digital content rights, digital piracy, and royalty disbursement to identify success criteria. The search was conducted on many research databases, including Google Scholar, Web of Science, and Scopus. Additionally, technical reports on blockchain usage in movies and music media were reviewed and referred to from websites. After analysing the data, we identified 14 Success Indicators for utilizing BT in the movies and music business. These 14 success factors are illustrated in **Figure 2**.

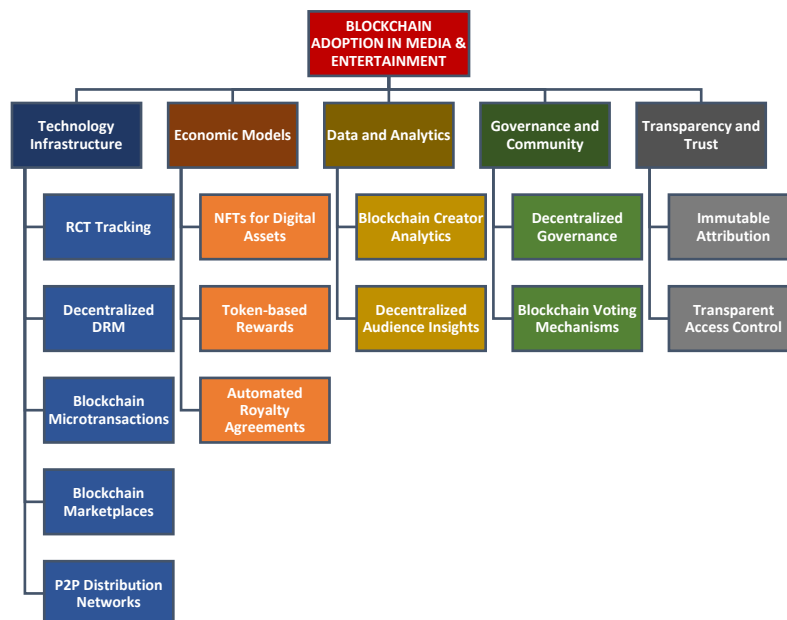


Figure 2. List of success factors of blockchain adoption in media and entertainment.

Table 3. Experts' profile.

Activity	Role	Blockchain related experience	Experience (Years)	No. of experts
Videographer	Production	DRM Platform Development	2-10	4
Musician	Creative and Design	Digital Content	4-12	7
Writer and Director	Direction	Platform Development	3-15	3
Multimedia Content	Training and Support	IP Tracking	2-6	6

Virtual meeting was held to consolidate the CSFs for BT adoption in movies and music. Experts discussed the study's preamble and documented their comments. The meeting was held online. The Zoom platform was used for an online meeting, and 20 experts responded via email. To strengthen the credibility of the study, steps were taken to ensure the objectivity and reliability of the findings. These steps are:

- (i) Experts Diversity
- (ii) Independence and Anonymity
- (iii) Response Aggregation
- (iv) Reviews for Consistency
- (v) Triangulation

The experts recognized the significance of the study and encouraged the authors to pursue unique study. Experts proposed categorizing the 14 CSFs into five major dimensions to understand them better. The CSFs are given in **Table 4**. Three steps were used to determine the 14 CSFs for blockchain adoption in the media and entertainment (M&E) industry: methodical literature review in stage 1, expert shortlisting and consolidation in stage 2, and pre-survey validation in stage 3.

Table 4. CSFs for BT adoption in the media and entertainment industry.

Dimensions	Critical success factors	Short name	Compact code	Factor notation
Technology Infrastructure	Real-time tracking of content usage/consumption	RCT Tracking	RTC	F11
	Decentralized Digital rights management (DRM)	Decentralized DRM	DDRM	F12
	Blockchain-based microtransactions	Blockchain Microtransactions	BBM	F13
	Blockchain-powered content marketplaces	Blockchain Marketplaces	BCM	F14
	Peer-to-peer content distribution networks	P2P Distribution Networks	P2P CDN	F15
Economic Models	NFTs (Non-Fungible Tokens) for digital creative assets	NFTs for Digital Assets	NFTs-A	F21
	Token-based rewards for community participation and fan engagement	Token-based Rewards	TBR	F22
	Automated royalty and licensing agreements	Automated Royalty Agreements	ARA	F23
Data and Analytics	Data analytics on Blockchain for creator performance	Blockchain Creator Analytics	BCA	F31
	Audience insights through decentralized analytics platforms	Decentralized Audience Insights	DAI	F32
Governance and community	Decentralized governance models for creator communities	Decentralized Governance	DGC	F41
	Voting mechanisms for decision-making on blockchain platforms	Blockchain Voting Mechanisms	BVM	F42
Transparency and Trust	Immutable attribution of content creation and modification	Immutable Attribution	IACM	F51
	Transparent permissions and access controls	Transparent Access Control	TPAC	F52

4.2 Phase 3: DEMATEL based Causal Relationship Analysis

To determine cause-and-effect relationship using DEMATEL approach, we perform these steps:

Step 1: Computation of 'Initial Matrix'

Field experts assisted in determining the degree of direct influence between the factors.

Table 7 shows the initial matrix produced using Equation (1).

Step 2: Compute ‘Normalized Direct-Relationship Matrix’

Equations (2) and (3) were used to normalize the initial matrix. **Table 8** shows the ‘normalized direct-relationship matrix’, represented by "D."

Step 3: ‘Total Influencing Matrix’

Table 9 shows complete influence matrix, indicated as "T." Equation (4) is used along with "D" to calculate it.

Step 4: Determine the Rows and Columns sum

Calculating the sum of the rows and columns using Equations (6) and (7). **Table 10** displays the "R" and "D" values.

Step 5: Draw Causal Diagram.

Causal diagram, depicted in **Figure 3**, is produced using the computed values (R + D) and (R-D) from step 4.

Step 6: Setting up the Threshold Value

Obtained the threshold value by adding one standard deviation to the average of all values in the matrix in **Table 9**. The average and standard deviation values are 0.839 and 0.065, respectively. As of now, 0.904 is the threshold value. **Table 9** highlights all results over the threshold value. **Table 5** exhibits the CSFs under each cause group. **Table 6** presents the four effect group CSFs and shows the inter-relationship between the different CSFs.

Table 5. Cause group CSFs.

Cause group CSFs	Influenced by cause group CSF
F11	F15, F21, F22, F23, F31, F32, F41, F42, F51, F52
F14	F31
F32	F21, F23, F31, F51
F41	F15, F21, F23, F31, F32, F42, F51, F52
F42	F23, F31, F51
F51	F21, F23, F31, F52
F52	F31

Table 6. Effect group CSFs.

Effect group CSFs	Influencing the effect group CSF
F21	F11, F32, F41, F51
F22	F11
F23	F11, F32, F41, F42, F51
F31	F11, F14, F32, F41, F42, F51, F52

4.3 Phase 4: Validation of Findings

The findings are evaluated in relation to literature and the opinion of experts were solicited to gain insights into the BT adoption for entertainment sector. We used a three-step validation procedure to guarantee the accuracy and legitimacy of the DEMATEL-based results: (1) Expert evaluation and input, (2) expert input consistency check, (3) sensitivity analysis. Results & discussion section includes expert recommendations for BT adoption.

Table 7. Initial matrix.

Factors	F11	F12	F13	F14	F15	F21	F22	F23	F31	F32	F41	F42	F51	F52
F11	0.000	2.667	3.167	2.778	3.000	2.889	2.944	3.000	3.000	3.000	3.222	2.889	3.278	2.444
F12	2.444	0.000	2.722	2.778	2.333	2.722	2.500	2.611	2.944	2.944	2.667	2.611	2.611	3.000
F13	2.278	2.667	0.000	2.389	2.278	2.833	3.000	3.056	3.000	2.556	2.889	2.667	2.556	2.444
F14	2.556	2.611	2.500	0.000	3.056	3.000	2.667	2.778	2.833	2.722	2.722	2.722	3.056	2.889
F15	2.556	2.556	2.722	2.667	0.000	2.833	2.722	2.778	2.389	2.889	2.833	2.889	3.111	2.944
F21	2.111	2.389	2.556	2.500	2.167	0.000	2.389	2.500	2.778	2.667	2.611	2.278	2.944	2.500
F22	2.500	2.444	2.389	2.389	2.667	2.333	0.000	2.333	2.444	2.444	2.611	2.667	2.667	2.556
F23	2.500	2.556	2.667	2.500	2.778	2.833	2.778	0.000	2.667	2.556	2.389	2.667	2.611	2.278
F31	1.944	2.167	2.167	2.333	2.333	2.444	2.333	2.444	0.000	2.278	2.000	2.167	2.444	2.444
F32	2.667	2.833	2.889	2.833	2.778	2.944	2.889	2.889	3.111	0.000	2.667	2.833	3.000	2.833
F41	2.444	2.833	2.722	2.833	3.111	2.889	2.889	3.222	3.000	3.056	0.000	3.056	2.722	3.222
F42	2.778	2.833	2.278	2.611	3.056	2.722	2.667	3.111	3.000	2.944	3.278	0.000	2.611	3.167
F51	2.889	2.833	2.722	3.056	3.000	3.056	2.611	3.167	3.333	2.611	2.722	2.944	0.000	3.000
F52	2.222	2.944	2.611	2.611	2.778	2.833	2.778	2.833	3.000	2.722	3.000	2.889	3.111	0.000

Table 8. Normalized direct relationship matrix “D”.

Factors	F11	F12	F13	F14	F15	F21	F22	F23	F31	F32	F41	F42	F51	F52
F11	0.000	0.070	0.083	0.073	0.078	0.075	0.077	0.078	0.078	0.078	0.084	0.075	0.086	0.064
F12	0.064	0.000	0.071	0.073	0.061	0.071	0.065	0.068	0.077	0.077	0.070	0.068	0.068	0.078
F13	0.060	0.070	0.000	0.062	0.060	0.074	0.078	0.080	0.078	0.067	0.075	0.070	0.067	0.064
F14	0.067	0.068	0.065	0.000	0.080	0.078	0.070	0.073	0.074	0.071	0.071	0.071	0.080	0.075
F15	0.067	0.067	0.071	0.070	0.000	0.074	0.071	0.073	0.062	0.075	0.074	0.075	0.081	0.077
F21	0.055	0.062	0.067	0.065	0.057	0.000	0.062	0.065	0.073	0.070	0.068	0.060	0.077	0.065
F22	0.065	0.064	0.062	0.062	0.070	0.061	0.000	0.061	0.064	0.064	0.068	0.070	0.070	0.067
F23	0.065	0.067	0.070	0.065	0.073	0.074	0.073	0.000	0.070	0.067	0.062	0.070	0.068	0.060
F31	0.051	0.057	0.057	0.061	0.061	0.064	0.061	0.064	0.000	0.060	0.052	0.057	0.064	0.064
F32	0.070	0.074	0.075	0.074	0.073	0.077	0.075	0.075	0.081	0.000	0.070	0.074	0.078	0.074
F41	0.064	0.074	0.071	0.074	0.081	0.075	0.075	0.084	0.078	0.080	0.000	0.080	0.071	0.084
F42	0.073	0.074	0.060	0.068	0.080	0.071	0.070	0.081	0.078	0.077	0.086	0.000	0.068	0.083
F51	0.075	0.074	0.071	0.080	0.078	0.080	0.068	0.083	0.087	0.068	0.071	0.077	0.000	0.078
F52	0.058	0.077	0.068	0.068	0.073	0.074	0.073	0.074	0.078	0.071	0.078	0.075	0.081	0.000

Table 9. Total influence matrix “T”.

Factors	F11	F12	F13	F14	F15	F21	F22	F23	F31	F32	F41	F42	F51	F52
F11	0.763	0.883	0.888	0.884	0.913	0.933	0.907	0.944	0.961	0.913	0.922	0.909	0.949	0.909
F12	0.759	0.749	0.810	0.816	0.827	0.856	0.827	0.861	0.885	0.841	0.839	0.832	0.861	0.850
F13	0.748	0.806	0.736	0.799	0.817	0.850	0.830	0.863	0.878	0.824	0.836	0.825	0.851	0.830
F14	0.785	0.838	0.830	0.773	0.869	0.889	0.856	0.892	0.910	0.862	0.866	0.860	0.898	0.874
F15	0.783	0.834	0.832	0.836	0.792	0.883	0.855	0.889	0.897	0.863	0.866	0.861	0.896	0.873
F21	0.704	0.757	0.756	0.759	0.771	0.737	0.773	0.805	0.827	0.783	0.785	0.772	0.815	0.787
F22	0.716	0.762	0.755	0.760	0.786	0.797	0.717	0.805	0.822	0.781	0.789	0.785	0.812	0.791
F23	0.739	0.789	0.786	0.786	0.813	0.835	0.810	0.773	0.854	0.809	0.809	0.809	0.836	0.810
F31	0.645	0.693	0.688	0.696	0.714	0.734	0.711	0.741	0.695	0.713	0.710	0.709	0.740	0.724
F32	0.806	0.863	0.858	0.862	0.883	0.909	0.882	0.915	0.938	0.816	0.885	0.883	0.917	0.893
F41	0.817	0.880	0.872	0.879	0.908	0.925	0.899	0.941	0.954	0.908	0.838	0.906	0.929	0.920
F42	0.808	0.862	0.844	0.856	0.889	0.903	0.876	0.920	0.935	0.887	0.898	0.814	0.908	0.901
F51	0.825	0.878	0.870	0.882	0.904	0.927	0.891	0.938	0.959	0.896	0.902	0.901	0.861	0.913
F52	0.781	0.849	0.836	0.841	0.867	0.889	0.862	0.897	0.918	0.866	0.876	0.868	0.903	0.808

5. Results and Discussion

The importance of CSFs is determined by prioritizing them based on the highest value of $(r_i + s_j)$ (refer to **Table 10**); the CSFs listed in order of their ranking are as follows:

$F51 > F41 > F32 > F42 > F52 > F15 > F23 > F14 > F11 > F12 > F21 > F13 > F22 > F31$.

The top three key CSFs in the list are immutable attribution, decentralized governance, and decentralized audience insights. Blockchain voting mechanisms, transparent access control, and P2P distribution networks follow them. In order of importance, the last three CSFs are blockchain microtransactions, token-based rewards, and blockchain creator analytics.

According to the DEMATEL analysis, the blockchain's tamper-proof, transparent, and verifiable characteristics—known as Immutable Attributes (F51)—have the highest prominence and net cause score. This implies that F51 is the primary factor influencing the successful adoption of blockchain technology by the M&E industry.

F51 has a direct impact on the second-ranked factor, Decentralized Governance (F41), which also emerged as a decisive causative factor. This study suggests that decentralized decision-making and untrustworthy coordination among stakeholders (such as platforms, distributors, and content providers) could not work well in the absence of guaranteed immutability. The interaction between these two CSFs highlights the interdependence of technical and governance processes, with immutable infrastructure serving as the foundation of trust for decentralized control systems.

The 14 CSFs required for Blockchain adoption in the Media and entertainment industry are divided in the cause-effect groups. As per the results, 10 CSFs belong to the cause group, which are: RCT Tracking (F11), Decentralized DRM (F12), Blockchain Microtransactions (F13), Blockchain Marketplaces (F14), P2P Distribution Networks (F15), Decentralized Audience Insights (F32), Decentralized Governance (F41), Blockchain Voting Mechanisms (F42), Immutable Attribution (F51), Transparent Access Control (F52). The CSFs that belong to the effect group are NFTs for Digital Assets (F21), Token-based Rewards (F22), Automated Royalty Agreements (F23), and Blockchain Creator Analytics (F31). It is also observed that all the CSFs under the three dimensions – (1) Technology Infrastructure, (2) Governance and Community, and (3) Transparency and Trust- are in the cause group. All CSFs under the economic models are in the effect group. Lastly, a dimension of data and analytics has two CSFs, one of which falls under cause group and the other in effect group. Their relative importance and causal configuration in the M&E business offer unique strategic insights, even though many of the observed CSFs are similar to those found in generic blockchain adoption frameworks. The effectiveness of digital rights enforcement, stakeholder readiness, and consumer transparency—all crucial in the fight against digital piracy—were found to be primarily influenced by legislative clarity, a concern frequently mentioned in broader technology contexts.

Results show that RCT Tracking (F11) has the maximum value of $(Di-Ri)$, i.e., 1.999, with the greatest influence. The real-time tracking of content usage/consumption is as per our expectation as in the applications based on blockchain traceability and trackability are the vital parameters (Abu et al., 2020; Geiger et al., 2019; Zhang et al., 2020). The second highest CSF in the cause group is Decentralized Governance (F41), which can be well justified with the Blockchain as decentralization is one of the prime properties of blockchain technology (Chung et al., 2019; Kamilaris et al., 2019). The third highest is the Blockchain Marketplaces (F14). Next in the line are Blockchain Voting Mechanisms (F42), Decentralized Audience Insights (F32), Immutable Attribution (F51), P2P Distribution Networks (F15), Transparent Access Control (F52), Decentralized DRM (F12), Blockchain Microtransactions (F13) is the lowest level with value of 0.132.

The effect group includes 4 critical success factors. Token-based Rewards (F22) is the effect group factor, with a value of -0.819. The next in the line are Automated Royalty Agreements (F23), NFTs for Digital Assets (F21), and Blockchain Creator Analytics (F31), with a value of -2.518, which is the last in the effect group. It is evident that of the 4 effect groups, CSFs - 3 belong to the Economic Model dimension, and only 1 factor lies with the Data and Analytics dimension. Real-time processing is very much required for blockchain applications, and CSFs of the effect group justify this statement (Haleem et al., 2021).

Ten elements were categorized as causative (drivers) and only four as impact (dependent) components, indicating a glaring disparity in the cause-effect classification. This discovery has significant strategic implications. It suggests that rather than reactive organizational reactions, preconditions and enablers—such as immutable qualities, decentralized governance, stakeholder alignment, and legal clarity—are what mainly determine blockchain adoption in the media and entertainment industry. DEMATEL offers a more nuanced, system-oriented perspective than AHP or ANP research, which focuses on relative importance without considering influence direction. This enables decision-makers to allocate resources and provide policy support to upstream causes.

Following the established DEMATEL method, the threshold value used to filter the entire relation matrix was set at 0.904, which is equivalent to the mean value of all matrix members. This value prevents undue network complexity and guarantees that only significant causal linkages are kept for visual mapping. We attempted to assess the threshold's resilience using different cut-off levels (0.850 and 0.950). Although there were some slight differences in the results, the top causative CSFs were consistently categorized. This attests to the stability of the basic causal structure. Additionally, the chosen expert-derived influence scores were adjusted by $\pm 10\%$ to perform a sensitivity analysis. The relative ranking of the top five CSFs remained unaffected by the slight changes in prominence and relation ratings that ensued.

The 14 CSFs are plotted in this diagram according to their net influence ($r-c$) and prominence ($r+c$) values. The vertical axis ($r + c$) shows the overall significance of each component in the system. In contrast, the horizontal axis ($r-c$) separates cause factors (right side) from effect factors (left side).

Table 10. Sum of rows and columns of matrix “T”.

Factor	R	D	R + D	R - D	Cause/Effect
F11	12.678	10.679	23.357	1.999	Cause
F12	11.613	11.444	23.057	0.170	Cause
F13	11.494	11.362	22.856	0.132	Cause
F14	12.002	11.429	23.431	0.572	Cause
F15	11.960	11.754	23.713	0.206	Cause
F21	10.832	12.068	22.900	-1.235	Effect
F22	10.877	11.696	22.572	-0.819	Effect
F23	11.257	12.185	23.442	-0.927	Effect
F31	9.914	12.432	22.347	-2.518	Effect
F32	12.310	11.763	24.073	0.547	Cause
F41	12.575	11.819	24.395	0.756	Cause
F42	12.303	11.733	24.036	0.570	Cause
F51	12.548	12.178	24.725	0.370	Cause
F52	12.060	11.883	23.943	0.177	Cause

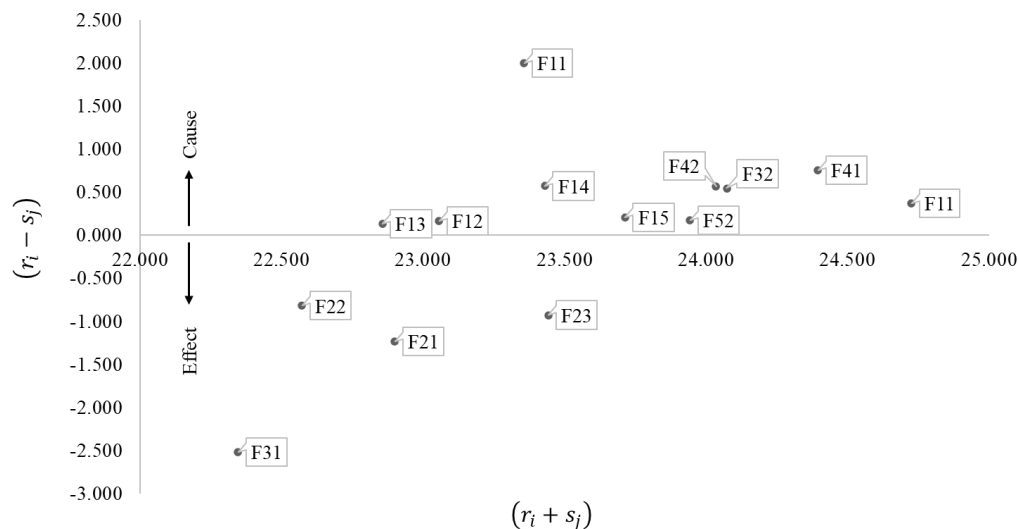


Figure 3. Casual diagram.

6. Study Implications

This work formulates a framework based on blockchain Technology. Initially, the success factors for implementing BT in entertainment industry were identified, thereafter, critical success factors were found and analyzed for their contributions. The proposed blockchain Technology has several implications for the media industry.

6.1 Theoretical Implications

The media and entertainment industry are undergoing a massive structural transformation with evolving technologies i.e., artificial intelligence, data science and machine learning. These technologies offer promising solutions to many of the longstanding challenges in the sector. This study proposes a framework developed using a DEMATEL technique to assist stakeholders in addressing key concerns related to transparency, copyright management, and royalty distributions. The findings highlight that CSF related to economic models and data analytics falls under the DEMATEL analysis's effect group, indicating that other factors significantly influence them in the system. In contrast, technology infrastructure, governance and community, and transparency and trust are categorized within the cause group CSFs, leading to blockchain technology adoption in media industry. While DEMATEL has proven effective in this context, future research may explore alternative MCDM techniques to enhance the generalizability of results. Additionally, further studies could incorporate a new dimension of regulatory and policy perspectives, investigating how the identified CSFs translate into practical implementation strategies, potential challenges, and performance outcomes within a real-world ecosystem. This study can also be replicated in the future to examine how the interrelationships and relative importance of success factors evolve, reflecting shifts in the technological, economic, and regulatory landscape. This study makes several significant theoretical advances. Using the DEMATEL method, which goes beyond conventional linear or ranking-based approaches, it first expands the literature on technology adoption by exposing causal interdependencies across blockchain adoption enablers. Second, it presents a novel industry-specific application of blockchain that has been largely overlooked in previous adoption models, focusing on mitigating digital piracy in the M&E sector. Third,

by connecting blockchain's potential to the more general objectives of transparency, traceability, and safe digital rights management, the findings provide a theoretical foundation for long-term digital change. By integrating the analysis into a multi-theoretical framework and applying it to a multifaceted policy, technology, and sustainability dilemma, this study goes beyond the simple use of DEMATEL. By doing this, it advances a theory of blockchain-enabled transformation in creative digital ecosystems that is specific to a given environment.

6.2 Managerial Implications

The study's finding offers valuable insights for stakeholders across the multimedia and entertainment industry, including videographers, musicians, writers, directors, and content creators. By emphasizing the role of BT, particularly for enhancing trust and transparency, the study highlights its potential to transform the media industry's supply chain. For producers, implementing Blockchain can reduce revenue leakage by preventing piracy and unauthorized distribution, thereby protecting intellectual property. Additionally, government agencies benefit from increased transparency in license issuance and revenue tracking and ensuring regulatory compliance. The proposed model offers a roadmap for building secure, efficient, and accountable ecosystem for creation and distribution of digital content.

The study offers practitioners throughout the media and entertainment value chain several focused and valuable insights. Investing in blockchain technologies that guarantee the immutability and traceability of content ownership is advised for content creators and rights holders. Digital documents that cannot be altered provide legal protection and foster trust when granting licenses or resolving disputes. Platform providers and distributors: prioritize decentralized governance methods to enhance automated smart contracts, royalty tracking, and content usage transparency. For developers and technology vendors, ensure that blockchain infrastructure possesses characteristics such as low latency, DRM compatibility, and easy-to-use metadata tagging that align with industry-specific standards. Common issues include a high upfront investment in digital infrastructure, resistance to change among content owners unfamiliar with blockchain, and a lack of stakeholder alignment among creative, technical, and legal teams. Stakeholders can transition from theoretical intent to strategic implementation by considering these pragmatic factors.

7. Conclusion

Blockchain technology penetrates all sectors, and solutions based on blockchain technology are adopted across the globe. The authors have finalized CSFs for blockchain adoption in entertainment and media industry. Initially, 14 critical success factors were highlighted based from the review of literature. Experts' opinions were solicited, and then the DEMATEL analysis categorized the factors into cause-effect groups. 10 factors were classified in the cause group, and 4 fell under the effect group. Results show that RCT Tracking (F11) has the maximum value of $(Di-Ri)$, i.e., 1.999, with the greatest influence on the complete system. Blockchain Creator Analytics (F31) is the effect group factor influenced by other CSFs, with a value of -2.518. Moreover, efficient management of digital assets, such as multimedia files, is a growing challenge. The multimedia industry grapples with asset tracking, rights management, and content distribution, which can be streamlined and made more efficient with transparent and decentralized ledger systems based on blockchain technology. Based on the framework, this study explains how the M&E industry's adoption of blockchain is influenced by a combination of organizational structure, technological preparedness, and legal environment, with sector-specific considerations such as IP vulnerability, piracy risk, and the fluidity of digital content. The study supports the development of sector-specific theories of digital governance and sustainable innovation by identifying and modeling the causal structure of CSFs, thereby advancing a more flexible and industry-sensitive understanding of blockchain dissemination.

The restrictions encountered in this research create opportunities for further study. Researchers could build on the model by incorporating ambiguity and improving prioritization through the use of fuzzy DEMATEL or hybrid MCDM techniques (such as F-DEMATEL–ANP), testing the CSF structure in bigger samples through empirical validations based on surveys. Contrasting results from other nations or content platforms (e.g., music vs. cinema vs. OTT) to evaluate transferability and improve contextual adaptations.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

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