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Supply Chain Costs in the Entertainment Industry Post COVID-19: Developing the Supply Chain Cost Ratio

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Abstract

Industries around the globe experienced supply chain disruption due to the COVID-19 global pandemic. It has been acknowledged by researchers and industry that there is a need to gain a better understanding of costs within the supply chain. However, the area of supply chain management remains diverse and fragmented. This research endeavors to evaluate the supply chain costs within the entertainment industry during the period spanning from 2000 to 2020 and to develop a new model (the Supply Chain Cost Ratio) that measures supply chain costs using financial ratios. Data for this investigation were obtained from publicly available information on the entertainment industry. The results of the multiple regression performed indicated that the Supply Chain Cost Ratio holds predictive value of an organization's supply chain costs $p<.0005$. From the study it was found that the Supply Chain Cost Ratio can be used as an indicator of supply chain costs in the entertainment industry.

Keywords: Supply Chain Management, COVID-19, Entertainment Industry, Supply Chain Cost Ratio
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1. Introduction

Understanding costs in the supply chain is crucial for optimizing operations, ensuring profitability, and maintaining competitiveness. It enables businesses to identify inefficiencies, make informed sourcing decisions, set appropriate pricing, and manage risks (Miswanto, et al., 2024). A transparent view of costs can also foster better collaboration among supply chain partners, leading to innovative cost-saving solutions. Ultimately, a comprehensive grasp of supply chain costs ensures that resources are used effectively, customer demands are met efficiently, and business sustainability is achieved (Jacobs & Chaes, 2023).

The global economy's increased integration has amplified the role of transnational supply chains in globalization. Their seamless operation enables efficiency-enhancing business changes, like just-in-time inventory management (Escaith et al., 2020). Rojas et al. (2023) highlighted the importance of identifying success factors in supply chain management for businesses. However, integrating multiple processes can introduce vulnerabilities in production, such as product damages, unscheduled labor, and distribution delays. These challenges can spike supply chain costs, driving up consumer prices, decreasing cash flows, and eroding competitive edge (Yu et al., 2023; Union et al., 2020). Oyewole, et al. (2024) noted that traditional analytical methods in supply chain management have difficulty adapting to market shifts and fluctuations and not approaches are required.

Mpwanya and Van Heerden (2017) noted rising supply chain costs across various industries. While companies seek precise cost data, few truly understand their customer service costs. The aim has traditionally been to minimize total costs in supply chain design. Strategies focus on cost control, but methods for effective cost management remain elusive (de Poot et al., 2021; Geng et al., 2021; Milewska & Milewski, 2022; Sun et al., 2022). To enhance productivity, lessen environmental impact, and optimize supply chain operations, organizations need to embrace digitalization, data analytics, and emerging technologies (Abaku, et al., 2024).

Researchers have turned to theories across disciplines to understand supply chain costs. Efficiency theory, transaction cost economics (TCE), and cost-based models are some examples. Yet, many of these models have limitations, being deterministic and linear, while real-world forecasting and inventory systems are often non-linear and unpredictable (Bolaños-Zúñiga & Vidal-Holguin, 2021; Ketokivi & Mahoney, 2020; Obayi & Ebrahimi, 2021; Yang & Xing, 2023).

Existing scholarly discourse indicates the predominant challenges in the entertainment industry's supply chain pertain to the optimal delivery of finalized products in a cost-effective manner. A challenge that necessitates further research into the role of cost management in the supply chain on companies in the entertainment industry.

The unprecedented challenges ushered in by the COVID-19 pandemic have exposed vulnerabilities in global supply chains across a myriad of sectors, especially the entertainment which has an outsized reliance on physical consumer attendance to generate profits (Nhamo et al., 2020).

The entertainment industry encountered severe and immediate demand deficits during the pandemic due to lockdowns and crowd restrictions. The inability to conduct their core business resulted in companies taking on oversized amounts of debt, altering business models, merging, among others, to survive and stay solvent. As such, post-COVID the industry has focused on evaluating and designing efforts to manage future supply chain disruptions (Moon, 2020; Ryu & Cho, 2022).

The Supply Chain Operations Reference (SCOR) model offers a systematic approach to evaluate various dimensions of the supply chain. A salient dimension explored by the SCOR model are the costs of the supply chain and its implications for overarching efficiency. The operational procedures embedded within the supply chain of entertainment companies can often be perceived as dynamic, demanding a more substantial and riskier allocation of resources than many other sectors. Consequently, the dependability of these supply chains becomes imperative for the quality assurance of the product. Given these intrinsic characteristics, the realization of economies of scale within the supply chain emerges as a critical determinant for maintaining a competitive edge. Enhancements in supply chain cost processes have the potential to augment their efficiency, leading to a streamlined production paradigm characterized by reduced raw materials, minimized rework, fewer quality assessments, and the elimination of other superfluous activities. Such refinements invariably culminate in amplified profit margins.

This research endeavors to evaluate the supply chain costs within the entertainment industry during the period spanning from 2000 to 2020, with particular emphasis on the repercussions of the COVID-19 pandemic. Building upon the foundational research by Roman Torres et al. (2023), Douglas et al., (2023) Forehand et al., (2023), and Forehand et al. (2021), we propose to construct a ratio derived from the SCOR model to ascertain supply chain costs for all the publicly traded corporations in the entertainment industry. Table 1 below details the examined companies in descending order by market capitalization.

Table 1. Companies in the Entertainment Industry

Name	Market Cap (Billions $)
The Walt Disney Company	$200.40
Netflix, Inc.	$162.37
Warner Bros. Discovery, Inc.	$36.43
Sirius XM Holdings Inc.	$22.95
Warner Music Group Corp.	$18.82
Liberty Media Corp	$18.34
Fox Corporation	$17.88
Formula One Group	$16.23
Paramount Global	$14.69
News Corporation	$11.94
Nexstar Media Group, Inc.	$7.40
Roku, Inc.	$7.32
World Wrestling Entertainment, Inc.	$6.38
Endeavor Group Holdings, Inc.	$6.25
iQIYI, Inc.	$6.06
Madison Square Garden Sports Corp.	$4.47
Manchester United plc	$3.69
AMC Entertainment Holdings, Inc.	$2.71
Bowlero Corp.	$2.24
Dave & Buster's Entertainment, Inc.	$1.98
Lions Gate Entertainment Corp.	$1.72
HUYA Inc.	$1.45
Sinclair Broadcast Group, Inc.	$1.42
Cinemark Holdings, Inc.	$1.38
IMAX Corporation	$0.97
AMC Networks Inc.	$0.76
The Marcus Corporation	$0.48

Source: Yahoo! Finance.

The cohort of 27 companies encompass a diverse spectrum of organizational architectures, comprising publicly traded corporations, state-owned enterprises, national entities, and multinational corporations. This heterogeneity

in business structures facilitates a nuanced cross-structural analysis. This study augments the extant scholarly literature on supply chain costs, representing a pioneering effort to devise a ratio whose outcomes are tailored for stakeholders external to the organization.

Research efforts on measuring supply chain costs have focused on developing tools with the internal decision maker as the end-user along with complicated variable relationships and simulations. As such, current tools rely on confidential company data to assess supply chain cost performance (Ramos et al., 2021). This investigation is novel in developing a streamlined metric for evaluating supply chain costs using publicly available data, with the primary focus being the external user. In doing so, it addresses a conspicuous gap in the current literature (Li et al., 2022).

2. Theoretical Framework

The Supply Chain Efficiency (SCE) ratio, initially introduced by Forehand et al. (2021), represents the pioneering effort to harness publicly accessible data in crafting a model to evaluate supply chain efficacy. Notwithstanding, the model appears detached from foundational supply chain theories. In our present study, we strive to redress this deficiency by refining the SCE Ratio and associating it with the Supply Chain Operations Reference (SCOR) metrics. Introduced in 1996 by the PRTM management consulting firm, the SCOR metrics later garnered endorsements from the Supply-Chain Council and the Association for Supply Chain Management (APICS). These metrics serve as supply chain indicators crucial to business operations. With its widespread acceptance, the SCOR model is now the definitive benchmark for gauging the efficacy of supply chain processes, encompassing supply chain costs. Recognizing the pivotal role of SCOR metrics in supply chain scholarship, our research aspires to augment the foundational work of Forehand et al. (2021) by devising a Supply Chain Cost (SCC) ratio predicated on the SCOR metrics.

Furthermore, this novel ratio seeks to augment the contributions to the supply chain discourse by Roman Torres et al. (2023), Douglas et al. (2023), and Forehand et al. (2023). It presents a model designed to appraise supply chain endeavors for an organization's external stakeholders. Our study also aims to contribute to the burgeoning body of literature examining the ramifications of COVID-19 on global supply chains. Notably, our research represents the first effort to gauge the supply chain performance of publicly traded entertainment firms.

While the SCOR metrics are anchored in sound theory, they exhibit an inherent limitation: They are tailored for internal analysts. Several data metrics, as delineated by the SCOR, remain proprietary, rendering them inaccessible to external entities such as investors, regulatory bodies, and scholars. The data repositories employed in this study to shape the SCC ratio derive from publicly available annual reports. Our study endeavors to link those accounts associated with supply chain costs to the financial statements.

SCOR metrics derive from the following indicators: Asset management, costs, flexibility, reliability, and responsiveness. Costs (i.e., the metric used in this investigation) is linked to externalities in the supply chain via the following accounts: operational expenses and average property, plant & equipment (PP&E). The Supply Chain Cost variables can be organized into the following function:

$$f = (\text{Operating Expenses, Average PP\&E})$$

Guided by the SCOR Level 1 Metric for costs, along with the research of Roman Torres et al. (2023), Douglas et al. (2023), Forehand et al. (2023), and Forehand et al. (2021), we determine the variables representing the process output (i.e., operating expenses) and the process inputs (i.e., average PP&E). The results of the SCC ratio will also provide insight into the organizations cost structure. Table 2 below details the SCC formula with additional details.

Table 2. Details on the SCC formula

Attribute	Performance Attribute Definition	Level 1 Metric	Chart of Accounts	Ratio	Financial Statement
Supply Chain Costs	The costs associated with operating the supply chain.	Cost of Goods Sold Total Supply Chain Management Costs Value-added Productivity Warranty-Returns-Processing Costs	Operational Expenses Average Property, Plant, & Equipment	Average PP&E / Operating Expenses	Income Statement Balance Sheet

Source: Supply Chain Council (2017).

Figure 1 presents the conceptual map of the SCC ratio, which includes the variables that make up the model, their relationship, and the estimate that the model generates.

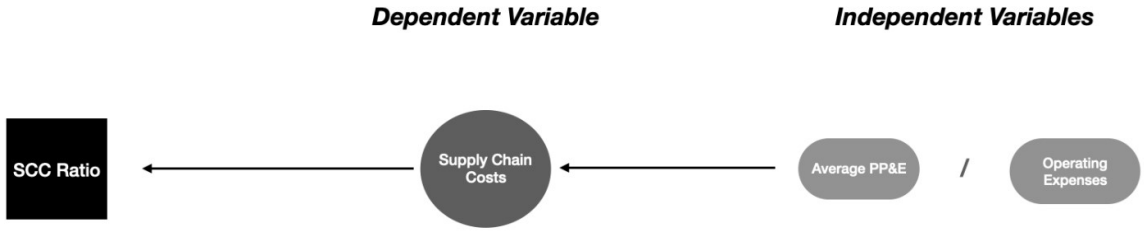

Figure 1. SCC Ratio

The SCC ratio results are interpreted as the higher the ratio result, the more efficiently is the company using their supply chain and leveraging their supply chain cost structure to generate revenue.

3. Research Questions

The research objective of this investigation is to develop a supply chain cost ratio for public companies in the entertainment industry from 2000 to 2022, based on changes in operating expenses and average PP&E. A secondary objective is to apply the SCC ratio and evaluate its impact on supply chain costs during the COVID-19 pandemic. Consequently, the following research questions arise:

RQ1: What is the association between supply chain costs and the SCC ratio?
RQ2: Are there any outliers in supply chain costs based on the SCC ratios for the 2000–2022-time frame?

4. Research Hypothesis

The research examines the relationship between supply chain costs and the SCC ratio. Additionally, it seeks to identify any outliers in the ratio during the 2000-2022 period, leading to the following research hypothesis:

H1: There is no statistically significant relationship between Supply Chain Costs and the SCC ratio.
H2: There are no statistically significant outliers identified by the SCC ratio for the 2000-2022-time frame.

This study offers a unique addition to the existing knowledge on supply chain costs. It pioneers the development of a straightforward performance ratio for the entertainment industry. Moreover, it investigates the potential effects of COVID-19 disruptions on the supply chain costs of entertainment companies. The results are specifically designed for users external to the organization.

5. Literature Review

5.1 Types of Supply Chain Costs

Supply chain costs represent the expenses associated with moving goods from raw material suppliers to end consumers. But navigating this intricate web isn't free; various costs emerge, each carrying its own tale. First, there's the procurement cost, a tale of negotiations and transactions. Every time a product is sourced, or a service is procured, expenses are incurred. These could be in the form of raw materials, components, or finished goods and each acquisition brings along its costs, like tendering, negotiation, contracting, and payment (Ramos et al., 2021).

Then there's the production cost, a story of transformation. Raw materials evolve into finished products, but this metamorphosis requires resources: labor, machinery, and energy. It's here that costs of machinery operation, labor wages, and quality control checks come to play.

Storage cost narrates the tale of warehousing. Goods await their destiny on warehouse shelves, incurring costs all the while. Inventory costs, stemming from stockouts or excess storage, can be particularly tricky, and risks like obsolescence or damage further heighten the drama. The transportation cost tells a journey's tale. Whether by air, sea, or land, moving goods from one place to another isn't free. Fuel, maintenance, vehicle depreciation, and regulatory fees are constant companions on these journeys (Ramos et al., 2021).

The tale of service and returns cost emerges from the world of after-sales. Addressing customer grievances, managing product returns, or replacing faulty goods, this cost embodies the brand's promise to its customers. Together, these tales paint a comprehensive picture of the supply chain. Understanding these costs is crucial for companies to optimize their supply chains, identify inefficiencies, and ensure profitability while meeting customer demands efficiently (Stevenson, 2021).

Technological advances have had a significant impact on supply chain costs. The use of analytics, artificial intelligence, and the digitization of business have altered global supply chains. According to Jacobs and Chaes (2023), digital procurement platforms, driven by advanced analytics, have ushered in transparency, enabling businesses to make informed sourcing decisions. Automated procurement systems can identify optimal suppliers, thereby ensuring cost-effectiveness. Furthermore, e-procurement reduces transaction costs by streamlining operations, minimizing manual interventions, and reducing errors.

Technologies such as the Internet of Things (IoT) and Artificial Intelligence (AI) have facilitated smart manufacturing. Advanced machinery equipped with sensors can predict maintenance needs, thus reducing downtime. Moreover, AI-driven demand forecasting can optimize production schedules, ensuring resource efficiency and reducing wastage. Separately, warehouse management systems, fortified by AI, have optimized inventory levels, reducing carrying costs. Furthermore, robotics and automation in warehousing have diminished labor costs and increased space utilization, leading to overall reductions in storage expenses (Simchi-Levi et al., 2022).

Technological advancements in fleet management software have facilitated route optimization, leading to significant fuel savings. Additionally, real-time tracking systems ensure efficient dispatching and reduce lead times, translating to decreased transportation costs. Finally, digital customer relationship management (CRM) tools have streamlined after-sales service, addressing issues promptly and reducing return-related costs. Predictive analytics also play a role in identifying potential product defects, leading to proactive remediation and lower service costs.

5.2 Supply Chain Cost Configuration and Determinants

Supply chain management, which pertains to the coordination and management of a network of interconnected businesses involved in the provision of product and service packages required by end customers, inherently consists of a multitude of cost components. An understanding of the underlying factors influencing these costs is imperative for efficient management and optimization. According to Swink et al. (2024), Yu et al. (2023), and Ramos et al. (2021) the main contributors to the supply chain cost structure are:

- Demand Forecasting: Accurate demand forecasting allows companies to plan better, reduce excess inventory, and minimize stockouts. Advanced forecasting techniques, like time-series analysis or machine learning, can be used to predict demand with greater accuracy.
- Economies of Scale: Leveraging economies of scale can reduce per-unit costs. This can be achieved by consolidating purchases or increasing production volume.
- Efficient Transportation Management: Cost-effective transportation can be realized through route optimization, consolidating shipments, choosing the right mode of transportation, and negotiating rates with carriers.

- Labor, Training, and Development: Investing in the training and development of employees can boost productivity, reduce errors, and optimize processes.
- Lean Management: Adopting lean principles across the supply chain can lead to the elimination of non-value-adding activities, optimizing operations and reducing costs.
- Optimized Inventory Management: Proper inventory management can significantly reduce carrying costs. Employing strategies such as Just-In-Time (JIT) or lean inventory management can minimize stock levels while ensuring product availability, thereby reducing stockouts and overstock costs.
- Process Improvement Initiatives: Embracing methodologies like Six Sigma or Total Quality Management (TQM) can lead to streamlined processes, reduced waste, and enhanced quality, subsequently reducing costs.
- Product Complexity and Variety: Managing a higher variety of SKUs or more complex products can result in increased costs due to the need for specialized handling, storage, and transportation.
- Reduction in Lead Time: Minimizing lead times through efficient processes can reduce safety stock requirements, further reducing inventory costs.
- Regulatory Compliance and Duties: Complying with local, national, and international regulations and standards can introduce additional costs. Duties and tariffs associated with cross-border trade can also significantly impact cost structures.
- Risk Management: Adopting risk management practices to identify, assess, and mitigate supply chain disruptions can prevent costly interruptions. This includes diversifying supplier base, insurance, and contingency planning.
- Sourcing Strategy: Global sourcing can lead to cost advantages. However, companies should consider total landed costs, which include shipping, duties, and other costs, to ensure that offshore sourcing provides net savings.
- Strategic Supplier Partnerships: Building strong relationships with suppliers can lead to volume discounts, better credit terms, and improved quality. Regular negotiations and long-term contracts can further optimize costs.
- Sustainability, Waste Reduction, and Ethics: Embracing sustainable and ethical supply chain practices can lead to reduced waste, optimized resource utilization, enhanced branding, and potential tax benefits or incentives.
- Technology Integration: Implementing integrated supply chain systems, like ERP (Enterprise Resource Planning) or TMS (Transportation Management Systems), can improve visibility, coordination, and efficiency, reducing manual errors and inefficiencies.

The literature suggests that a multifaceted approach to understanding and managing the determinants of supply chain costs is essential for organizations to achieve optimal financial performance and operational excellence. According to Yu et al.(2023), strategic decisions concerning scale, technology adoption, supplier relationships, and risk management, among others, must be made in the context of these determining factors. Managing and reducing supply chain costs necessitates a strategic approach. The supply chain cost configuration outlined by Swink et al. (2024), Yu et al. (2023), and Ramos et al. (2021) exemplify the SCOR Level 1 metrics for supply chain costs. By considering all components of the supply chain, companies can identify opportunities for savings, improve efficiency, and optimize overall performance.

5.3 Empirical Studies on Supply Chain Costs

Research on supply chain costs has predominantly revolved around creating models, simulations, and theories to elucidate cost dynamics in supply chains. The literature is rich in studies that cover a wide variety of supply chain cost topics. Empirical investigations have been published on the automotive, fashion, finance, healthcare, hospitality, retail, and technology industries. Academics have also examined the role of cost sharing strategies, inventory management, utilities (e.g., power plants), and manufacturers on the costs of the supply chain. However, the specificity of the models developed to address the research problem in each of the studies has been a constant limitation. The research results are sound and rigorous but lack universal applicability.

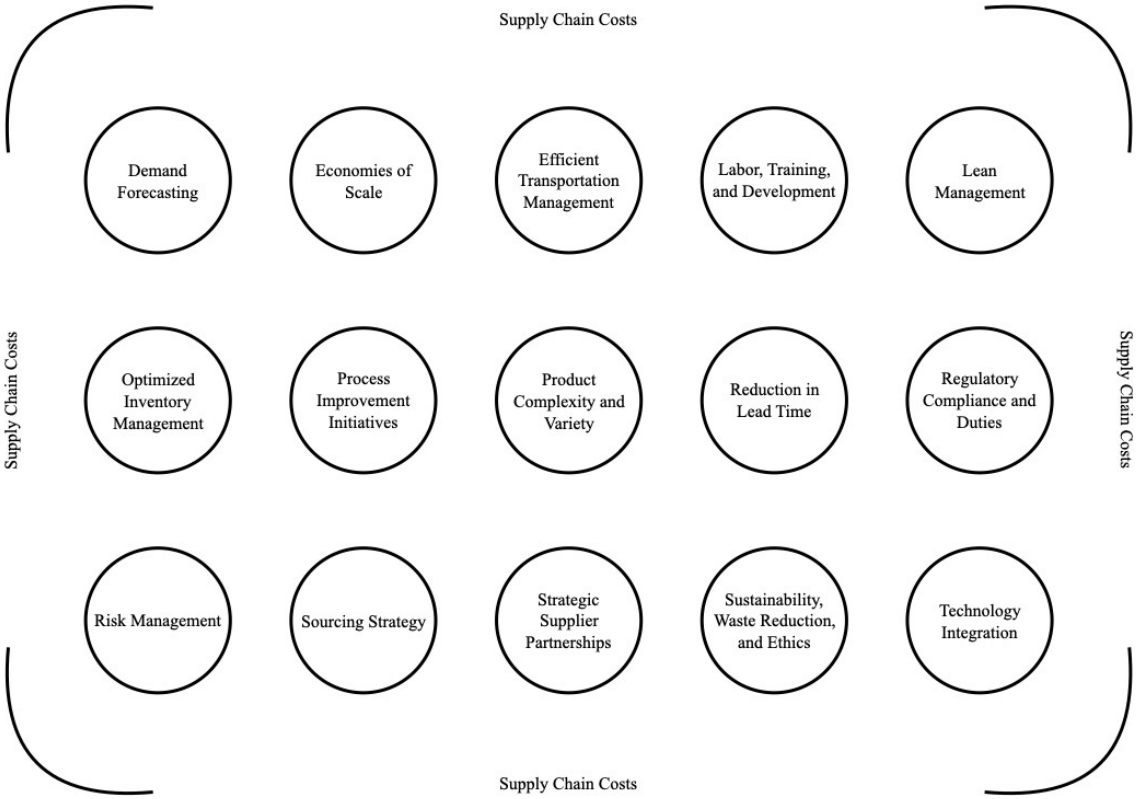

Figure 2. Supply Chain Cost Configuration

The overarching method of reducing supply chain costs found in the current literature has been cost sharing strategies. Numerous empirical investigations have been undertaken that evaluates the fit, effectiveness, and applicability of such strategies on supply chain costs across a wide array of countries, sectors, industries, and markets (Li et al., 2021; Rathnasiri et al., 2022; Yu et al., 2020; Zhu et al., 2018). However, there is a lack of consensus in the literature of the impact of cost sharing strategies on total supply chain costs. The reason for the inconsistent results appears to center on the differences among the business operations, environment, and the unique nature of each supply chain (Gustafsson et al., 2021). That said, a consensus has emerged in the success metrics of cost sharing contracts the result in reduced supply chain costs. The literature suggests that planning, coordination, and communication among the supply chain participants are the essential components of successful cost sharing contracts.

Current studies on supply chain costs forms a crucial foundation for broader supply chain cost studies. A recent model by Yang and Xing (2023) evaluated the costs of product delivery in varying time frames. They pinpointed cost disparities to derive optimal delivery times and subsequently gauged its effect on overall supply chain costs and efficiency. Their findings highlight the benefits of fine-tuning delivery times for better performance and cost reduction.

In 2022, Ghanbari et al. assessed the impact of strategic cost management on supply chain practices and Top Management Support (TMS) vis-a-vis financial performance. Utilizing a Senior Management Survey (SMS), they gauged supply chain practices across 165 companies from the Tehran Stock Exchange. They found the interplay between strategic cost management, TMS, and supply chain practices to be non-linear in enhancing financial performance. Furthermore, they theorized that Supply Chain Integration (SCI) is most effective at lower to medium levels.

Bolaños-Zúñiga and Vidal-Holguin (2021) used a Monte-Carlo simulation to gauge the relationship between

inventory costs and supply chain efficacy. They identified average inventory hold-ups and warehouse throughput as key cost determinants. Their findings indicated that the simulation didn't notably influence the optimization of the supply chain through inventory cost management.

In 2020, Ketokivi and Mahoney explored the relevance of Transaction Costs Economics (TCE) theory to supply chain efficiency. Their analysis revealed a strong correlation between TCE principles and supply chain expenses. Wang et al. (2018) studied green supply chain investments across 246 global firms to pinpoint key cost drivers. Their research identified firm size as a significant influencer, with larger enterprises being more impacted.

Asmussen et al. (2018) evaluated how managerial dynamics and supply chain intricacies affect decision-making and cost structures. Their insights reveal that heightened complexity in decision-making impairs cost estimate precision. Early acknowledgment of this complexity can refine strategic choices, bolstering cost management. Albertzeth and Pujawan (2018) devised strategies to address transportation interruptions in supply chains. Focusing on five companies, they used simulations and cost-effectiveness analysis (CEA). Their findings showed that while maintaining surplus stock quickened deliveries, it escalated overall costs. Conversely, adaptable distribution routes enhanced cost control but spiked disruptions.

Wang et al. (2018) examined decision-maker responses to rising costs from supply chain interruptions. Their observations indicated a preference for strategies that bolster reliability and evenly distribute risks. Lastly, Guo (2013) explored cost accounting information's influence on supply chain networks. By creating a mathematical model, he aimed to optimize enterprise accounting. His outcomes indicated the model's efficacy in refining cost account data utilization.

Supply chain cost investigations that are industry-centric consist of Ahlsell et al. (2023) who crafted a cost model focusing on the acquisition of automotive industry spare parts and its subsequent impact on the supply chain. Their study on 14 distinct spare parts found that only three resulted in reduced supply chain expenses. In 2020, Escaith et al. explored how Brexit influenced the supply chains of the UK and EU's automotive sectors. Their insights indicated that the UK's auto sector might need to overhaul its supply chain configurations to maintain competitiveness.

Koren and Shnaiderman (2023) put forth a forecasting model tailored to the fashion sector. They believed that precise predictions could curtail supply chain costs by decreasing mistakes and waste. Their findings emphasized the importance of inventory maintenance and demand adaptability. Yang et al. (2018) investigated the effect of various pricing strategies on fashion industry supply chain costs. Their conclusion was that imbalanced supplier information can inflate costs.

Essila's (2023) study of 80 hospitals showed that effective implementation of inventory systems could slash hospital supply chain expenses. Rojas et al. (2023) proposed a model for predicting inventory cost savings across pharmacy supply chains, discovering that the best savings come from addressing low-success factors. In 2021, Thomas et al. applied a cost control model to a Congolese healthcare facility, resulting in significant reductions in several supply chain cost areas, although replicating these results elsewhere might be challenging.

Bi and Yang (2022) focused on the financial flow from banks to retailers and found more efficient supply chains reduced retailer financing costs. Li et al. (2022) demonstrated that merging traditional and supply chain financing significantly reduced costs across multiple Chinese industries. However, the extent of cost reduction differed among industries. Geng et al. (2021) posited that prioritizing cost reduction could inadvertently produce inefficient supply chain designs. A 2020 study by Union et al. at Baghdad Tourism hotel highlighted that concurrent engineering practices could lead to more efficient supply chain operations.

Liu et al. (2021) analyzed a two-tier supply chain, concluding that efficient value-added services decrease supply chain costs, while information sharing can have varied impacts. Xu and Ma (2021) discovered the profound influence of retail costs on supply chain structures, suggesting a tension between manufacturer and consumer benefits. Gustafsson et al. (2021) linked supply chain uncertainties with increased product returns in online retail, with disruptions leading to elevated costs. Benrqya's 2019 case study revealed that while a cross-docking strategy increased costs, combining it with traditional warehousing could achieve savings.

Chatterjee et al. (2023) found that digitalizing the supply chains of tech firms considerably enhanced cost performance. Roeck et al. (2020) noted that while distributed ledger technology offers long-term cost benefits, its full advantages are often overshadowed by short-term objectives. Mpwanya and Van Heerden (2017) developed a cost-reduction framework for the South African mobile phone industry, suggesting strategic collaboration and outsourcing as key to cost efficiency.

In recent years, research has delved into the benefits of cost-sharing approaches in supply chain management to

curtail expenses. For example, Rathnasiri et al. (2022) investigated the potential of cost-sharing contracts to enhance e-commerce supply chain outcomes and trim unnecessary expenses. Their research revealed that dynamic cost-sharing agreements can effectively reduce overall supply chain expenses.

In a 2021 study, Li et al. explored the impact of revenue-cost sharing (RCS) contracts within an item-level RFID inventory and demand management framework on total supply chain expenses. Their results indicated that RCS contracts can lead to significant cost reductions, especially when there's cohesive coordination between retailers and wholesalers and clear role definitions. Yu et al. (2020) delved into retailer and wholesaler tendencies when opting between revenue-sharing and cost-sharing to regulate supply chain expenses. They discovered that while wholesalers lean more towards revenue-sharing agreements, retailers' choices are influenced by consumer inclinations and taxation. Additionally, they noted that revenue-sharing contracts promote competitive pricing and enhance consumer advantages.

Lastly, Zhu et al. (2018) research focused on the extent of coordination required to fully harness the benefits of a supply chain cost-sharing arrangement, specifically within the realm of food production involving suppliers and producers. Their findings highlighted that strong coordination between suppliers and producers amplifies supply chain efficiency and cost savings. In essence, a well-synchronized cost-sharing agreement yields higher profits for both entities compared to uncoordinated scenarios in a decentralized supply chain setting.

5.4 Overview of the Communication Services Sector and the Entertainment Industry

The Communication Services Sector encompasses companies that facilitate communication and information dissemination, including telecom, media, and internet enterprises. The Entertainment Industry is a subsection of the communications sector that focuses on providing leisure and recreational activities to audiences, covering areas like film, television, music, and live performances. Both sectors are integral to modern information and cultural exchange.

Prior to the COVD-19 pandemic, supply chain disruptions had gained significant attention by scholars (Albertzeth & Pujawan, 2018). The outbreak of the COVID-19 pandemic exacerbated supply chain disruption in various ways. The entertainment industry was hit particularly hard due to its reliance on live events and gatherings to generate revenue. To navigate these unprecedented challenges, supply chain managers have taken steps to rejuvenate and strengthen their operations. In addition, some companies introduced changes to their core business models to survive. Given the scope of these actions, it's essential to employ project management principles and tools for a seamless transition to post-pandemic supply chains, as noted by Hajiagha et al. (2022).

There have been a few empirical investigations post COVID-19 that have looked at the costs of supply chain disruptions. For instance, Fassas et al. (2021) analyzed the reactions of 3,279 U.S. businesses spanning all sectors to the commercial implications, financial obstacles, and probable economic ramifications of the COVID-19 crisis. Their research highlighted that managers were chiefly concerned with supply chain disruptions and rising costs. Interestingly, management's favored approach to address these issues was salary cuts, a contrast to past economic downturns where workforce reductions were more prevalent. In Hoek (2020) studied the supply chains of seven diverse companies during the pandemic, gauging the overall cost implications of supply chain disruptions. The study revealed that fostering supplier partnerships and adopting a comprehensive cost assessment can curtail supply chain Expenses. However, Hoek Notes That The Initial Investment In These Strategies Might Be Considerable And Time Intensive.

6. Method

This investigation aims to build upon the models developed by Roman Torres et al. (2023), Douglas et al. (2023), Forehand et al. (2023), and Forehand et al. (2021), which measure supply chain efficiency. The foundation of the Supply Chain Cost (SCC) ratio lies in the efficiency formula: the Supply Chain Efficiency (SCE) Ratio proposed by Forehand et al. (2021) and the supply chain ratios introduced by Roman Torres et al. (2023), Douglas et al. (2023), and Forehand et al. (2023). There is limited literature concerning supply chain costs, especially research that aims to quantify supply chain efficiencies by evaluating cost structures. This study represents the inaugural effort to formulate a streamlined supply chain cost ratio, which promises to shed light on the supply chain efficiencies of businesses within the entertainment sector.

The primary objective of this investigation is to craft the SCC for public companies in the entertainment sector spanning the years 2000 through 2020. The SCC ratio derives from alterations in operating expenses and the average value of property, plant, and equipment (PP&E). A secondary aim is to employ the SCC ratio to gauge its influence on supply chain costs during the COVID-19 pandemic.

7. Research Design

This study employs a quantitative, non-experimental, descriptive, cross-sectional design. Such a quantitative design is suitable, as the research seeks to gather extant financial data from all public corporations in the entertainment sector to scrutinize supply chain expenses. The ratio amalgamates multiple independent variables to compile supply chain details. These variables enable the assessment of supply chain costs, drawing on prior financial data. The cross-sectional, non-experimental design fits the purpose, given that the data pertains to a distinct period (2000-2020) and revolves around a pre-existing phenomenon (COVID-19). Additionally, a descriptive approach is relevant because the phenomenon undergoes analysis in its innate context without any variable manipulation in the SCC model (Burkholder et al., 2019).

This research endeavors to build upon the foundation laid by Forehand et al. (2021) and subsequently expanded by Roman Torres et al. (2023), Douglas et al. (2023), and Forehand et al. (2023) in quantifying supply chain efficiency. It furthers the foundational understanding of supply chain efficiency vis-à-vis the SCOR metrics by formulating a supply chain cost ratio. The objective is to ascertain whether the SCC ratio can predict supply chain costs. Integrating various independent variables associated with supply chain expenses enhances the analysis. Data points that construct the model are publicly accessible via financial statements, facilitating rigorous result verification through diverse techniques.

Data was culled from companies' annual reports using MS Excel® 2010, with the SCC ratio as the primary research tool. All relevant annual reports were obtained, either directly from company websites or the EDGAR database. Data pertaining to operating expenses and property, plant, and equipment (PP&E) from these reports, spanning 2000 to 2020, was methodically extracted, catalogued, and incorporated into the SCC model.

The simulation yields a “score” conducive to comparative analysis, thereby facilitating evaluations both within and across sectors, akin to financial ratio analysis. The resulting ratio undergoes rigorous scrutiny across specific categories to evaluate its relevance. A multiple regression model was employed to ascertain the significance of each hypothesis, given the multiple predictors used to compute the supply chain cost score.

The regression model incorporated the two requisite financial indicators for the SCC ratio and established time intervals at a .05 significance level. The instrument's primary goal was to evaluate the predictability of the independent variables over the two-decade span. Given the public nature of the data sources, potential biases such as participant inclinations or human errors are inherently minimal. The researchers upheld stringent objectivity when handling the research tool and input data.

8. Results

This study first aimed to investigate the possible correlation between supply chain cost efficiency and the SCC (Supply Chain Cost) ratio in the entertainment business. A thorough investigation was conducted by utilizing a multiple regression model that was constructed on the SCC ratio as the main predictor variable.

The results of this model have shown that the SCC ratio can be a dependable indication of supply chain cost effectiveness in the entertainment industry. Out of the 27 companies analyzed, Bowlero and Endeavor lacked sufficient data for regression analysis. The SCC ratio is a reliable predictor, as our studies have shown statistical significance.

Table 3. Regression Results

							Hypothesis Results	
		Coefficients	t Stat	P-value	F-value	R Square	H1	H2
AMC Ent.	Operating Expenses	-1.3217E-07	-6.10	0.000290393	19.23	0.83	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	2.50602E-07	5.43	0.000622188				
AMC Net.	Operating Expenses	-3.14074E-08	-6.22	9.8206E-05	89.45	0.95	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	4.6485E-07	10.73	8.28954E-07				
Bowlero	Operating Expenses	Not enough values to run regression.						
	Average PP&E							
Cinemark	Operating Expenses	-4.2418E-07	-8.10	1.19117E-06	33.31	0.83	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	6.45407E-07	7.90	1.58008E-06				
Dave & Buster's	Operating Expenses	-8.56022E-07	-13.30	3.17633E-06	131.71	0.97	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	1.43614E-06	16.17	8.4001E-07				
Disney	Operating Expenses	-2.40787E-05	-15.14	2.03207E-12	160.74	0.94	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	2.63389E-05	17.41	1.49832E-13				
Endeavor	Operating Expenses	Not enough values to run regression.						
	Average PP&E							
Fox	Operating Expenses	-1.14791E-05	-14.83	2.96654E-12	348.48	0.97	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	5.52389E-05	24.96	1.5122E-16				
HUYA	Operating Expenses	-5.97234E-09	-15.02	0.0044038	190.65	0.99	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	6.58651E-07	19.21	0.002697931				
IMAX	Operating Expenses	-1.89701E-06	-5.80	1.37852E-05	313.23	0.97	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	4.05495E-06	15.93	1.89657E-12				
iQIYI	Operating Expenses	-9.16611E-09	-22.94	0.001895417	807.95	1.00	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	2.08044E-07	40.18	0.000618966				
Liberty One	Operating Expenses	-4.53058E-05	-9.62	6.05967E-09	50.13	0.83	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	0.000166216	7.37	4.04844E-07				
Liberty Live	Operating Expenses	-2.30315E-08	-12.53	1.1035E-09	80.38	0.91	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	2.63589E-07	8.30	3.44319E-07				
Lions Gate	Operating Expenses	-3.2263E-08	-5.79	1.15068E-05	35.08	0.78	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	2.36997E-06	7.16	6.24506E-07				
MSQ Sports	Operating Expenses	-8.37914E-07	-4.33	0.004936785	57.92	0.95	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	1.21176E-06	8.51	0.00014456				
Manchester United	Operating Expenses	-1.23422E-06	-11.64	9.97241E-07	72.22	0.94	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	2.84665E-06	7.40	4.12119E-05				
MARCUS Corp.	Operating Expenses	-3.05686E-06	-12.27	9.21744E-11	75.33	0.88	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	1.99602E-06	8.76	2.77756E-08				
Netflix	Operating Expenses	-5.00627E-09	-3.63	0.0017931	6.58	0.41	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	1.05303E-07	3.40	0.0029849				
News Corp.	Operating Expenses	-2.47212E-05	-9.84	6.8079E-09	69.17	0.88	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	5.19008E-05	10.76	1.58648E-09				
Nexstar	Operating Expenses	-3.30417E-07	-3.21	0.004827195	5.16	0.36	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	7.76298E-07	3.12	0.005915782				
Paramount	Operating Expenses	-7.48399E-06	-11.27	4.11619E-10	164.23	0.94	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	5.10877E-05	17.39	1.52674E-13				
Roku	Operating Expenses	-2.46047E-07	-2.58	6.13943E-05	12.70	0.86	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	2.0773E-06	3.19	0.033103374				
Sinclair	Operating Expenses	-5.31927E-07	-8.49	6.8175E-08	155.47	0.94	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	1.63555E-06	17.56	3.33121E-13				
Sirius	Operating Expenses	-5.34191E-07	-2.18	0.041074324	2.39	0.19	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	1.03307E-06	1.63	0.001192919				
Warner Music	Operating Expenses	-2.00134E-05	-15.50	4.67086E-11	323.19	0.98	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	0.000301948	23.22	9.43832E-14				
Warner Bros.	Operating Expenses	-2.86415E-06	-7.58	5.27194E-07	235.59	0.96	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	2.56944E-05	19.82	1.12315E-13				
WWE	Operating Expenses	-4.38926E-07	-8.91	2.11541E-08	77.36	0.89	Null hypothesis is rejected	Null hypothesis is rejected
	Average PP&E	2.18776E-06	11.60	2.45086E-10				

The hypothesis testing results confirmed statistical significance with a p-value below 0.05, resulting in the rejection of the null hypothesis.

The analysis then broadened its focus to identify any statistically significant outliers by analyzing the SCC ratio from 2000 to 2022. The analysis of this prolonged period consistently showed a significant correlation between the SCC ratio factors. The hypothesis testing confirmed the findings by producing a p-value below 0.05. This result confirms the rejection of the second null hypothesis and highlights the presence of statistically significant outliers in the SCC ratio data for the defined period.

9. Discussion

The SCC ratio is determined by the relationship between property, plant & equipment (PP&E) and operational expenses. PP&E are crucial for a company's financial stability in the long run, and high levels of PP&E indicate confidence in the company's potential for profitability. Companies accumulate operating expenses when engaging in revenue-generating activities. The SCC ratio assesses a company's utilization of its long-term assets to support revenue-generating activities.

Low SCC ratios indicate that a corporation is effectively utilizing its Property, Plant, and Equipment to generate revenue. It may also suggest that further expenditures in property, plant, and equipment may be necessary to efficiently run the supply chain and increase income to the maximum extent. On the other hand, high SCC results could indicate inefficiencies in the supply chain due to the underutilization of PP&E or a mismatch between long-term assets and operating expenses.

A relationship between supply chain costs and model results is indicated by the findings. The correlation between variables shows that the SCC ratio can be used as an indicator of supply chain cost efficiency. The results are consistent with existing research on supply management, indicating that managers prioritize expenditures in the supply chain that enhance supply chain reliability and reduce supply chain costs (Wang et al., 2018).

9.1 Addressing Gaps in the Literature via SCC Ratio Results.

The SCC ratio is based on the correlation between operating expenses and long-term assets. Operating expenses directly affect costs related to logistics, supply chain, and services. Long-term assets are crucial for companies to meet their supply chain responsibilities and deliver products or services to customers. The SCC ratio provides decision makers with valuable information on managing carrying costs, storage expenses, transportation costs, and service costs, which is an area that requires further investigation, as noted by Simchi-Levi et al. (2022). The results confirm Ketokivi and Mahoney's (2020) conclusion that transaction costs significantly influence supply chain expenses.

Supply chain costs are influenced by various factors such as cost sharing initiatives, economies of scale, demand forecasting, inventory management, transportation costs, technology integration, supplier partnerships, labor costs, regulatory compliance, product complexity, warehousing, lead time variability, risk management, process improvement, sourcing strategies, training, sustainability, and ethical considerations (Swink et al., 2024; Koren & Shnaiderman, 2023; Yu et al., 2023; Bi & Yang, 2022; Essila, 2023; Li et al., 2022; Rojas et al., 2023; Bolaños-Zúñiga & Vidal-Holguin, 2021; Liu et al., 2021; Ramos et al., 2021; Yang et al., 2018).

All the components stated are categorized as operating expenses in terms of financial reporting. Hence, the SCC ratio can operate as a performance benchmark for these elements. Long-term assets are crucial in assessing a company's capacity to manage various factors, making the SCC ratio a valuable tool in supply chain planning. Decision makers must use the SCC benchmark appropriately as research shows that concentrating simply on cutting supply chain costs has resulted in ineffective supply networks (Albertzeth & Pujawan, 2018; Geng et al., 2021).

The SCC ratio utilizes standard corporate accounts such as operational expenses and PP&E as independent variables in the model, which are often found in financial statements. The ratio can be used to calculate results for any organization in any industry. The simplicity with which the SCC ratio can be computed and utilized overcomes a major constraint identified in the existing literature. The peculiarity of supply chain models tailored to a particular organization or industry limits their applicability beyond that specific context.

Research indicates that recognizing cost differences, company size, and efficient decision-making processes can enhance cost effectiveness in supply chains (Asmussen et al., 2018; Ghanbari et al., 2022; Yang & Xing, 2023; Wang et al., 2018). SCC results add to this body of evidence as each criterion mentioned affects a company's operational expenses and property, plant, and equipment. The SCC ratio, based on operational expenses, can

assist decision-makers in evaluating the efficiency of cost-sharing strategies in the supply chain, which is a commonly used method for reducing supply chain costs (Gustafsson et al., 2021; Li et al., 2021; Rathnasiri et al., 2022; Yu et al., 2020; Zhu et al., 2018).

The investigation's findings contribute to the increasing body of data that implementing effective strategic cost management concepts can enhance supply chain cost efficiency. The SCC ratio offers managers a basic data point to evaluate supply chain efficiency issues and determine if further assessments are needed. This benchmark is akin to financial ratios, which are commonly used in business research.

When analyzing the performance of companies in the communications entertainment sector from 2000 to 2022, it is evident that those with SCC ratios of 0.5 and higher depend significantly on utilizing PP&E to deliver services that generate revenue. On the other hand, entertainment firms with the lowest SCC ratio utilized their PP&E to provide services without requiring customers to be physically present. They either used a third party's PP&E to hold events and offer services. These findings indicate that organizations in the communications entertainment industry should develop a PP&E strategy that effectively balances operational expenses with revenue to optimize supply chain cost efficiency.

9.1 Discussion of SCC Results in the Communications Entertainment Industry

SCC ratio data can help decision-makers evaluate shortcomings in the approach of providing leisure and recreational activities, which are essential functions in the communications and entertainment industry (Hoek, 2020). As to the Supply Chain Council (2017), supply chain cost efficiency includes the cost of items sold, value-added productivity, and processing costs. The qualities are reflected in the operational expenses and PP&E accounts, demonstrating a business's capacity to create income based on the correlation between these accounts. The SCC ratio is based on the effectiveness of this relationship. The SCC ratio findings for a company in the communications entertainment industry indicate how efficiently they are managing their supply chain expenses to deliver their goods to their customers. The COVID-19 outbreak posed a significant danger to several organizations in the communications entertainment sector. Several organizations experienced revenue loss because of limitations on access and delivery of their goods caused by disruptions in their supply chain. The revenue disruption and fixed obligations have posed serious threats to many entertainment companies' financial stability, leading them to seek alternative sources of capital to ensure their survival (Fassas et al., 2021).

By utilizing the SCC ratio, an entertainment firm can assess the correlation between their revenue structure and fixed responsibilities. We suggest that implementing this model before the COVID-19 outbreak could have informed decision-makers about their supply chain's vulnerability to disruptions. Encouraging management to create risk management plans, such as cost-sharing agreements, diversifying product delivery systems, and exploring new revenue sources, to reduce the risk. According to research, entertainment companies heavily impacted by the COVID-19 pandemic were those dependent on gathering people for their services, leading to higher SCC ratios. In contrast, companies delivering products digitally or with adaptable methods for product delivery managed to handle the revenue challenges of COVID-19 better, resulting in lower SCC ratios (Mahendher et al., 2021; Moon, 2020; Nhamo et al., 2020; Ryu & Cho, 2022).

The investigation’s results have led the authors to conclude that the communications entertainment industry has a unique supply chain cost structure. The supply chain cost determinants as outlined by Swink et al. (2024), Yu et al. (2023) and Ramos et al. (2021) remain unchanged, and the SCC ratio variables of operating expenses and PP&E are statistically relevant but they are founded on the process upon how products-services are delivered. The delivery of products and services in the entertainment sector can be categorized into three main groups: stationary, mobile, and digital (figure 3). Each company's choice of delivery process is contingent upon their primary business activities. The delivery techniques necessitate different levels of costs and resources.

Table 4
SCC Ratios for Communication Services Entertainment Companies

Year	AMC Ent.	AMC Net.	Bowlero	Cinemark	Dave & Buster's	Disney	Endeavor	Fox	HUYA	IMAX	iQIYI	Liberty Obe	Liberty Live	Lions Gate	MSG Sports	Manchester United	MARCUS Corp.	Netflix	News Corp.	Nexstar	Paramount	Roku	Sinclair	Sirius	Warner Music	Warner Bros.	WWE	Industry SCE Ratio
2022	0.415	0.071	0.718	0.514	0.575	0.868	0.141	0.175	0.014	0.840	0.046	0.211	0.081	0.015	0.040	0.354	1.111	0.052	0.404	0.356	0.063	0.130	0.150	0.212	0.075	0.081	0.249	**0.295**
2021	0.620	0.093	0.598	0.850	0.713	0.996	0.122	0.186	0.007	1.102	0.039	0.225	0.164	0.024	0.047	0.466	1.621	0.049	0.427	0.237	0.076	0.142	0.137	0.230	0.074	0.125	0.199	**0.354**
2020	0.465	0.114	0.479	1.162	1.245	0.980	0.084	0.199	0.009	1.129	0.042	0.245	0.316	0.037	0.076	0.479	2.129	0.037	0.442	0.463	0.095	0.156	0.091	0.227	0.067	0.132	0.220	**0.412**
2019	0.533	0.109	-	0.606	0.707	0.985	-	0.180	0.011	0.923	0.044	0.268	0.092	0.038	1.018	0.408	1.271	0.028	0.481	0.424	0.070	0.115	0.192	0.255	0.064	0.108	0.191	**0.365**
2018	0.592	0.096	-	0.646	0.694	1.225	-	0.169	0.009	0.847	0.024	0.384	0.087	0.045	0.801	0.435	1.608	0.026	0.453	0.365	0.105	0.058	0.297	0.368	0.058	0.081	0.171	**0.386**
2017	0.618	0.084	-	0.680	0.684	1.264	-	0.227	-	0.747	-	0.395	0.085	0.042	0.785	0.480	1.568	0.026	0.427	0.262	0.115	0.055	0.383	0.378	0.062	0.088	0.182	**0.419**
2016	0.734	0.079	-	0.643	0.662	1.127	-	0.097	-	0.726	-	0.597	0.091	0.032	0.841	0.568	1.540	0.025	0.445	0.333	0.118	0.029	0.336	0.392	0.070	0.109	0.177	**0.425**
2015	0.489	0.064	-	0.608	0.634	1.083	-	0.125	-	0.702	-	0.473	0.100	0.015	1.001	0.653	0.919	0.025	0.539	0.365	0.134	-	0.409	0.431	0.079	0.118	0.177	**0.416**
2014	0.481	0.043	-	0.636	0.612	1.120	-	0.136	-	0.680	-	0.494	0.102	0.009	0.554	0.682	1.593	0.028	0.575	0.491	0.133	-	1.363	0.507	0.068	0.127	0.212	**0.484**
2013	0.455	0.068	-	0.602	0.332	1.121	-	0.247	-	0.553	-	0.316	0.113	0.005	-	0.807	1.655	0.032	0.584	0.492	0.170	-	1.598	0.575	0.059	0.127	0.235	**0.483**
2012	0.133	0.068	-	0.609	-	1.109	-	0.394	-	0.476	-	0.126	0.123	0.004	-	0.856	1.623	0.038	0.578	0.586	0.209	-	0.492	0.641	0.063	0.146	0.225	**0.425**
2011	-	0.077	-	0.623	-	1.033	-	0.297	-	0.420	-	0.363	0.136	0.006	-	0.441	1.694	0.047	0.883	0.549	0.230	-	0.513	0.735	0.053	0.164	0.199	**0.445**
2010	-	0.043		0.659	-	1.043	-	0.291	-	0.326	-	0.134	0.145	0.008	-	-	1.723	0.069	0.261	0.572	0.227	-	0.540	0.738	0.038	0.173	0.209	**0.400**
2009	-	-	-	0.703	-	1.050	-	0.339	-	0.311	-	0.145	0.193	0.019	-	-	1.740	0.087	0.272	0.575	0.244	-	0.412	0.761	0.035	0.184	0.222	**0.429**
2008	-	-	-	0.750	-	1.016	-	0.308	-	0.258	-	0.124	0.203	0.017	-	-	1.774	0.096	0.339	0.383	0.114	-	0.298	0.187	0.038	0.124	0.186	**0.366**
2007	-	-	-	0.840	-	1.031	-	0.278	-	0.188	-	0.144	0.240	0.009	-	-	1.763	0.076	0.308	0.492	0.250	-	0.501	0.563	0.044	0.463	0.175	**0.433**
2006	-	-	-	0.606	-	0.960	-	0.274	-	0.206	-	0.150	0.230	0.011	-	-	1.701	0.051	0.278	0.477	0.237	-	0.521	0.481	0.047	0.407	0.204	**0.402**
2005	-	-	-		-	0.947	-	0.256	-	0.249	-	0.179	0.272	0.020	-	-	2.308	0.043	0.191	0.474	0.176	-	0.616	0.798	0.051	0.338	0.218	**0.446**
2004	-	-	-		-	0.836	-	0.189	-	0.293	-	0.199	0.144	0.038	-	-	1.841	0.029	1.117	0.464	0.131	-	0.615	1.223	0.054	0.361	0.217	**0.485**
2003	-	-	-		-	0.789	-	0.193	-	0.401	-	0.245		0.069	-	-	1.927	0.029	0.746	0.395	0.329	-	0.632	2.191	-	0.351	0.108	**0.600**
2002	-	-	-		-	0.823	-	0.204	-	0.423	-	0.409		0.111	-	-	1.892	0.042	0.254	0.218	0.311	-	0.561	1.729	-	0.076	0.052	**0.515**
2001	-	-	-		-	0.822	-	0.234	-	0.124	-	0.280		0.138	-	-	1.989	0.036	0.131	-	0.297	-	3.427	3.166	-	-	0.088	**0.894**
2000	-	-	-		-	0.753	-	0.216	-		-	0.454		0.166	-	-	1.097	-	-	-	0.268	-		6.530	-	-	0.064	**1.193**
Average	**0.503**	**0.078**	**0.598**	**0.690**	**0.686**	**0.999**	**0.116**	**0.227**	**0.010**	**0.542**	**0.039**	**0.285**	**0.154**	**0.038**	**0.574**	**0.552**	**1.660**	**0.044**	**0.461**	**0.427**	**0.178**	**0.098**	**0.640**	**1.014**	**0.058**	**0.185**	**0.182**	**0.409**

Note: SCC Ratio Results for Communication Services Entertainment Companies.

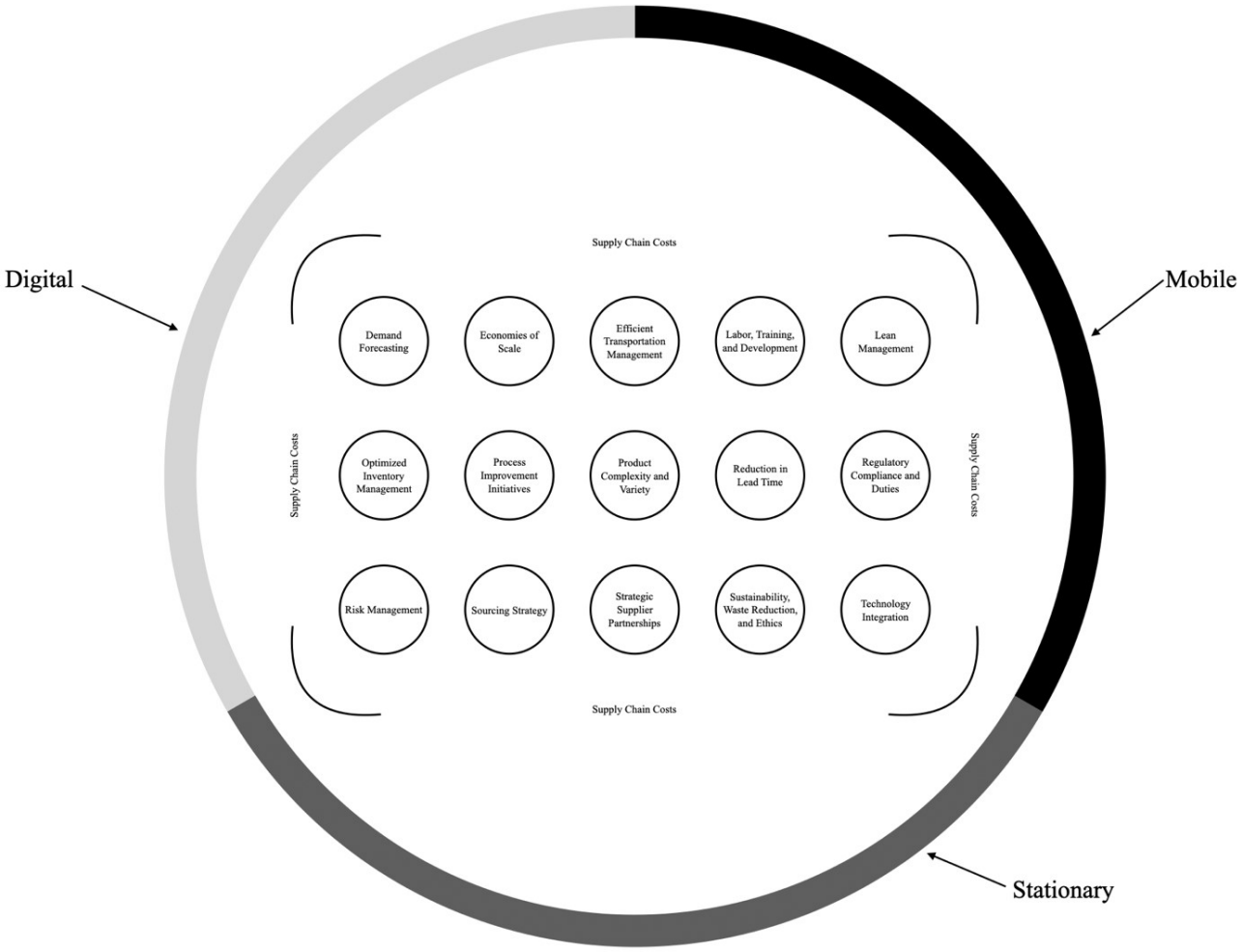

Figure 3. Supply Chain Cost Structure of the Communications Entertainment Industry

Several entertainment companies have used all three strategies into their operations. Most industry participants concentrate on a single product delivery process. Disney, Endeavor, and WWE utilize a blended method, whilst AMC Ent., Cinemark, and MARCUS Corp. employ a single technique.

Disney's strategy involves using some of its products as foundational elements for generating additional sources of income. When Disney publishes a new movie, its revenue is not only dependent on theater ticket sales. Disney officials anticipate that the movie will establish a new brand or enhance an existing one to capitalize on their many revenue sources like as merchandising, theme parks, and cruises. Therefore, the operational costs associated with a specific product, like as a movie, might provide multiple long-term sources of income. Disney's SCC ratio must be evaluated within the framework of their primary business and other supply chain functions such as asset management, flexibility, reliability, and responsiveness.

Similar reasoning can be used for other entertainment firms involved in film production such as Warner Bros., Paramount, Lions Gate, and AMC Net. These companies lack the comprehensive product range of Disney, which includes theme parks, vacation clubs, cruises, and more. Warner Bros., Paramount, Lions Gate, and AMC Networks participate in licensing, marketing, and franchising various product brands. Nevertheless, those income-producing activities lack a significant PP&E aspect, unlike operating a theme park. Therefore, they have more control over their operating expenses, leading to lower SCC ratios.

Media firms such as Fox Corporation, Nexstar, News Corp., Sinclair Broadcasting Group, and Sirius, owned by Liberty Media Corporation, utilize a hybrid approach involving publishing and broadcasting live and recorded material. The dependence on live events, such as news, sports, TV broadcasts, and live radio, for ad revenue was affected by COVID-19. Recorded and digital material, including as streaming platforms, digital production, and

digital distribution, helped offset the decrease in revenues caused by the lockdowns.

An examination of the media organizations' operations showed that the income impact was linked to the level of investment in their recorded material. Nexstar and News Corp have invested in streaming platforms and licensed content to streaming businesses to distribute part of their content. They generated ad revenue from its TV stations through syndicated content according to Nexstar Media Group Inc. (2021) and News Corp (2022, 2021). News Corp and Nexstar exhibit greater SCC percentages than the industry average. The inquiry findings indicate that investments in digital media helped optimize supply chain costs, perhaps reducing losses during the COVID-19 pandemic.

Fox Corporation has the lowest SCC ratio among the studied media companies during the examined period. Fox has implemented a digital content plan for an extended period (Fox Corporation, 2022). Their SCC ratio is significantly lower compared to that of most other media companies. An analysis of Fox Corporation's financial accounts indicates that the asset sale to Disney had an unusual effect on revenue, leading to a decrease in the SCC score. The Fox score matches News Corp and Nexstar when adjusting for the Disney sale, indicating a comparable supply chain cost structure.

The SCC ratio for Sirius is the second highest among the companies analyzed and significantly exceeds the rates of media companies. Sirius has had financial challenges due to significant debt levels resulting from mergers with XM Radio, acquisition of Pandora Media, and investment in live radio infrastructure (Sirius XM Holdings, 2022; Team, 2023). Sirius' supply chain costs during the pandemic were significantly affected by high debt levels, dependency on fixed PP&E, dependence on live content, and reduced car driving.

Endeavor, Formula One, Liberty Live, and WWE utilize the mobile product distribution technology. The mobile system uses third-party PP&E to provide the product. These companies mostly depend on organizing live events in various venues. The live event depends on utilizing vegetation and real estate to efficiently distribute the goods. Nevertheless, the frequent relocation of these enterprises necessitates them to rent venues, offering increased adaptability and lower expenses. Being able to cancel events without bearing the maintenance costs of the venues helped these enterprises decrease operating expenses during COVID-19, leading to reduced SCC ratios.

Companies such as AMC Entertainment, Bowlero, Cinemark, Dave & Buster's, IMAX, Manchester United, Marcus Corporation, and MSQ Sports utilize a stationary product delivery system. This means they depend on their PP&E to deliver their products, and they are responsible for owning and maintaining it, leading to increased operating costs. These companies primarily focus on gathering large groups of people in one place to efficiently distribute their product. During COVID-19, enterprises faced significant cash flow challenges and high SCC ratios by integrating crowd assembly and PP&E operational costs as a fundamental element to produce income.

Companies that utilize the digital product delivery technique have the lowest SCC ratios. Businesses employing this method may experience elevated operational costs, which are balanced off by the little property, plant, and equipment required to produce the product. This allows decision-makers to have significant flexibility in controlling supply chain charges. Furthermore, delivering the goods to consumers digitally has less impact on the revenue generation process. During the analyzed period, HUYA, iQIYI, Netflix, Roku, and Warner Music had the lowest SCC ratios. These companies primarily operate using a digital business model with minimal physical assets, either owning minimum PP&E or leasing the necessary PP&E for product development, resulting in sustained cost efficiency (Paik et al., 2020). An analysis of the yearly financial statements of digital product delivery companies shows that they managed to maintain a steady supply of products to consumers during the COVID-19 pandemic, leading to minimal impact on their revenue (HUYA, Inc, 2022; iQIYI, Inc., 2022; Netflix Inc., 2022; Roku Inc., 2022; Warner Music Group, Inc., 2022).

Media enterprises typically incur greater than average PP&E expenses relative to the industry due to the fixed property and equipment required for delivering their products, such as TV stations. The data research indicates that media organizations typically adhere to a set schedule, which restricts their ability to adjust supply chain expenses. Radio and TV stations have set programming schedules that require consistent content to complete, leading to increased supply chain expenses. On the other hand, businesses who implement a mobile or digital product delivery system see enhanced adaptability in managing their supply chain expenses. Companies such as Endeavor, Formula One, Liberty Live, and WWE utilize a flexible schedule because of the portable nature of their product. These companies can cancel pre-planned events, giving them increased control over their supply chain expenses.

During the analyzed timeframe, multiple communication entertainment enterprises encountered shifting SCC ratios due to factors such as varying operating expenses, consistent PP&E costs, and the selected product

delivery approach. Before COVID-19, entertainment businesses had set up product distribution methods that produced consistent revenues. The investigation findings indicate that the pandemic caused enterprises in the fixed and mobile product distribution system to redirect investments towards digital platforms for survival. The modifications significantly raised their supply chain expenses with inconsistent outcomes in revenue generation.

Chatterjee et al. (2023) stated that supply chain cost efficiency depends on how effectively goods or services are transferred from the manufacturer or supplier to the end customer. Authors emphasize that supply chain cost efficiency is maximized when management has increased control over the cost structure. The SCC ratio findings indicate that the impact of the COVID-19 epidemic varied among communications and entertainment firms. Companies that utilized a digital product delivery system saw an increase in revenue during the pandemic, while those using stationary or mobile delivery systems faced significant revenue drops. They had to invest in transitioning to digital systems to stay competitive and avoid bankruptcy.

10. Conclusion

This study is the first to develop a simple performance ratio for the communications entertainment industry and investigate the impact of COVID-19 disruptions on supply chain cost efficiency for entertainment companies. The results are customized for users external to the organization. The model results indicate correlations between the SCC ratio and supply chain costs.

This study aims to fill important gaps in the supply chain cost literature by creating a tool to assess supply chain costs from an external stakeholder viewpoint and utilizing a simplified metric based on publicly accessible data (Li et al., 2022; Ramos et al., 2021). This study is the first empirical assessment of supply chain costs in the communications entertainment industry, known for its highly unpredictable cost structure according to Mahendher et al. (2021). Research results demonstrate how investing in long-term assets and controlling operational expenses can improve supply chain cost efficiency, particularly in times of uncertainty such as the COVID-19 pandemic.

The SCC ratio findings indicate that the method of product/service delivery plays a crucial role in determining supply chain efficiency costs for enterprises in the communications entertainment sector. Analysis of the data indicates that communication and entertainment enterprises employing stationary, mobile, digital, or hybrid methods for product/service delivery saw significantly varied financial outcomes throughout the epidemic. Businesses that utilized the digital strategy saw an increase in income. Businesses who employed a mobile and combined strategy faced little challenges but successfully adjusted to the evolving customer landscape. Corporations who adopted a stationary approach experienced severe financial losses during COVID-19, with several on the brink of bankruptcy. The primary cause of these challenges was probably the inflexibility un handling operational expenses and property, plant, and equipment costs, which are the key cost elements of the supply chain.

Further research is required to confirm the validity of the SCC ratio across other sectors and businesses. Due to the statistical importance of the SCC ratio, practitioners should employ the model as a supply chain cost metric, particularly in organizations with rapidly fluctuating cost structures. The ratio can provide decision-makers with information into areas for enhancing the supply chain cost structure.

This inquiry builds upon previous research on supply chain efficiencies conducted by Forehand et al. (2021), Douglas et al. (2023), Forehand et al. (2023), and Roman Torres et al. (2023). The authors created ratios using the SCOR metrics to analyze several elements of the supply chain, such as flexibility, reliability, and responsiveness. Future research modelling the validity of a combined supply chain metric encompassing cost, efficiency, flexibility, reliability, and responsiveness is warranted. Finally, additional research is required to understand the effects of the COVID-19 pandemic on global supply networks.

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