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## “BUZZING ISSUES IN SUPPLY-CHAIN PERFORMANCE MEASUREMENT: A REVIEW PAPER”

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### ABSTRACT

*The shift from firm-level competition to supply chain-level competition has fundamentally reshaped how organizations create and sustain competitive advantage. This shift raises important questions about the adequacy of traditional performance measurement systems, which were originally designed for internally focused, hierarchical structures. This paper reviews the evolution of performance measurement within the context of supply chain management (SCM) and critically assesses its ability to capture the complexity of inter-organizational relationships. Drawing on prior literature, the study highlights the critical role of performance measurement in enhancing coordination, transparency, and strategic alignment among supply chain partners. It identifies two main research streams: one advocating the adaptation of traditional performance measures, and another calling for the development of integrated, supply chain-specific systems. Although frameworks such as the Balanced Scorecard (BSC) and the Supply Chain Operations Reference (SCOR) model represent important advances, they remain limited in addressing key challenges, including interdependencies among partners, weak strategic alignment, overreliance on financial metrics, and insufficient integration of sustainability dimensions. A central issue emphasized in this review is the inherent complexity of measuring supply chain performance. This complexity arises from the lack of a universally accepted definition of supply chain boundaries, the absence of standardized performance criteria, and persistent difficulties in information sharing among partners. These challenges—driven by mistrust, data confidentiality concerns, and technical incompatibilities—constrain the development of integrated and reliable performance measurement systems.*

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**KEYWORDS:** Supply Chain Management (SCM); Performance Measurement; Supply Chain Performance; Balanced Scorecard (BSC); SCOR Model; Inter-organizational Relationships; Integrated Performance Systems; Competitive Advantage; Information Sharing; Sustainability.

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## 1. INTRODUCTION

Firms increasingly compete not as isolated entities, but as integral parts of broader supply chains, where competitive advantage is shaped by the collective efficiency and coordination of interconnected partners. This perspective encourages managers to look beyond firm boundaries and recognize opportunities embedded in inter-organizational relationships, fostering collaboration with suppliers, distributors, and other stakeholders (Nikhil et al., 2021). As competition shifts toward supply-chain versus supply-chain dynamics, traditional management accounting systems—originally designed for internally focused, hierarchical organizations—may offer only limited support for such integrative and externally oriented strategies. This has led to an ongoing debate in the literature regarding the adequacy of existing management accounting techniques in a supply-chain context. Some scholars argue for the development of new tools and frameworks that better capture inter-firm value creation, cost sharing, and joint performance (Hald & Thrane, 2015). Others contend that traditional techniques can still be relevant if they are adapted and applied in more collaborative and strategically aligned ways (Ghandour, 2021). This tension reflects a broader shift from firm-centric to network-centric performance logic.

Organizations are increasingly redesigning their structures, processes, and decision-making approaches to align with supply chain thinking, recognizing that sustainable competitive advantage now depends on the effectiveness of the entire network rather than the performance of a single firm. This shift requires closer coordination, information sharing, and strategic alignment with external partners such as suppliers, distributors, and logistics providers. However, management accounting practices have not always kept pace with this transformation. Traditionally, these practices were developed to serve internally focused organizations, emphasizing cost control, efficiency, and performance within firm boundaries. As a result, they often lack the outward-looking perspective necessary to support inter-organizational relationships and collaborative value creation across supply chains.

A similar debate emerges in the area of performance measurement within supply chains. Effective performance measurement systems are seen as critical enablers of coordination, transparency, and mutual understanding among supply-chain partners (Kamble and Gunasekaran,

2020). Supply chain actors can align incentives, improve communication, and support joint decision-making. However, designing such systems remains challenging due to the blurred organizational boundaries, differing objectives, and information asymmetries that characterize supply chains (Singh et al., 2025).

Despite its importance, empirical research on supply-chain performance measurement—particularly from a practitioner perspective—remains relatively limited. Much of the existing literature is conceptual, with insufficient attention to how organizations actually implement and use these systems in practice. Here is a fully paraphrased, expanded, and more humanized academic version with clearer logic and stronger depth:

Given this limitation, a continuing debate has emerged in the literature whether existing management accounting techniques can be adapted to meet the demands of supply chain environments, or whether entirely new approaches are required. While some scholars advocate for innovation in accounting tools to better capture joint performance, shared costs, and relational dynamics, others argue that the issue lies not in the tools themselves but in how they are applied and integrated across organizational boundaries. Despite this ongoing discussion, there is broad agreement that performance measurement plays a central and indispensable role in enabling effective supply chain management.

The literature highlights several serious efforts to design and implement integrated or joint performance measurement systems that reflect a more holistic, supply chain-wide perspective. These systems aim to improve transparency, align incentives, and enhance coordination among partners. However, translating these conceptual models into practice remains challenging. One of the most significant barriers is the limited availability and reliability of supply chain-level data, as organizations are often reluctant or unable to share sensitive information across boundaries. In addition, there is a lack of comprehensive, multi-dimensional frameworks that guide practitioners in selecting and balancing appropriate performance measures—financial and non-financial—across different entities within the supply chain.

Consequently, while the importance of integrated performance measurement is widely recognized, its practical implementation continues to face considerable obstacles. These challenges highlight the need for further research that not only advances theoretical models but also provides actionable guidance for practitioners

operating in complex, interdependent supply chain environments. Against this backdrop, this paper reviews the relevant literature to explore practitioners' perspectives on performance measurement in a supply-chain context. It begins by tracing the evolution of performance measurement systems in response to changing business environments. It then critically examines different scholarly viewpoints on supply-chain performance measurement. Subsequently, it investigates the key challenges faced by practitioners in designing and implementing integrated performance measurement systems across supply chains. The paper concludes by summarizing key insights and suggesting directions for future research.

## 2. THE EVOLUTION OF PERFORMANCE MEASUREMENT IN SUPPLY-CHAIN CONTEXT

The landscape of modern business management has undergone a profound transformation, shifting from competition among independent firms to competition among interconnected supply chains as a means of achieving superior competitive advantage (Kamble and Gunasekaran, 2020). This transition reflects the core principle of supply chain management (SCM), which encourages organizations to move beyond internal operations and actively consider their relationships with

upstream suppliers and downstream customers (Jenkins and Scott, 2025). Within this broader and more integrated context, the traditional role of performance measurement has come under increasing scrutiny. Unlike firm-level systems, supply chain performance measurement must address a wider scope, encompassing multiple organizations, shared processes, and collective outcomes, which fundamentally alters how performance is defined, monitored, and controlled (Yan et al., 2025).

The concept of SCM first emerged in the early 1980s through consultancy practices and has since attracted significant attention from both academics and practitioners (Seal et al., 1999). Over time, it has been widely recognized by managers as a critical approach for building and sustaining competitive advantage in increasingly complex and dynamic markets (Ujam, 2025). Earlier foundational work by Porter (1985) emphasized the importance of analyzing the entire value chain, advocating that firms should retain only those activities that generate true competitive value while outsourcing others to more capable partners. Building on this logic, Christopher (2011) argued that the value chain perspective has naturally evolved into the broader concept of the supply chain. By extending value-creating activities beyond the boundaries of a single firm, organizations have given rise to what is often described as the "extended enterprise," where competitive advantage is co-created through the coordinated efforts of all supply chain partners rather than by the focal firm alone.

**Table (1): Traditional Versus Supply-Chain Philosophy: Performance Measurement Implications.**

Dimensions	Traditional performance measurement	Supply-chain performance measurement
<b>Objective</b>	Traditional performance measure mainly concerned to measure the performance of a single company to support decision making purposes.	Supply-chain performance measurement is not only confined to provide feedback information; diagnosing problems and promoting communication; but also to facilitate inter-understanding and cooperation among supply-chain partners.
<b>Model (measures)</b>	<ul style="list-style-type: none"> <li>• Return on investment (ROI) and,</li> <li>• EVA.</li> </ul>	<ul style="list-style-type: none"> <li>• Return on supply-chain assets</li> <li>• Order fulfilment lead time</li> <li>• Cash-to-Cash cycle and</li> <li>• Assets utilization.</li> </ul>
<b>The focus of information</b>	Mainly financial information around the firm's hierarchal view to enhance controlling and decision-making purposes.	Information that covers the whole span of the Supply-chain (i.e. the inclusion of a broader inter-organisational information about activities and processes of other chain' partners outside the boundaries of a single firm). The challenge here is embedded in the difficulty of revealing sensitive information among supply chain partners due to some social (e.g. trust) and technical (e.g. cost accounting systems) requirements.

Historically, Hopwood (1996) called for research on accounting in inter-organizational setting. He argued that management accounting is mainly developed to assist the hierarchal structure of a single firm, and most accounting developments made in 1980s and the beginning of 1990s are concerned to endorse such vertical relationships. As a result of the interdependence and interrelationship between independent companies embedded within supply-chains, management accounting might provide

modest assistance, and researchers should exert the due care to handle such horizontal relations. A great bulk of literature had responded to that call and pursued to determine the potential role of management accounting within supply-chain context. Despite the ongoing research efforts to explore how management accounting is involved within the inter-organizational setting, a lot is missing and further research is needed (e.g., Silberstein et al., 2025; Zhao et al., 2025). Performance

measurement topic also did not receive an adequate consideration in the supply chain literature and need further attention. It is argued that without appropriate performance measurement, many companies might fail to realize the potential benefits of their supply-chain (Nikookar et al., 2025).

The relevant literature accentuates the importance of appropriate performance measures and performance measurement needed to adequately measure supply-chain’s efficiency and effectiveness (Silberstein et al., 2025; Zhao et al., 2025). Within the supply-chain context, effectiveness is related to how well supply-chain objectives are met, such as minimizing waste and improving cycle time throughout supply-chain (Brewer and Speh, 2000; and Lai et Azad, 2025). However, efficiency is concerned with achieving the best use of supply-chain’s resources, mainly by minimizing the inventory levels to the lowest possible (Brewer and Speh, 2000).

Performance measurement has critical roles in facilitating inter-understanding and co-operation among supply-chain partners. It is needed to promote effective planning, controlling and decision making by submitting the necessary feedback information to reveal progress; diagnose problems and re-design business goals and strategies, and re-engineering processes (Thakkar et al., 2009). In addition, it has an obvious role in promoting social ties and trust-building that influence partner

selection and the design of supplier relationships; and in revealing other improvement opportunities, such as targeting the most profitable market segments, service differentiation and cost reduction (Fridner, 2025). It seems that there is no agreed upon the guidelines for designing an integrated performance measurement system that can assess supply chain performance toward achieving competitive advantage (Aladwey and Alsudays, 2024). Tracking papers in the area of performance measurement within supply-chain context reveals disparities among researchers’ point of views regarding the main categories, types, and contents of performance measurement system (Banomyong and Supatn, 2011).

### 3. SUPPLY CHAIN PERFORMANCE MEASUREMENT: EVOLUTION, APPROACHES, AND RESEARCH GAPS

The relevant literature can be tackled around such concern into two main groups (as shown in figure 1); those who appreciate existing performance measurement and propose certain modifications to transcend from organizational to supply-chain level, and those who believe that totally new tailor-made measurement should be evolved to address the different issues of supply-chain.

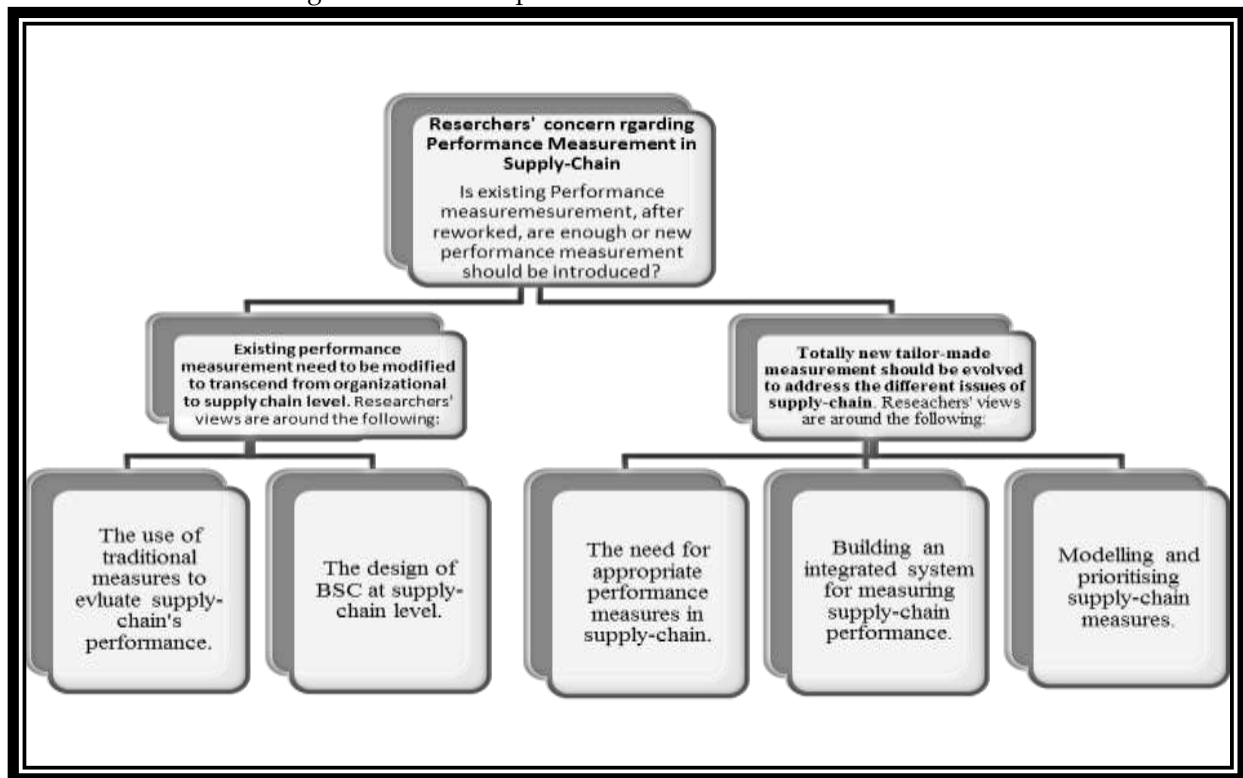


Figure (1): Performance Measurement Within Supply-Chain Context.

#### 3.1. Supply Chain Performance Measurement: Traditional vs. Integrated Approaches

The literature on supply chain performance measurement can broadly be categorized into two main streams. The first group of researchers argues that existing (traditional) performance measurement systems, if appropriately adapted to align with supply chain thinking, can effectively support firms in achieving competitive advantage. According to this perspective, traditional measures remain useful for evaluating key logistics dimensions such as time, cost, and customer satisfaction. For instance, prior studies highlight the continued relevance of indicators such as order fulfillment time, total cost per unit, and customer satisfaction in assessing supplier performance (Asamoah, 2025).

Building on this view, Pohlen and Coleman (2005) proposed a dyadic framework integrating Economic Value Added (EVA) and Activity-Based Costing (ABC) to evaluate inter-firm performance while linking operational measures to shareholder value creation. Similarly, conventional financial metrics such as Return on Investment (ROI), Net Present Value (NPV), and Internal Rate of Return (IRR) have been suggested as useful tools for evaluating supply chain value, particularly in relatively simple supply chain structures (Bhagwat and Sharma, 2007). However, despite their importance, these measures provide only a limited and often incomplete view when applied to the complex and dynamic nature of modern supply chains.

Indeed, traditional performance measures have been widely criticized for several shortcomings. They are often overly financial and unidimensional, neglecting intangible and relational aspects critical to supply chain success. As noted by Jyoti and Akter (2022), measures such as total cost of ownership and profitability offer a narrow perspective that fails to capture the holistic nature of supply chain operations. Moreover, these measures tend to be internally focused, emphasizing firm-level logistics activities rather than the broader, interconnected supply chain (Lambert and Pohlen, 2001). This inward orientation can encourage local optimization at the expense of overall supply chain performance.

Additional limitations include the lack of explicit cause-effect relationships, insufficient consideration of interdependencies among metrics, and the absence of a balanced and integrated measurement framework (Cai et al., 2009). Collectively, these shortcomings highlight the lack of consensus regarding the adequacy of traditional measures and have motivated the development of more comprehensive performance measurement approaches.

### **3.2. Integrated Performance Measurement**

### **Systems**

In response to these limitations, a second stream of research emphasizes the need for integrated performance measurement systems that capture the supply chain as a whole. This perspective advocates for the use of coordinated and cross-organizational metrics that promote supply chain thinking rather than isolated firm-level evaluation.

One prominent approach within this stream involves extending the Balanced Scorecard (BSC) to the supply chain context. Several studies have explored the applicability of BSC at the supply chain level (e.g., Brewer and Speh, 2000; Park et al., 2005; Cullen, 2009; Chia et al., 2009). Brewer and Speh (2000) proposed a modified BSC framework incorporating integrated measures across its four perspectives—financial, customer, internal processes, and learning and growth—to align performance measurement with supply chain objectives. Similarly, Park et al. (2005) suggested expanding the internal process perspective to include inter-organizational processes and adapting the customer perspective to reflect demand chain performance.

Despite these contributions, the application of BSC at the supply chain level remains contested. Garcia-Buendia et al. (2024) argue that the BSC was originally designed for single organizations, and its effectiveness diminishes when applied across multiple firms. For example, while Brewer and Speh's (2000) framework advances integration, it has been criticized for overemphasizing top management perspectives while neglecting operational-level alignment—thereby undermining a core principle of the BSC: translating strategic objectives into actionable targets across all organizational levels.

Furthermore, Cai et al. (2009) contend that although the traditional BSC accounts for cause-effect relationships, it is not well-suited to capturing the complex, intertwined interdependencies inherent in supply chains. Consequently, researchers have called for the development of new performance measurement systems (PMSs) tailored specifically to supply chain contexts.

### **3.3. Emerging Research Directions in Supply Chain Measurement**

**The evolving literature reflects three primary research directions:**

1. Designing individual performance measures,
2. Developing integrated performance measurement systems, and
3. Prioritizing key performance indicators (KPIs)

to enhance decision-making.

Early efforts in supply chain performance measurement focused on individual metrics. Chow et al. (1994) provided one of the earliest attempts, conceptualizing logistics performance as part of overall firm performance. Beamon (1998) expanded this perspective by defining supply chains as interconnected systems of suppliers, manufacturers, distributors, and retailers, and proposed a framework incorporating both qualitative and quantitative measures across multiple organizational objectives, including customer satisfaction, flexibility, and cost efficiency. Chan (2003) further developed this classification by linking performance measures to objectives such as resource utilization, quality, visibility, trust, and innovation.

Subsequent research emphasized the importance of carefully designing individual metrics. Varadejsatitwong et al. (2022) highlighted that the selection of appropriate metrics is fundamental to the effectiveness of the entire measurement system. Similarly, Gunasekaran and Kobu (2007) sought to identify a minimal yet sufficient set of KPIs for evaluating supply chain performance efficiently. Chae (2009) proposed structured guidelines for KPI development, organizing metrics across key supply chain processes—plan, source, make, and deliver—and distinguishing between primary and secondary indicators.

However, reliance on individual measures alone has been deemed insufficient. Scholars increasingly argue that supply chain performance measurement must be holistic, integrated, and capable of capturing interrelationships among metrics. This has led to a growing emphasis on integrated frameworks. Lambert and Pohlen (2001) and Baah (2022) underscore the importance of evaluating performance across supply chain partners and incorporating both qualitative and quantitative dimensions.

### 3.4. Integrated Frameworks and Models

A significant body of research has focused on developing conceptual frameworks for integrated supply chain performance measurement (Shepherd and Günter, 2011). Beamon (1998) proposed a model based on three key dimensions: resources, outputs, and flexibility. Other frameworks emphasize multiple performance dimensions, including cost, productivity, time, flexibility, and quality, while highlighting the need for combining financial and non-financial measures.

One of the most influential contributions is provided by Gunasekaran et al. (2004), who categorized performance measures according to decision-making levels (strategic, tactical, and operational) and key supply chain processes (plan, source, make, deliver). This approach offers a structured and hierarchical framework for performance evaluation.

Another widely recognized model is the Supply Chain Operations Reference (SCOR) model, developed by the Supply Chain Council (SCC) in 1997. SCOR provides an integrated framework for measuring supply chain performance across five core processes: plan, source, make, deliver, and return. It offers a systematic and multi-level approach that aligns performance metrics with supply chain objectives and facilitates benchmarking across organizations. The model emphasizes the importance of adopting a balanced set of performance measures and has been widely acknowledged as a comprehensive tool for supply chain evaluation (Shepherd and Günter, 2006; Aramyan et al., 2007; Ramaa et al., 2009).

Despite its widespread adoption, the SCOR model is not without limitations, and ongoing research continues to explore ways to enhance its applicability in increasingly complex and dynamic supply chain environments.

Table (2): Scor Model: Level 1 Metrics.

Level 1 Metrics	Performance Attributes				
	Customer-Facing			Internal-Facing	
	Reliability	Responsiveness	Flexibility	Cost	Assets
Perfect Order Fulfilment	★				
Order Fulfilment Cycle Time		★			
Upside Supply Chain Flexibility			★		
Upside Supply Chain Adaptability			★		
Downside Supply Chain Adaptability			★		
Supply Chain Management Cost				★	
Cost of Goods Sold				★	
Cash-to-Cash Cycle Time					★
Return on Supply Chain Fixed Assets					
Return on Working Capital					



Source: [Http://People.Ischool.Berkeley.Edu/~Glushko/IS243Readings/SCORV8.Pdf](http://People.Ischool.Berkeley.Edu/~Glushko/IS243Readings/SCORV8.Pdf)

### 3.5. *Limitations of SCOR And Hybrid Measurement Approaches*

Despite its widespread adoption, the SCOR model has been subject to considerable criticism. One of its primary limitations is the lack of alignment with organizational strategy, as it does not provide a systematic mechanism for prioritizing performance measures. Additionally, SCOR fails to capture cause-effect relationships among individual metrics, which are essential for understanding performance dynamics within supply chains (Cai et al., 2009). Its complex structure further limits its practical applicability, particularly for small and medium-sized enterprises (SMEs) (Banomyong and Supatn, 2011).

To address these shortcomings, several scholars have proposed integrating SCOR with the Balanced Scorecard (BSC). For instance, Bullinger et al. (2002) developed a hybrid performance measurement framework that embeds SCOR metrics within the BSC structure. This model combines top-down and bottom-up approaches and introduces additional perspectives, including operational, process, and inter-organizational dimensions. However, its applicability at deeper operational levels remains limited. Similarly, Thakkar et al. (2009) proposed a SCOR-BSC framework tailored for SMEs, aiming to enhance performance through systematic diagnosis and strategic corrective actions.

### 3.6. *Empirical Gaps in Supply Chain Performance Measurement*

A notable limitation in the literature is the predominance of conceptual models, with relatively limited empirical validation (Cuthbertson and Piotrowicz, 2008). Many proposed performance measures lack rigorous field testing, raising concerns about their practical applicability (Lambert and Pohlen, 2001; Gunasekaran and Kobu, 2007; Gopal and Thakkar, 2012).

Only a few studies have attempted empirical validation. For example, Chia et al. (2009) examined the application of the BSC within supply chain entities in Singapore using 15 generic performance measures. Their findings indicated a stronger emphasis on financial metrics compared to non-financial indicators. Similarly, Bhagwat and Sharma (2007) conducted a case study on SMEs in India and identified several implementation deficiencies in BSC, including neglect of long-term objectives, weak cause-effect linkages, and inadequate articulation of scorecard logic. Despite these contributions,

empirical research in this area remains limited, highlighting the need for further field-based investigations.

Integrated supply chain performance measurement models have also faced significant criticism. A commonly cited limitation is their weak linkage to organizational strategies and the broader supply chain network (Beamon, 1999; Holmberg, 2000; Morgan, 2007). Many firms continue to prioritize internal performance metrics rather than adopting a holistic supply chain perspective (Holmberg, 2000).

As noted by Pohlen (2003), supply chain measures often focus on individual firms rather than cross-organizational processes. This limitation reduces their ability to identify opportunities for enhancing both customer and shareholder value across the supply chain (Lambert and Pohlen, 2001). Furthermore, these models frequently lack clearly defined cause-effect relationships and fail to capture interdependencies among hierarchical performance measures (Cai et al., 2009). They also do not provide clear criteria for classifying measures across strategic, tactical, and operational levels (Banomyong and Supatn, 2011).

Another key limitation is the lack of balance between financial and non-financial measures. While some frameworks emphasize financial indicators, others focus on operational metrics, resulting in fragmented evaluation systems (Morgan, 2007; Gunasekaran and Kobu, 2007). In practice, many organizations still rely heavily on financial KPIs, thereby neglecting long-term and forward-looking performance dimensions (Holmberg, 2000).

The literature also reveals limited attention to social and environmental performance dimensions. Most existing models prioritize economic objectives, with insufficient integration of sustainability considerations (Cuthbertson and Piotrowicz, 2008). Although some efforts have been made to develop green supply chain performance frameworks (e.g., Hervani et al., 2005), there remains no consensus on standardized environmental performance measures (Bullinger et al., 2002; Gopal and Thakkar, 2012a). This highlights a significant gap in the development of comprehensive and sustainability-oriented performance measurement systems.

### 3.7. *Prioritization Of Supply Chain Performance Measures*

Another major challenge lies in the excessive number of available performance measures, which complicates the selection of the most relevant

indicators. Akyuz and Erkan (2010) argue that firms should focus on a limited set of critical measures to ensure effective performance evaluation.

In response, a third stream of research emphasizes the prioritization and modeling of key performance indicators. Prioritization is essential for guiding decision-making and maintaining supply chain performance on an optimal trajectory (Gunasekaran and Kobu, 2007; Cai et al., 2009). Various methodological approaches have been proposed in this regard. For instance, Chan et al. (2025) suggested the use of fuzzy set theory to prioritize performance measures across supply chain processes. Similarly, Lahane et al. (2024) integrated the BSC with the Analytic Hierarchy Process (AHP) to assign weights to performance measures and determine their relative importance. They also combined AHP with pre-emptive goal programming (PGP) to enhance decision-making.

However, despite its usefulness, AHP has been criticized for its inability to capture interdependencies among performance measures, which are crucial in supply chain contexts (Cai et al., 2009).

Overall, the supply chain performance measurement literature remains fragmented, with several unresolved issues. Existing studies largely focus on classifying performance measures, identifying their limitations, and advocating for more integrated approaches. However, current models still struggle to capture the complex interdependencies and cause-effect relationships inherent in supply chains. Moreover, there is limited guidance on selecting appropriate performance measures for specific contexts, particularly in inter-organizational settings. Questions remain regarding the identification, measurement, and processing of accounting information that is both relevant and applicable across supply chain partners.

Despite differences in perspectives, there is broad consensus that designing and implementing supply

chain performance measurement systems is inherently complex (Gopal and Thakkar, 2012). As noted by Van Hoek (1998), measuring supply chain performance often involves "measuring the unmeasurable," reflecting the multifaceted and dynamic nature of supply chains. These challenges form the foundation for further investigation, as discussed in the following subsection.

#### 4. CHALLENGES OF PERFORMANCE MEASUREMENT IN SUPPLY-CHAIN CONTEXT

A well-designed system of supply chain metrics can play a critical role in the success of supply chain collaboration. Supply chain performance measurement may be viewed as a comprehensive system that captures overall performance by aligning common goals and defining the responsibilities and actions of supply chain members. However, developing an integrated performance measurement system for supply chains remains a challenging and elusive task (Van Hoek, 1998; Pohlen, 2003).

One of the primary reasons for this complexity is the absence of a universally accepted definition of supply chain management (SCM) and its scope (Van Hoek, 1998; Holmberg, 2000; Lambert and Pohlen, 2001; Pohlen, 2003; Morgan, 2007). A reductionist perspective defines the supply chain as an extension of logistics activities beyond the boundaries of a single firm to include suppliers and customers (Lambert and Pohlen, 2001). However, this narrow view overlooks the complexity and variability of real-world supply chains, particularly interactions that extend beyond simple dyadic relationships. Consequently, performance measurement systems based on this perspective tend to be functionally oriented and primarily reflect how first-tier suppliers and customers influence performance at the firm level, rather than capturing the dynamics of the entire supply chain.

**Table (3): Challenges of Measuring Performance at Supply-Chain Level.**

Challenges of Measuring Supply-Chain Performance	Authors
<ul style="list-style-type: none"> <li>The lack of a widely accepted definition for supply chains that identify their scope.</li> </ul>	Beamon and Chen, (2001), Lambert and Pohlen, (2001), Hettler and Graf- Vlachy, (2024).
<ul style="list-style-type: none"> <li>No agreed upon set of criteria to measure performance measures in supply-chain.</li> </ul>	Lambert and Pohlen, (2001), Bhagwat and Sharma, (2007), Chae, (2009), Gopal and Thakkar, (2012); Kumar et al., (2023)
<ul style="list-style-type: none"> <li>The difficulty to share information required to build integrated supply-chain performance measurement system due to, mistrust; Technical problems, and Others.</li> </ul>	Gopal and Thakkar, (2012); Aladwey and Alsudays, (2024)

An alternative perspective conceptualizes the supply chain as an extended network encompassing all activities involved in producing and delivering a

final product—from the supplier's supplier to the customer's customer. Factors such as intensified competition, globalization, aggressive outsourcing

practices, and increasingly blurred organizational boundaries have significantly expanded the scope of supply chain management (SCM) (Gopal and Thakkar, 2012). Conceptually, SCM extends beyond logistics to include the planning and control of material and information flows across multiple organizations. Accordingly, the supply chain is not a linear sequence of one-to-one relationships but a complex, interconnected network of actors. This broader conceptualization introduces additional challenges for performance measurement.

A typical supply chain consists of multiple tiers of organizations, each comprising numerous facilities and operational units (Beamon, 1999). Moreover, the strength and nature of relationships among partners vary across different points in the supply chain and over time (Van Hoek, 1998). It is also common for firms to participate in multiple supply chains simultaneously. The multiplicity of actors and the complexity of their interrelationships make the selection of appropriate performance measures particularly difficult (Beamon, 1999). This complexity is further compounded by the fact that, although overall supply chain performance depends on the collective contribution of all participants, each entity operates under independent management with its own objectives, performance metrics, and optimization criteria (Schmitz and Platts, 2004). These objectives may conflict and do not necessarily align with the performance of the supply chain as a whole, making system-wide evaluation challenging (Lai et al., 2002; Aramyan et al., 2007). For example, purchasing managers are often incentivized to minimize procurement costs, while suppliers aim to maximize selling prices, potentially undermining long-term collaborative relationships (Holmberg, 2000). Such divergent perspectives can lead to inconsistencies in performance measurement and, ultimately, suboptimal supply chain outcomes (Gunasekaran et al., 2001). Consequently, the broad and interconnected nature of supply chains necessitates an expansion of the performance measurement context beyond firm-level boundaries.

To address these challenges, the literature examines inter-organizational relationships within supply chains at two levels of analysis. The first focuses on dyadic relationships between two collaborating firms, which may take the form of vertical relationships (e.g., buyer-supplier or firm-customer) or horizontal collaborations among firms serving the same market. Vertical relationships are the most extensively studied within the inter-organizational accounting literature (Aladwey and Alsudays, 2024). However, growing trends in

outsourcing and strategic alliances have shifted attention toward more complex network-level interactions.

The second level of analysis considers supply chains as networks of interdependent relationships among multiple organizations. In such settings, relationships are embedded within a broader network structure, meaning that the characteristics of any single relationship are influenced by other interconnected relationships. Desai (2023) highlights that inter-organizational accounting practices in supply chain networks are shaped by this embeddedness, where managing one relationship cannot be isolated from the dynamics of others. This interdependence adds another layer of complexity to performance measurement.

As organizations become increasingly interconnected, the need for consistent and harmonized performance measurement criteria becomes critical to ensure alignment and avoid sub-optimization (Lohman et al., 2004). However, achieving such consistency remains challenging due to the absence of robust multi-criteria frameworks capable of capturing trade-offs among diverse performance dimensions. Consequently, there is still no universally accepted set of measures for evaluating supply chain performance as an integrated whole (Gopal and Thakkar, 2012).

Uncertainty also persists regarding what to measure, how many indicators to include, and how to design effective performance metrics. Developing a comprehensive and applicable performance measurement system requires access to extensive and reliable information across all supply chain activities. However, information sharing is often hindered by conflicting interests, power imbalances, and concerns over trust and competitive advantage.

Technical barriers further complicate this issue. Differences in accounting systems, levels of sophistication, and data capabilities across firms limit the comparability and usability of information. Smaller firms may lack the financial and human resources needed to participate effectively in performance measurement initiatives, while medium-sized firms may struggle to translate available data into meaningful metrics. Additionally, limited transparency is a common feature of complex supply chains with numerous actors and interdependent relationships, further constraining the development of effective performance measurement systems.

## 5. CONCLUSION

Firms are overhauling their practices to comply

with supply chain thinking to gain better competitive positions. Unfortunately, management accounting practices may not be ready to enhance supply-chain relationships due to their limited inward rather than outward looking. Traditional management accounting practices may be emerged and evolved without these complex relationships. In this regard, there is an ongoing debate among researchers regarding whether or not new management accounting techniques is needed to comply with supply-chain environment. Although the debate is still valid, the literature highlighted considerable roles of performance measurement within supply-chain context.

As literature showed, there were some serious attempts which aimed at designing and implementing joint performance measurement systems to embrace an integrative approach, however, the practices is still facing unintended complexities. On the top of these complexities are the insufficiency and unavailability of supply-chain

information needed for building an integrated performance measurement system, as well as the absence of multi-criteria guidance that help in designing appropriate accounting measures. Overall, the literature on supply chain performance measurement remains fragmented, with significant conceptual diversity and limited practical consensus. While numerous frameworks and models have been proposed, many fail to adequately address the interdependencies, strategic alignment, and dynamic nature of supply chains. Consequently, the design and implementation of effective supply chain performance measurement systems remain complex and challenging (Gopal and Thakkar, 2012). As noted by Van Hoek (1998), measuring supply chain performance often resembles "measuring the unmeasurable," reflecting the inherent complexity of inter-organizational systems. These challenges underscore the need for further research, particularly empirical studies that bridge the gap between theory and practice.

**Author Contributions:** For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used "Conceptualization, L.A. and S.K.; methodology, H.Y.; software, A.T.; validation, L.A., H.Y. and A.T.; formal analysis, S.K.; investigation, S.K.; resources, L.A.; data curation, A.T.; writing – original draft preparation, H.Y.; writing – review and editing, L.A.; visualization, A.T.; supervision, H.Y.; project administration, S.K.; funding acquisition, Y.Y. All authors have read and agreed to the published version of the manuscript."

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