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Performance Evaluation of Indian "Supply Chain Management" for Manufacturing Sector

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Abstract: ***In most organizations, financial results have been the key metric of progress. On a weekly, quarterly, and annual basis, the companies have created reporting structures and financial statements to measure their "supply chain" success. Companies, on the other hand, have struggled to establish successful real-time "supply chain" output analysis and processes. Companies today are working in an ever-changing and volatile world while still competing against global competition. As a result, the principle of "supply chain" management (SCM) has assumed strategic significance. So far, research has shown that many modern businesses have struggled to maximize their "supply chain's capacity because they have often failed to develop the success metrics required to properly leverage their "supply chain". Manufacturing companies in India are no exception. The authors of this paper want to suggest whether or not a specific solution is appropriate in the case of Indian manufacturing companies. All required factors influencing a company's "supply chain" success have been incorporated, and the suitability of "supply chain" measurement methods, especially for manufacturing organisations, has been suggested. A scale for "supply chain" efficiency methods was established using data obtained from 100 manufacturing organizations throughout India. The research findings are supposed to have important consequences for Indian manufacturing companies in terms of understanding the factors that contribute to effective SCM operations.***
Keywords: "supply chain management (SCM)", "supply chain" performance, Manufacturing, flexibility

I. INTRODUCTION

Supply chain or distribution network chin in simple terms can be referred to something related to logistics. A proper supply chain management is a very crucial part in determining the success of any manufacturing firm. In general there are lots of strategies to use supply chain starting from our household products to heavy industrial setups. One can aver this statement that aberrant behavior of supply chain network would lead to the exacerbating of the whole market scenario. In modern globalization everyone is really dependent upon how well the distribution market works, in other words all the peers that are linked to a particular supply chain will get effected if there found any sort mislead by any one of the supply chain agent like distributer, manufacturer, inventory holder etc.

In India, the industrial sector is steadily expanding while in most industrialized economies it is shrinking. According to a study on the "global manufacturing industry", western firms have gradually downsized over the past decades, resulting in increased manufacturing competitiveness and widespread adoption of lean manufacturing techniques. Emerging economies focus on mass production and price competition. China, India, and Korea [1] are the top three countries in the "Global Competitiveness Index". Many manufacturing executives agree that their businesses actually have no knowledge in their "supply chain" outside tier-1 vendors (49 percent globally; 54 percent in the United States) [2].

The annual survey of 300 international "supply chain" patterns, including the design and development of the future "supply chain" networks in the face of increasing globalization and outsourcing, the preservation of product quality and safety as well as the management of many internal and external partners worldwide and the segregation of distribution network have been searched for responses to crucial issues. The survey's aim is to offer crucial insight into how industry leaders are globalizing their "supply chain" processes to gain a strategic edge in today's difficult market world. The survey shows a variety of tactics used by businesses to navigate their multinational "supply chains". There are a few big developments that are behind creative "supply chain" planning and configuration in all sectors. Globalization is speeding up, resulting in major strategic changes for global "supply chain" organizations and new obstacles to effectively navigate "supply chains". Across markets and regional areas, companies' agendas and "supply chain" efficiency are converged on optimizing "supply chain" flexibility and performance.

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The market criteria of industrial companies have shifted from manufacturing site versus manufacturing site to “supply chain” versus “supply chain”. In the new age of competitive procurement and global rivalry, “supply chain” improvement is crucial to a company's bottom line. Going a step further, the “supply chains” maturity determines a company's success, impacting both the top and bottom lines. In the domestic market, Indian industry faces competition from foreign corporations as well as imports. The latest market is based on higher quality, higher performing goods, lower costs, a broader variety of products, and better support, all offered at the same time [4].

Many businesses have struggled to realize the full value of their “supply chain” because they have failed to develop the success indicators and benchmarks needed to completely integrate their “supply chain” for maximum productivity and quality [5]. “Supply chain” management was shown to have a good uptake and perceived efficacy in a global survey of contemporary industrial processes [6]. With these low levels of adoption and efficacy, one would expect more attention to be paid to improving measuring methods and metrics for assessing “supply chain” efficiency. Similarly, assessing “supply chain” efficiency has been proposed as a way to get a better view of the “supply chain” and increase overall company performance [7].

Today's strategy has evolved from straightforward “supply chains” to dynamic networks of companies collaborating to generate comparative edge and value, referred to as value networks or "external “supply chains". As a result, networks that crisscross organizational borders are forming, and the focus is shifting from inter- to trans-organizational networks.

Also listed is the principle of “enabling performance management [8]. The importance of people's participation at all levels is emphasized, beginning with the selection of metrics. Performance measurement problems, the need for a developmental methodology in performance measurement, the importance of delegating performance measurement at any level of hierarchy, and the concept of "metrics for people" were all discussed. It has also been proposed that the human dimension has an important impact on the efficacy of SCM [9]. Employees are the main asset that drives “supply chain” success, so human factors influence management” at different levels and processes in a “supply chain” [10].

It has also been proposed that businesses should recognize that, while financial performance metrics are critical for management decisions and external reporting, non-financial indicators are much best for day-to-day monitoring of production and delivery activities [11]. Choosing the number of metrics to use is another field where inequality exists. Companies frequently have a vast range of success metrics to which they continue to incorporate depending on employee and expert feedback. They refuse to recognize that performance evaluation can be best handled by focusing on a few key areas—not superficial areas, but those that are crucial to progress. A few other issues of output assessment have also been raised [5] [12].

II. LITERATURE REVIEW

The authors suggest a conceptual model in this paper that links relationships with supplier-buyer relationships, external “supply chains”, environmental conditions, human indicators, knowledge exchange, success measurement methods, and SCM performance in the context of Indian manufacturing organizations in a single analysis. However, performance assessment methods are given a lot of attention in this article.

A. Performance Measurement Approaches

A “supply chain (SC) is a network of companies that work together to conduct a range of procedures and operations in order to produce value in the form of goods and services for customers. In this article, the authors propose a conceptual model that, in the context of Indian manufacturing organizations, connects relationships with supplier-buyer relationships, external “supply chains”, environmental factors, human metrics, information sharing, progress assessment approaches, and SCM efficiency in a single study. The techniques of performance evaluation, on the other hand, are given a lot of coverage in this paper. In this article, the authors propose a conceptual model that, in the context of Indian manufacturing organizations, connects relationships with supplier-buyer relationships, external “supply chains”, environmental factors, human metrics, information sharing, progress assessment approaches, and SCM efficiency in a single study”.

The techniques of performance evaluation, on the other hand, are given a lot of coverage in this paper. Customers [13] “supply chain” management (SCM) is a marketing practice that is widely being used in today's business climate, and it has recently attracted scholarly and corporate attention [14].

Due to the fact that the philosophy of SCM is still evolving, many theoretical concepts and analysis methodologies must be established. However, several papers in different fields have been published in an attempt to describe the SCM and address future paths as well as the scientific testing methods [15][16][17].

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Supply chain management is a multi-dimensional construct that includes both the upstream and downstream aspects of the "supply chain" [18]. Outsourcing, supplier partnerships, knowledge exchange, processing time, compression, and continuous process flow are all practices that fall under the SCM umbrella [19]. SCM is an integrated and process-oriented approach to "supply chain" management, design, and regulation, with the goal of creating value for the end user through both customer support and cost reduction [20]. Manufacturing businesses face a number of SCM problems. Customers' needs, for example, are constantly changing, and it's difficult to predict what they will change [21]. When customers raise their requests without prior agreement with the company, they are accustomed to receiving goods in a brief time period. Aside from that, the production firm has a strong supplier domination. This ensures that firms have no control over the relationship with their suppliers and must embrace the supplier's consistency, price, and terms and conditions [22]. Apart from that, both within and outside the business, there is a shortage of integrated applications and systems [23]. Because of inept infrastructure, certain vendors are unable to reach the company's supplier portal. Many papers on "qualitative-based Performance Measurement (PM) in SC systems have been published in the literature. For example, a conceptual model of integrated business" processes was created based on a qualitative analysis of SC integration [24]. In the 1990s, researchers started to concentrate on SCM as a whole, promoting customer loyalty, buyer-supplier cooperation, and knowledge exchange [13] [25] [26] [27]. The impact of creative tactics and other non-financial indicators such as coordination and lead times on operational success is often explained [29], as is the role of calculating intangibles in SCs. Measurement of external, customer, value-based competitiveness, network efficiency, and intellectual capital has also been suggested as a way to increase SC productivity [30]. As a result, improving "supply chain" efficiency is a vital strategy for businesses to gain a strategic edge [31].

1) Researchers [10] have also identified the following main guidelines for future research:

a) "More studies on performance assessment methods for 21st-century business models, the need for more accurate mechanisms and empirical testing of performance metrics, and action research" are all required.

b) "Validation of developed success metrics, establishment of relationship KPIs, and development of templates to cover virtual and e-commerce environments".

c) To allow benchmarking, SCOR is developing measurement and performance frameworks in the form of new maturity models.

d) Cross-industry research is needed.

e) There is a need to create metrics for calculating its efficiency and suitability in SCM.

f) Measurement and metrics for attentive SC performance.

The majority of businesses use financial and non-financial success metrics, but they do not view them in a holistic manner. The fundamental issue is whether financial and non-financial PMs are appropriate for evaluating the success of a SC system. Strategic level PMs, for example, are mostly dependent on financial metrics. Both financial and non-financial metrics can be used to test PMs at the tactical stage. The majority of nonfinancial metrics are used to evaluate operational efficiency. However, we will not be able to generalize this understanding, because this decision can be made dependent on the unique features of each company. Although some businesses focus on financial success indicators, others focus on operating indicators [25]. Such disparities do not contribute to metrics that provide a clear view of the organization's results. According to researchers, an efficient output assessment scheme is a crucial prerequisite for successful "supply chain" management [32]. There are articles on "supply chain" efficiency assessment methods and metrics that objectively examine the current literature and propose alternative research avenues [33]. In order to evolve a reliable and competitive "supply chain", SCM must be evaluated for its efficiency [34].

Another result shows that customer satisfaction is rapidly being recognized as an effective metric for assessing how effectively a single company is achieving its goal, and that customer satisfaction surveys can be used to optimize the entire process.

However, a host of significant issues are yet to be resolved [33]. These cover the influences that influence the effective deployment of "supply chain" performance assessment schemes, the forces that shape their development over time, and the challenge of maintaining them. New organizations must cope with a variety of success demands, which necessitates the use of appropriate techniques [35]. The research also serves as clear evidence of the need for a modern output assessment and costing scheme. Few other methods have been suggested to support the concept of a modern performance assessment method. The optimized "supply chain" productivity calculation methodology blends "Economic Value Added (EVA), Balanced Scorecard (BSC) and Activity-based Costs (ABC)" evaluating the effectiveness of overall management and a balanced approach. Other approaches concentrate on the reliability of the ERP "supply chain" and provide an integrated basis for measuring the "supply chain" success of an ERP-based three-chelon "supply chain" structure [36].

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2) In most organizations, a financial result has been the key metric of progress. On a weekly, quarterly, and annual basis, the "companies have created reporting structures and financial statements to measure their "supply chain" success. Companies, on the other hand, have struggled to implement successful real-time or near-real-time "supply chain" output monitoring and management processes. For the following factors, monitoring financial results is inadequate to assess the "supply chain" performance of today's logistics" firms:

a) The indicators don't have any forward-looking information.
b) The metrics have little to do with strategic, non-financial outcomes like customer experience or product efficiency.
c) The metrics don't have a clear link to efficacy or performance.
d) Process-oriented and cross-organizational aspects are not included in the initiatives.

"Performance assessment and progress measurements should be those that truly embody the nature of corporate performance. A measuring scheme should make it easier to allocate metrics to the most suitable places. Measurement objectives must incorporate organizational goals, and metrics chosen should provide a combination of financial and non-financial indicators that can be related to political, tactical, and operational" dimensions of decision making and control for successful performance measurement and progress.

3) Quality assessment [5] [12] identifies the following major issues:

a) Quality analysis and metrics are incomplete and inconsistent.
b) Failing to provide a balanced system between financial and non-financial interventions, with some focusing on financials and some on operating measures.
c) Having a vast range of metrics makes it impossible to distinguish between the important few and the insignificant many.
d) The strategy and the calculation are not related.
e) Putting a skewed emphasis on financial indicators.
f) Being too self-absorbed.

Measurement goals must take into account the total SC goals as well as the metrics to be used for good SC management. These should take a holistic approach and be listed at the political, tactical, and organizational stages, as well as include financial and non-financial interventions [34]. With both of these issues in mind, there seems to be no general agreement on appropriate "supply chain" quality efficiency metrics, and widely used "supply chain" benchmarks are fragmented and practically unknown [37]. Many evaluation schemes struggle to define the most suitable criteria because they neglect strategy consistency, a holistic methodology, and systemic thinking [31]. According to [31], these measurement schemes do not have a clear cause–effect relationship among a large number of hierarchical individual KPIs. It's also noted that "many measurement systems are static, so they lag the trend." The significance of hierarchy and interdependence among various KPIs is emphasized [38].

4) The following is a list of suitable SCPM characteristics compiled from various sources [34] [39] [40] [41].Some of them are applicable to all measures, and others are only applicable to a subset of a firm's measures. When developing a PMS, it's also difficult to meet any of the criteria proposed in the literature [40]. The success indicators for a company should include the following:

a) Be straightforward and easy to use.
b) Have a definite goal in mind.
c) Give immediate reviews.
d) Focus on performance enhancement rather than simply reporting.
e) Reiterate the company's plan.
f) Relate both the organization's long-term and short-term goals.
g) Complement the company's culture.
h) They should not be at odds with one another.
i) Be horizontally and vertically blended into the organizational system.
j) Follow the company's current acknowledgment and compensation scheme.
k) Concentrate about what matters to consumers.
l) Concentrate about what the competitors are doing.
m) As a result, waste will be identified and eliminated.
n) Assist in the acceleration of corporate learning.

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5) Financial accounting standards, much of which date back to the ancient Egyptians and Phoenicians, have traditionally been used to track company results. Financial accounting metrics are critical for determining whether or not organizational improvements are enhancing an organization's financial stability, but they are inadequate to determine "supply chain" efficiency for the following reasons:

a) The interventions are usually retrospective in nature and do not have a forward-looking viewpoint.

b) Customer service/loyalty and product consistency are examples of significant strategic, non-financial results that are not measured.

c) The metrics aren't linked to organizational productivity and performance.

The conventional and advanced "performance measurement (PMS) systems have been compared [42], showing the differences between the traditional and innovative performance measurement systems". Table 1 depicts the contrast.

Table.1 Comparison of traditional v/s innovative PMS [42]

Traditional PMS	**Innovative PMS**
Based on cost/efficiency	Based on value
Trade-off between performances	Compatibility of performances
Profit oriented	Client oriented
Short term orientation	Long term orientation
Individual metrics prevail	Team metrics prevail
Functional metrics prevail	Transversal metrics prevail
Comparison with the standard	Monitoring of improvement
Aimed at evaluation	Aimed at evaluation and involvement

6) Performance assessment is critical because it is the only way to determine "whether process performance is improving or deteriorating, and whether immediate corrective action is required [43]. In performance measurement, a metric is a numerical value used to calculate and record a key performance attribute for a business, organization, team, product line, or entity". Customer loyalty, product efficiency, execution accuracy, and cost savings are examples of performance assessment metrics.

a) It's crucial to monitor success [23] because it allows you to:

b) Provides necessary guidance and aids in the establishment of goals.

c) Measures and tracks progress and focuses on the most important problems

d) Identifies sectors that are gaining a lot of interest for both organizations and people.

e) Aids in the communication of important problems and outcomes

f) People and teams are measured and rewarded.

To classify processes, a variety of "different types of performance" metrics have been used, especially for manufacturing, delivery, and inventory systems. Quality measure collection is problematic due to the vast number of possible performance measurements [39]. These systems all have their own set of advantages and disadvantages, with the most important disadvantage being a lack of guidelines for the particular selection and application of steps [44]. Businesses rarely want to construct a PMS from the ground up, and most administrators want to fix any flaws in their current structure [45]. Despite the many functional applications of these models and structures, there was a paucity of literature focused on rigorous empirical studies on the implementation of PMS [46] [47].

A variety of calculation techniques have been developed in response to some of the shortcomings of conventional accounting strategies for calculating "supply chain" efficiency (Table 2). In light of changing economies and business conditions, several analysts have introduced new success indicators and metrics. However, there is some ambiguity about certain steps, and In SCM systems, metrics about their importance and particular areas of deployment are important. External, customer, value-based competitiveness, network efficiency, and intellectual capital are five groups of recent emerging indicators that have been proposed [30]. Companies that outperform their rivals excel in four main operating areas: (1) distribution efficiency, (2) versatility and "responsiveness, (3) logistics costs, and (4) inventory management [49].

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SC partners do not share a shared view of or respond to the same collection of indicators, according to a study focused on a sample of 22 firms' SC structures [50]. Many academic papers dealing with output assessment in a SC sense [27] have recently been published in the literature. However, the majority of them are prescriptive and are not dependent on historical evidence", their interpretation, shifting business and operational conditions, or well-founded analytical analysis. Furthermore, they lack a comprehensive understanding of both success indicators and metrics of new business contexts at various stages of decision-making. The rationale for selecting appropriate criteria based on existing and evolving new business environments is highlighted in an analysis of PMSs in SCMs environments.

There aren't many research papers on logistics and "supply chain" efficiency indicators and metrics. A review and assessment of the performance metrics used in SC models is given, as well as a framework for selecting PMSs for manufacturing SCs [39]. Resources, output, and stability are defined as three categories of PMs that must be present in any "supply chain" PMS. Traditional PM models, according to another analysis, should use co-relational relations between SCM output and its determinants.

Table. 2 List of Performance Measurement Models [48]

Name of the model	Period of introduction
The ROI, ROE, ROCE and derivates The economic value added model (EVA)	Before 1980s
The activity-based costing (ABC) – the activity-based management (ABM,1988) The strategic measurement analysis and reporting technique (SMART,1988) The supportive performance measures (SPA,1989) The customer value analysis (CVA,1990) The performance measurement questionnaire (PMQ,1990)	1980-1990
The results and determinants framework (RDF,1991) The balanced scorecard (BSC,1992) The service-profit chain (SPC,1994) The return on quality approach (ROQ,1995)	1991-1995
The Cambridge performance measurement framework (CPMF,1996) The consistent performance measurement system (CPMS,1996) The integrated performance measurement system (IPMS,1997) The comparative business scorecard (CBS) The integrated performance measurement framework (IPMF,1998) The business excellence model (BEM,1999) The dynamic performance measurement system (DPMS,2000)	1996-2000
The action-profit linkage model (APL,2001) The manufacturing system design decomposition (MSDD,2001) The performance prism (PP,2001) The performance planning value chain (PPVC,2004) The capability economic value of intangible and tangible assets model (CEVITA,2004)	2001-2004
The performance, development, growth benchmarking system (PDGBS,2006) The unused capacity decomposition framework (UCDF,2007)	2006-2007

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The authors suggest similar theories about the "proposed relationship between the variables, as well as a conceptual model. According to a study of theoretical and scientific literature, the aforementioned topics have been extensively researched. To the authors' knowledge, no prior research has attempted to combine all six determinants of SCM efficiency, namely, "supplier-buyer relationships, external "supply chain", environmental conditions, information exchange, performance assessment methods", and SC performance measurement, into a single study. The suggested conceptual model's structure is shown below.

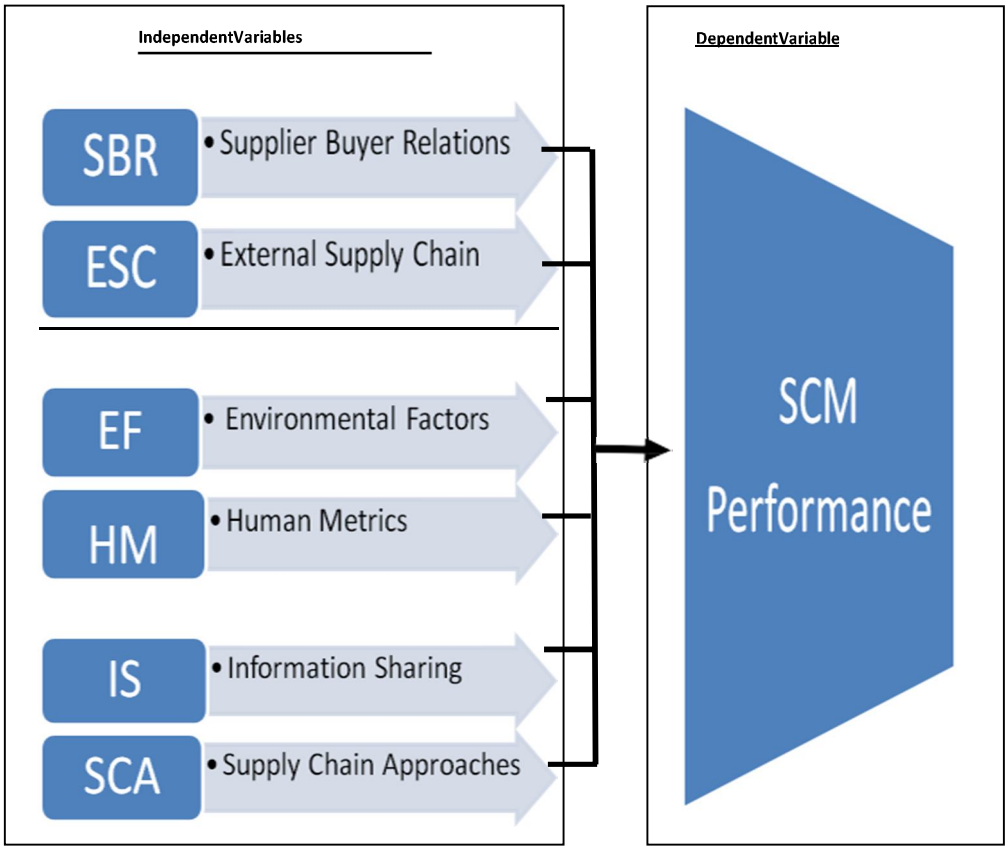

Figure.1 A proposed conceptual model

III. METHODOLOGY

This study's methodology is focused on viewpoints that are isolated from more innovative non-cost metrics like time, accuracy, and versatility [51].

IV. PROPOSED CONCEPTUAL MODEL

A model [52] has been developed to investigate the "Relationship between supply chain" efficiency and the degree of linkage among suppliers, internal integration, and customers. In light of this information, the researchers suggest that a model for manufacturing firms be built based on [39] and [53], namely, PMS should create accurate metrics to provide input on different performance areas by avoiding overlapping (duplication) metrics and using the most relevant logistics and "supply chain" management metrics". [39] Has concentrated on the major metrics of time, resource use, output, and resilience in order to provide a framework for creating more comprehensive success indicators and metrics in new business environments.

This pilot study's sample includes ordering, processing, logistics, and delivery divisions in Indian manufacturing firms. The key tools of this analysis are questionnaires (both online and offline). After a thorough analysis of the literature, questionnaire items are developed. A 5-point like a scale was used in this study.

There are a total of 21 pieces available (excluding the demographic items).

The questionnaire is emailed to different respondents, and of the 108 answers submitted, 100 are complete in any way and are thus included in this pilot study. To exclude redundant items from the questionnaire, factor analysis is conducted on each construct using SPSS, and reliability analysis is performed to see how well the items in a package are positively compared to one another".

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V. RESULTS

The overall number of elements is reduced from 21 to 7 using factor analysis. The below is a list of the elements before and after the factor analysis (Tables 3 and 4).

Table.3 Initial Items

S. No.	Items	Details
1	SPA1	Sales
2	SPA2	Cash flow
3	SPA3	Profit / Sales
4	SPA4	Quality of accounting policies
5	SPA5	Customer complaints
6	SPA6	Percent of missed delay rates
7	SPA7	Customer Surveys
8	SPA8	Percent of products rejected by quality control
9	SPA9	Manufacturing cycle time
10	SPA10	Capacity utilization
11	SPA11	Safety record
12	SPA12	Absentee rates
13	SPA13	Employee training
14	SPA14	Customer diversification
15	SPA15	Percent of sales from proprietary products
16	SPA16	Environmental policies implemented
17	SPA17	Community involvement
18	SPA18	Experience/reputation of management

Table.4 Final Items

S. No.	Items	Initial	Extraction
1	SPA4	1.000	.638
2	SPA7	1.000	.536
3	SPA10	1.000	.655
4	SPA12	1.000	.626
5	SPA15	1.000	.815
6	SPA16	1.000	.334
7	SPA17	1.000	.655
	Extraction Method: Principal Component Analysis		

Table.5 Reliability Scores

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.778	.777	7

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VI. CONCLUSIONS

The concept ""“supply chain” management" allows for varying interpretations of a “supply chain” based on customer-supplier relationships. Clearly, there is no one-size-fits-all approach to defining the roadmap to optimum “supply chain” efficiency assessment. The presented approach provides logistics networks with a novel tool for designing a balanced supply-chain efficiency assessment.

The proposed model establishes a co-relational connection between supplier-buyer relationships, external “supply chains”, environmental considerations, knowledge exchange, performance assessment methods, and SCM performance. “The authors' goal is to fill in the gap in “supply chain” management research that examines the importance of key success factors in Indian manufacturing organizations. Furthermore, “the research that will be conducted as a result of the proposed model is planned to explore the crucial success factors” that lead to SCM efficiency in order to improve Indian manufacturing organizations’ competitive edge. The main challenge for managers is to come up with “appropriate success assessments” and “benchmarks to help them make better choices that can increase their organization's productivity”. The concern now is whether standard success metrics can be used, and if so, which ones should be prioritized for assessing efficiency in a modern business setting. It also aims to emphasize the rationale for selecting suitable criteria that will provide management with the right knowledge at the right time to make choices that will improve the organization's productivity. The focus of this research, however, is limited to a few manufacturing companies in India. It may be expanded to include other organizations.

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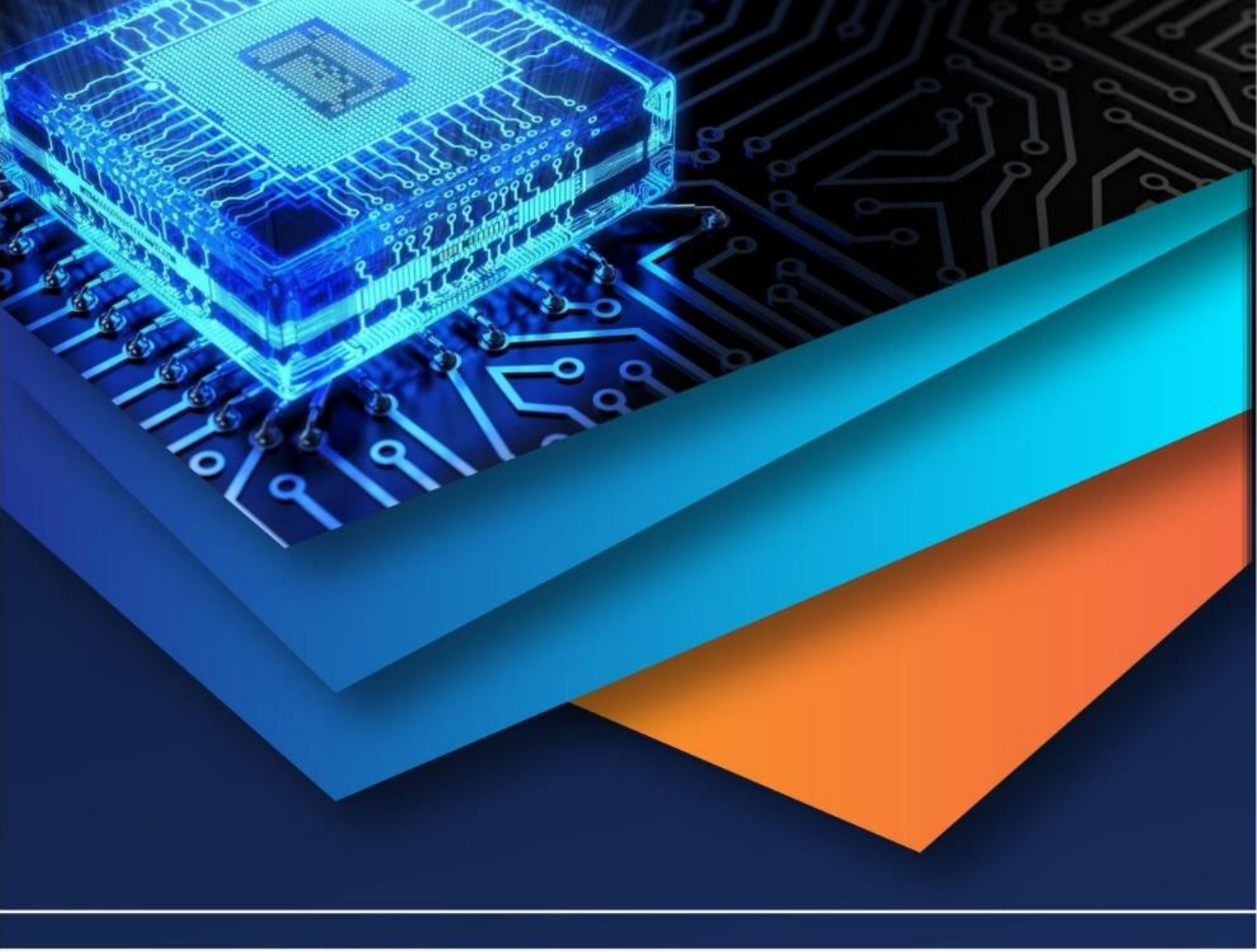

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