

Constructing Performance Measurement Index for the Manufacturing Industry: An Empirical Study

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Abstract

Studies have been carried out along with literature on supply chain performance, yet manufacturing companies fail to attain a precise performance measurement evaluation due to a lack of an Integrated Supply Chain Performance Measurement (ISCPM) model and knowledge in the manufacturing industry. Though it has been widely accepted and adopted—performance evaluation through the Balanced Scorecard (BSC) and the Supply Chain Operations Reference (SCOR) model, however, it needs to address a holistic approach considering the current complexity and market dynamics changes. This study formulates a conceptual Integrated Supply Chain Performance Measurement (ISCPM) model with thirty-six performance measurement index through ten attributes in the outlook of input-process-output considering the BSC and the SCOR model at three decisions levels with an application of quantitative techniques to bring synergic effect to all stakeholder issues such as supplier relationship management (SRM), internal supply chain management (ISCM), and customer relationship management (CRM). The conceptual model was tested in the manufacturing industry of Bangladesh. Finally, it recommends the urgency for an Integrated Supply Chain Performance Measurement (ISCPM) model which connects all the stakeholders aligning the organizational performance.

Keywords

Integrated Supply Chain Performance Measurement (ISCPM), Performance Measurement Index (PMI), The Balanced Scorecard (BSC), SCOR

1. Introduction

American Production and Inventory Control Society conceptualized the defini-

tion of Supply Chain Management (SCM) as the process of overseeing the flow from raw materials to the consumption of end products by consumers (Agrawal et al., 2019). This description implies that SCM is a system that synchronizes the entire functions and sub-functions of the internal and external entities of an organization. In the same line, some other authors extended the importance of emphasizing the incorporation of the information system in the definition of SCM.

Manufacturers have been investigating innovative methods to attain competitive leverage in consequence of globalized competition. Practically, such methods can be referred to as SCM, which has been chosen as an enormous measure of consideration by the analysts and experts. SCM is reflected as an effective strategic approach to enhance competitive advantage in this modern era of intense global competition, and as such, SCM is gaining endless attention. Indeed, the effectiveness of SCM is impactful on the quality of product value, logistics, and by extension on customer satisfaction and organizational profitability (El-nouaman & Ismail, 2016).

Performance evaluation of an integrated supply chain management for the manufacturing industry induces supply chain management (SCM) to deal as an extended movement connecting organizations in diverse areas and empower business partners to escalate efficiency to understand the bottom-line impacts of an organization from procurement, manufacturing, warehouse, distribution, customer service as well as financial aspects of an organization. Manufacturing companies have been studying innovative methods to attain competitive leverage where integrated SCM is reflected as an effective strategic approach to enhance competitive advantage in this modern era of intense global competition.

Business dynamic forces have been transformed that put the arm on the legislative requirements to measure the performance for the manufacturing industry where companies have been witnessing to unlock the tools that can assess the supply chain performance measurement (SCPM) commendable (Kurien & Qureshi, 2018). As of now, the supply chain performance measurement (SCPM) is evaluated into a financial and non-financial measurement system. Business enterprises witnessed a paradigm transformation to evaluate SCPM, where Global companies adopted either Supply Chain Operations Reference (SCOR) model or Balanced Scorecard (BSC) model.

A significant study has been carried out on designing on comprehensive performance measurement framework model such as Balanced Scorecard (BSC) model, SCOR model, Key Performance Indicators (KPI), Management by Objectives (MBO), Total Productivity Management, Activity-Based Costing, and Economic Value Added. Yet, a lot of corporations were unsuccessful in implementing effective performance measurement methods in their operations (Kottala & Herbert, 2019).

This study has developed a comprehensive performance measurement index to evaluate the supply chain performance for the Bangladeshi manufacturing industry and established a conceptual framework to evaluate the firm's SCM at

different decision levels. The study also formulated a conceptual framework and illustrated the urgency for an Integrated Supply Chain Performance Measurement (ISCPM) model to address issues to all its stakeholders to impact the organizational bottom-line performance, vision, mission, values, and objectives (Garcay-Rondero et al., 2019).

This study consists of seven sections which are: 1) Introduction, 2) literature review, 3) performance measurement index (PMI), 4) research methodology, 5) conceptual framework, 5.1) conceptual model, 5.2) ISCPM model, 6) discussion, 7) conclusion and 8) recommendation & future research. The literature review discusses different aspects of performance measurement models, its strengths and limitations. The 36-performance measurement index (PMI) has been illustrated which has been constructed through 10 attributes in Section 3. The conceptual framework is illustrated in Section 5, where the conceptual model and ISCPM model are elaborated in Section 5.1 and section 5.2. The discussion in Section 6 highlights how the performance measurement indexes are embedded into the ISCPM model. And finally, conclusions have been made in Section 7, and recommendations and future research are illustrated in Section 8.

2. Literature Review

The Balanced Scorecard (BSC) model was pronounced as an authoritative performance measurement instrument, and it allows administrators to detect a composed understanding, where the researchers recommended four basic perceptions that administrators should observe and follow—financial, customer feedback, internal business processes & innovation, and learning perceptions. The author demonstrated how SCM structure is connected in a balanced scorecard model, where the BSC model is dominant in delivering managers with a comprehensive image of business performance. Nevertheless, it undergoes two elementary restraints. First, it is a top-down tactic. Hence, it is not participative and might miscarry to perceive prevailing collaborations between different procedure metrics (Kurien & Qureshi, 2018).

A group of research scholars unlocks multi-dimensional limitations of the BSC model, particularly in its thoughts, execution, and usage. The same group of research scholars resists that could either challenge the efficiency of the BSC model or trigger businesses to modify the BSC model for an improved and comprehensive performance measurement substitute. Hence, encouraged by the above, these critiques deliver a methodical assessment of the execution, practice, benefits, and restrictions of the model and exercise of the BSC model that finally endorses a substitute performance measurement model (Saleheen et al., 2018). The Balanced Scorecard (BSC) model was conceptualized to resolve the gaps of the conventional financial-based performance measurement tool that was eventually endorsed and implemented by large corporations. Since then, organizations have been adopting the BSC model to encounter the conventional performance measurement methods which emphasize the financial metrics on isolation. Besides, the BSC model stresses three performance metrics (learning and

growth, internal process, and customer) to provide a comprehensive performance perspective. Despite its tremendous acceptability and recognition within the organization; on several occasions, there are unsuccessful incidents discovered in the BSC model.

Simultaneously, the SCOR model was formulated by the SC Council (SCC) to support businesses to enhance the effectiveness of their SCs and to deliver a process-based approach to SCM, where the SCOR model carries a common process-oriented language in communicating among its SC associates in Plan, Source, Make and Deliver, where SCOR model designate, measure and estimate any SC configuration. There are twelve performance matrices as part of the SCOR Model to evaluate process performance: delivery reliability, flexibility, responsiveness, costs, and an asset to derive a quantifiable SC performance measure.

Alternatively, the SCOR model does not contemplate market uncertainty, where information visibility, IT-related issues, business sustainability, training and development, capacity building, etc. are also excluded in the scope of the SCOR model. No clear interaction of inter and intra organizational or functional activities are mentioned in the SCOR model (Miraz et al., 2022). To measure the supply chain performance, there are several tools and methods which have been already applied, however, each model had its challenges and opportunities. Regardless of its advantages and critics were the most perceived constraints of supply chain performance measurement (SCPM) are lack of a methodical technique, nonexistence of a balanced approach, multiple metrics and measures, supply chain attributes, and performance measurement index are not established, connecting with bottom-line impacts of an organization.

Similarly, absence of provision for benchmarking, lack of association with the organization's mission and strategy, failure in addressing the practicalities of measurement, lack of methodical thinking of measuring SC as a whole, and lack of a systematic method for prioritizing measures (Saleheen et al., 2019).

3. Performance Measurement Indexes

The researcher classified ten supply chain performance measurement attributes in **Table 1**, for a manufacturing firm at different stages from Supplier Relationship Management (SRM), Internal Supply Chain Management (ISCM), and Customer Relationship Management (CRM) are Financial Health (FH), Collaboration (CL), Velocity (VC), Resilience (RE), Reliability (RL), Continuous Improvement (CI), Visibility (VS), Work People Health (WPH), Sustainability (SS), and Service Excellence (SE). The researcher further classified thirty-six-performance measurement index (PMI) from FH1 to SE 36. The attributes are as follows (Saleheen & Habib, 2021).

Attribute 1 is denoted as Financial Health (FH). The Financial Health (FH) in the supply chain (SC) diagnoses and tries to understand how an organization is performing financially and eventually it connects the company's topline and bottom-line performance. The performance measurement index (PMI) is further

Table 1. Performance measurement index (PMI).

Attributes	Performance Measurement Index (PMI)	Reference
Financial Health (FH)	Economic Performance	FH 1 (Alora & Barua, 2019;
	Cost	FH 2 Kurien & Qureshi,
	Budget Variance	FH 3 2018)
Collaboration (CL)	Inventory	CL 4 (Panahifar et al., 2018;
	Planning Variance	CL 5 Garay-Rondero et al.,
	Partnership	CL 6 2019)
Velocity (VC)	Capacity Flexibility	VC 7 (Kurien & Qureshi,
	Speed	VC 8 2018; Sreedharan et
	Flexibility Consistency	VC 9 al., 2019)
Resilience (RE)	Global Risk	RE 10
	Enterprise Risk	RE 11
	Human Capital and Management Risk	RE 12 (Panova & Hilletoft,
	Supplier Risk	RE 13 2018; Chen, 2018)
Reliability (RL)	Be on Time	RL 14
	Be on Specifications	RL 15 (Garay-Rondero et al.,
	Be on Utilization	RL 16 2019; Zhang, 2017)
Continuous Improvement (CI)	Process Standardization	CI 17
	Culture for TQM	CI 18
	Culture for Continuous Improvement	CI 19
	Application of 5S	CI 20 (Kumar et al., 2020;
	Application of Lean	CI 21 Sreedharan et al., 2019)
	Application of Total Productive Maintenance	CI 22
Visibility (VS)	Integration	VS 23
	Traceability	VS 24 (Sundram et al., 2018;
	ERP Transactions	VS 25 Kumar et al., 2020)
Work Place Health (WPH)	Leadership	WPH 26
	Ethics, Integrity & Compliance:	WPH 27 (Sabiou et al., 2019;
	Talent Attraction and Retention	WPH 28 Kumar & Goswami,
	Health & Safety	WPH 29 2019; Tuniet et al.,
	Culture, Value and Employee Engagement	WPH 30 2018)
Sustainability (SS)	Sustainability to Nature:	SS 31 (Kumar & Goswami,
	Sustainability to Community	SS 32 2019; Shokri Kahi et
	Application of Green SC	SS 33 al., 2017)

Continued

	Innovation in Technology	SE 34	
Service Excellence (SE)	Customer Satisfaction	SE 35	(Kumar et al., 2020; Ghadge et al., 2020)
	Service Facilities & Technical Skills	SE 36	

segregated into Economic Performance (FH 1), Cost (FH 2), and Budget Variance (FH3).

The Economic Performance (FH 1) deals with Sales, Gross Margin, EBITA, Net Profit, Market Capitalization, Total Assets, Total Liability, Cash to Cash Cycle Time, Net Working Capital, Contribution to National Exchequer, Total CSR, etc. Cost deals with Cost of Goods Sold (COGS), Operating Cost, Total SCM Cost, and Logistics Cost related factors. And Budget Variance deals with Budget Variance in Customs Duty, Customs, Penalty, C&F Cost, Demurrage, Handing Damage, Cost of Production/Unit, Annual Wastage, Delivery Cost/Trip, etc.

Attribute 2, is denoted as Collaboration (CL). The Collaboration (CL) in supply chain diagnoses and tries to understand how does the organization maintains the stakeholder relationship. The relationship spans from the upstream to the downstream, internal as well as external. The performance measurement index (PMI) is further segregated into CL 4, CL 5, and CL 6, which are Inventory, Planning Variance, and Partnership.

Inventory deals with Inventory Holding Days, and aging & Turnover. Planning Variance deals with Production, Distribution, Forecast, Supply Chain Cycle Time. And Partnership deals with Supplier & Buyer Trust Level, Joint Problem Solving Initiative, Training, Continuous Improvement Goal Setting, Information Sharing on Production Plan, Inventory and Forecasting.

Attribute 3, is denoted as Velocity (VC). Velocity (VC) in supply chain diagnoses and tries to understand how long does an organization takes to respond to the market changes. The performance measurement index (PMI) is further segregated into Capacity Flexibility (VC 7), Speed (VC 8), and Flexibility Consistency (VC 9).

Capacity Flexibility (VC 7) deals with the flexibility level of the Finance, Production, Storage, Transportation, Material Equipment, Cold Chain, Technology, IT Integration. Speed (VC 8) deals with Manufacturing Time/Unit, No of Delivery Per Week, Loading/Unload Time, Goods Handling Volume (Storage, Service), Urgent Response Time, and Flexibility Consistency (VC 9) deals with Preventive & Scheduled Maintenance, Buffer Spares Parts, Line Balancing, Total Down Time.

Attribute 4, is denoted as Resilience (RE). Resilience (RE) in supply chain diagnoses and tries to understand how does an organization predicts future changes. The performance measurement index (PMI) is further segregated into RE 10, RE 11, RE 12, and RE 13 which are Global Risk (RE 10), Enterprise Risk (RE 11), Human Capital & Management Risk (RE 12), and Supplier Risk (RE

13).

Global Risk (RE 10) deals with Environmental, Political, Economic, Technological, Government, Legal, Ethical Business, Terrorism. Enterprise Risk (RE 11) deals with Planning to Payment, Alternate Sourcing, Security Program, Theft, Sabotage, and Counterfeit goods. Human Capital & Management Risk (RE 12) deals with Critical resource issues, risk, and trends of demographic skills, appropriate workforce, and skills. And Supplier Risk (RE 13) deals with Documentation of Supplier Contract Terms, Scope, Credit, Service, Specifications, Penalty, Litigations, Appraisal, Checklist for Commercial Documents (To avoid customs penalty).

Attribute 5, is denoted as Reliability (RL). Reliability (RL) in supply chain diagnoses and tries to understand how reliable is the supply, process, and distribution of an organization. The performance measurement index (PMI) is further segregated into RL 14, RL 15, and RL 16 which are Be on Time (RL 14), Be on Specifications (RL 15) and Be on Utilization (RL 16). Be on Time (RL 14) deals with On-Time Arrival, Delivery, (RM, FG, Transport), Receive & Submission of PI, LC, Document, Customs Clearance, Freight Forwarder, etc., and Product Fill Rate.

Be on Specifications (RL 15) deals with Goods Receiving as Per Specifications, Percentage of Delivery Rejects, Percentage of Return, Time to Respond Urgent Calls, and Be on Utilization (RL 16) deals with Raw Material Consumption Ratio, Machine Utilization Ratio, Delivery Fill Rate, and Field Failure Ratio, etc.

Attribute 6, is denoted as Continuous Improvement (CI). Continuous Improvement (CI) in supply chain diagnoses and tries to understand the ongoing activities to make the company remain competitive. The performance measurement index (PMI) is further segregated into Process Standardization (CI 17), Culture for TQM (CI 18), Culture for Continuous Improvement (CI 19), Application for 5S (CI 20), Application of Lean (CI 21), and Application of Total Productive Maintenance (CI 22). Process Standardization (CI 17) deals with SOP, Quality Management Systems, Environmental Management Systems, Occupational Health, and Safety Management Systems, Energy Management System, Information Security Management, Certification on Asset Management, Anti Bribery Certification, Data Protection Certification, Certification: Food Safety, Six Sigma, Lean, Kaizen, Kanban, etc.

Culture for TQM (CI 18) deals with 1) Top management commitment, 2) employee involvement, 3) Customer focus, 4) Facts based management, 5) Process monitoring & control, 6) Incentive and recognition, 7) Continuous improvement orientations, 8) Quality performance, 9) Service culture. Culture for Continuous Improvement (CI 19) deals with 1) Organizational direction and CI goals, 2) Balanced innovation and improvement plan, 3) Constant change culture, 4) Standardized process, 5) Standardized improvement method, 6) Training and career path, 7) Information & technical support.

Application of 5S (CI 20) deals with 1) Sort, 2) Straighten, 3) Shine, 4) Standardize, 5) Sustain. Application of Lean (CI 21) deals with 1) Over production,

2) Inventory, 3) Motion, 4) Transport, 5) Process, 6) Defects, 7) Waiting times. And finally, Application of Total Productive Maintenance (CI 22) deals with 1) Focused improvement, 2) Autonomous maintenance, 3) Planned maintenance, 4) Quality maintenance, 5) Cost deployment, 6) Training & Education, 7) Safety, Health & Equipment and 8) Early Equipment Maintenance including all buffer stock of parts.

Attribute 7, is denoted as Visibility (VS). Visibility (VS) in supply chain diagnoses and tries to understand the level of traceability of the organizational activities. The performance measurement index (PMI) is further segregated into Integration (VS 23), Traceability (VS 24), and ERP transactions (VS 25). Integration (VS 23) deals with Assessment and integration for in transit, production, on hand, and SC cost visibility. Traceability (VS 24) deals with Product traceability and quality information from planning to payment, and ERP transactions (VS 25) deal with Product traceability and quality information from planning to payment (Saleheen & Habib, 2022a).

Attribute 8, is denoted as Work People Health (WPH). Work Place Health (WPH) in supply chain diagnoses and tries to understand what are the ongoing company activities to achieve organizational excellence. The performance measurement index (PMI) is further segregated into WPH 26, WPH 27, WPH 28, WPH 29, and WPH 30 which are Leadership (WPH 26), Ethics, Integrity, & Compliance (WPH 27), Talent Attraction & Retention (WPH 28), Health & Safety (WPH 29), and Culture, Value and Employee Engagement (WPH 30).

Leadership (WPH 26) deals with Written Vision & Mission, Objective, KPI, Performance Appraisal Process. Ethics, Integrity, & Compliance (WPH 27) deals with Anti-corruption/bribery policy, ethical procurement policy, supplier ethical code of conduct. Talent Attraction & Retention (WPH 28) deals with Diversity and equal opportunity, fair market salary and benefits, performance-based reward policy, Career development plan, capacity building initiative, and succession plan, monitoring employee turnover.

Health & Safety (WPH 29) deals with Occupational health and safety practice, safety audits, safety performance assessment and report and finally Culture, Value and Employee Engagement (WPH 30) deals with Organizational written values, Defined job classifications and decision making authorities, Employee Respect, Positive change, and healthy cultural environment, Labor/Management relations, Unscheduled Employee Absenteeism.

Attribute 9, is denoted as Sustainability (SS). Sustainability (SS) in supply chain diagnoses and tries to understand what are the organizational activities for the people and planet. The performance measurement index (PMI) is further segregated into SS 31, SS 32, and SS 33 which are Sustainability to Nature SS 31, Sustainability to Community SS 32, and Application of Green Supply Chain (SC) SS 33.

Sustainability to Nature (SS 31) deals with Activities on Environmental Impact on Clean Energy & Conversion, Activities on GHG Emission (CO₂ emission/Ton of Production), Activities on Air Emission, Activities on Biodiversity,

Activities on Waste Management, Environmental Compliance Policy aligning with UN Sustainable Development Goal. Sustainability to Community (SS 32) deals with Corporate Social Responsibility (CSR) aligning with UN Sustainable Development Goal, and finally, application of Green Supply Chain (SS 33) deals with green procurement, green product development, and green logistics.

Attribute 10, is denoted as Service Excellence (SE). Service Excellence (SE) in supply chain diagnoses and tries to understand what are the company activities to achieve customer service excellence. The performance measurement index (PMI) is further segregated into SE 34, SE 35, and SE 36 which are Innovation in Technology (SE 34), Customer Satisfaction (SE 35), and Service Facilities & Technical Skills (SE 36). Innovation in Technology (SE 34) deals with Application of Artificial Intelligence, Application of Industry 4.0, Application of Industrial Internet of Things (IIoT), any innovation to improve product quality through technology.

Customer Satisfaction (SE 35) deals with Overall service rating, Field Failure Ratio (FFR), Lead time from complaint and problem solving, Sales people's friendliness and professionalism, Environment neatness and comfort for the service center, Call center feedback clarity, Accessibility of call center, online payment facility, etc. And finally, Service Facilities & Technical Skills (SE 36) deal with Team skills, technical facilities (Miraz et al., 2022).

4. Research Methodology

The study applied an exploratory study method based on primary and secondary data. Review of journal papers on supply chain performance measurement was made. The target population in this study was Bangladesh manufacturing industry, which consists of twenty-four manufacturing sectors. Based on the analysis, twenty-four manufacturing sectors have around 7570 manufacturing companies. Therefore, the population size is 7570. From the 7570 lists of the respondent companies, 1832 individual companies have been chosen randomly and emails have been sent to the supply chain heads to respond.

An individual company's supply chain professional has been considered as the unit of analysis. This study applied simple random sampling and used the Taro Yamane table at $\pm 7\%$ precision level, and confidence level at 95% the sample size of this research is 199. In this study, the researcher composed 207 respondents from the manufacturing industry. Hence, 207 respondents are the sample size in this study. Apart from these, the study also explored secondary data from Emerald, IJSCM, IGI, Nova publishers etc.

5. Conceptual Framework

The researcher classified thirty-six performance measurement index (PMI) under ten performance attributes through which Integrated Supply Chain Performance Measurement (ISCPM) model can be developed for a manufacturing firm are summarized below:

5.1. Conceptual Model

This exploratory study classifies and assembles SCOR model (supplier's supplier, supplier, your company, customer, and customer's customer); input, process, and output model as Supplier Relationship Management (SRM), Internal Supply Chain Management (ISCM), and Customer Relationship Management (CRM); at three decision levels with strategic (ST), planning (PL), and operational (OP). In order to bring a competitive position, a company needs to be strategically equipped to formulate its supply chain (SC) strategy either through responsiveness or efficiency, where six driving forces govern the competitive positions are—sourcing, facility, transportation, inventory, information, and pricing illustrated in **Figure 1** are beefed-up to formulate an SCM strategy either at a responsive or an efficient level. And then, the concept is infiltrated and attached to the framework.

In the conceptual model, the researcher classified the SRM in **Figure 1** where the attention was on the supplier as well as supplier's supplier for the supplier to supply all types of materials such as raw, packaging. These semi-finished or finished component materials are considered as supplied inputs. Supplied inputs will be transported through inbound logistics services at the factory premises. The researcher classified the ISCM in **Figure 1**, which is considered as a core process, where the focus is on the internal purchase, production, and distribution of goods from inbound logistics to outbound logistics. The purchase function focuses on the internal procurement which is seamlessly connected through factory production as well as the distribution to ensure the raw materials to bring in time to the manufacturing site and to bring out the finished goods from the manufacturing site to the end customers. Commercial activities such as clearing & forwarding (C&F), freight forwarding (FF), customs, port terminals, inbound and outbound logistics are closely knitted through this process.

The researcher identified the CRM in **Figure 1**, which is considered as a customer's as well as a customer's customer who will consume the finished goods. CRM deals with finished goods (FG) for different customers internally as well as externally. This exploratory study identifies SC macro-environmental process in **Figure 1**, which describes supplier relationship management (SRM) as a supplier, internal supply chain management (ISCM) as a manufacturer and customer relationship management (CRM) as a customer. Three decision levels are embedded in **Figure 1** are strategic (ST), planning (PL), and operational (OP).

5.2. ISCPM Model

This exploratory study classifies the ISCPM model in **Figure 2** where the balanced scorecard (BSC), SCOR model, Input-Process-Output, Supply Chain Macro process, Supply Chain drivers have been embedded to develop the Integrated Supply Chain Performance Measurement (ISCPM) model. SRM is considered as an Input, ISCM is considered as Process, and CRM is considered as Output. Within the Input-Process-Output, the conceptual model elaborates ten

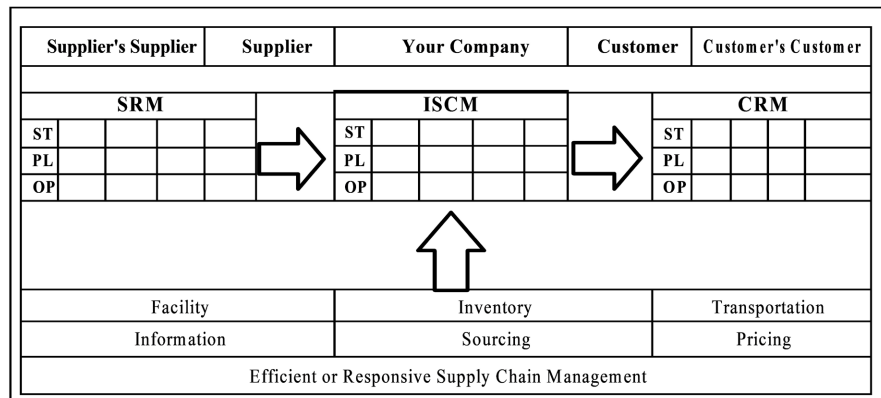


Figure 1. Conceptual model (Saleheen & Habib, 2022b).

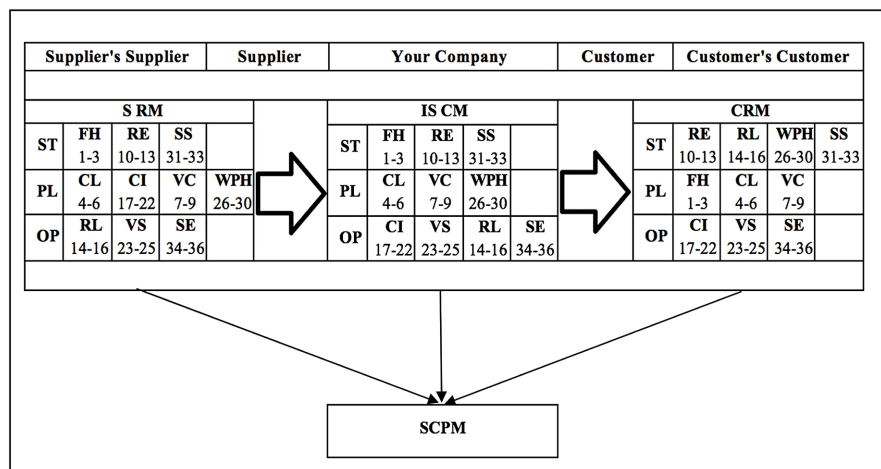


Figure 2. ISCPM model (Saleheen & Habib, 2022b).

attributes and thirty-six performance measurement indexes in three decision levels which are strategic, planning, and operational.

6. Discussion and Results

The researcher in Section 3, illustrated the 36-performance measurement index (PMI) which have been constructed through 10 attributes discussed in Table 1. Finally, the 36 PMI and 10 attributes are being embedded into the ISCPM model Figure 2. In Figure 2, the researcher elaborates that there are three decision levels at Supplier Relationship Management (SRM), International Supply Chain Management (ISCM), and Customer Relationship Management (CRM) are Strategic, Planning, and Operational.

In SRM at a strategic level, Financial Health (FH) needs to be measured which consists of Economic Performance, Cost, and Budget Variance. Resilience (RE) consists of Global Risk, Enterprise Risk, Human Capital & Management Risk, and Supplier Selection & Appraisal. Sustainability (SS), consists of Sustainability to Nature, Sustainability to Community, and Application of Green Supply Chain.

In SRM at the planning level, Collaboration (CL) consists of Inventory, Planning Variance, and Partnership. Continuous Improvement (CI) consists of Process Standardization, Culture for TQM, Culture for Continuous Improvement, Application for 5S, Application of Lean, and Application of Total Productive Maintenance. Velocity (VC) consists of Capacity Flexibility, Speed, and Flexibility Consistency. Work Place Health (WHP) consists of Leadership, (Ethics, Integrity, & Compliance), Talent Attraction & Retention, Health & Safety, and (Culture, Value and Employee Engagement).

In SRM at an operational level, Reliability (RL) consists of Be on Time, Be on Specifications and Be on Utilization. Visibility (VS) consists of Integration, Traceability, and ERP transactions. And Service Excellence (SE) consists of Innovation in Technology, Customer Satisfaction, and Service Facilities & Technical Skills.

For the Internal Supply Chain Management (ISCM), and Customer Relationship Management (CRM)—ten attributes and thirty-six performance measurement indexes have been clustered at a Strategic, Planning, and Operational level simultaneously similar to Supplier Relationship Management (SRM) illustrated above (Miraz et al., 2016, 2017; Saleheen & Habib, 2022a).

7. Conclusion

In the past few decades, the world has witnessed a lot of turmoil such as global financial crashes, natural calamity, terrorist activists, cyber-attacks, and the recent one—the global pandemic outbreak has affected an enormous impact on people’s lives, and societies. Amid these critical conditions, organizations are operational in uncharted waters. It is evident that crafting supply chain procedures and results based upon cost-competitiveness is no longer adequate; businesses will require to reconsider approaches that hold “risk-competitiveness” to warrant resilience moving forward. While there are, many elements associated, succeeding resilience will require that the next generation of supply chain winners move away from the traditional competitive advantages originated from economies of scale toward a greater highlight on what we stretch “economies of skill”. The study formulates a conceptual model where thirty-six performance measurement indexes have been illustrated through ten attributes. With these attributes, an organization can evaluate the supply chain performance holistically connecting the qualitative as well as quantitative factors through seamless integration of the top and bottom-line performance of an organization.

8. Recommendation and Future Research

The 36 Performance Measurement Index (PMI) illustrated above has been developed through 10 attributes in **Table 1**, which are directly connected to the ISCPM model in **Figure 2** based on twenty-four manufacturing industrial sectors and validated empirically. And this model can measure supply chain performance measurement holistically where the stakeholders such as shareholders,

customers, people, nature, & community can be better served with the appropriate strategies to review and appraise their performance toward fulfillment of the ultimate goals.

However, it is suggested to implement this in real-life applications, particularly in the manufacturing industry. This model also could be implemented in the service industry as well such as tourism & hotel, hospital, banking, etc. Simultaneously, other than twenty-four sectors there are many industrial sectors that could be explored by future researchers. Therefore, the application of the ISCPM model in both the manufacturing and service industry through PMI could have elaborate research opportunities with scope in applied research.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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