Evaluating and Prioritizing the Enablers of Supply Chain Performance Management System (SCPMS) for Sustainability

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Abstract: A business organization needs a supply chain performance management system (SCPMS) to build an effective and efficient supply chain (SC) that will provide much-needed sustainability. The performance evaluation of supply chain management (SCM) is difficult and needs consideration of several important enablers. In such situations, the development of an SCPMS can facilitate understanding and integration among the SC partners. The SCPMS is influenced by many enablers that play a positive role; hence, the study of these enablers becomes significant. Therefore, the purpose of this study was to identify and rank the key SCPMS enablers. The identified SCPMS enablers were modeled using interpretive structural modeling (ISM) and ranked through an interpretative ranking process (IRP). The SCPMS enablers were further categorized using MICMAC. The results show that “SCPMS awareness”, “top management commitment”, and “financial commitment towards SCPMS” must be controlled for sustainability as they are independent enablers. “Benchmarking”, “appropriate performance matrix”, and “employee commitment” were the three top enablers.

Keywords: Delphi technique; interpretative ranking process (IRP); interpretive structure modeling (ISM); MICMAC; supply chain (SC); supply chain management (SCM); supply chain performance management system (SCPMS)

1. Introduction

Increasing organizational effectiveness, competitiveness, customer service, and profitability all depend on supply chain management (SCM). Evaluation of supply chain (SC) performance is the procedure that leads to the organization’s efficacy and efficiency in utilizing its SC [1]. Key performance indicators (KPIs) must be managed as part of a continuous SCM process to meet management objectives. SCM has therefore become crucial for businesses to manage the effectiveness and efficiency of their SC to have sustainability. In the digital age, business organizations must adopt a supply chain performance management system (SCPMS) that can provide important and factual information by combining performance measures from different angles so that legitimate inferences can be drawn from the SCPMS [2]. Numerous companies have been shown to continue using traditional, cost-related metrics such as cash flow, profit margin, and return on investment that offer little information, hence requiring changes [3]. Hence, there is a need to modify them by mapping the SC processes and their scope through SCM metrics in such a way that it covers all the functional areas of the SC and meets the overall business strategy. Business organizations need to take a new approach that uses digital technology and big data to be proactive instead of reactive [4].

One of the most important concerns for organizations is to address SC performance. Further, incorporating sustainability into the SC is becoming a key priority for many companies [5]. The sustainability of an SC can be accomplished through systematic supply chain evaluation and its accomplishments by evaluating the system, identifying the issues and their root cause, and solving them [6]. A good and effective SCPMS may be able to reduce cost and increase competitiveness for enhanced sustainability [7]. Due to the complexity of the systems, selecting relevant SC performance measures can be challenging [8]. When a
dynamic SC is involved in business, it is more challenging and complex for SC partners, such as suppliers, producers, distributors, and merchants, to become and remain competitive. Toyota, Dell, Wal-Mart, Samsung, Lenovo, Gome, and other SC-based businesses have used SCPMS in practice to coordinate their SC initiatives [9]. The choice of factors becomes crucial since there may be multiple elements in an SCPMS that have a substantial impact on SC performance. Additionally, it is suggested that a variety of performance indicators could provide a greater knowledge of the crucial connections in the SC, enabling model creation for operating features and SC configurations [8]. A conceptual model was formulated to investigate the connections between SC performance and lean and green practices [10].

The SC performance matrix may include various enablers that may provide fulfillment of specific objectives: visibility, leagility, personalization, information governance, SC warning, green, innovation, and learning will help the green initiatives of an organization. The environmental impact may be measured by including resource utilization, environmental contamination, and recyclable materials in the performance metrics [11]. Similarly, process visibility in an SC improves the effectiveness of monitoring SC status, allowing for a more efficient SCM [12]. The leagility indicator provides a good measurement for lean, flexibility, and agility in the SC. Thus, an SCPMS may provide a good measurement of various intended objectives by facilitating information sharing, coordination, and trust for the success of the SC [13]. Furthermore, it makes it easier for management to understand the effectiveness of strategies and seek future potential opportunities. SCM managers benefit while making important decisions in many areas, such as changing business goals, taking strategic actions, or re-engineering processes.

Even though many SC performance indicators and matrices have been developed, more research to raise awareness is urgently needed for the SCPMS, and the research of its enablers is crucial. Furthermore, the study of enablers will aid in the realization of a balanced SCPMS for a given organization that will fulfill its strategic objectives by achieving SC performance. It will also help in building an efficient SCPMS that provides useful information based on which management can spot inefficient activities and implement the appropriate corrective measures for continuous improvement. It is crucial to explore relationship modeling to fill this gap in the SCPMS literature. Thus, based on the above premises, the current study aims to respond to the following questions: (a) What are the various enablers that influence the SCPMS? (b) How should their contextual relationship be modeled through ISM and classified using MICMAC? (c) How can the SCPMS enablers be ranked using the interpretive ranking process (IRP)?

The paper is structured as follows: In Section 2, a review of the literature is given that identifies the SCPMS enablers. The ISM, MICMAC, and IRP research methodologies are presented in Section 3. Section 4 provides results obtained through the systematic application of methodologies. A discussion of the current studies is provided in Section 5. Lastly, Section 6 provides a conclusion.

2. Literature Review

A successful SCM initiative must include a performance management system. This is also a crucial strategic element for enhancing operational effectiveness and makes it easier for the organization to achieve its objectives [14]. Studying SCM practices is also crucial [15]. For a business to manage its financial performance, an SCPMS is essential. The outcome of a successful SCPMS depends upon good information collection and further processing for correct decision making. Since SC efficiency is a complex phenomenon that must be characterized using multiple criteria, a multi-factor performance measurement approach could be used to gauge the effectiveness of the SC [16]. To measure SC efficiency, various modeling approaches have been found in the literature. Using data envelopment analysis (DEA) [17], a decision-making model was made to figure out how efficient the SC was in its internal efficiency. In the recent past, several researchers have studied the SCPMS adopted by various organizations. They have been successful in trying to understand the
various SCPMSs through a careful review of the literature [15–22]. SC performance-based literature was reviewed considering machine learning applications for its sustainability [19]. Quantitative-based models for the evaluation of the SC were also reviewed [20].

A quantitative framework based on a methodical approach for enhancing the SC KPIs was prepared [9]. The created approach was able to pinpoint significant KPI accomplishment expenses and suggest SC management performance improvement options. An analysis of the SC literature reveals the problems with SCPM. The following outlines the main issues [21]: (a) an absence of a strong separation between measures at the strategic, tactical, and operational levels as well as a lack of a clear connection to strategy; (b) a lack of balanced integration of financial and non-financial data; (c) a focus on local optimization and, thus, the absence of a thorough SC context; (d) PM and metrics are inconsistent, incomplete, and lack relational structures; (e) there are several metrics; (f) being internally focused and neglecting to adequately pay attention to exterior factors (customers, suppliers, and competitors) and looking and, as a result, not paying enough attention to exterior factors (customers, suppliers, and competitors); and (g) practicing more on short-term, profit-driven, and static conditions.

Fourteen SCPMS enablers were considered for carrying out its relationship modeling using ISM [13]. The variables considered were “effective information system”, “employee’s commitment”, “dynamic”, “inter-connectable”, “cross-functional and usable SCPMS”, “partnership with dealers”, “distributors and retailers”, “appropriate performance metrics”, “overcoming mistrust”, “funds for PMS implementation”, “commitment by top management”, “awareness about PMS in SC and consistent with strategic goals. Setting objectives”, “evaluating performance and determining the future course of action”, “proactive management”, and “benchmarking and effective and efficient SC”. An ISM-based model of ten selected enablers of the SCPMS in the auto sector was prepared [22]. A conceptual framework for the SCPMS lifecycle that covers various phases of design, execution, use, and review was prepared [23]. They also discussed how to conduct research and how the various SCPMS actors view the system and may act to facilitate effective adoption. Further, to identify the key components of an SCPM system, they concentrated on the design stage. Several authors [11,15,24–27] tried to use the SCPMS framework for both small and medium enterprises (SMEs) and large enterprises. A comprehensive performance measurement framework using a balanced scorecard (BSC) and supply chain operation reference (SCOR) was employed for SMEs [15,24]. SCPM has also been attempted in various industries such as the construction industry [25], automobile industry [26], apparel industry [27], footwear industry [28], etc. It has also been attempted in Industry 4.0 using intelligent approaches [29]. A comprehensive framework was prepared to accomplish SCPM. The process-focused framework based on human judgment was prepared [14].

A predictive SCPM model that integrated process modeling, performance measurement, data mining methods, and web portal technologies was used [4]. Various SC systems may greatly benefit from the Internet of Things (IoT), for instance, manufacturing, performance management, transportation, and other related areas [30]. Expiry waste at retailers’ end was tracked using IoT, and the waste percentage was reduced to a minimum of 45 and a maximum of 75% at various non-active retailers [31]. Some barriers play a negative role in discouraging SCPM. A significant barrier is the SC’s complexity as well as the measurement method for SCPM [18,23]. A fuzzy-logic-based SCPM model was proposed to predict performance based on causal relationships between SC metrics and the SCOR model [32]. Later on, a fuzzy- and scenario-based model to stimulate and quantify the possible effect of external factors on the SC’s performance was developed to accomplish a real target [33].

Table 1 provides the list of various enablers used in the SCPM studies. The number of enablers used in the studies varies from ten to twenty. Further, interpretive structural modeling (ISM) has been largely used for contextual relationship modeling along with other methods such as the AHP, DEMATEL, DEA, BSC, and SEM. On reviewing the literature, fourteen SCPM enablers were identified which are discussed further: Loyalty to the SC is
the degree of commitment of SC actors to the SC operations covered in the SCPMS. Loyalty to the SC helps in building a serene environment in SCM [34]. Financial commitment toward the SCPMS and the top management’s commitment to the financial requirement for the SCPM system. A lack of financial commitment derails supply chain initiatives [18]. Trust is an essential intangible asset prevailing among SC actors [35]. Trust enables information sharing in SC players [36]. Satisfaction among the SC actors is the outcome of a sound SCPMS. Internal communication among SC partners enhances trust and satisfaction among SC partners [37]. An effective information system for systematic use is a result of a sound SCPMS. An organization believing in a sound information system can take quick actions through quick decision making. Awareness of the SCPMS is very important know-how for the SC stakeholders. Awareness of the SCPMS helps an organization to take initiatives for the SCPMS [15]. Top management commitment is the willingness of top managers to effectively participate in the SCPMS and lead by example [13]. Employee commitment is the contributory role of each employee toward the SCPMS. There is a positive influence of employee commitment and supply chain integration on organization performance [38]. An appropriate performance matrix is the basic need of the SCPMS to define, measure, and control SC activities with defined performance [39]. Benchmarking is the process of setting the SCPMS comparable to leaders in the business [40]. Sustainable SCM is the result of effective coordination, planning, and performance in the SCPMS [15]. The SCPMS enablers play a vital role in maintaining sustainability through effective SCM. The SCPMS enablers may help maintain the effective system for SC performance measurement.

Table 1. The SCPMS enablers used in various studies.

| Sr. No. | Enablers Used in Studies                                                                                           | Methodology  | Reference |
|---------|-------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| 1       | The order entry method, Order lead-time, The customer order path, Flexibility, The customer query time, Post transaction measures of customer service, Range of products and services, Capacity utilization, Effectiveness of scheduling techniques, Performance evaluation of delivery link, Measures for delivery performance evaluation | 11 BSC       | [41]      |
| 2       | Effective information system, Employee commitment, Dynamic, inter-connectable, cross-functional, and usable SCPMS, Partnership with dealers, distributors, and retailers, Appropriate performance metrics, Overcoming mistrust, Funds for PMS implementation, Commitment by top management, Awareness about PMS in SC, Consistent with strategic goals, Setting objectives, evaluating performance and determining the future course of action, Proactive management, Benchmarking, Effective and efficient supply chain | 14 Interpretive Structural Modelling (ISM) | [13]      |
| 3       | Information sharing, Strategic planning to implement sustainable practices in SC, Consumer concern towards sustainable practices, Collaborative relationships, Metrics to quantify sustainability benefits in an SC, Regulatory framework, Support to partners in the SC, Top management commitment, Awareness about sustainable practices in SC, Availability of funds | 10 ISM       | [42]      |
| 4       | Energy Efficiency Saving, Carbon Trading Penalties, Carbon Trading Allowances, Environment Policy, ISO Accreditation, FTSE Good Index, Environmental management system, Carbon Emission Ratio, EMS Certification, Benchmarking, Cleaner SC, Renewable Energy, Environmental Team, Environment Index, Social Index, Economic Index | 16 BSC and AHP | [36]      |
| Sr. No. | Enablers Used in Studies                                                                                                                                                                                                                                                                                                                                 | Enablers | Methodology                          | Reference |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------------------------------|-----------|
| 5      | Order entry method, Order lead time, Supplier selection, Buyer-supplier relationship, Effectiveness of master production schedule, Quality, Delivery lead time, Flexibility of delivery systems to meet particular customer needs, Flexibility to meet particular customer needs, Customer query time, Flexibility to meet particular customer needs                                                                 | 10       | ISM                                 | [22]      |
| 6      | Employment stability, Health and safety issues, Community economic welfare, Adoption of safety standards, Adoption of green purchasing, Adoption of green practices, Eco-design, Government regulation, Hazard management, Customer satisfaction, Environmental cost, Economic input to infrastructural development, Improvement of product characteristics                                                                 | 13       | ISM                                 | [43]      |
| 7      | Total order cycle time, Rate of return on investment, Rate of return on investment, Cash to cash cycle time, Truthfulness of demand predictability/forecasting method, Level of energy utilization, Level and quality of information sharing, Extent of buyer-vendor cost-saving initiative, Extent of cooperation leading to improved quality, The entity and stage at which supplier is involved, Extent of mutual assistance in problem-solving efforts, Level of capacity and resource utilization, Value added productivity, Extent of production flexibility, Perfect order fulfillment, Total distribution cost, Order fill rate, Level of flexibility to meet particular customer needs, Customer query time, Level of customer perceived value of product and service | 20       | Structural equation modeling (SEM) and fuzzy analytic hierarchy process (FAHP) | [44]      |
| 8      | Capital, Distribution costs, Manufacturing cost, Inventory, Volume flexibility, Delivery flexibility, Mix flexibility, New product flexibility                                                                                                                                                                                      | 8        | BSC and DEA                         | [34]      |
| 9      | Higher customer satisfaction, Proper capacity utilization, Making proper performance measurement, Information sharing, Effective integration of suppliers, Higher degree of integration across the supply chain, Information availability and customer responsiveness, Alignment of systems throughout the supply chain, Open and transparent communication, Reduction of new product development cycle time, Adoption of modern manufacturing practices, Effectiveness of scheduling techniques, Long-term, strategic relationships, Quality of the supply chain relationships, Adoption of a market orientation | 15       | Fuzzy DEMATEL                      | [45]      |
| 10     | Market research and forecasting ability, Product research and development, Flexibility practice and feedback, Relationship with vendors, Cost of changing supplier, Cost of changing inventory, Material flexibility, Supply logistics, Multiple production facilities, Outsourcing, Postponement of final assembly, Machine flexibility, Process flexibility, Ability to shift mode of transportation, volume & mix transported, Change in response time when order changes, Cost for order changes and Responsiveness to urgent orders | 18       | BSC and AHP                         | [46]      |
Table 1. Cont.

| Sr. No. | Enablers Used in Studies                                                                 | Enablers | Methodology | Reference |
|---------|-----------------------------------------------------------------------------------------|----------|-------------|-----------|
| 11      | Pressure by various governmental, regulating agencies, and non-government bodies, Incentives and support of various agencies to undertake sustainable initiatives, Understanding customer and other stakeholder requirements, Understanding the sustainability initiative importance and benefits, Management involvement, support, and commitment, Resources allocation and information sharing within and across the hierarchy, Joint efforts, planning and capacity building for delivering sustainability-focused products, Monitoring and auditing the ongoing supply chain activities, Competitive advantages, Cost-effectiveness and improvements in overall performance | 10       | ISM and Fuzzy DEMATEL                      | [47]      |

The literature review mentioned above leads to the conclusion that the SCPMS is essential to the business community. They can obtain maximum benefits from it, but it depends upon the effectiveness and efficacy of the SCPMS. The ways and means of measuring SC performance offer an avenue of research for the benefit of stakeholders. It is further found that the contextual relationship between the SCPM enablers and the IRP ranking approach is missing in the literature. Hence, there is a need to bridge this gap. The contextual relationship will help practicing managers understand the nature and behavior of the enablers for designing the SCPMS [48]. The IRP is an efficient methodology that will help in understating the hierarchical importance [49]. The findings of this study will help organizations focus on certain significant enablers to improve their SC performance [50]. The combinatorial approach of ISM, MICMAC, and the IRP is well-proven for contextual relationships, categorization, and ranking of enablers [51].

3. Research Methodology

The present research methodology is covered in three phases, which are depicted in Figure 1. Further, each phase is described in detail as follows:

**Phase 1** deals with the SCPMS enabler identification. The process of SCPMS enabler identification may follow a systematic review of the literature. The comprehensive review of the literature with specific keywords helps in identifying the most relevant SCPMS enablers from the academic research databases. Collected enablers through such a process may further need segregation, categorization, or shortlisting. They may be shortlisted according to their importance, degree of relevance to the case problem, influence over another enabler, etc. The appropriate enabler may be obtained by evaluating through the brainstorming or value-focused brainstorming methods by engaging an expert group. The 4-step value-focused brainstorming may be employed [52]. The 4-step value-focused brainstorming deals with (a) identifying a problem; (b) objective identification of a problem solution; (c) generating alternative solutions (individually); and (d) generating alternative solutions (collectively).

**Phase 2** provides the ISM and MICMAC modeling approaches adopted in evaluating SCPMS enablers. ISM reveals contextual relationships and provides a model to prepare the self-structural self-interaction (SSIM) matrix. It further helps in formulating a reachability and conical matrix which ultimately provides a digraph and an ISM model. The ISM and MICMAC approach is broken down into the following steps: Step 1: Creating an SSIM; Step 2: Creating an initial and final reachability matrix; Step 3: Creating a level partition and lower triangular matrix; Step 4: Creating a digraph and converting it into an ISM model; Step 5: Determining driver-driven power for a MICMAC analysis; Step 6: Classifying driving-driven dependence for MICMAC analysis; and finally, Step 7: Identifying the four clusters for further interpretations. In creating an SSIM, the contractual relationship is used to understand the relationship between enablers. Let “a” and “b” be considered SCPMS enablers. The relationships among these two enablers “a” and “b” may follow the following
rules: if enabler “a” drives or influences enabler “b”, the relationship will be denoted by “V”; “A” will be used when “b” drives or influences enabler “a”; “X” will be used when enablers “a” and “b” influence each other, and if enablers “a” and “b” do not influence each other, “O” will be used. Following the ISM methodological steps, a contextual relationship among enablers yields an SSIM. The SSIM has a contextual relationship among enablers identified by the expert group. The initial reachability matrix (IRM) may be obtained by transforming the SSIM using binary digits “1” and “0”. The following conditions decide to replace “V”, “A”, “X”, and “O” with “1” and “0”. (a) If the SSIM’s (a, b) entry is “V”, the reachability matrix’s (a, b) entry becomes 1, and the (b, a) entry becomes 0; (b) if the SSIM’s (a, b) entry is “A”, the reachability matrix’s (a, b) entry becomes 0, and the (b, a) entry becomes 1; (c) if the SSIM’s (a, b) entry is “X”, the reachability matrix’s (a, b) entry becomes 1, and the (b, a) entry similarly becomes 1; and (d) if the SSIM’s (a, b) entry is “O”, the reachability matrix’s (a, b) entry becomes 0, and the (b, a) entry similarly becomes 0.

Figure 1. Research methodology.

The formation of a reachability matrix is carried out using an SSIM so that the transitivity is incorporated. The SSIM is transformed into a reachability matrix using binary digits “0” and “1”. Transitivity may be explained as: if a > b and b > c, then a > c wherein “>” provides a degree of interaction. The reachability element and antecedent element for each enabler is accomplished through the final reachability matrix (FRM). It includes the enabler itself and another enabler that helps. The antecedent elements have their elements as well as another enabler that influence them. The various elements of the iterative process are derived using the intersection among them. When the intersection satisfies these
requirements, then the identified enabler is placed at the top, and the enabler is excluded from the further process of revealing interaction. With this method, the categorization will be determined from the highest level to the lowest level. Thus, using the FRM, the structural model may be derived. Subsequently, a digraph is prepared by the removal of the transitivity. To obtain the digraph, a lower triangular matrix (LTM) is used to obtain the relationship modeling. The digraph shows a directed graph that provides a detailed understanding of each enabler. The digraph is used to create an ISM model of SCPMS enablers, which is shown in Figure 2.

Figure 2. ISM for SCPMS enablers.

SCPMS enablers may be represented graphically using the MICMAC methodology. It presents an opportunity to research and analyze the relative significance of each SCPMS enabler. MICMAC analysis categorizes the SCPMS enablers into 4 categories—autonomous, dependent, linkage, and independent—using the driving-dependence power of each enabler. It is also possible to refer to the categories produced by the MICMAC analysis as clusters.

Phase 3 uses the interpretive ranking process (IRP) to rank the SCPMS enablers [53]. The IRP employs an interpretative matrix with a paired-comparison matrix. When an expert judgmental bias is present or it is occasionally difficult to make a clear decision in cases of complicated hierarchies, the IRP can eliminate such deficiency present in the AHP. Further, the IRP uses the interpretive logic that provides dominance among the enablers for its comparison. The advantageous part of the IRP is that it is not necessary to have the dominant information while performing such a comparison. Thus, the IRP offers a methodical ranking of the SCPMS enablers based on their merits. The general IRP steps are documented in the literature [53,54]. These steps are: (a) Identifying two sets of variables, the one which needs ranking concerning the other. Here, SCPMS enablers are ranked. (b) Preparation of a cross-interaction matrix between an SCPMS enabler and SCPM indicators. (c) Cross-interaction matrix conversion to an interpretive matrix. (d) Formation of pairwise comparison depending upon the interpretive matrix to obtain a dominating-interaction matrix. (e) Ranking of SCPMS enablers and subsequent exploration of dominance and its rank.
4. Results

The results of each phase are derived and documented as follows:

4.1. Phase 1

Phase 1 helped in SCPMS enabler identification. A systematic review employing the keywords of “Supply chain performance measurement variable”, “Supply chain performance measurement system”, “SCP measurement system factors”, and “SC performance measurement system enabler” was carried out. Various databases such as Scopus, Web of Science, ScienceDirect, etc., were reviewed. Collected enablers were further segregated. Fourteen of the most relevant variables as per their significant importance, degree of relevance to the case problem, and its influence over another enabler were identified. Eight experts from different industries were identified from the industrial development corporation along with three academicians. All experts had more than five years of experience in their respective fields. All industry experts and academicians had a minimum graduation degree in either engineering or management disciplines. A short meeting session was arranged to brief the objectives of the present research. After a brief meeting, six SC practitioners and three academicians readily accepted the invitations. Two SC practitioners were dropped from the group because of their pre-occupancy. Thus, a nine-member expert team was formed. All the consulted SC practitioners and academicians agreed voluntarily to participate in the present study with the liberty and flexibility to leave the study at short notice. This expert group formation was in line with previous similar studies [55,56]. Relevant literature on SCPMS enablers, the scope of the study, and the research methodology to be used were shared. The appropriate enabler may be obtained by evaluating through the brainstorming or value-focused brainstorming methods by engaging an expert group.

A brainstorming technique was used to identify factors of world-class manufacturing practices [55]. In the present study, value-focused brainstorming [52] was adopted. The four-step process of value-focused brainstorming was conducted in two sessions. During the first session, the expert group was informed about the brainstorming rules for the session. Three rules were adopted: (a) idea generation without criticism; (b) freedom to idea generation; and (c) new idea generation. It was observed that brainstorming rules helped in systematic proceedings. Fourteen SCPMS enablers were reduced to eleven at the end of the sessions.

The fourteen SCPMS enablers were discussed for their appropriateness in the present study. The three SCPMS enablers “higher degree of integration across the supply chain”, “the supply chain system alignments”, and “adoption of a market orientation” were found to be less significant in the present study by the expert group. Thus, the remaining eleven SCPMS enablers “loyalty to SC”, “financial commitment towards SCPMS”, “trust”, “satisfaction”, “effective information system”, “awareness to SCPMS”, “top management commitment”, “employee commitment”, “appropriate performance matrix”, “benchmarking”, and “sustainable SCM” were shortlisted. The identified eleven SCPMS enablers were further subjected to the ISM, MICMAC, and IRP methodologies.

4.2. Phase 2

Methodologies such as MICMAC and ISM were used to form various matrices. An SSIM was developed based on the contextual relationship obtained from the expert group. The contextual relationships between several SCPMS enablers were used to derive the SSIM which is shown in Table 2. The previously described guidelines formed the basis of the derived SSIM. For example, enabler 1 “loyalty to SC” is compared with enabler 11 “sustainable SC” for their contextual relationship. Since enabler 1 influences enabler 11, the contextual relationship of “V” is considered.
Table 2. Self-structural self-interaction (SSIM).

| Enabler Code | SCPMS Enablers                  | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2  |
|--------------|--------------------------------|----|----|----|----|----|----|----|----|----|----|
| 1            | Loyalty to SC                  | V  | V  | V  | V  | A  | A  | A  | X  | V  | A  |
| 2            | Financial Commitment towards SCPMS | V  | V  | V  | V  | A  | A  | V  | V  | V  | V  |
| 3            | Trust                          | V  | V  | V  | V  | A  | A  | X  | V  | V  | V  |
| 4            | Customer Satisfaction         | V  | V  | V  | V  | A  | A  | V  | V  | V  | V  |
| 5            | Effective Information System   | V  | V  | V  | V  | A  | A  | V  | V  | V  | V  |
| 6            | Awareness to SCPMS            | V  | V  | V  | V  | A  | A  | V  | V  | V  | V  |
| 7            | Top Management Commitment      | V  | V  | V  | V  | V  | V  | V  | V  | V  | V  |
| 8            | Employee Commitment           | V  | V  | V  | V  | V  | V  | V  | V  | V  | V  |
| 9            | Appropriate Performance Matrix | V  | V  | V  | V  | V  | V  | V  | V  | V  | V  |
| 10           | Benchmarking                   | V  | V  | V  | V  | V  | V  | V  | V  | V  | V  |
| 11           | Sustainable SCM                | V  | V  | V  | V  | V  | V  | V  | V  | V  | V  |

Similarly, “A”, “X”, and “O” may be used to represent the contextual relationship as discussed in the previous section. Similarly, other relationships were completed. Later on, “V”, “A”, “X”, and “O” were replaced with “1” and “0” following the rules discussed in the methodology section to obtain the initial reachability matrix (IRM). Table 3 provides the IRM.

Table 3. Initial reachability matrix.

| Enabler Code | SCPMS Enablers                  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|--------------|--------------------------------|---|---|---|---|---|---|---|---|---|----|----|
| 1            | Loyalty to SC                  | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 |
| 2            | Financial Commitment towards SCPMS | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 |
| 3            | Trust                          | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 |
| 4            | Customer Satisfaction         | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 |
| 5            | Effective Information System   | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 |
| 6            | Awareness to SCPMS            | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7            | Top Management Commitment      | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| 8            | Employee Commitment           | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 9            | Appropriate Performance Matrix | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 10           | Benchmarking                   | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| 11           | Sustainable SCM                | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

The IRM was turned into the final reachability matrix following the transitivity principles (FRM). In addition to displaying the FRM, Table 4 also displays the driving and driven power created by combining the sums (total of vertical and horizontal) for each SCPMS enabler.

Table 5 describes the reachability set and antecedent set. Furthermore, the intersection among the various enablers was carried out to reach the level partition. The enabler “sustainable SCM (11)” was found to take place at level I. In the ISM, it occupies the top spot. Similar to this, repeated iteration resulted in different levels. The iteration results ii–vii are displayed in Table 6.
Table 4. Final reachability matrix.

| Enabler Code | SCPMS Enablers | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 |
|--------------|----------------|----|----|----|----|----|----|----|----|----|----|----|
| 1            | Loyalty to SC  | 1  | 0  | 1  | 1  | *  | 0  | 0  | 1  | 1  | 1  | 1  |
| 2            | Financial Commitment towards SCPMS | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 1  | 1  | 1  | 1  |
| 3            | Trust          | *  | 0  | 1  | 1  | 1  | 0  | 0  | 1  | 1  | 1  | 1  |
| 4            | Customer Satisfaction | 1  | 0  | 1  | *  | 1  | 0  | 0  | 1  | 1  | 1  | 1  |
| 5            | Effective Information System | 1  | 0  | 1  | *  | 1  | 0  | 0  | 1  | 1  | 1  | 1  |
| 6            | Awareness to SCPMS | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
| 7            | Top Management Commitment | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 1  | 1  | 1  | 1  |
| 8            | Employee Commitment | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  |
| 9            | Appropriate Performance Matrix | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
| 10           | Benchmarking   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  |
| 11           | Sustainable SCM | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  |

*: Enabler has transitivity.

Table 5. First iteration of SCPMS enablers level iteration i.

| Enabler Code | Reachability Set | Antecedent Set | Intersection Set | Level |
|--------------|------------------|----------------|------------------|-------|
| 1            | 1, 3, 4, 5, 8, 9, 10, 11 | 1, 2, 3, 4, 5, 6, 7 | 1, 3, 4, 5 | V     |
| 2            | 1, 2, 3, 4, 5, 8, 9, 10, 11 | 2, 6, 7 | 2 | -     |
| 3            | 1, 3, 4, 5, 8, 9, 10, 11 | 1, 2, 3, 4, 5, 6, 7 | 1, 3, 4, 5 | -     |
| 4            | 1, 3, 4, 5, 8, 9, 10, 11 | 1, 2, 3, 4, 5, 6, 7 | 1, 3, 4, 5 | -     |
| 5            | 1, 3, 4, 5, 8, 9, 10, 11 | 1, 2, 3, 4, 5, 6, 7 | 1, 3, 4, 5 | -     |
| 6            | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 | 6 | 6 | -     |
| 7            | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 | 6, 7 | 7 | -     |
| 8            | 8, 9, 10, 11 | 1, 2, 3, 4, 5, 6, 7, 8 | 8 | -     |
| 9            | 9, 10, 11 | 1, 2, 3, 4, 5, 6, 7, 8, 9 | 9 | -     |
| 10           | 10, 11 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 | 10 | -     |
| 11           | 11 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 | 11 | I     |

Table 6. Iteration results (ii–ix).

| Iteration | Enabler Code | Reachability Set | Antecedent Set | Intersection Set | Level |
|-----------|--------------|------------------|----------------|------------------|-------|
| 1         | 1            | 1, 3, 4, 5 | 1, 2, 3, 4, 5, 6, 7 | 1, 3, 4, 5 | V     |
| 2         | 2            | 2 | 2, 6, 7 | 2 | VI    |
| 3         | 3            | 1, 3, 4, 5 | 1, 2, 3, 4, 5, 6, 7 | 1, 3, 4, 5 | V     |
| 4         | 4            | 1, 3, 4, 5 | 1, 2, 3, 4, 5, 6, 7 | 1, 3, 4, 5 | V     |
| 5         | 5            | 1, 3, 4, 5 | 1, 2, 3, 4, 5, 6, 7 | 1, 3, 4, 5 | V     |
| 6         | 6            | 6 | 6 | 6 | VIII |
| 7         | 7            | 7 | 6, 7 | 7 | VII   |
| 8         | 8            | 8 | 1, 2, 3, 4, 5, 6, 7, 8 | 8 | IV    |
The FRM helps in formulating a lower triangular matrix (LTM) by rearranging it as per the level partition. The structural model was generated using an LTM. Based on the level partition, all the enablers were arranged. This gives the lower triangulation matrix (LTM). Table 7 shows the LTM based on the level partitions.

### Table 7. Lower triangulation matrix (LTM).

| Enabler Code | SCPMS Enablers                      | 11 | 10 | 9 | 8 | 1 | 3 | 4 | 5 | 2 | 7 | 6 | DP |
|--------------|-------------------------------------|----|----|---|---|---|---|---|---|---|---|---|----|
| 11           | Sustainable SCM                     | 1  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1  |
| 10           | Benchmarking                        | 1  | 1  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2  |
| 9            | Appropriate Performance Matrix      | 1  | 1  | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3  |
| 8            | Employee Commitment                 | 1  | 1  | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4  |
| 1            | Loyalty to SC                       | 1  | 1  | 1 | 1 | 1 | 1 | 1 | 1 | *| 0 | 0 | 8  |
| 3            | Trust                               | 1  | 1  | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 8  |
| 4            | Customer Satisfaction               | 1  | 1  | 1 | 1 | 1 | 1 | 1 | *| 1 | 1 | 0 | 8  |
| 5            | Effective Information System        | 1  | 1  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 8  |
| 2            | Financial Commitment towards SCPMS  | 1  | 1  | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 9  |
| 7            | Top Management Commitment           | 1  | 1  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 10 |
| 6            | Awareness to SCPMS                  | 1  | 1  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 11 |
| Total        | Total dependence                    | 11 | 10 | 9 | 8 | 7 | 7 | 7 | 7 | 3 | 2 | 1 |     |

*: Enabler has transitivity.

All the SCPMS enablers were arranged as per the level partition matrix to obtain the digraph. Figure 2 depicts the ISM for SCPMS enablers.

SCPMS enablers possess driving power and their dependence, using which each enabler can be plotted. Figure 3 shows the driving power and dependence of each SCPMS enabler. The clusters I to IV may be obtained as a result of MICMAC analysis. The enablers “awareness to SCPMS (6)”, “top management commitment (7)”, and “financial commitment towards SCPMS (8)” were found to possess high driving power and weak dependence thus falling into the group of independent SCPMS enablers. The enablers “employee commitment (8)”, “appropriate performance matrix (9)”, “benchmarking (10)”, and “sustainable SCM (11)” have strong dependence and weak driving power thus forming a dependence group. SCPMS enablers “loyalty to SC (1)”, “trust (3)”, “customer satisfaction (4)”, and “effective information system (5)” were found in the linkage group.

The identified enablers and the interpretive structure modeling (ISM) model and MICMAC analysis classification for SCPMS enablers were validated through the Delphi method. Three experts in the area of SC practices were consulted, and, on their willingness, they were nominated to constitute the Delphi panel. The Delphi panel was identified from various SCs of fast-moving consumer goods (FMCG), electrical cables, and centrifugal pumps. Each Delphi had commendable working experience in the SC. The Delphi panel was different from the expert group selected for SCPMS enabler identification. All the Delphis were provided relevant information on SCPMS enablers. The ISM model was presented for validation. Each Delphi agreed on the contextual relationship provided by the expert group for SCPMS enablers. Thus, after the first round, the identified SCPMS enablers.
enablers were validated. The driving and dependence power of each enabler were checked to confirm the contextual relationship. At the end of the second round, the ISM model was validated. The Delphi panel also agreed to the MICMAC analysis diagram, and therefore, a total consensus was reached.

### Table 7. Lower triangulation matrix (LTM).

| Enabler Code SCPMS Enablers | 11 | 10 | 9 | 8 | 1 | 3 | 4 | 5 | 2 | 7 | 6 | DP |
|-----------------------------|----|----|---|---|---|---|---|---|---|---|---|----|
| Sustainable SCM             | 1  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1  |
| Benchmarking                | 1  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2  |
| Appropriate Performance Matrix | 1  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3  |
| Employee Commitment         | 1  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4  |
| Loyalty to SC               | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5  |
| Trust                       | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6  |
| Customer Satisfaction       | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7  |
| Effective Information System | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8  |
| Financial Commitment towards SCPMS | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9  |
| Top Management Commitment   | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| Awareness to SCPMS          | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |

*Enabler has transitivity.*

### Figure 3. Driving power and dependence diagram of SCPMS enablers using MICMAC (Legend: SCPMS enabler classification: I, Autonomous; II, Dependent; III, Linkage; IV, Independent.).

#### 4.3. Phase 3

Six performance criteria [42] were chosen by examining the SC performance measuring literature to complete the interpretive ranking process (IRP) of the SCPM enabler. The performance criteria P1 to P6 selected were Quality management (P1), Production volume linked productivity (P2), Manufacturing lead-time (P3), Product-related design and development process (P4), Profitability (P5), and Brand value in the market (P6). A binary value of “1” or “0” was utilized to indicate if a relationship existed or not between SCPMS enablers and SC performance criteria. Table 8 shows the cross-interaction matrix (CIM).

### Table 8. Cross-interaction matrix (CIM) of SCPMS enablers and SC performance criteria.

| Enabler Code SCPMS Enablers | P1 | P2 | P3 | P4 | P5 | P6 |
|-----------------------------|----|----|----|----|----|----|
| 1                           | 1  | 1  | 1  | 1  | 0  | 1  |
| 2                           | 1  | 1  | 0  | 0  | 0  | 0  |
| 3                           | 0  | 1  | 1  | 0  | 1  | 1  |
| 4                           | 1  | 1  | 0  | 0  | 0  | 1  |
| 5                           | 1  | 0  | 0  | 0  | 1  | 0  |
| 6                           | 1  | 0  | 0  | 0  | 0  | 1  |
| 7                           | 1  | 1  | 1  | 0  | 0  | 0  |
| 8                           | 1  | 0  | 0  | 1  | 0  | 1  |
| 9                           | 1  | 0  | 1  | 0  | 0  | 1  |
| 10                          | 1  | 0  | 1  | 0  | 0  | 1  |
| 11                          | 1  | 1  | 0  | 0  | 0  | 0  |
Using the contextual relationship from the cross-interpretive matrix, the SCPMS enablers and SC performance requirements are compared. The interpretive matrix illustrating the connection between the SC performance requirements and the SCPMS enablers is shown in Table 9. The construction of dominant and non-dominating SCPMS enablers is facilitated by the SCPMS knowledge base matrix.

Table 9. Interpretive matrix.

| SCPMS Enablers/Performance Criteria | Quality Management | Production Volume Linked to Productivity | Manufacturing Lead-Time | Product-Related Design and Development Process | Profitability | Brand Value in the Market |
|-------------------------------------|--------------------|----------------------------------------|-------------------------|-----------------------------------------------|---------------|----------------------------|
| 1. Awareness to SCPMS               | Its awareness of quality control to produce finer products | Its awareness helps to optimize productivity and reduce the overall cost | Its awareness leads to planned and cost-effective SC increasing its profitability | Its awareness leads to customer satisfaction due to good products and service quality, thus increasing the market position | Its awareness gives customer satisfaction due to good service quality |
| 2. Top management commitment        | Its role is to manage and maintain the whole system, schedule, and program that gives direction to all the employees | The management provides all the necessary resources to perform all tasks, thus increasing the productivity | | | |
| 3. Financial commitment             | It increases the financial productivity | Financial independence helps increase the profitability | It helps to capitalize all the processes at a lower cost reducing the manufacturing costs | It helps in establishing the brand value in the market |
| 4. Loyalty to SC                    | It indirectly affects the customer’s faithfulness | SC execution that meets delivery promises in a cost-effective manner | | It leads to good-quality services leading to happy and satisfied customers |
| 5. Customer satisfaction            | Good-quality products make customers satisfied | Good product and good service quality makes customer propagate and spread the company name | | Good-quality services make customers happy |
| 6. Trust                            | Buyers trust the suppliers for their good-quality products | | | Buyers’ supplier commitment to providing the good services |
| 7. Effective information system     | It helps in keeping track of all product information and manufacturing good products | Transparency and flow of information at all levels increase productivity | Sets the foundation to perform all the transactions and decisions as per the need |


Table 9. Cont.

| SCPMS Enablers/Performance Criteria | Quality Management | Production Volume Linked to Productivity | Manufacturing Lead-Time | Product-Related Design and Development Process | Profitability | Brand Value in the Market |
|------------------------------------|--------------------|------------------------------------------|-------------------------|-----------------------------------------------|---------------|--------------------------|
| P1                                 | P2                 | P3                                       | P4                      | P5                                            | P6            |                          |
| 8. Employee commitment             | Committed employees assist in making good-quality products | Committed employees bring an innovative and improved design to the table as per current trends and demands, therefore increasing the market position of the company | Committed employee provides good services to the customers leading to content customers |
| 9. Appropriate performance matrix  | Qualitative measures, such as lead time, flexibility, and response time, increase the quality of the product | All the measures ensure the profits of the company | All the measures help study customers' needs fulfilling the demands |
| 10. Benchmarking                   | To study customer needs to make good-quality products | It helps in financial analysis of the market | Studying the customers' demands and needs leads to less risk of returns and product failures, thus pleasing the customers |
| 11. Sustainable SCM                | It helps improve the quality and protect the company's name | It helps to enhance productivity and cost at the same time |                          |

The interpretive matrix is utilized in comparing the SCPMS enablers for the reference variables (SC performance areas) considering each enabler. Enabler “1” may be compared with enabler “3” for various performances P1 to P6, and the interpretive logic of dominating interaction between “1” and “3” for different SC performances is noted in the SC knowledge base using interpretive logic. Table 10 shows the SC knowledge base using interpretive logic.

Table 10. SC knowledge base using interpretive logic.

| Dominance Comparison of Enablers | Performance Indicator(s) Influenced | Dominance Comparison of Enablers | Performance Indicator(s) Influenced |
|---------------------------------|-------------------------------------|---------------------------------|-------------------------------------|
| 1 Dominating 3                  | P2, P3                              | 7 Dominating 5                  | P1                                  |
| 1 Dominating 5                  | P1, P5                              | 7 Dominating 6                  | P1                                  |
| 1 Dominating 6                  | P1, P6                              | 7 Dominating 8                  | P1                                  |
| 2 Dominating 1                  | P1, P2                              | 7 Dominating 9                  | P1, P3                              |
| 2 Dominating 3                  | P2                                  | 6 Dominating 11                 | P1, P3, P6                          |
| 2 Dominating 4                  | P1                                  | 9 Dominating 1                  | P3, P6                              |
Table 10. Cont.

| Dominance Comparison of Enablers | Performance Indicator(s) Influenced | Dominance Comparison of Enablers | Performance Indicator(s) Influenced |
|----------------------------------|-------------------------------------|----------------------------------|-------------------------------------|
| 2 Dominating 5                   | P1                                  | 9 Dominating 3                   | P1                                  |
| 2 Dominating 6                   | P1                                  | 9 Dominating 4                   | P1, P3, P6                          |
| 2 Dominating 9                   | P1                                  | 9 Dominating 5                   | P1, P6                              |
| 2 Dominating 10                  | P1                                  | 9 Dominating 6                   | P1, P6                              |
| 2 Dominating 11                  | P1, P2                              | 9 Dominating 8                   | P1, P6                              |
| 3 Dominating 4                   | P2                                  | 10 Dominating 1                  | P1, P3, P6                          |
| 3 Dominating 5                   | P6                                  | 10 Dominating 3                  | P1, P6                              |
| 3 Dominating 6                   | P6                                  | 10 Dominating 4                  | P1, P3, P6                          |
| 4 Dominating 1                   | P1, P2, P6                          | 10 Dominating 5                  | P1, P6                              |
| 4 Dominating 6                   | P1, P6                              | 10 Dominating 8                  | P1, P6                              |
| 4 Dominating 8                   | P1, P6                              | 10 Dominating 9                  | P1, P3, P6                          |
| 5 Dominating 4                   | P1, P6                              | 10 Dominating 11                 | P1                                  |
| 6 Dominating 5                   | P1, P6                              | 11 Dominating 1                  | P1, P2                              |
| 6 Dominating 10                  | P1, P6                              | 11 Dominating 3                  | P2                                  |
| 7 Dominating 1                   | P1, P2, P3                          | 11 Dominating 4                  | P1, P2                              |
| 7 Dominating 2                   | P1, P2                              | 11 Dominating 5                  | P1                                  |
| 7 Dominating 3                   | P2, P3                              | 11 Dominating 8                  | P1                                  |
| 7 Dominating 4                   | P1, P2                              | 11 Dominating 9                  | P1                                  |

Table 11. Dominating interaction matrix.

| Enabler Code | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|--------------|---|---|---|---|---|---|---|---|---|-----|----|
| 1            | P1, P2 | P3, P4, P6 | P1, P4, P5 | P3, P4 | P2, P3 | P2, P3, P4 | P4, P6 | P2, P3 | P2, P4 | P2, P4 | P3, P4, P6 |
| 2            | P1, P2, P6 | P1 | P1, P2 | P1, P2 | P1, P2 | P1, P2 | P1, P2 | P1, P2 | P1, P2 | P1, P2 | P1, P2 |
| 3            | P2, P3, P6 | P2, P3, P5, P6 | P3, P5 | P2, P3, P5 | P2, P3, P5 | P5, P6 | P2, P3, P5, P6 | P2, P5 | P2, P5 | P2, P5 | P3, P5, P6 |
| 4            | P1, P2, P6 | P4, P6 | P1, P4, P6 | P1, P4, P6 | P1, P4, P6 | P4, P6 | P4, P6 | P4, P6 | P4, P6 | P4, P6 | P4, P6 |
| 5            | P1, P2 | P3 | P1, P4, P6 | P1, P4, P6 | P1, P4, P6 | P4, P6 | P4, P6 | P4, P6 | P4, P6 | P4, P6 |
| 6            | P1, P4, P6 | P4, P6 | P1, P6 | P1, P6 | P1, P6 | P6 | P6 | P6 | P6 | P6 |
| 7            | P1, P2, P3 | P3 | P1, P2, P3 | P1, P2, P3 | P1, P2, P3 | P1, P2, P3 | P2, P3 | P2, P3 | P2, P3 | P3 |
| 8            | P1, P4, P6 | P4, P6 | P1, P4, P6 | P1, P4, P6 | P1, P4, P6 | P4, P6 | P4, P6 | P4, P6 | P3, P6 | P3, P6 |
| 9            | P1, P3, P6 | P3, P6 | P1, P3, P6 | P1, P3, P6 | P1, P3, P6 | P1, P3, P6 | P1, P3, P6 | P1, P3, P6 | P1, P3, P6 | P3, P6 |
| 10           | P1, P3, P6 | P3, P6 | P1, P3, P6 | P1, P3, P6 | P1, P3, P6 | P1, P3, P6 | P1, P3, P6 | P1, P3, P6 | P1, P3, P6 | P1, P3, P6 | P3, P6 |
| 11           | P1, P2 | P1, P2 | P1, P2 | P1, P2 | P1, P2 | P1, P2 | P1, P2 | P1, P2 | P1, P2 | P1, P2 | P1, P2 |

The matrix of dominant interactions is displayed in Table 11. All the dominating SCPMS enablers are summarized in the dominating interaction matrix.

Table 12. The dominance matrix is displayed in Table 12. The diagram can be used to understand the influence of the enablers in the SCPMS. An interpretive ranking model is displayed in Figure 4.
Table 12. Dominance matrix.

| Enabler Code | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | (D) * | (D–B) ** | Rank |
|--------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|----------|------|
| 1            | 3   | 3   | 2   | 2   | 3   | 2   | 2   | 2   | 2   | 3   | 24   | −3      | 8       |
| 2            | 2   | 1   | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 19  | −1    | 7       |
| 3            | 3   | 4   | 2   | 3   | 3   | 2   | 3   | 2   | 2   | 27  | −1    | 4       |
| 4            | 3   | 1   | 3   | 1   | 1   | 1   | 1   | 1   | 1   | 14  | −11   | 11      |
| 5            | 3   | 2   | 3   | 3   | 1   | 2   | 1   | 1   | 2   | 20  | −4    | 9       |
| 6            | 2   | 1   | 2   | 2   | 2   | 1   | 1   | 1   | 1   | 20  | −7    | 10      |
| 7            | 3   | 1   | 3   | 3   | 3   | 2   | 1   | 1   | 1   | 21  | 0     | 6       |
| 8            | 3   | 2   | 3   | 3   | 3   | 2   | 3   | 1   | 2   | 23  | 2     | 3       |
| 9            | 3   | 2   | 3   | 3   | 2   | 3   | 3   | 1   | 2   | 25  | 10    | 2       |
| 10           | 3   | 2   | 3   | 3   | 3   | 2   | 3   | 3   | 1   | 26  | 12    | 1       |
| 11           | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 2   | 20  | 1     | 4       |
| (B) ***      | 27  | 20  | 26  | 25  | 24  | 21  | 21  | 15  | 14  | 19  |       |         |

* Number of cases dominating, ** Net dominance, *** Number of cases being dominated.

Figure 4. An interpretive ranking process model for SCPMS enablers.

5. Discussion

The main motivation for this research was to investigate the effectiveness of the SCPMS enabler that supports the SCPMS. Eleven enablers that play a significant role were identified through a literature review and feedback from the expert group. They identified eleven enablers that are essential to having sound SCPM.

The SC partners may possess the SCPMS necessary to evaluate the effectiveness of the entire SC to meet the requirements of the end customer. To achieve complete
knowledge of each enabler, a contextual relationship model using ISM was formulated. The dependency of each enabler among other SCPMS enablers may be realized and studied for their fulfillment. The interpretive structural modeling (ISM) model provides a hierarchy of courses of action that management can imbibe in their strategies to achieve sustainable SCM through an SCPMS. Once the context relationships are known, management will be able to take steps to fix the problem. The management may further modify their SCM alignment strategies to accomplish the most needed sustainability in their SC. Resource management is another area that management finds difficult to manage.

The MICMAC analysis provides the driver and dependence diagram for SCPM enablers. It further classifies all the SCPMS enablers into four categories, or clusters, thus providing total visibility to each enabler. The transparency of the contextual relationship of each enabler and its position in the hierarchy is revealed. That helps management to revisit their strategies and modify the course of action toward SCM. Eleven SCPMS enablers are classified into four groups: autonomous enablers, dependent enablers, linkage enablers, and independent enablers. Based on their driving power and dependence, the four enablers “employee commitment (8)”, “appropriate performance matrix (9)”, “benchmarking (10)”, and “Sustainable SCM (11)” are classified as dependent enablers. The dependent enablers of “awareness to SCPMS (6),” “top management commitment (7),” and “financial commitment towards SCPMS (2)” may be controlled by the independent enablers. Management must control the independent enablers to accomplish the SCPM objectives. The analysis further provides the four enablers “loyalty to SC (1)”, “trust (3)”, “customer satisfaction (4)”, and “effective information system (5)” as linkage enablers.

The IRP found that the SCPMS should be based on customer satisfaction. Customer satisfaction decides the further quantity of flow up- and downstream of the SC. The SCPMS should be such that it takes account of feedback from customers about the products so that they may be subjected to various departments for product and service improvement. Awareness of the SCPMS is essential as it will decide the amount of information required for assessing SC performance. SCPMSs have evolved around the effective information system. In the present digital age, a large amount of information can be found from the sales of a product that can be useful for SC efficiency. Loyalty to the SC is very important as it can maximize revenue in a given time by minimizing cost and customer acquisition. Financial commitment toward the SC takes care of the cost of managing the SCPMSs. The fund allocation by top management will help them to design and enact an efficient SCPMS. “Top management commitment” toward the SCPMS increases as the funds flow. The development of an SCPMS will be fast once the funds are available. Trust plays a significant role in the decision making in the performance measurement system. SCPM must imbibe sustainability in SCM to have a long-lasting SC. “Employee commitment” plays a vital role in the SCPMS. It is also known that “employee commitment” makes the SCPMS possible. An effective SCPMS should have an appropriate matrix to measure with accuracy the desired performance. “Benchmarking (10)”, “appropriate performance matrix (9)”, and “employee commitment (8)” are the first three ranks obtained by the IRP. “Benchmarking (10)” is very important to the SCPMS to make it compatible with other SCPMSs of leading organizations. It also provides the data for comparison so that more strategies are formulated to compete with the rivals in local and global markets. SCPMSs should be able to measure a variety of metrics to help the strategy makers make short-term and long-term SC-related decisions. It further reveals that employee commitment to the SCPMS plays a significant role.

6. Conclusions

The best of both worlds can be accomplished if managers who are in the field use effective SCPMSs to deploy their resources effectively and efficiently. The SCPMS may deliver useful information toward cost minimization with efficiency maximization using the right tools for decision making. The present research examined the SCPM enablers using ISM, MICMAC, and the IRP. ISM makes it easier to quantify the influence of each
SCPM enabler with other SCPM enablers using contextual relationships, whereas MICMAC aids in cluster classification.

The paper provides modeling based on ISM, MICMAC, and the IRP for contextual relationship modeling and ranking the SCPMS enablers which will be helpful to academicians and practitioners in the field. The academicians can use the applied methodologies in exploring the SCPM domain to develop a typical performance-based system suiting a specific sector or a type of industry. The academicians may also be able to explore the applied methodologies in evaluating the various barriers to the SCPMS for enhancing sustainability. Practicing managers can use the relationship modeling to ensure effective and sustainable SCM. Practitioners of management can utilize the results of both techniques to comprehend the SCPM enablers. The relation modeling also reveals a substantial correlation among the SCPM enablers. This aids in developing strategies and making decisions. The IRP approach used in this study has two key advantages, i.e., (a) information about dominance levels is optional, and (b) it provides simplicity in measuring and comparing interactivity’s impact. Ranking of the SCPM enablers provides liberty to practicing managers to prioritize strategies and decision making.

A logical extension to this work could involve mathematical modeling in the crisp and fuzzy environment to assess and rank the SCPMS enablers. The results from the exploratory analysis and structural equation modeling could be intriguing. Future research may also investigate the role of various enablers related to the environment, organizational soft practices [58,59], and smart technologies in the SCPMS to enhance sustainability [29].

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