

Article

ISO 9001 and Supply Chain Integration Principles Based Sustainable Development: A Delphi Study

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Abstract: Driven by the increasing stakeholder and societal pressures, organizations and supply chains face the multi-dimensional challenges of not only integrating economic, environmental and social agendas into their management systems but also driving continual sustainability performance improvement. Aiming to support organizations in this sustainable development challenge, this paper explores the strategic management principles of ISO 9001 and supply chain integration from the lens of triple bottom line sustainability. Derived from theoretical synergies, a conceptual framework for integration, measurement, and improvement of triple bottom line sustainability is constructed and a business diagnostic tool introduced to facilitate the implementation of the framework. The developed conceptual framework and diagnostic tool are verified through an expert panel-based Delphi study and positive relationships formulated between the management principles of ISO 9001, supply chain integration and sustainability management. The facilitating and catalyzing role of quality management and supply chain management principles for integration and improvement of organizational sustainability is outlined.

Keywords: quality management; supply chain management; ISO 9001:2015; supply chain integration; sustainability; sustainable development; integrated management framework; Delphi study

1. Introduction

Satisfying or excelling stakeholder and customer needs is central to quality management (QM), including coordination, management, and alignment of organizational products, services and processes [1,2]. As a strategic management approach, QM facilitates parameters key to sustainability of firms such as continuous improvement, performance measurement and customer satisfaction improvement through widely established principles, tools, techniques and practices [1–4]. Thus, a wide scope of activities internal and external to organizations, throughout the lifecycle of products and services are included, such as externally provided goods, operations, logistics and after sales [1,2]. With the involvement of participants from 163 world countries, the International Organization for Standardization (ISO) was established in 1987, catalyzing deployment of key quality management principles such as standardization, measurement, and improvement on a global scale [4,5]. ISO 9001 was introduced as a basis of business management systems, outlining the building blocks of organizational performance measurement, stakeholder management, and sustainable development [4–8]. QM approaches such as total quality management (TQM) and Lean Six Sigma (LSS) were also positively associated with sustainable development, adopting key principles of engagement of people, business culture change, enhanced process repeatability, reduced waste and realization of products/services that are fit for stakeholder requirements [9–12]. Quality awards in various geographical regions such as the EFQM global excellence award and Malcolm Baldrige National Quality Award (MBNQA) not only provided noteworthy developments in operational and

supply chain performance and quality but also possess the potential to catalyze our journey towards more sustainable operations and supply chains [4,9,13].

As an outcome of the current globalization, growing competition and tougher market conditions, more and more activities, processes and services are being outsourced, resulting in more complex supply chain networks and interorganizational interactions. Cross-enterprise integration and coordination across the supply chain network is at the core of supply chain management (SCM) [14]. Supply chain includes the channel of materials, information, goods and services, associating the features of supply, transformation and demand [14]. SCM revolves around planning, execution, and control of material, information, logistics, and relationships internal and external to firms, seeking to meet customer and stakeholder requirements [14,15]. Thus, SCM involves intra and interorganizational activities that range throughout the product and service lifecycles, from raw material transformation through manufacturing and through its use and end of life stages [16]. Hence, SCM is a fundamental parameter for business continuity, performance and improvement of organizations along with significant impact on how they are perceived by their stakeholders and sustainability [17–19].

“Meeting the needs of the present without compromising the ability of future generations to meet their own needs” lies at the heart of sustainability and sustainable development [20]. The pressure applied on firms and supply chains driven by the highly growing nature of worldwide consumption rate and demand for products and services is offering significant challenges for our environment and public [18]. Considering our inclining consumption trends, the boundaries of our natural resources (planet) and society (people), radical changes are required to be adopted by all actors of the society including the organizations [20,21]. This strategically positions sustainability as an increasingly growing imperative as a customer, market, societal, legislative, and societal stakeholder requirement for firms, imposing alignment of management activities for sustainable development [21–23]. In this context, sustainability management (SM) is articulated as following [9,24]:

SM: “Accelerating the adoption of best management principles, models, and practices throughout the operation system, and enabling the environment to achieve sustainable development”.

In the context of firms, the three dimensional nature of sustainability was articulated as the business case (economic or profit), the natural case (environmental or planet), and the societal case (social or public), which is generally described as triple bottom line (TBL) [8,25]. The multi-dimensional agendas introduced by SM offers not only internal but also external conflicts and complexity for integration, policy formulation, action deployment, measurement and sustainable development [9,26–28]. This highlights the key industrial need for new and holistic management approaches and conceptual contributions for catalysis of the intricate but important matter of integrating sustainability into organizational and supply chain processes [8,17–19,26,29–31]. This fundamental management research problem is resonated, specifying that “future research should move from focusing on whether or not companies need to integrate corporate sustainability into strategic management to how this could be done in practice” [8]. A number of attempts were made, contributing to our body of knowledge through systematic reviews and conceptual constructs for integration of sustainability into strategic management [8], for embedding of sustainability in activities of small and medium enterprises [32], for incorporation of sustainability performance into business [21], for inclusion of sustainability in firm performance management and measurement systems [28] and for enhanced decision making balanced through the integrated lens of triple bottom line [33]. However, the practical tools, techniques, processes and means for business managers to integrate, measure, communicate, drive and improve sustainability internally and across the supply chain network still remains as a highly current need for academics and practitioners [8,19].

On the other hand, conventional management principles, tools, techniques and approaches regarded as “best practice”, that are already in place and well recognized by managers for driving change, performance measurement, stakeholder satisfaction, and improvement carry a significant

potential in speeding up the management transformation into integrated and holistic approaches for sustainability [9]. Through established stakeholder focus, deep functional and operational scope within and outside the boundaries of firms and inherent in almost every organization globally, QM and SCM approaches are in pole position for facilitation and catalysis of embedding sustainability into organizations and supply chains [18,19,22]. QM and SCM highly influence activities internal and external to firms at both softer (e.g., culture, relationships, and engagement of people) and harder levels (e.g., capabilities, systems, coordination, and processes), therefore are strategically positioned for driving change towards sustainable management. This view point is further shared by several authors in the literature, emphasizing the role of deeply rooted QM and SCM philosophies for embedding of sustainability into management systems and processes for reporting, measurement, communication, and improvement [8,9,19,34–36]. Quality and supply chain management offer a response strategy for developing the business capabilities, systems, and processes necessary for achievement of sustainability and sustainable development [9]. The relationship between QM principles and triple bottom line sustainability in the context of supply chains was described as “fruitful” for establishment of a sustainability management framework, QM facilitating implementation, standardization, monitoring, and continual improvement of TBL agendas, the effect of which would be increased through supply chain deployment and integration via SCM [19]. A positive association between QM and corporate sustainability is discussed, where QM systems (e.g., ISO 9001, IATF16949) and models (e.g., TQM, LSS), outlining the complementing relationship between QM and sustainability, sustainability increasing the quality of products, services, work, life of employees and customers, and QM promoting the integration of sustainability [8]. On a similar note, QM was put forward as: “a management system that could be expanded to include components of sustainable development”, defining the process management principle as key for integration of economic, environmental, and social requirements into organizational mechanisms [34]. This stand point was echoed where the facilitating role of QM in transformation towards sustainability management was highlighted on the basis of enhanced organizational capability in formulation and implementation of harmonious aims, goals, objectives, minimizing potential conflicts that may arise from the introduction of multiple (triple bottom line) agendas [35]. Moreover, QM was projected as a management approach to lay the foundations of embedding various stakeholder and sustainability related issues in firms including environmental, legislative, societal, public and market requirements, structured through QM principles such as relationship management, process approach and customer focus [36]. QM and SCM, when implemented in conjunction with each other, reinforce intra and interorganizational cooperation for change and improvement, which offers significant potential for supporting management evolution into incorporation of triple bottom line [19,37].

The integrated perspective of “sustainable operations management” has remarkably grown since the early 2000s, in the search of holistic and synergistic concepts for total incorporation of ecologic, societal and economic issues, QM and SCM being utilized as reference points in our journey towards sustainable operations, organizations, and supply chains [8,16,18,19,22,31]. Recent systematic review contributions on the integration of QM and sustainability [22], the integration of SCM and sustainability [17,18], and the collective integration of QM, SCM, and sustainability [19], not only outline the supporting role of QM and SCM for integration of sustainability but also highlight the need for further adaptation and pioneering of extant QM and SCM approaches for sustainable development. Our research motivation originates from this societal and industrial research problem and highly relevant gap evident in the literature, aiming to present theoretical, conceptual and empirical contributions to accelerate the organizational transition into integrated and holistic sustainability management practice, constructed upon the deeply rooted principles of QM and SCM as illustrated in Figure 1. Hence, the following research questions are formulated as the foundations of this paper:

RQ1: *How may the QM and SCM approaches facilitate integration of triple bottom line into organizational and supply chain mechanisms?*

RQ2: Which QM and SCM principles can be framed for sustainable development of organizations and supply chains?

RQ3: How can such a framework be operationalized by industrial practitioners and decision makers?

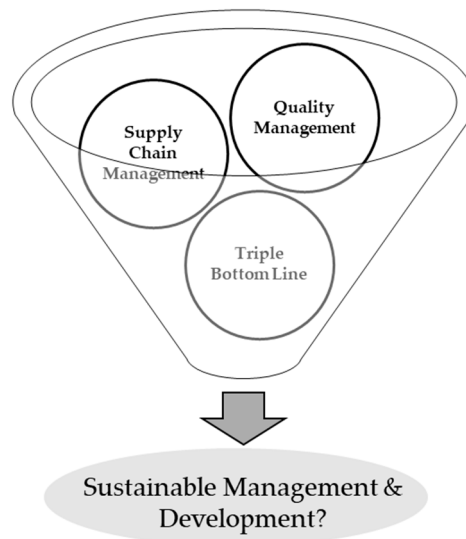


Figure 1. Key research problem addressed in the article.

The subsequent sections of this article are structured as following: the theoretical research framework, integrating QM, SCM principles and sustainability is presented in Section 2; constructed upon the synergistic propositions between QM, SCM and sustainability, a concept for sustainability integration and development of organizations and supply chains is introduced in Section 3; the research materials and methodology deployed for verification of the theory and concept developed is explained in Section 4; the results of the Delphi study conducted are provided in Section 5; and finally, the discussion of the results is outlined in Section 6 along with limitations and future research directions.

2. Theoretical Framework and Formulations

Theoretical framework “serves as the foundation upon which a research is constructed, consists of theories that seem interrelated with their propositions deduced and offers a focal point for approaching the unknown research in a specific field of inquiry [38]. For management research, the role of novel theory developments is also highlighted, in particular for adoption of tailored perspectives with a view to address current research problems such as sustainable development of firms [39,40].

First put forward by [19] as a fruit of the collective QM, SCM and sustainability integration lens to tackle the organizational sustainable development challenge and developed into a comprehensive theoretical and conceptual framework by [24], the sustainable supply chain quality management (SSCQM) approach includes all the ISO 9001:2015 QM principles, as “the ISO 9001 approach is coherent, comprehensive and widely implemented across organizations globally for performance measurement and improvement along with its high potential indicated for sustainability” [6,19,24,41–48]. The supply chain integration principle of SCM was identified as a building block or the “glue” of sustainable supply chains and sustainable supply chain management (SSCM) for integration of sustainability into intra and interorganizational processes and culture along with the leadership principle [18,19,24,29,49,50]. Other QM and SCM principles were excluded “to ensure coherence of the ISO 9001 framework, maintain conciseness, avoid further complexity and prevent confusions in practice that could arise from adoption of similar QM, SCM principles e.g., TQM principles of employee involvement and process centered” [24].

The SSCQM theory was constructed based on the rationale of addressing the complexities of integrating multiple sustainability agendas (economic, ecologic, social) through a fashioned

management perspective, incorporating the deeply rooted QM and SCM principles for structuring, facilitating and catalyzing organizational sustainable development [17–19,24,26,27,30]. A highly growing number of organizations, operating in a wide range of geographical regions and industrial sectors are adopting ISO 9001 quality management system, making ISO 9001 philosophy (and its seven principles) a fundamental part of the SSCQM construct due to “its wide implementation level in organizations globally, its applicability to most business sectors, high availability of support for its implementation compared to other QM methods, familiarity of managers with its principles and its well-recognized role in structuring and catalyzing organizational performance measurement and improvement” [5,6,19,24,41–43,46,48]. The supply chain integration principle was added as the eighth principle of the construct, with a view to reinforce the influence of QM principles internally and externally, facilitating implementation of sustainable development across the supply chain network, identified as a critical enabler of SSCM [18,19,24,29,41,46,49,50].

Sound theoretical frameworks are required to be “built on a foundation of convincing argumentation and grounded in reasonable explicit views of human nature and organizational practice” [40]. The SSCQM theory was built on the standpoints of a wide base of authors in the literature, linking the eight SSCQM principles quantitatively and qualitatively with embedding of triple bottom line sustainability in the organizational and supply chain context [24]. The overview and description of management principles framed under SSCQM are provided in Table 1 along with supporting references of scholars positively associating each principle with integration of sustainability and sustainability management. The descriptions of the management principles were formulated from key sources on ISO 9001:2015 quality management principles and supply chain management literature on supply chain integration [24,50–52].

Table 1. The management principles forming sustainable supply chain quality management (SSCQM) and authors supporting a positive relationship with sustainable development (adapted from [24]). QM: quality management; SCM: supply chain management.

SSCQM Framework	Description	Supporting Ref.
QM Principles (ISO 9001:2015)	1. Customer focus “Meeting customer requirements and exceeding customer expectations”	[16,19,24,53–56]
	2. Leadership “Creation of conditions where all team members are engaged to deliver business objectives”	[4,17,19,24,35,53,57]
	3. Engagement of people “Involvement, recognition and empowerment of staff in achieving business goals”	[4,19,24,35,47,53,54,58]
	4. Process approach “Management of key activities and their interrelations as a process through defined responsibilities, objectives, resources and interfaces for consistent results”	[4,19,24,34,53,54]
	5. Improvement “Firm reflex to changes through ongoing focus on innovation and capability development”	[4,19,24,35,47,53]
	6. Evidence based decision making “More effective decisions with higher objectivity and confidence levels are made as a result of analysis of facts, evidence, information and data”	[9,19,24,35,53,54,59]
	7. Relationship management “Identification and management of relationships with key business stakeholders, fundamental to success and sustainability of the organization”	[17,19,24,35,53,54,57,60]
SCM	8. Supply chain integration “Close alignment, open communication, coordination and cooperation on the basis of continuous information flow (internally and externally) among the supply chain members”	[17–19,24,29,30,49,50,61,62]

Stemming from the knowledge base established and synergies formulated between QM, SCM, and sustainable development, the theoretical research framework of SSCQM was developed as schematically represented in Figure 2. This framework suggested significant implications for the

academia and industry, providing insights on how the QM and SCM principles can be used towards integration of sustainability (RQ1) and which QM and SCM principles can be framed for sustainable development in the organizational context (RQ2).

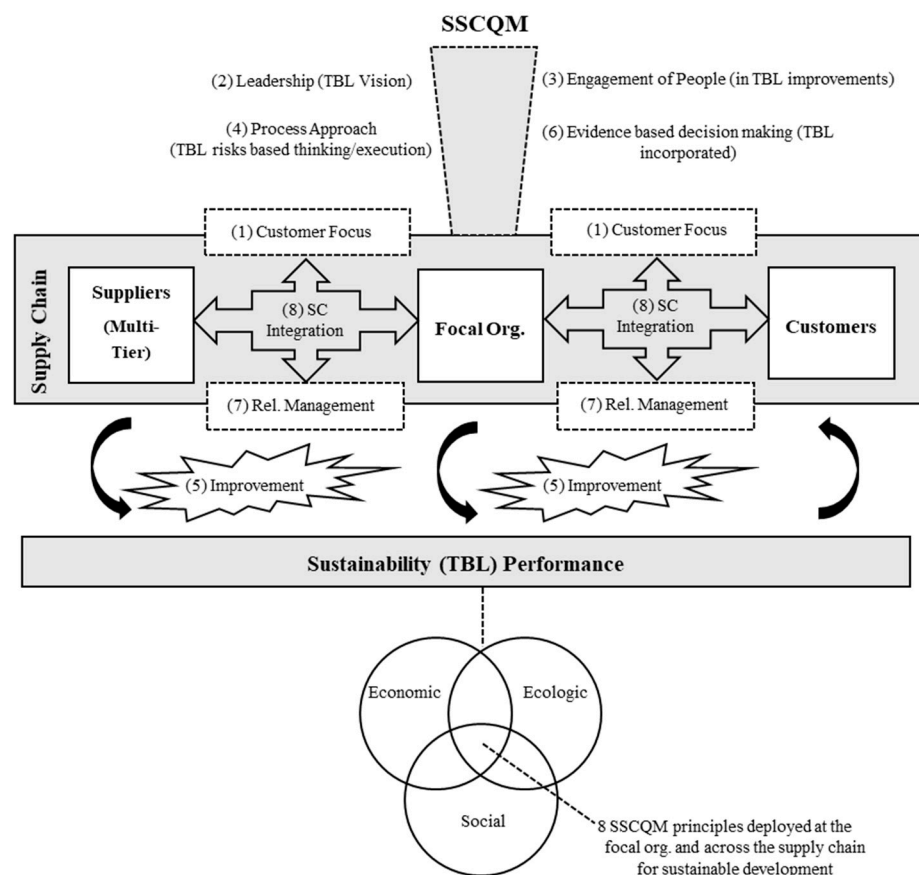


Figure 2. The framework of SSCQM, integrating QM and SCM principles for sustainable development. (Reprinted from: Sustainable supply chain quality management: A systematic review, 181, Bastas A. and Liyanage K. Journal of Cleaner Production, 726–744, Copyright 2018, with permission from Elsevier). TBL: triple bottom line.

3. Conceptual Framework for Sustainable Development of Organizations and Supply Chains

3.1. Conceptual Framework

Conceptual frameworks are usually constructed from the theories that underpin the research, “consisting of concepts interconnected to explain the relationships between them and how the researcher asserts to answer the research problem defined, aimed at encouraging the development of a theory that would be useful to practitioners in the field” [38]. The SSCQM theory introduced in Section 2 forms the basis of a QM and SCM principle based organizational sustainable development concept for business managers and practitioners, with a view to address RQ3 set out in Section 1 [24].

Identification, prioritization involvement, and management of business stakeholder (internal and external) sustainability expectations is identified as a key enabler of triple bottom line sustainability integration and improvement in organizations, utilized as a key stage in extant integrated sustainability management concepts in the literature [8,11,21,32,35,54]. Thus, the voice of the stakeholders (VOS) identification and prioritization stage with reference to triple bottom line sustainability and the context of the implementing organization forms the foundations of the SSCQM concept. Outlined as *Step 0* in our conceptual framework, economic, ecologic and social parameters essential for the stakeholders of the organization are determined, adopting a balanced triple bottom line view. The

management principles utilized in the SSCQM construct such as “leadership, relationship management, and customer focus”, can facilitate this stage for establishment of stakeholder sustainability needs and requirements, communication, involvement, cooperation, and formulation of business objectives aligned with considerations fundamental to the stakeholders of the business.

The triple bottom line indicators set out by Global Reporting Initiative (GRI) are adopted for determination, reporting, and performance measurement of sustainability priorities, which is a framework widely adopted by sustainability scholars and practitioners due to its holistic nature and incorporation of a wide scope of stakeholder sustainability considerations [63,64]. The concept includes strategic, tactical, and operational aspects, which are fundamental to organizational and supply chain planning, decision-making, and transformation [65,66]. The distinction between the relative terms of strategy and tactics is articulated as: “strategy is concerned with long-range objectives and ways of pursuing them that affect the system as a whole; tactics are concerned with shorter-run goals and means for reaching them that generally affect only a part of the organization” [66]. Strategic aspects include the long term view (mission, vision, objectives, policies) at the highest management level, tactical aspects concern the middle management and how to achieve policies in the medium term and operational aspects involve lower managers and simpler issues on the day-to-day basis, harmony of which is essential for attaining organizational goals and driving sustainable change [66].

Organizational diagnosis involves “tapping of existing information channels and the opening of new ones to clarify and define the issues”, forming the basis of organizational development and decision making [67]. Subsequent to establishment of “voice of the stakeholders”, the current state of the organization with reference to sustainable management is mapped through deployment of SSCQM principle maturity assessment diagnostic tool (presented in Section 3.3). In this stage, which is outlined as *Step 1*, the organization is assessed (self or external) against the indicators of each SSCQM principle as per set criteria against triple bottom line parameters established in *Step 0*. Maturity in the business context involves “the support structure, procedures, processes, resource commitments and degree of knowledge in the business along with deployment effectiveness of the principles under evaluation” [24,68]. This provides a detailed diagnostic for the organizational practitioners, regarding sustainability synergistic principles of SSCQM with a view to confirm triple bottom line sustainability integration aligned with the stakeholder expectations of the organization. The analysis of the results reveals the strengths, weaknesses, opportunities and threats (SWOT) for the organization in relation to sustainable development, which forms the basis of *Step 2*. These are determined from the SSCQM principle maturity levels that prescribe the implementation level of triple bottom line indicators (identified in *Step 0*) along with current performance levels against each indicator. Benchmarking analysis with similar organizations and operations also forms part of this stage, establishing gaps and placing the organization with reference to competition. This stage not only entails strategic management elements (SWOT analysis) but also tactical management elements (performance measurement).

As a result, countermeasures, policies, strategies, processes, and improvement actions internally and across the supply network with key partners are deployed as part of *Step 3*, at strategic (long term business direction), tactical (medium term improvement projects) and operational (execution of improvement actions and operations in line with TBL objectives) levels. *Step 4* entails the monitoring and control of the effects of the actions implemented, to review progress, reinforce the cultural transformation and ensure effectiveness. The “check” phase involving the measurement and review process to test whether the changes implemented delivered the desired outcomes and deploying appropriate countermeasures as required, is a critical phase of organizational improvement [69]. Organizational learning is captured through standard work practices with a view to freeze and sustain effective organizational changes with reference to TBL sustainability integration and performance. As part of the *Act* stage, *Steps 0 and 1* are revisited, through periodical reassessment of stakeholder requirements that are susceptible to changes due to the dynamic business

environment and organizational maturity levels against triple bottom line sustainability for continual sustainable development.

Deming's organizational continual improvement framework Plan–Do–Check–Act (PDCA) is positively associated with performance improvement, change management, and sustainable development [9,47]. Hence, a similar structure was adopted to provide a conceptual structure that is well recognized by industrial practitioners for deployment and cyclic approach for enhanced business transition management [9,47]. The fundamental application stages of the SSCQM conceptual framework are demonstrated in Figure 3 and Table 2, along with description of each step, intended management implementation level and desired outputs from each step. The areas introduced in the light of Delphi expert panel feedback (Section 5) are denoted with “*”.

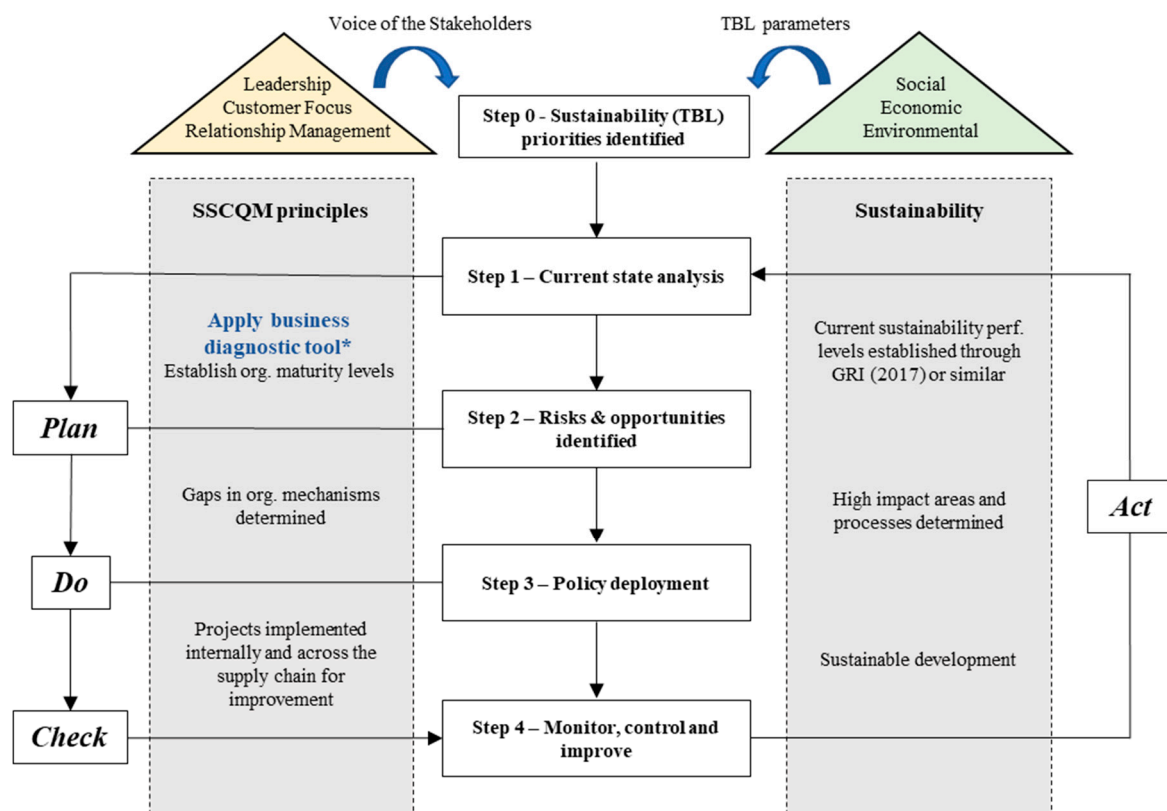


Figure 3. SSCQM conceptual framework. * Please refer to Section 3.3 for business diagnostic tool. (Reprinted from: Integrated quality and supply chain management business diagnostics for organizational sustainability improvement, 17, Bastas A. and Liyanage K. Sustainable Production and Consumption, 11–30, Copyright 2018, with permission from Elsevier.)

Table 2. SSCQM conceptual framework application stages for sustainable development.

PDCA Step	Description	Management Level *	Output
<i>Plan—Step 0</i>	Identify the key economic, ecologic, and social sustainability requirements of the stakeholders of your organization. Consider sustainability requirements of your customers and other interested parties (e.g., public, legislative bodies). Establish the key economic, social, and environmental sustainability indicators from the GRI framework, in line with the stakeholder requirements of your organization, adopting a balanced view on triple bottom line *.	<i>Strategic</i>	Sustainability priorities of the organization identified
<i>Plan—Step 1</i>	Using the SSCQM principle maturity assessment tool (diagnostic tool), assess your organization against the indicators of each principle versus economic, ecologic and social sustainability parameters identified in Step 0, as per the assessment criteria **.	<i>Strategic</i>	SSCQM principles maturity with reference to triple bottom line sustainability established
<i>Plan—Step 2</i>	Analyze the findings, establishing the organizational strengths, weaknesses, risks and opportunities with reference to the SSCQM principle maturity levels and embedding level of economic, ecologic and social sustainability parameters. Measure and determine current sustainability performance levels for the economic, ecologic and social parameters identified as key in Step 0. Refer to GRI framework for performance measurement and reporting. Conduct benchmarking analysis with similar organizations and operations *.	<i>Strategic and Tactical</i>	Strengths, weaknesses, opportunities, and risks with reference to sustainable management established. Current sustainability performance levels determined as per GRI *. Benchmarking conducted with similar organizations *.
<i>Do—Step 3</i>	Deploy policies and improvement projects internally (within the organization) and across the supply chain for the areas identified as high risk and requiring improvement.	<i>Strategic, Tactical, and Operational</i>	Sustainability improvement action plan generated
<i>Check—Step 4</i>	Measure and monitor effects of policies and improvement projects deployed. Redeploy improvement actions and sustain improvements through standard work as required.	<i>Strategic, Tactical, and Operational</i>	The effect of improvement actions monitored and controlled for sustainable development
<i>Act</i>	Revisit Step 0 and 1, reassessing the voice of the stakeholders, organizational maturity levels against triple bottom line sustainability for continual sustainable development.	<i>Strategic and Tactical</i>	Continual cycle of sustainable development through Plan–Do–Check–Act (PDCA)

* Included as per Delphi study verification feedback (Section 5). ** **Assessment Criteria:** “0”—No evidence of implementation; “1”—Informal/inadequate processes in place; “2”—Partially implemented (All voice of the stakeholders (VOS) TBL indicators not included or implemented); “3”—Formal process in place inclusive of all VOS TBL sustainability parameters; “4”—“3” plus evidence of continuous improvement; “5”—Fully implemented inclusive of all Global Reporting Initiative (GRI) sustainability indicators.

3.2. Deployment for Sustainable Development of Supply Chains

True sustainable development requires a global perspective and commitment, highlighting importance of the life-cycle and holistic supply chain approaches [17]. Transferring sustainability impacts upstream or downstream the supply chain network may push issues outside the boundaries of organizations or relocate their locations, however the overall sustainability impact is unaffected [18]. Although the supply chain vision is incorporated within the proposed SSCQM concept through the key sustainable SCM principle of supply chain integration, this concept enables sustainability integration, evaluation, and implementation at the organizational level, but not across supply chains.

With a view to address this issue and facilitate application at supply chain level, a deployment strategy was formulated [24]. As modelled in Figure 4, SSCQM scores of suppliers, focal organization, and customers can be generated, enabling cumulative supply chain sustainability management maturity assessments (SSCQM assessments) and improvement. This concept introduces significant implications for the sustainability of supply chains along with the potential of realizing further supply chain collaboration, enhanced cross-enterprise communication, inter-organizational exchange of know-how, aligned sustainability goals across the supply chain network, shared resources and efficiencies for sustainable development of the overall supply chain.

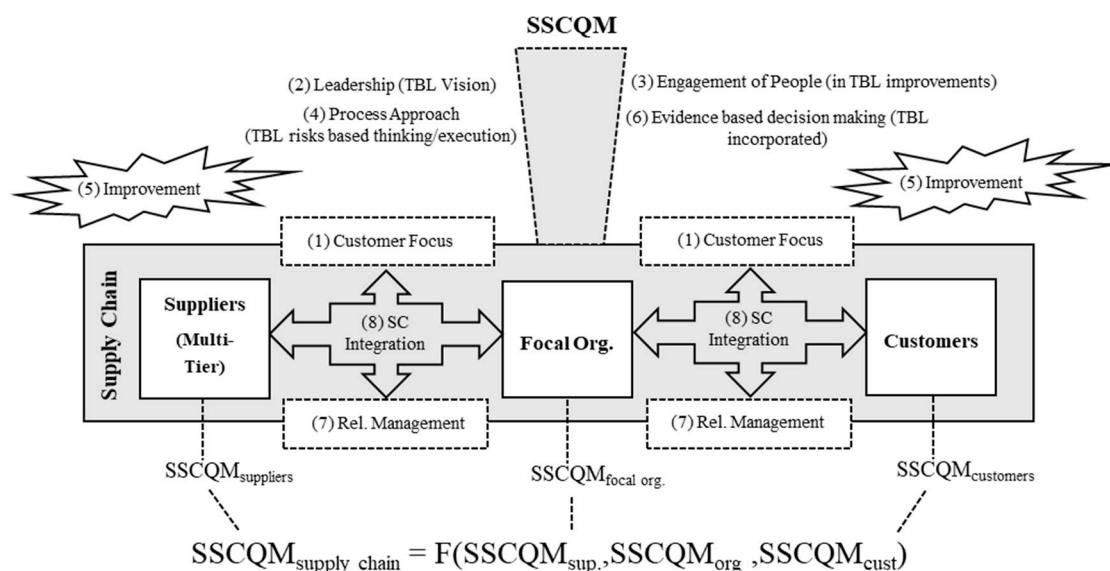


Figure 4. SSCQM for sustainable development of supply chains. (Reprinted from: Integrated quality and supply chain management business diagnostics for organizational sustainability improvement, 17, Bastas A. and Liyanage K., Sustainable Production and Consumption, 11–30, Copyright 2018, with permission from Elsevier).

3.3. Diagnostic Tool for Sustainable Management Principle Maturity Assessment and Integration

With a view to structure application of the fundamental step (step 1—current state analysis) in SSCQM concept, a MS Excel based diagnostic tool was constructed as shown in Figure 5 to facilitate:

- Maturity assessment of prospective sustainability management principles (denoted as “Principle Maturity”)
- Gauging alignment of organizational mechanisms, structures and processes with TBL i.e., economic, environmental, and social sustainability (denoted as “Sustainability Integration”).

This is achieved through assessment of maturity (self or third party, awarding scores of 0 to 5 as per set criteria) against the indicators of each principle with reference to economic, environmental and

social sustainability parameters (e.g., maturity assessment of principle indicators presented in Table 3). The assessment scoring criteria of 0 to 5 was defined as follows:

- “0”—No evidence of implementation;*
- “1”—Informal/inadequate processes in place;*
- “2”—Partially implemented (All VOS TBL indicators not included or implemented);*
- “3”—Formal process in place inclusive of all VOS TBL sustainability parameters;*
- “4”—“3” plus evidence of continuous improvement;*
- “5”—Fully implemented inclusive of all GRI sustainability indicators.*

The definition and establishment of indicators for the 8 SSCQM principles formed the foundations of the diagnostic tool, which were initially extracted from the indicative QM and SCM literature [51,70]. These indicators were revised and adapted from the lens of sustainable development and additional indicators included as a result of Delphi expert panel feedback to capture a wide scope of issues integral to each principle, as outlined in Table 3, where each indicator would be assessed as per the identified scoring criteria (0 to 5) for current state analysis and managerial improvement action identification. The full list of indicators along with the specific “look for” references for organizational application is provided in the Appendix A. On the other hand, it is noteworthy that practitioners in different business sectors may simplify or add to these sets of indicators to capture industry-specific issues and tailor the tool in line with the context of their organizations and stakeholder needs.

The proposed tool was developed to facilitate organizational practitioners to draw current state (current SSCQM principle maturity and sustainability integration scores) and future maps (future SSCQM principle maturity and sustainability integration scores), develop internal and cross-enterprise development policies and strategies harmonious with triple bottom line sustainability, provide a platform for gap analysis and benchmarking and formulate sustainability improvement objectives along with the mechanisms, processes, and maturity levels required to achieve them [24]. In the case of sample scenario demonstrated in Figure 5 (designed as a simulation for demo purposes), the tool is indicating that the principles of “customer focus” with maturity score of 0% and supply chain integration with maturity score of 7% offer significant opportunities for directing improvement efforts through development of policies, procedures, processes and culture for integration of sustainability. Moreover, the TBL dimension of “social” is indicated as weakest, suggesting management focus in this area for embedding and implementation of social parameters, KPIs, and considerations (prioritized based on voice of the stakeholders of the organization), integration of which is catalyzed through the sustainability synergistic principles of SSCQM.

Although a stakeholder risk and prioritization based approach is utilized in the SSCQM concept, ultimate goal for each organization is required to be implementation and improvement of all GRI indicators, outlined for each TBL dimension (economic, ecologic, and social), organizational principle translation of which equates to a judgment of 5 out of 5 in the tool [64]. Depending on the maturity and level of sustainability integration, a score range of 60–80% was identified as “satisfactory”, which would equate to overall scores of 3 and 4 that indicates implementation of all triple bottom line agendas key to the stakeholders of the organization and above 80% was denoted as “world class”. Scores lower than 60% would be classed as requiring immediate improvement. This provides a benchmarking avenue for organizations globally, facilitating comparison against similar operations and providing a reference point for sustainable development. A similar classification based on the level of corporate sustainability integration was adopted in the literature [71], and divided into three fundamental phases of “reactive, proactive, and sustainable” [32]. Our three key scoring categories aligns with the extant literature definitions on corporate sustainability integration maturity as following:

Scores <60% (Requiring Immediate Improvement)—Reactive Organization

Scores between 60–80% (Satisfactory)—Proactive Organization

Scores >80% (World Class)—Sustainable Organization

SSCQM Principle	Maturity	Economic	Ecologic	Social	Assessment Scoring Criteria (0 - 5)
Customer Focus	0%	0%	0%	0%	
Leadership	32%	60%	33%	3%	0: No evidence of implementation 1: Informal/inadequate processes in place 2: Partially implemented 3: Formal process in place inclusive of all YOS TBL parameters 4: Formal process in place along with evidence of Cont Impr. 5: Fully implemented inclusive of all GRI sustainability indicators
Engagement of people	40%	73%	40%	7%	
Process Approach	31%	60%	30%	3%	
Improvement	27%	40%	20%	20%	
Evidence Based Decision Making	40%	75%	25%	20%	
Relationship Management	22%	30%	35%	0%	
Supply Chain Integration	7%	0%	20%	0%	
		42%	25%	7%	Unidimensional TBL score
				25%	Organizational SSCQM Score

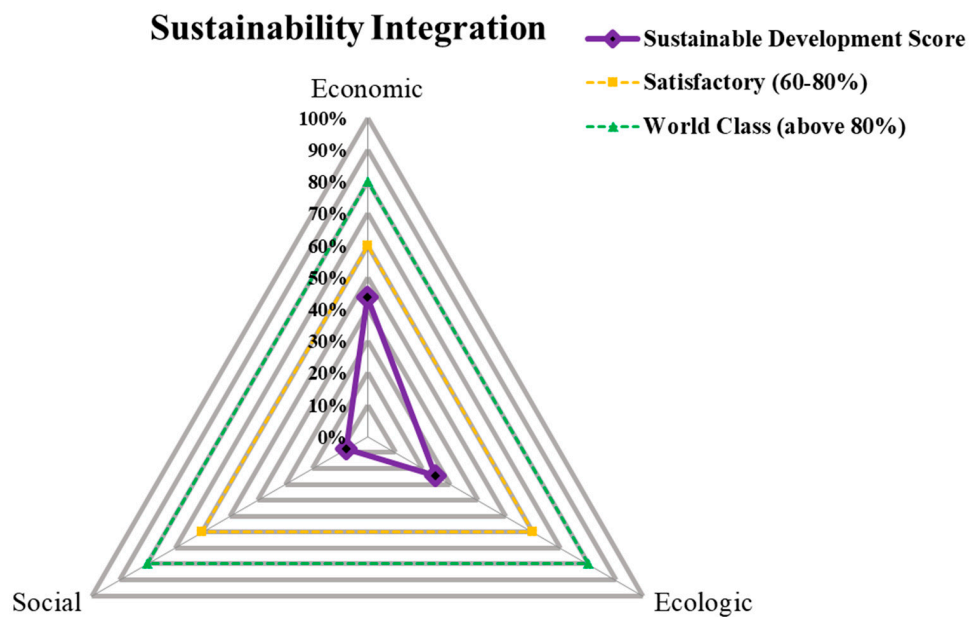
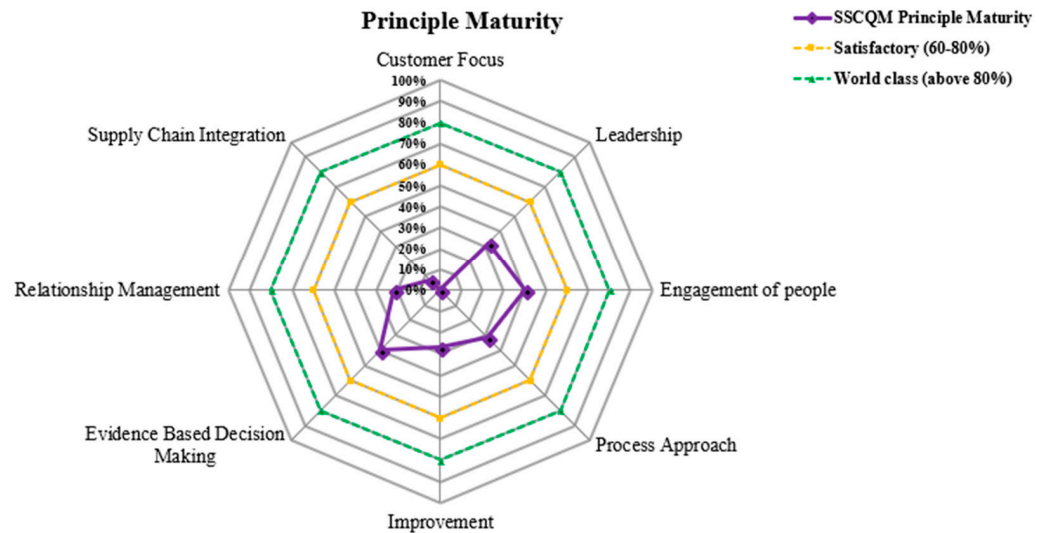


Figure 5. SSCQM Diagnostic Tool Summary Dashboard (Sample).

Table 3. Indicators of SSCQM principles for organizational maturity assessment.

<i>1. Customer focus</i>	
1.1	Are the current and future sustainability needs and requirements of current and potential customers identified, and risk analysis conducted?
1.2 *	Is there engagement with the customers with regards to their sustainability awareness and expectations?
1.3	Are the sustainability needs and requirements of customers aligned with the objectives of the organization?
1.4	Is the customer satisfaction with reference to sustainability performance of the organization measured and monitored along with implementation of actions as appropriate?
1.5	Are the sustainability needs and requirements of customers communicated throughout the organization?
1.6	Are the organizational members at all levels aware of customer sustainability needs and requirements?
1.7	Are the needs and appropriate expectations of the interested parties ** that can affect customer satisfaction with reference to sustainability performance identified and actioned?
1.8	Are the products, services and processes of the organization aligned with the sustainability needs and requirements of the customers and the market?
<i>2. Leadership</i>	
2.1	Are the leaders of the organization committed to sustainable development through clear mission, vision, policies and objectives?
2.2	Are the sustainable development mission, vision, policies, and objectives articulated throughout the organization?
2.3	Is the organization-wide commitment to sustainable development encouraged?
2.4	Is the workforce provided with the necessary resources, training and authority to drive sustainability improvement activities?
2.5	Are people in the organization inspired and encouraged to engage in sustainability improvement activities, being recognized both at individual and team levels?
2.6 *	Is benchmarking analysis conducted with similar operations and organizations?
2.7	Are the leaders of the organization at all levels, positive examples to people in the organization with reference to sustainable development?
2.8 *	Does the organization review the effectiveness of its sustainability leadership policies? Is feedback collected and actioned?
<i>3. Engagement of people</i>	
3.1 *	Is there a common understanding and awareness of sustainability among the employees at all levels of the organization?
3.2	Is collaboration promoted for sustainable development throughout the organization?
3.3	Is sharing of knowledge, experience and information facilitated among employees for sustainable development?
3.4	Is the workforce empowered to determine constraints, challenge current practices, take initiatives and contribute to sustainable development as required?
3.5	Is there an established communication with people to promote understanding of the importance of their individual contribution to sustainable development?
3.6	Is people's contribution, learning and improvement with reference to sustainable development recognized and acknowledged?
3.7 *	Are roles, responsibilities and levels of authority for individuals defined with reference to sustainability?
3.8	Do the people of the organization conduct self-evaluation of performance with reference to their contribution to the sustainable development against personal objectives?
<i>4. Process approach</i>	
4.1	Are the sustainability objectives of the organization defined along with the processes necessary to achieve them?
4.2	Are the high-risk activities and processes determined for organizational sustainability performance (sustainability risk-based thinking)?
4.3	Are the high-risk processes and their interrelations managed effectively and efficiently as a coherent system in line with sustainability objectives?
4.4	Are the organizational capabilities understood and resource constraints established and actioned with reference to sustainable development?
4.5	Is the necessary information available to monitor, analyze and improve the sustainability performance of the overall system?
4.6 *	Is there an established process to capture organizational learning with reference to sustainable development?
4.7	Is the authority, responsibility and accountability established for managing processes in line with sustainability objectives?
<i>5. Improvement</i>	
5.1	Are the sustainability improvement objectives implemented at all levels of the organization?
5.2 *	Are sustainability performance KPIs implemented along with defined measurement and improvement processes, in line with the sustainability priorities of the organization (Step 0)?
5.3	Is the workforce trained and competent in promoting, tracking and completing sustainability improvement projects in line with the objectives?
5.4	Are the sustainability improvement considerations incorporated into the new product, process and service introduction processes?
5.5 *	Does the organization promote innovation with regards to sustainability when developing and introducing new products and services?
5.5	Are the sustainability improvement projects' planning, implementation, completion and results tracked, reviewed and audited?
5.6	Is organizational sustainability improvement recognized and acknowledged?
5.7	Is there a process to implement sustainability improvement projects throughout the organization?

Table 3. Cont.

<i>6. Evidence based decision making</i>	
6.1	Are the key performance indicators (KPIs) for organizational sustainability improvement objectives identified, monitored and controlled?
6.2	Is the workforce trained and competent in sustainability performance data capturing, evaluation and analysis methods?
6.3	Is accurate and reliable data and information measured and evaluated for organizational decision making and sustainability improvement action deployment?
6.4 *	Is employee feedback on sustainability within the organization captured and evaluated?
6.5	Is all data and information with reference to sustainability improvement available to the relevant people throughout the organization?
<i>7. Relationship management</i>	
7.1	Are the current and future sustainability needs and requirements of interested parties ** identified, and risk analysis conducted?
7.2 *	Are relationships with employees managed for sustainable development?
7.3 *	Are relationships with customers managed for sustainable development?
7.4	Is the information, feedback, expertise and resources being exchanged with other interested parties ** for sustainable development?
7.5	Are collaborative sustainability improvement activities established with suppliers, partners and other interested parties **?
7.6	Are sustainability improvements and achievements by external providers and partners recognized and encouraged?
<i>8. Supply chain integration</i>	
8.1 *	Is sustainability a shared value across the supply chain network?
8.2	Is information being shared between supply chain members with reference to sustainable development?
8.3	Are joint cooperation activities being held across the supply chain including cross-enterprise participation for sustainable development?
8.4 *	Is supply chain integration for sustainable development encouraged, rewarded and benefits mutually shared?
8.5 *	Is future business linked to supply chain integration for sustainable development?
8.6 *	Is risk analysis conducted, identifying high-risk supply chains and suppliers for prioritization of supply chain integration for sustainable development?
8.7	Is there an association among supply chain members based on commitment, long term orientation and trust with ref. to sustainable development?
8.8 *	Is a supply chain integration statement in place with appropriate KPIs to monitor effectiveness and drive improvement?

* Included as per Delphi study verification feedback (Section 5.3). ** Interested parties include: Legislative Bodies (e.g., Governmental Institutions, British Safety Council); Public (e.g., local community); Suppliers external providers/partners; Customers; Employees; Shareholders/Owners; Certification bodies e.g., UKAS, TURKAK.

4. Materials and Methods

Delphi study is a highly utilized method for verification, pioneering and construction of novel concepts [72,73], adopted in a wide range of subjects including systems management [74], international business [75], innovation management [76], and medical [77], especially in the cases of no or highly limited comparable sources are present in the area of novel concept developed [78]. Adoption of Delphi study to verify the SSCQM theory and concept, integrating QM and SCM for sustainable development was proposed by [24]. A panel of experts are selected as per set qualification criteria and anonymously express their opinions, feedback, and criticism about the novel development through independent questionnaires with a view to improve its practical relevance and significance [79–81]. The researcher then analyses the feedback, summarizes the results and confirms the aspects where consensus has been established. The concept is then updated in the light of the expert feedback and re-shared with the panel of experts, until consensus has been reached on all aspects [79–81]. The expert invitation, data collection, analysis, and verification process adopted in this study is schematically represented in Figure 6.

It was evidenced that a significant ratio of Delphi studies adopted percent agreement approach to define consensus [82]. Similarly, percent agreement method has been applied in this study, where above 75% was decided to be considered as consensus for the particular aspect under investigation through expert feedback. The decision for the percentage value of agreement is often variable and down to the researcher's interpretation [83], 51% accepted by some [84], and 100% accepted by the others [85], for consensus. The percent agreement was calculated through the ratio of agree/disagree feedback sought to individual questions, relating to various aspects of the concept under investigation.

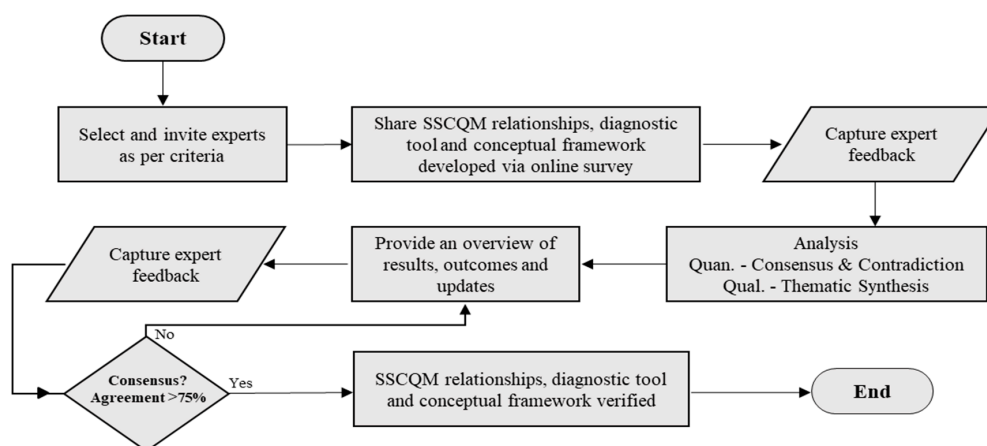


Figure 6. Delphi study analysis and verification process.

Since the opinion of the Delphi panelists is based upon their experience, knowledge and perceptions of the field, diversification on the basis of research orientations, backgrounds and sectors is fundamental for not only capturing a rich level of data but also for minimization of bias due to similar experiences. The output quality for Delphi studies is heavily dependent on the expert criteria and selection [86], willingness and interest of experts to participate being a key factor for fruitful outcomes [78]. Experts possessing a scholar and/or research background were classified as “academics” whereas, experts with industrial management, decision making, and implementation background were described as “practitioners”. Established academic and practitioner specialists in the area of operations, supply chain and quality management with established experience/knowledge on sustainability were included in this study based on the following expert selection criteria:

- Must possess 4 years of organizational management, decision making, working, teaching or research experience of sustainable development and supply chain, quality and operations management OR;

- Must have an active engagement in organizational sustainable development research with international publication contributions in high impact journals in the field (e.g., Sustainability (MDPI), Journal of Cleaner Production (Elsevier)).

Delphi studies were reviewed from the perspective of sample size (number of participants) as a significant variable, panel size ranging from 3 to 345 experts and 80% accommodating between 20 and 50 participants [87]. Low number of participants may result in limiting the scope of information captured along with the risk of missing key information and data essential to the study, on the other hand, very high numbers may lead to unconstructive conflicts, overload of data and diversion of focus to issues that are irrelevant or non-value added to the research inquiry [88]. In the case of this study that adopts heterogenous sample, optimum number of participants is proposed to be between 20 and 40 [89].

Academics and practitioners were identified and invited as per defined expert criteria above, with a view to include specialists that represented a wide range of industrial, academic and regional backgrounds to reduce risk of bias and for a more enriched data collection. As a result, as presented in Table 4, 20 academic and industrial experts from various business sectors (e.g., automotive, construction and sustainability research) international institutions and world class organizations took part in the study from a wide scope of geographical regions including Mexico, UK, USA, Turkey, Cyprus, Macedonia, and Morocco. The Delphi panel expert profile consisted of a 1:1 ratio of panelists from developing (e.g., Turkey) and developed (e.g., UK) countries along with a 55% to 45% split between academics and practitioners, both of which can be reflected as balanced ratios with low selection bias implications.

Table 4. Distribution of Delphi panel experts by type of institution, sector, experience and geographical region.

<i>Expert No</i>	<i>Type of Institution</i>	<i>Sector</i>	<i>Experience and Expertise</i>	<i>Country</i>
1	University	Research	Lecturer in Sustainable Supply Chain Management	UK
2	University	Research	Researcher in Sustainability, Lean and Circular Economy	UK
3	University	Research	Sustainability and Engineering Scholar	USA
4	Industry	Manufacturing—Automotive	Lean and Supply Chain Development Professional	UK
5	University	Research	Researcher in Sustainable Supply Chain Management	Mexico
6	Industry	Manufacturing—Steel	Quality Assurance Manager	UK
7	University	Research	Senior Lecturer in Supply Chain Improvement	UK
8	University	Research	Sustainability Management Modelling and Decision Making Scholar	UK
9	Industry	Manufacturing—Aerospace and OEM *	Supply Chain Performance Manager	UK
10	University	Research	Associate Professor in Sustainability Decision Making	Macedonia
11	University	Research	Associate Professor in Sustainable Development and Engineering	Cyprus
12	Industry	Manufacturing—Steel	Quality Systems Manager	Turkey
13	Industry	Manufacturing—Steel	Continuous Improvement and Planning Manager	Turkey
14	Industry	Manufacturing—Automotive	Senior Corporate Manager in Environment & Energy	Mexico
15	Industry	Construction	Business and Continuous Improvement Director	Cyprus
16	University	Research	Lean, Green and Sustainability Scholar	Morocco
17	University	Research	Researcher in Sustainable Supply Chain Management	UK
18	Industry	Manufacturing and Service	Organizational Development and Management Consultant	Cyprus
19	University	Research	Sustainability Management Scholar	Cyprus
20	Industry	Manufacturing—OEM *	Supply Chain Development Professional & Management Systems Auditor	UK

* OEM—Original Equipment Manufacturer.

The main objectives of the study were to verify the following through expert feedback:

- The relationships between the 7 ISO 9001:2015 quality management principles, supply chain integration principle of supply chain management and triple bottom line sustainability in the context of organizational sustainable development (Section 5.1)
- The SSCQM conceptual framework developed to facilitate organizational and supply chain sustainability performance improvement (Section 5.2)
- The diagnostic tool developed to allow maturity assessment of the 8 principle under the SSCQM research framework, facilitating organizational gap analysis (Section 5.3)

The experts indicated their opinions and suggestions on various aspects under investigation through quantitative (Likert scale agree/disagree questions) and qualitative feedback (open ended questions). The feedback data collected was analyzed in quantitative (percent agreement consensus analysis) and qualitative (thematic synthesis) components. This brought together a mixed research method approach, which is highly limited in the QM, SCM and sustainability integration literature, although the benefits implied for management research [19,90]. Similar view point was reinforced, outlining that combination of qualitative and quantitative methods leads to data enrichment and establishment of more balanced views with enhanced reliability, on the research inquiries [91]. In this study, the consensus (above 75% agreement) has been reached on all theoretical and conceptual aspects of our developments at the first round. On the other hand, although the achievement of expert consensus, a number of improvement areas were identified and implemented as a result of the thematic qualitative feedback analyses (presented in Section 5) on the areas of relatively lower consensus and circulated back to the Delphi panel for further feedback and confirmation. The ratio of response obtained at the first round was realized as 100%. The response at the final confirmation stage was not mandatory therefore, the ratio of response measure was not deemed as applicable to this stage.

5. Results




5.1. Verification of Theoretical Relationships and Propositions

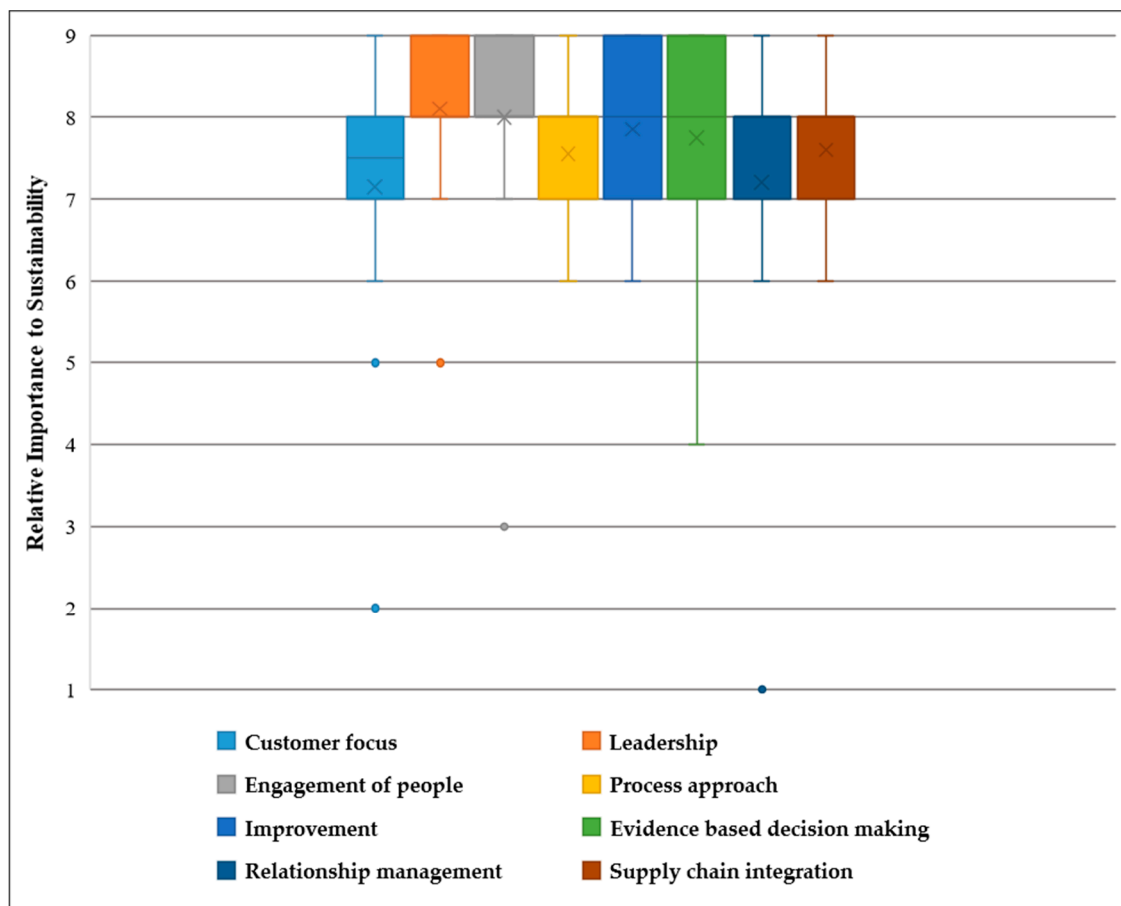
The aim of this section was to verify the relationships between the ISO 9001:2015 QM principles, supply chain integration principle of SCM and triple bottom line sustainability, framed under the SSCQM theory and concept. Delphi panelists were asked to indicate their opinion on whether they agree or disagree that the principles under consideration can be used towards improvement of economic, ecologic and social sustainability.

Furthermore, the experts ranked the 8 SSCQM principles according to their relative importance to integration and improvement of sustainability in the organizational context, using a scale of 1 (not important) to 9 (extremely important). The rankings of the 20 panelists were averaged, resulting in the final relative importance scores and determination of the principle hierarchy rankings for sustainability. The findings are presented in Table 5. The boxplot presented in Figure 7 demonstrates the statistical range and quartile values of the relative importance rankings, outlining the level of variability in the judgements of our Delphi panel.

The positive relationship between the 8 SSCQM principles and TBL sustainability has been verified through high (90% and above) percent agreement consensus rates among the Delphi study experts. Additionally, the relative importance of the principles to sustainable development was established (i.e., most important principle—leadership; least important principle—customer focus).

Table 5. Expert consensus analysis on the relationships between the 8 management principles framed under the theoretical framework of SSCQM and sustainability.

Principle	Consensus (Percent Agreement)			Relative Importance to Sustainability	Hierarchy Ranking
	Economic 	Ecologic 	Social 		
Leadership	95%	95%	95%	8.10	1st
Engagement of People	95%	95%	100%	8.00	2nd
Improvement	100%	100%	95%	7.75	3rd
Evidence based decision making	100%	100%	100%	7.75	4th
Supply chain integration	100%	100%	90%	7.60	5th
Process Approach	95%	95%	90%	7.55	6th
Relationship management	100%	95%	100%	7.20	7th
Customer Focus	95%	90%	100%	7.15	8th

**Figure 7.** Statistical summary—relative importance judgements regarding SSCQM principles.

5.2. Verification of Conceptual Framework for Sustainable Development

5.2.1. Quantitative Analysis—Conceptual Framework

Verification criteria for Delphi studies include the verification of practical relevance aspects of the proposed conceptual framework such as completeness, correctness, conciseness and clarity [92]. The aim of this section was to verify these aspects fundamental to the operationalization of the proposed SSCQM approach, as a conceptual framework to facilitate sustainable development of organizations and supply chains, results of which are provided in Table 6.

Table 6. Expert consensus analysis on the correctness, completeness, clarity, conciseness, and supply chain deployment aspects of the conceptual framework.

Correctness	Rating
New management approaches are much required for integration of sustainability into management processes for sustainable development	100%
The components of the framework are aligned with established theories and methodologies	95%
Quality and supply chain management principles adopted in this framework are compatible for integration of sustainability into management structures of organizations	95%
Plan-Do-Check-Act and step-by-step structure utilized is feasible for this type of framework for driving continual sustainability improvement	100%
The framework facilitates measurement and improvement of organizational sustainability performance	90%
The framework facilitates managerial decision making and action deployment with reference to sustainable development	100%
The framework contributes to the body of knowledge through a novel framework integrating Sustainability with Quality and Supply Chain Management	95%
Completeness	
The framework is complete to drive integration of sustainability into organizational processes	95%
The framework covers all essential steps necessary to drive continual sustainable development	95%
Clarity	
The description of the components aligns with the framework	100%
The description of the framework is explicit and clear	95%
The application of the framework is feasible	95%
Conciseness	
The framework is neither complex nor over simplified	90%
The interconnections between the components of the framework are clear	90%
The framework is of practical use to industry	95%
Supply Chain Deployment	
The promotion and implementation of similar SSCQM assessments at the upstream and downstream of supply chain networks will provide cumulative sustainability assessments and improvements for supply chains	85%

5.2.2. Qualitative Analysis—Conceptual Framework

The experts were also given the chance to express their opinions, suggestions and criticism through open ended questions, providing their reasons for disagreement with any particular aspect of the conceptual framework, outlining their suggestions for improvement. The qualitative data was then analyzed systematically through following the five key stages (compiling, disassembling, reassembling, interpreting and concluding) for thematic coding and synthesis as suggested by [93]. All recommendations recorded as part of the qualitative feedback were first compiled in the form of a list, validity of the suggestions confirmed, valid suggestions disassembled into codes/themes, then reassembled according to these themes and the results interpreted in the form of a concept map. As shown in Figure 8, eight suggestions were recognized as valid, which have been categorized into key themes and presented in the form of a concept map of the qualitative feedback collected. These eight suggestions were concluded as three key areas of “completeness”, “clarity”, and “pilot study required to demonstrate practical implementation aspects”, pointing towards improvement opportunities regarding these areas of the conceptual framework along with their weightings represented with the percentages (e.g., 25% of the suggestions were noted with regards to the “completeness” aspect of the conceptual framework).

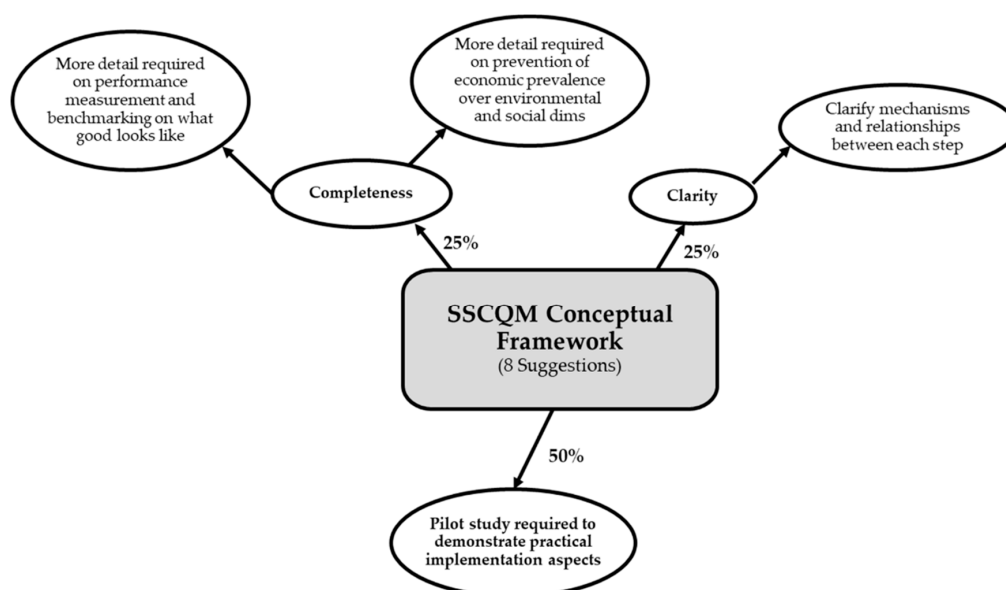


Figure 8. Thematic Map for SSCQM Conceptual Framework Qualitative Feedback.

5.2.3. Changes Adopted and Conclusions—Conceptual Framework

Consensus was reached in all aspects (i.e., correctness, completeness, clarity, conciseness, supply chain deployment) of the conceptual framework (85% and above against the consensus acceptance rate of 75%). On the other hand, in the light of the qualitative analysis, several key further development themes were established as presented in Figure 8, and the conceptual framework updated and re-shared with the Delphi panel for confirmation as described in Table 7. The changes implemented as a result of the Delphi panel feedback and suggestions are denoted in Table 2 with “*”.

Table 7. Key suggestion themes and actions implemented in the conceptual framework.

Suggestion Theme	Action Implemented
Pilot study required to demonstrate practical implementation aspects	The diagnostic tool and the conceptual framework to be validated through a case study as the next step of the research to analyze and demonstrate practical implementation aspects
Clarify mechanisms and relationships between each step	“Management level” column added for further clarity and detail on the management level of planning/decision making
Further detail required on performance measurement and benchmarking on “what good looks like”	Detail on GRI sustainability indicators, reporting and benchmarking added to clarify KPI identification and measurement
Further detail required on prevention of economic prevalence over ecologic and social dimensions	Additional comment added on clear separation of economic, ecologic and social sustainability along with emphasis on adoption of a balanced view on triple bottom line

5.3. Organizational Principle Maturity Assessment Tool

5.3.1. Quantitative Analysis—Tool

The aim of this section was to verify the indicators for the 8 SSCQM principles and verify the usability of the diagnostic tool developed. Delphi study specialists indicated their opinions on whether they agree or disagree that the indicators formulated accurately represent the management principles under consideration to allow maturity level assessments, the results of which are presented in Table 8.

Table 8. Expert consensus analysis on the indicators of eight SSCQM principles.

Principle	Consensus Rate
Customer Focus	89%
Leadership	89%
Engagement of People	89%
Process Approach	89%
Improvement	79%
Evidence based decision making	95%
Relationship management	89%
Supply chain integration	79%

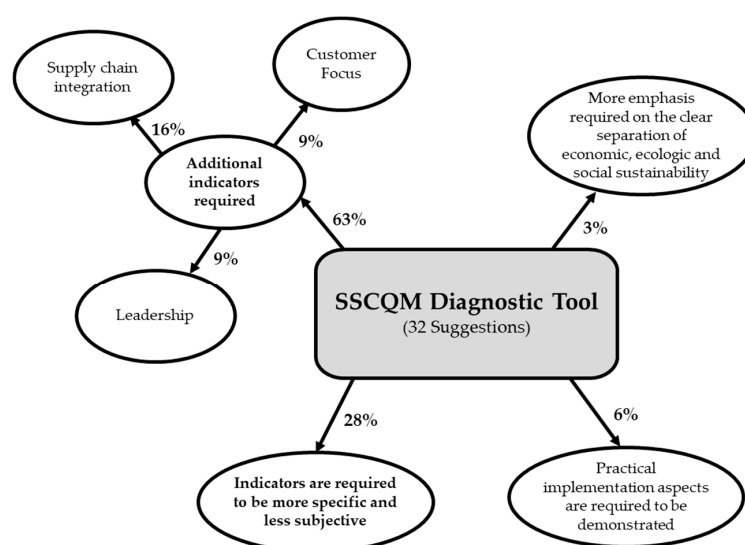
The experts were then asked to rate their agreement levels on the various aspects of the tool developed and the results are tabulated in Table 9.

Table 9. Expert consensus analysis on the practical relevance of the diagnostic tool developed.

Aspect	Rating
The diagnostics tool enables maturity assessment of prospective sustainability management principles	100%
The diagnostics tool enables gauging alignment of organizational mechanisms, structures and processes with sustainability parameters	95%
The application of the tool is feasible	100%
The tool is of practical use to industry	95%

5.3.2. Qualitative Analysis—Tool

Similar to the conceptual framework, qualitative feedback was collected from the Delphi panel regarding the diagnostic tool and its indicators, capturing potential suggestions for improvement and additional indicators judged as essential to definition and maturity assessment of the management principles under the SSCQM framework. The systematic thematic analysis and synthesis process described in Section 5.2.2 was also followed for analysis, interpretation and conclusion of the qualitative feedback captured (compiling, disassembling, reassembling, interpreting, and concluding as suggested by [93]). Thirty-two valid suggestions were recognized and grouped under four improvement categories of “additional indicators required”, “indicators are required to be more specific and less subjective”, “more emphasis on the clear separation of TBL”, and “demonstration of practical implementation aspects” as presented in the thematic concept map in Figure 9.

**Figure 9.** Thematic Map for SSCQM Diagnostic Tool Qualitative Feedback.

5.3.3. Changes Adopted and Conclusions—Tool

Consensus was reached in all aspects (indicators and practical relevance) of the diagnostic tool (79% and above against the consensus acceptance rate of 75%). Contrariwise, in the light of the qualitative analysis, several key further development themes were established, and the diagnostic tool and the conceptual framework updated and re-shared with the Delphi panel for confirmation as shown in Table 10. As demonstrated in Figure 9, key suggestion theme was established around inclusion of additional indicators to enable more accurate and representative maturity assessments, in particular for the “supply chain integration”, “customer focus”, and “leadership” principles. With a view to address this, indicators put forward by the Delphi specialists were captured as part of the qualitative feedback and included in the diagnostic tool, as denoted in Table 3 with “*”. The Delphi participants also brought attention to development of more specific and less subjective indicators to mitigate risk of assessment variability. Stemming from this recommendation, the “look for” column has been embedded in the tool as a fundamental development action through definition of specific mechanisms, processes and activities key to implementation of each indicator to allow more objective and repeatable assessments (complete list enclosed in the Appendix A).

Practical implementation for demonstration purposes was further noted as a recommendation, which forms the next step of our research to apply the tool and the concept developed in their intended context, with a view to outline practical and contextual factors for application including the enablers and barriers. Finally, a suggestion revolving around the signification of separate assessments that are required for economic, ecologic and social sustainability was captured. Further clarity on this aspect has been provided on the conceptual framework, emphasizing the adoption of a balanced view on triple bottom line, as denoted in Table 2 with “*.”.

Table 10. Key suggestion themes and actions implemented in the diagnostic tool.

Suggestion Theme	Action Implemented
Additional indicators required	Indicators for each principle fully revised, embedding 14 additional indicators as per Delphi panelist suggestions
Indicators are required to be more specific/less subjective	“Look for” column added, specifying organizational mechanisms and/or specific requirements for each indicator
Practical implementation aspects are required to be demonstrated	The diagnostic tool and the conceptual framework to be validated through a case study as the next step of the research to analyze and demonstrate practical implementation aspects
More emphasis required on the clear separation of economic, ecologic and social sustainability	Additional comment added to the conceptual framework on clear separation of economic, ecologic and social sustainability along with emphasis on adoption of a balanced view on triple bottom line

6. Discussion

This research addressed a current matter that is highly relevant to our society and industry: integrating the multi-dimensional phenomenon of triple bottom line sustainability into organizations for sustainable development. Stemming from the strategic positions and deep roots of the influential management philosophies, quality and supply chain management, three key research questions were formulated on how these approaches may enable integration of sustainability (RQ1), which principles within these philosophies can be used towards sustainable development (RQ2) and how such an approach can be conceptualized and operationalized for industrial application (RQ3). In the light of these, a theoretical framework was presented in Figure 2, as originally introduced by [19] and developed by [24], outlining the complementing role of ISO 9001:2015 and supply chain integration principles for sustainable development. This research finding echoes with the QM and sustainability

integration literature [4,9,19,22,34,35,53]; as well as the stakeholder management, supply chain management and sustainability integration literature [17,29,59,94], emphasizing the role of QM and SCM in firm performance improvement and sustainability. The viewpoints of other references in this special issue are further supported with our theoretical, conceptual, and empirical contributions towards the linkage of ISO 9001 and sustainable development including [95], that concluded the facilitating role of ISO 9001 in the implementation of organizational environmental practices in their state-of-the-art systematic review study and [96], that laid out the integral role of business excellence models and their associated management principles in organizational sustainability assessment.

The fashioned perspective framed under sustainable supply chain quality management (SSCQM) was translated into an extensive conceptual framework in Figure 3, along with a diagnostic tool presented in Figure 5, providing a road map for implementation in organizational contexts [24]. As part of this, a detailed set of indicators were provided for each principle in Table 3 along with detailed descriptions (“look for” information provided for each indicator in the Appendix A) to allow gap analysis, maturity assessments, benchmarking studies, and an avenue for sustainability embedding and improvement. The conceptual framework adopted a step by step approach as outlined in Table 2, incorporating strategic, tactical and operational elements for continual integration, measurement, and improvement of sustainability in organizations along with a supply chain deployment strategy that is demonstrated in Figure 4.

The theory and the concept developed was then verified through an international Delphi panel, that established a high level of consensus on both the theoretical (relationships between the 8 SSCQM principles, and TBL sustainability—presented in Table 5) and practical (correctness, completeness, clarity, conciseness, and supply chain deployment—presented in Table 6) aspects of the framework. All the management principles framed under SSCQM achieved an overall highly important rating (the average of importance scores ranging from 7.15 to 8.10 where 9 is extremely important) as shown in Table 5. Furthermore, the quartile statistics summary of the Delphi specialist judgements regarding the relative importance of the SSCQM principles to integration and improvement of organizational sustainability was provided in Figure 7 in the form of a box plot, pointing towards a strong consensus among our international Delphi panel, with most of the principles achieving a statistical range above the score of 6 out of 9 (where 9 is extremely important). Additionally, the experts favored certain principles against the others, placing the principles of “leadership” [4,17,35,53,57]; “engagement of people” [35,47,53,54,58]; and “improvement” [4,35,47,53] as the three most important principles for organizational sustainable development respectively, resonating with the standpoints of several scholars in the literature. These findings underline the critical role of senior management direction, commitment and an embedded improvement culture at all levels of the organization for integration and development of sustainability. On the other side, at least one expert considered “customer focus”, “engagement of people”, and “relationship management” as “not significantly important” to sustainability, denoted as outliers in Figure 7. Although, this represents a very low percentage of the Delphi panel expert opinions, these principles are put forward for a more in-depth investigation and will be closely monitored in the next step of our research, where the concept and tools developed are planned to be applied in an organizational setting.

Moreover, significant implications are offered for industry and academia, pointing towards a priority based approach to integrating sustainability through QM and SCM principles, where the improvement opportunities and risks regarding the more important principles can be strategically prioritized based on the principle maturity assessments and contextual circumstances involved, as demonstrated in the simulation case of Figure 5. Sharing the views of [8,11,21,32,35,54], stakeholder risk based approach formed the foundations of the SSCQM concept, aligning the sustainability integration and development efforts with the context of the organization and the needs of parties key to its existence. There are currently a number of quantitative and qualitative tools utilized in the industry for sustainability assessment and decision making [97]. Our diagnostic tool adds to this list of quantitative tools through management principle, sustainability integration and overall organizational sustainable

development score determination to guide embedding of triple bottom line into measurement and decision making processes [97].

Although the theoretical and conceptual standpoints in this paper were constructed upon quantitative and qualitative data from a wide range of authors with different backgrounds, certain limitations are reasonably relevant, such as the contextual factors of “who, where, and when” that map the generalizability, constraints, application range and boundaries of every research proposition [39,40]. With a view to address this issue, an in-depth Delphi study was conducted for verification of the theoretical relationships, conceptual framework and diagnostic tool developed. Although the wide utilization base and clear benefits offered by the Delphi study method in verification of novel concepts, limitations of this approach include: the opinion (not fact) based outcomes due to representation of perceptions of a group of experts [98]; bias introduced by researcher during the selection of experts [99]; and selection of which elements to include in feedback [87]. Several measures were taken to reduce impact of these shortfalls such as selection of experts with high interest to take part in the study from various backgrounds, sectors and geographical regions and adoption of a systematic quantitative and qualitative data analysis and feedback process.

Ultimately, this paper entails several contributions to the quality, supply chain and sustainability integration, and management body of knowledge. Firstly, the well-recognized principles of quality management and supply chain management have been redefined in the form of indicators, processes, and mechanisms from the lens of the current and future imperative, sustainability, presented in the form of a novel, quantitative organizational assessment tool to guide sustainable development. This tool formed the foundations of an operationalization map, prescribing the industrial managers and practitioners with the steps, tools and techniques key to integration and continual improvement of sustainability in organizations and supply chains. More importantly, the practicality, suitability and novelty of such an approach has been empirically verified through an extensive Delphi study, not only evidencing the relationships between ISO 9001, supply chain integration and triple bottom line sustainability, but also determining the hierarchy and relative importance among these significant phenomena. To the best of our knowledge, this is the first study to rank the ISO 9001 principles according to their importance to organizational sustainability through structured Delphi study feedback, which suggests significant implications to over a million organizations and their practitioners currently certified to ISO 9001 and to many more that are planning to adopt this influential methodology [24].

7. Concluding Remarks and Future Research Directions

This study is one of the first studies to empirically put forward the highly supportive role of ISO 9001 methodology and its principles in embedding and driving organizational sustainability, unfolding its fruitful potential beyond the originating agendas of customer satisfaction, quality and firm performance improvement. This entails significant implications for managers in a wide base of industries adopting ISO 9001 philosophy, that can fashion their quality management systems and its principles to integrate measurement and monitoring of not only financial KPIs but also environmental and social KPIs for sustainable development. Furthermore, it is highlighted by our study that leadership and engagement at all levels of the organization form the foundations of a successful and complete implementation of TBL sustainability at strategic, tactical and operational levels. The implementing managers may choose to commence assessment from the more important principles revealed by our Delphi study as “leadership, engagement of people, and improvement”.

As in the case of every organizational transformation initiative, senior management commitment and vision remains key to successful application and embedding of the concept and tool provided in this paper. Determination, prioritization, and alignment with stakeholder requirements with reference to sustainability is set at the heart of our model. Current state analysis is also noted as a fundamental step in the journey towards sustainable development, establishing organizational sustainability strengths, weaknesses, opportunities, and threats under the facilitation of the diagnostic

tool introduced, outcomes of which will direct improvement action decision-making. Expanding the view to the supply chain level, exchange of information, resources, expertise, collaboration and alignment with inter-organizational partners are identified as critical activities for sustainability improvements across the overall supply chain networks, which is the ultimate target for true sustainable development.

Future research is encouraged for further verification, validation and development of the SSCQM phenomenon and its constructs under varying scenarios of who, where and when (e.g., the variables of business cultures, regions, market conditions and sectors) [40]. A similar view point was shared by our Delphi expert panelists, suggesting demonstration of the propositions, concept, tools and techniques introduced in this paper in a real organizational scenario, along with critical evaluation of the practical implementation aspects to facilitate industrial application and potential ways of overcoming roadblocks, challenges and resistance that may be faced on the organizational transformation journey towards sustainable development. Hence, as part of the next steps of our research, a detailed case study is planned for implementation at an organization and supply chain, further analyzing qualitative and quantitative outcomes of the SSCQM philosophy.

A further research agenda also revolves around further development of the SSCQM concept and business diagnostic tool, to minimize and/or eliminate subjectivity during industrial implementation, adopting enhanced structure, coding and guidelines for the application of the tool where the mechanisms required are broken down as part of the SSCQM scoring system and GRI sustainability indicators and sustainability priorities established as a result of the voice of the stakeholders analysis are further incorporated into the maturity assessment process.

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Appendix A. Sustainable Management Principle Assessment (Diagnostic) Tool Indicators

Indicators		Look for
1. Customer Focus		
1.1	Are the current and future sustainability needs and requirements of current and potential customers identified, and risk analysis conducted?	Sustainability awareness and expectations feedback sought from key markets and customers. Current and future TBL sustainability requirements of key customers identified. Risk analyses with reference to customer sustainability needs and requirements carried out.
1.2	Is there engagement with the customers with regards to their sustainability awareness and expectations?	Customer and market sustainability awareness questionnaires/interviews. Customer feedback with ref. to sustainability captured. Customer sustainability awareness training conducted periodically with key customers of the business. Sustainability improvement projects and outcomes communicated periodically to key customers.
1.3	Are the sustainability needs and requirements of customers aligned with the objectives of the organization?	Sustainability needs, and requirements of key customers/markets identified. Sustainability KPIs are established as per GRI framework, aligned with customer/market needs and requirements. Customer sustainability KPIs are embedded into organizational objectives for monitoring and improvement.
1.4	Is the customer satisfaction with reference to sustainability performance of the organization measured and monitored along with implementation of actions as appropriate?	Customer and market sustainability satisfaction feedback captured, evaluated, and actioned via questionnaires/interviews or similar. Customer satisfaction feedback capturing process includes sustainability.
1.5	Are the sustainability needs and requirements of customers communicated throughout the organization?	Sustainability needs, and requirements of key customers established. Sustainability needs, and requirements of customers are communicated to employees at all levels periodically. Communication channels identified and supported.
1.6	Are the organizational members at all levels aware of customer sustainability needs and requirements?	Sustainability needs, and requirements of customers are communicated to employees at all levels periodically. Communication channels identified and supported. Employee feedback with reference to customer sustainability requirements is captured, evaluated and actioned.
1.7	Are the needs and appropriate expectations of the interested parties that can affect customer satisfaction with reference to sustainability performance identified and actioned?	Needs and expectations of key stakeholders (interested parties) that can affect customer satisfaction with reference to sustainability performance identified, risk analyses conducted and actioned appropriately.
1.8	Are the products, services and processes of the organization aligned with the sustainability needs and requirements of the customers and the market?	Sustainability needs, and requirements of key customers/markets identified. Current product/services/processes sustainability performance monitored and controlled in line with customer sustainability performance expectations. Customer sustainability needs/requirements reviewed and implemented as part of New Product/Service/Process Introduction processes.
2. Leadership		
2.1	Are the leaders of the organization committed to sustainable development through clear mission, vision, policies and objectives?	Sustainability mission, vision and policies for environmental, social, and economic sustainability are in place and are reviewed periodically. Sustainability objectives for economic, social, and ecologic sustainability are in place in line with the voice of the stakeholder's analysis of the organization. Performance against the sustainability objectives is monitored by senior management and controlled.
2.2	Are the sustainable development mission, vision, policies and objectives articulated throughout the organization?	Sustainability mission, vision, policies and objectives for environmental, social, and economic sustainability are communicated periodically at all levels of the organization. Communication channels for periodical communication are identified and are supported.
2.3	Is the organization-wide commitment to sustainable development encouraged?	Organizational sustainability values are in place and are part of the recruitment processes with reference to sustainable development. Organizational commitment statement is in place and is communicated to key stakeholders (employees, suppliers, public etc.). Contribution to sustainability improvement activities is encouraged, recognized, and rewarded.
2.4	Is the workforce provided with the necessary resources, training, and authority to drive sustainability improvement activities?	Sustainability awareness and performance measurement training conducted. Resources required for key sustainability KPI monitoring and improvement are identified and supported. Roles & responsibilities with reference to sustainability improvement activities are defined and authority established.
2.5	Are people in the organization inspired and encouraged to engage in sustainability improvement activities, being recognized both at individual and team levels?	Key contributors to sustainability improvement activities at individual and team levels identified, recognized, and rewarded.

Indicators		Look for
2. Leadership		
2.6	Is benchmarking analysis conducted with similar operations and organizations?	Benchmarking analysis is conducted with similar organizations and operations identified in the market for key sustainability KPIs of the organization. Sustainability information is transferred between similar organizations for benchmarking, cooperation, and improvement. Improvement actions are deployed and monitored as appropriate.
2.7	Are the leaders of the organization at all levels positive examples to people in the organization with reference to sustainable development?	Organizational sustainability values are in place and are part of the recruitment processes. Leaders that possess the sustainability values of the organization are recruited. Leaders reinforce sustainable development values of the organization.
2.8	Does the organization review the effectiveness of its sustainability leadership policies? Is feedback collected and actioned?	Sustainability policies are in place. The effectiveness and adherence to policies are evaluated periodically. Feedback is captured from employees at all levels for evaluation and control.
3. Engagement of people		
3.1	Is there a common understanding and awareness of sustainability among the employees at all levels of the organization?	Sustainability awareness training is conducted periodically for employees at all levels. Benefits of sustainability improvement projects demonstrated. Importance of sustainability and sustainable development articulated. Sustainability mission, vision, policies and objectives articulated to employees at all levels.
3.2	Is collaboration promoted for sustainable development throughout the organization?	Organizational sustainability objectives are aligned with departmental, team, and individual objectives. Cross-functional teams and sustainability circles are established to facilitate collaboration for sustainability improvement.
3.3	Is sharing of knowledge, experience, and information facilitated among employees for sustainable development?	Information, knowledge, and experience sharing sessions are held periodically for employees at all levels.
3.4	Is the workforce empowered to determine constraints, challenge current practices, take initiatives, and contribute to sustainable development as required?	Key contributions to sustainability improvement and learning activities at individual and team levels identified, recognized, and rewarded. Self-managing teams are established for sustainability performance measurement and improvement. Contribution to sustainability improvement encouraged through the clear mission, vision, policies and objectives.
3.5	Is there an established communication with people to promote understanding of the importance of their individual contribution to sustainable development?	Employees at all levels encouraged to participate in sustainability improvement activities and benefits of sustainability improvement projects demonstrated. Key contributions are recognized and rewarded. Sustainability communication sessions are held periodically for employees at all levels.
3.6	Is people's contribution, learning, and improvement with reference to sustainable development recognized and acknowledged?	Key contributions to sustainability improvement and learning activities at individual and team levels identified, recognized, and rewarded.
3.7	Are roles, responsibilities, and levels of authority for individuals defined with ref. to sustainability?	Roles & responsibilities with reference to sustainability performance measurement and improvement activities are defined and authority established.
3.8	Do the people of the organization conduct self-evaluation of performance with reference to their contribution to the sustainable development against personal objectives?	Sustainability improvement objectives of the organization and teams are linked with personal objectives of the employees. Sustainability KPIs of the organization are measured and are available to all employees. Employees can self-evaluate their performance in line with their personal objectives that are linked to the sustainability perf. of the organization.
4. Process approach		
4.1	Are the sustainability objectives of the organization defined along with the processes necessary to achieve them?	Sustainability objectives for economic, social, and ecologic sustainability are in place in line with the voice of the stakeholder's analysis of the organization. Sustainability KPI monitoring and improvement processes are established and in place.
4.2	Are the high-risk activities and processes determined for organizational sustainability performance (sustainability risk-based thinking)?	Risk analyses conducted for organizational sustainability performance. High risk activities and processes for organizational sustainability performance determined.

Indicators		Look for
4. Process approach		
4.3	Are the high-risk processes and their interrelations managed effectively and efficiently as a coherent system in line with sustainability objectives?	High risk activities and processes for organizational sustainability performance determined. Sustainability performance of high-risk activities and processes measured, evaluated, and controlled. Effectiveness of sustainability improvement projects on high risk processes evaluated periodically.
4.4	Are the organizational capabilities understood and resource constraints established and actioned with reference to sustainable development?	Organizational capabilities and resources required to achieve organizational sustainability objectives are established and actioned.
4.5	Is the necessary information available to monitor, analyze, and improve the sustainability performance of the overall system?	Sustainability objectives for economic, social, and ecologic sustainability are in place in line with the voice of the stakeholder's analysis of the organization. Sustainability KPI monitoring and improvement processes are established and in place. Sustainability KPI information is captured, reviewed, and actioned periodically.
4.6	Is there an established process to capture organizational learning with reference to sustainable development?	Process is in place for sustainability information, knowledge, learnings, and experiences to be documented and shared periodically among the employees at all levels of the organization. Sustainability improvement projects status and their benefits to key stakeholders documented and communicated periodically.
4.7	Is the authority, responsibility, and accountability established for managing processes in line with sustainability objectives?	Sustainability objectives for economic, social, and ecologic sustainability are in place in line with the voice of the stakeholder's analysis of the organization
5. Improvement		
5.1	Are the sustainability improvement objectives implemented at all levels of the organization?	Sustainability objectives for economic, social, and ecologic sustainability are in place in line with the voice of the stakeholder's analysis of the organization. The sustainability objectives are communicated at all levels and are aligned with departmental and personal objectives.
5.2	Are sustainability performance KPIs implemented along with defined measurement and improvement processes, in line with the sustainability priorities of the organization (Step 0)?	Economic, social, and ecologic sustainability KPIs for measurement, reporting, and improvement established as per the GRI framework in line with the VOS analysis. Improvement objectives for each KPI in place along with timescales and review mechanisms.
5.3	Is the workforce trained and competent in promoting, tracking and completing sustainability improvement projects in line with the objectives?	Workforce are trained in improvement project management tools and techniques. Workforce are fully aware of sustainability KPIs and objectives of the organization. Roles, responsibilities, and authority for sustainability improvement projects are established. Projects are tracked, formally reviewed and issues are actioned.
5.4	Are the sustainability improvement considerations incorporated into the new product, process, and service introduction processes?	New Product/Service/Process Introduction processes include sustainability performance considerations and improvement, in line with the organizational mission, vision, policies, and objectives. Sustainability aspects and impacts reviewed and actioned as part of New Product/Process/Service Introduction processes.
5.5	Does the organization promote innovation with regards to sustainability when developing and introducing new products and services?	Key contributions and innovations for sustainable product and service development are recognized and rewarded.
5.5	Are the sustainability improvement projects' planning, implementation, completion, and results tracked, reviewed and audited?	Sustainability improvement project tracking process is in place. Project management resources are in place for sustainability improvement projects. Sustainability improvement projects status are formally reviewed by senior management and issues are logged and actioned appropriately.
5.6	Is organizational sustainability improvement recognized and acknowledged?	Key contributions to organizational sustainability performance improvement is recognized and rewarded. Organizational sustainability improvement scheme is in place.
5.7	Is there a process to implement sustainability improvement projects throughout the organization?	Sustainability improvement projects are developed, evaluated, prioritized, and supported based on risk analysis. Resources required for each improvement project identified and supported.
6. Evidence based decision making		
6.1	Are the key performance indicators (KPI)s for organizational sustainability improvement objectives identified, monitored, and controlled?	Voice of the stakeholder's analysis conducted, identifying the TBL sustainability priorities of the organization. Economic, social and ecologic sustainability KPIs for measurement, reporting, and improvement established as per the GRI framework. Improvement objectives for each KPI in place along with timescales and review mechanisms.

Indicators		Look for
6. Evidence based decision making		
6.2	Is the workforce trained and competent in sustainability performance data capturing, evaluation, and analysis methods?	Employees at all levels are fully aware of economic, ecologic, and social sustainability and their indicators. Sustainability KPIs are communicated to employees at all levels along with defined roles & responsibilities. Sustainability awareness training conducted to all personnel periodically. Sustainability performance measurement tools & techniques training conducted to all relevant personnel.
6.3	Is accurate and reliable data and information measured and evaluated for organizational decision making and sustainability improvement action deployment?	Sustainability performance data and information captured as per GRI framework guidelines. Sustainability performance data is reported periodically to senior management for monitoring and control purposes. Sustainability performance improvement actions tracked and documented.
6.4	Is employee feedback on sustainability within the organization captured and evaluated?	Feedback captured periodically from employees at all levels with reference to sustainability performance and improvement. Employee sustainability improvement scheme in place. Employee sustainability feedback analysis and improvement process in place.
6.5	Is all data and information with reference to sustainability improvement available to the relevant people throughout the organization?	Roles & responsibilities with reference to sustainability KPI monitoring and improvement defined throughout the organization. Sustainability performance data and information captured and presented to process owners at all levels and performance reviewed by senior management.
7. Relationship management		
7.1	Are the current and future sustainability needs and requirements of **interested parties identified, and risk analysis conducted?	Key stakeholders identified. Sustainability awareness and feedback sought from key stakeholders. Current and future TBL sustainability requirements of key stakeholders identified. Risk analyses with reference to stakeholder sustainability needs and requirements carried out.
7.2	Are relationships with employees managed for sustainable development?	Employee relationship management process in place. Feedback sought from employees with reference to TBL sustainability performance and improvement. Employees at all levels encouraged to participate in sustainability improvement projects and benefits of sustainability improvement projects demonstrated.
7.3	Are relationships with customers managed for sustainable development?	Customer relationship management process in place. Market analysis conducted on sustainability needs and requirements. Feedback obtained from customers with reference to their sustainability needs and requirements. Customers included in sustainability improvement projects. Benefits of sustainability improvement projects communicated to the customers.
7.4	Is the information, feedback, expertise, and resources being exchanged with other interested parties for sustainable development?	Key information and resources required for TBL sustainability performance/priorities identified. Key stakeholders identified along with their information needs and categorization of resources possessed/availability. Process in place for periodical exchange of information, expertise, and resources with key stakeholders.
7.5	Are collaborative sustainability improvement activities established with suppliers, partners, and other interested parties?	Current and future TBL sustainability requirements of key stakeholders identified. Risk analyses with reference to stakeholder sustainability needs and requirements carried out. Sustainability improvement projects established for high risk areas with key stakeholders.
7.6	Are sustainability improvements and achievements by external providers and partners recognized and encouraged?	Sustainability performance and improvement is part of long-term business deals and contractual agreements with suppliers. Improvement targets of cross-enterprise sustainability projects agreed and in place. Process in place for supply chain members that take part in sustainability improvement projects to be recognized and awarded. Benefits sought communicated and shared.
8. Supply chain integration		
8.1	Is sustainability a shared value across the supply chain network?	Sustainability training and awareness sessions held with key supply chain members. Sustainability is communicated as a core value of the business and forms part of contractual supply chain agreements.
8.2	Is information being shared between supply chain members with reference to sustainable development?	IT Support for sustainability information sharing in place. Key communication channels for sustainability performance monitoring and improvement identified and in place between supply chain members. Accuracy of the information periodically verified between all parties.
8.3	Are joint cooperation activities being held across the supply chain including cross-enterprise participation for sustainable development?	Team members identified from each participating organization in the supply chain. Joint sustainability improvement projects in place. Participation in joint cooperation activities agreed contractually. Benefits of joint cooperation communicated to all parties.

Indicators		Look for
8. Supply chain integration		
8.4	Is supply chain integration for sustainable development encouraged, rewarded, and benefits mutually shared?	Suppliers/customers that actively take part in sustainability improvement projects are identified. Rewarding process in place for key contributors. Economic, environmental, and social benefits sought as a result of joint activities mutually shared.
8.5	Is future business linked to supply chain integration for sustainable development?	Sustainability performance is part of supplier selection process. Sourcing decisions include sustainability of the suppliers/supply chain. Suppliers/Customers that actively take part in joint sustainability improvement projects are recognized and awarded future business.
8.6	Is risk analysis conducted, identifying high-risk supply chains and suppliers for prioritization of supply chain integration for sustainable development?	Risk analyses for environmental, social, and economic sustainability conducted periodically. High risk supply chains and suppliers for sustainability identified and prioritized. Sustainability improvement projects coordinated across the supply chain based on risk.
8.7	Is there an association among supply chain members based on commitment, long term, orientation and trust with reference to sustainable development?	Sustainability performance and improvement is part of long-term business deals and contractual agreements with suppliers. Improvement targets of cross-enterprise sustainability projects agreed and in place. Process in place for supply chain members that take part in sustainability improvement projects to be recognized and awarded.
8.8	Is a supply chain integration statement in place with appropriate KPIs to monitor effectiveness and drive improvement?	Declaration of commitment to sustainable development objectives in place between all parties. Improvement targets of cross-enterprise sustainability projects agreed and in place. KPIs with reference to TBL sustainability are identified monitored, and controlled by all parties.

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