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An Archaic Modelling-Based Approach Towards Sustainability While Integrating Supply Chain Management Through Digitalization

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Abstract: The current study aims to answer two main research questions: What are the challenges in implementing Sustainable Supply Chain Management (SSCM) in Supply Chain Management integration and can new methodologies effectively integrate supply chain management with sustainability. The study focuses on improving the supply of deliverables, including industrial management and process engineering concepts, through the integration of processes. The stabilization of the supply chain system can be achieved through sustainability, and the study explores the use of system modeling as the foundation for integrating supply chain management. The study highlights the importance of cross-functional teams in streamlining supply chain processes, and how organizations can apply this concept to their manufacturing processes and other related processes such as inventory control, warehousing, and logistics.

Keywords: Supply Chain Management; Integration; Deliverables; Modelling; Digitalization

1. Introduction

Multi criteria decision making in enhancement of supply chain processes with Mathematical and System Modelling plays an important role in simulation of real-time solutions as well as applications in the current industries that includes manufacturing sector, retail sector, process industries, project management and consultancy services, educational sectors, stock and supplies merchandising, etc.

Not only this, online and virtual models play an important role in escalation of digital business such as B2B marketing and online shopping ventures. This commonly includes big business units such as Amazon, Alibaba, Flipkart, Myntra, Walmart, Swiggy, Zomato, etc. Due to the success of digital ventures some traditional ventures have also started their online sales and distribution in which flagships have governed by some restaurants and food delivery deliverables. Some of these transformable deliverable business ventures are Pizza Hut, Dominos, Mc. Donald, Slice of Italy, KFC, etc.

In this context the main purpose is to characterize the modelling approaches followed during the execution and management of supply chain system. Here the review of some selected cases is made and then concluded with an analysis[1-3]. The engagement of deep relationships or partnerships in supply chain system forms a strong bond between the company and the suppliers as well as vendors in order to integrate the supply chain management system of any organization. This can virtually be systematized in the form of a modelling approach from where identification of the real bottom line for the successful integration of the supply chain management system is done.

Furthermore analysis of the sustainable supply chain management complexity can be understood by sectioning it into five types of complexities that include the following: Decision-making complexity, Structural complexity, Behavioral complexity, Ecological complexity and Geographical complexity as what deemed fit and belief of the authors of this paper. When chiefly envisaged about the analysis, then some complexities are depicted as dependent types while other are direct and independent. Dependent complexity require more effort in order to leap the gap while fostering towards excellence in persuasion during the integration of Supply Chain Management System[4-6].

Since supply chain management procedures are taken into consideration, integrated supply chain management refers to an enterprise resource planning (ERP) strategy. Instead of having various systems or the cascade effect inside the firm, an effective business system controls all distribution and logistics operations through a single system and enables connections with all of its suppliers. The integrated supply chain method primary advantages are concentrated professional experience and cost effectiveness. A coordinated system for managing the logistics and transportation functions of a manufacturing,

wholesale, or retail organization is known as supply chain management (SCM)[7-9].Optimizing efficiency in supply chain distribution operations is the main goal of supply chain management. With an integrated supply chain approach, everyone in the chain works together to provide the highest value to customers. The study is focused on handling the general scenario of a manufacturing business, where ERP plays a significant role in Supply Chain Integration (SCI) by ensuring sustainability.

In the current research, it is proposed to use the IoT and cloud computing methods, which can be based upon AI and ML techniques. Where with IoT based embedded devices, viz. Logistics Vehicles, packaging devices and machineries, stores' inventory devices and warehouses, it becomes very transparent while retrieving the required data that enable real-time tracking and monitoring of supply chain activities, from raw material sourcing to final product delivery. Enhancing supply chain resilience and risk management is essential for mitigating the impacts of climate change, natural disasters, geopolitical instability, and other external shocks. The objective should be to develop digital tools and predictive analytics capabilities that enable companies to anticipate and respond to sustainability-related risks in a timely and proactive manner. Finally, the objective is to foster a culture of innovation and continuous improvement within the supply chain. This involves encouraging experimentation with new technologies, business models, and sustainability practices, as well as learning from both successes and failures to drive ongoing progress towards sustainability goals.

2. Literature Review

The application of operational research and related models i.e. formal modelling for closed loop Supply Chain Management and reverse logistics is effectively reviewed. Numerous possibilities and insights can be gained from expanding the type of tools and factors considered in formal modelling efforts. Overall it can be stated that model-based SSCM is comparably a young and increasingly developing research discipline. The study employs a systematic and methodologically rigorous process to review quantitative SSCM models. The study also uses content analysis to access a large sample of related papers and to identify current gaps and future perspectives of model-based SSCM research. The essence of increased flows in information in order to incur more profits needs a proper insight in focusing upon analytical approach in order to combat supply chain issues. Thus a deep focus is needed upon supply chain modelling. For this the relationships of the firms with their organizations is very much essential. Indeed these relationships require firms to view the supplier not as an enemy but rather as a collaborator, or to put it another way, not as a cost but as a capability[10-13].

Car manufacturers are currently attempting to develop the 'three day car', from order to manufacture to delivery. With the enhancement in digitalization for integration of supply chain management and related processes, now-a-days many internet based marketplaces are growing popularity. But due to lack of awareness the electronic marketplace is mostly neglected by researchers and do not properly handled by e-commerce institutions and organizations. So a need for examination of electronic marketplaces and its related categories is necessary as this finds relevancy of supply chain management in various market segments. The role of Information Technology continuously finds useful in possessing an immense incite in order to attain an implied Supply Chain Management[14-17]. This will thus integrate activities of supply chain which results in achieving a better service quality to the stakeholders, chiefly customers. In exploring the evaluation of supply chain integration propose a framework for evaluating the portfolio of integration technologies that are used to unify inter-organizational and intra-organizational information systems. The permutations of information systems are defined and classified that are available according to their characteristics and integration requirements.

The level of idiosyncratic investments to supply chain partners, the degree of dependence between supply chain partners and the level of product stability of manufacturer would enhance commitment and consequently the integration of the Supply Chain Management business process. The level of supply response allows buyers to customize their products/services and have them delivered with surprising speed. To achieve performance gains and supply chain integration (SCI) in organizations, the management need to develop an IT enabled infrastructure in order to attain operational excellence as well as revenue growth. This is aided with the information flow, material flow and funds flow as well as by collaborating with other partners from same domain which results in effective governing ability for regulating essential supply chain processes efficiently[18-21].

The relationship between Quality Management (QM) and Supply Chain Management (SCM) and its impact on organizational performance is not well understood. The current literature mostly focuses on using traditional technology for supply chain integration. The role of Sustainable Supply Chain Management (SSCM) is to generate valuable inter-organizational resources and provide a competitive advantage through collaboration on environmental and social issues. Further case study research is needed to understand the complex interrelationships between firms in Supply Chain Integration (SCI). Integrating resource-oriented strategic management, SCM, and SSCM with social network theory and organizational theory is crucial for explaining

inter-organizational processes such as mutual organizational learning and trust-based interdependencies between supply chain actors. QM has been considered a crucial strategic management tool for two decades and should be applied to all levels of an organization. SSCM has evolved to consider sustainability as the triple bottom line and is becoming a theoretical framework. The importance of Service Supply Chain Management is also highlighted, and operational models are used to make fair business decisions related to the service supply chain. However, there is a lack of empirical research on the effects of situational factors on information integration success in SCM[22-28].The integration of SCM and ERP software will result in a unified, smooth system that is better suited to boost an enterprise's productivity and efficiency. The integrated system also enables the business to manage the flow of raw materials from suppliers, have a more thorough understanding of its entire operations, and optimize its production schedules. Timely information that is consistently exchanged throughout the whole system is a key component of SCM. More than 60% of Fortune 1000 organizations, according to the study, have installed basic ERP, finance, and human resource management systems.[29-31].

The results of the paper indicate that combining Quality Management (QM) and Supply Chain Management (SCM) can lead to the integration of both approaches, resulting in significant organizational benefits. The paper focuses on integrating QM and SCM through shared practices and provides a new contribution to the understanding of the crucial factors for effective integration of Supply Chain Quality Management.[32-35].

This research delves into the enduring impacts of the COVID-19 pandemic on supply chains, suggesting a lasting transformation in their operational landscape. It evaluates disruptions, challenges, and emerging trends resulting from the pandemic across various supply chain stages and aspects. A proposed framework aims to navigate supply chains through COVID-19, fostering global value chain enhancement and ongoing improvements. Concurrently, organizations are increasingly adopting Machine Learning, Deep Learning, and Data analytics in supply chain management to mitigate transportation costs and optimize processes. This integration of ML is deemed essential for sustainable development and growth across different companies. Additionally, a mathematical model assesses transportation disruptions' impact, balancing production and shipping decisions while considering economic and environmental factors. In the context of low carbon business operations, a hybrid MCDM model incorporating DEMATEL, ANP, TOPSIS, and fuzzy methodologies aims to effectively evaluate and select low carbon suppliers. This study also identifies key variables and barriers influencing last mile delivery performance, offering managers valuable insights for enhancement. Notably, it is among the pioneering research endeavors to scrutinize last mile delivery challenges within Indian warehouse distribution, thereby contributing uniquely to the field.[36-40].

Because it takes into account more stakeholder requirements, larger sustainable performance targets, enhanced sustainable business practices and technology, and linkages among those organizations, sustainable supply chain management (SSCM) faces higher complexity. Compared to conventional supply chains, SSCM is more challenging to manage and run due to this added complexity. Modern science's reductionist research paradigms need the development of novel research methodologies for complex systems. In the context of cloud-based technology results show that it has positive effect on SCI and the cloud enabled SCI is positively related to supply chain performance which eventually influenced firm sustainability. This research extends prior research of information and communication technologies enabled SCI and its effect on supply chain performance which overly remains inconsistent.

3. Research Methodology

Observational findings during the literature review has made this research paper approach towards generating a model based process in SCI. This model will cover important aspects which include information and communication technologies in fusion with the conventional standard operating procedures for generating a thorough aspect which correlates the important parameters in consideration with the scope of current work.

So, strategy adopted is supportive in the generation of the model. This modelling technique explains the general and analytical phenomenon related to the hypothesis of this study which follows an archaic approach towards integration of supply chain management through sustainability.

3.1 Description of modelling technique

The basis of effective SCI always intended towards its in-house processes which are the key role players for enhancing Supply Chain Management. While studying various literature reviews we would like to participate by bringing self-thought ideas as a part of the contribution. As per the reviewed papers, where the basis of strong ERP implementation and thus making it enabled through information & communication technologies such as cloud based serving processes. This basis put an ideation in making the models which show the role of a cloud based enabled ERP in SCI. Here an approach is made with the help of business models for a manufacturing organization which constantly make their feedback on the basis of cloud enabled ERP thus maintaining sustainability.

In the current models we have centralized the ERP system by making the information system server as a cloud based application which is accessible to the concerned delegates and business processes managers. The information across the centralized server is shared through cloud based technology (probably IOT basis). The integration limits extends from Baseline foundations to Frontlines Business processes thus leading towards effective quality and supply chain management.

The baselines foundations are referred to backend departments which includes Production Planning & Control Department, Quality Control Department, Inventory & Material Handling Department, Purchase & Procurement Department, Quality Assurance Department, and After Sales & Services Department. On the other hand the frontlines business processes are referred to as frontend departments which includes Marketing & Survey Department, Research & Development Department, Business Analytics & Due Diligence Department, Corporate Planning & Human Resource Department, Business Process Outsource (BPO) & Knowledge Process Outsource (KPO) Department.

Now accordingly Two Models get generated, bearing same target for integrating the Supply Chain Management but with different approaches. The First Model (Fig. 1) is a generalized form of model that explains the basic functionaries of various departments through cloud enabled ERP where each department is directly connected with the information system in the form of a centralized server. This model is represented as follows:-

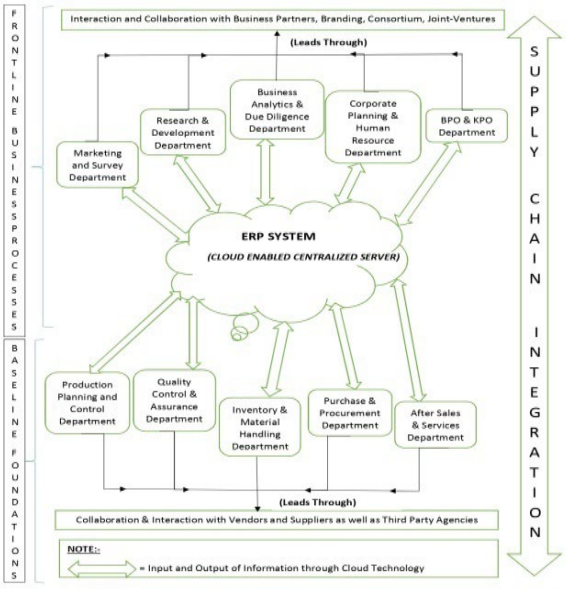

Fig. 1: Model showing the role of cloud based enabled ERP in SCI: Our approach through a business model for a manufacturing organization witnessing sustainability

The Second Model (Fig. 2) is more focused upon analytical procedure. Here various departments already segmented between two limits of the integrated process will work as different variables. Here the model itself reveal as a symbol of cyclic integration. The SCI is mentioned as a cyclic interaction methodology where the variable at frontline matches with the variable of baseline, thus forming a complete cycle.

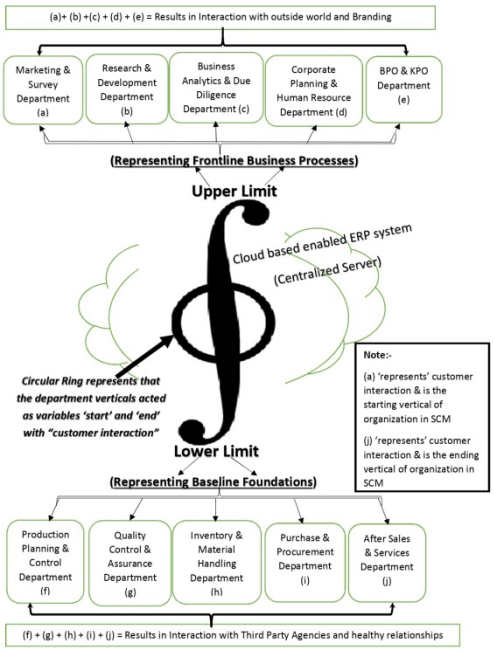

Fig. 2: Model showing the role of cloud based enabled ERP in SCI analytically: Our approach through a business model for a manufacturing organization witnessing sustainability through circular ring

In this way the above model gives rise to analytical approach in understanding the concept for SCI and hence can be helpful while application in mathematical modelling techniques.

3.2 Problem formulation related to the generated models' hypothesis

The current modelling approach is based upon a manufacturing organization. The key segments which are an important part of current models are the various departments associated in serving the ERP system continuously thus making it consistent. Let us first briefly explain these different departments effort to be taken in a hierarchy order as below:-

3.2.1Marketing & Survey Department :

This is the first and the foremost department for starting up any business unit. Its primary objective is to bring orders in form of work and projects for its organization for business development. It focuses on current market trends mixed with consumer behaviour.

3.2.2Research & Development Department :

Next comes research & development department which focuses on practical applications and simplifications of problems faced in society. This department tries ro develop a best fit product for consumer need and satisfaction.

3.2.3Business Analytics & Due Diligence Department :

This is the third department which monitors all the predecessor and successor activities of a complete product life cycle. It generally devise strategies in order to sustain in market with cost optimization by accounting all the business verticals and departments. It is also known as the department of highest authority in an organization.

3.2.4Corporate Planning & Human Resource Department :

This department seeks the order from business analytics & due diligence department for resource allocations to each and every department vertical. It evaluates and apprise further regarding deployment of human resource throughout the organization.

3.2.5BPO & KPO Department :

These are the short dialing facilities of customers for any problem and query related to the product. Any query or complaint through customer is first lodged here and then transferred to the concerned department.

3.2.6Production Planning & Control Department :

This department generally works with all aspects of manufacturing and defining a set standard targets by evaluating materials and manufacturing requirements in order to earn productivity. It generally seeks the order from marketing department. It is regarded as the nucleus of the manufacturing plant.

3.2.7Purchase & Procurement Department :

This department arranges all resources in form of materials needed for successful operation of a manufacturing plant. This department takes the orders from Production Planning & Control Department and directly deals with outside vendors and suppliers.

3.2.8Quality Control & Quality Assurance Department :

This department sets its own principles and targets and perform its ultimate effort in achieving all of them. Its working starts during the Incoming Goods Inspection and continues till product delivery to end customer and thus prevails till guarantee and warrantee periods.

3.2.9Inventory Control & Material Handling Department :

This department reserves the raw material need for manufacturing. This raw material comes from outside vendors and suppliers. When the product is ready to be dispatched (after manufacturing , testing and inspection) then this department keeps it safe in the assigned logistics area as Finished Goods.

3.2.10After Sales and Services Department :

Once the finished goods get transferred from logistics to the distributors & whole-sellers where the product reaches the retailers and thus finally to end customer, this department interacts with the end customer for commissioning of product as well as any repairment arises under warranty period or any replacement occurs under guarantee period.

Now coming to the current model based approach we will now try to generate some mathematical concepts out from them. Here both of the current models lead to same conclusion but by adapting different approach. So as per First Model (Fig. 1) we draw out some conceptions in a tabular form as follows:-

Table 1: Conceptual study of First Model referring Fig. 1

Concept	Deliverable(s)	Leads to/ Results In
Baseline Foundations	Production Planning & Control Department Purchase & Procurement Department Quality Control & Quality Assurance Department Inventory Control & Material Handling Department After Sales & Services Department	Basic SCM or Basic Supply Chain Management (I)
Frontline Business Processes	Marketing & Survey Department Research & Development Department Business Analytics & Due Diligence Department Corporate Planning & Human Resource Department BPO & KPO Department	QM or Quality Management (II)

When baseline foundations and Frontline business processes are combined then this too results in the combination of basic Supply Chain Management (SCM) and quality management which is the resultant for integrated Supply Chain Management. This Integrated Supply Chain Management is enabled through Cloud Based technology which thus provides sustainability. Thus basic SCM and QM when perceived through digitalization is an another form of Integrated and Sustainable Supply Chain Management. Moreover Basic Supply Chain Management covers Quality Control and Quality Assurance Department which on accumulation

with Quality management results in Total Quality Management (TQM). Nevertheless a correlated hypothesis is developed which depicts equivalence of Total Quality Management and Integrated and Sustainable Supply Chain Management. In this way the First Modelling approach and concept is formulated and thus correlated with respect to Fig. 1.

Now, as per Second Model (Fig. 2), here we will draw out the concepts more in an analytical manner where the essence of mathematics comes into play in order to generate the equations and related hypothesis. So we will make some assumptions by considering the different departments mentioned by us in form of variables which are the major considerations in calculus. Thus we will try to formulate this methodology with reference to the concept of Integration (calculus) and then correlating the same with an Integrated approach towards SSCM. Let us consider an Assumption 1 where Department(s) taken as variables for simplicity are marked as (a), (b), ……., (j). Therefore the above briefly described departments are marked as follows :-

Table 2 : Marking of departments taken as variables for simplicity in the formulation work referring Fig. 2

S.N.	Name of the department (taken as variable)	Marked as
3.2.1	Marketing & Survey Department	(a)
3.2.2	Research & Development Department	(b)
3.2.3	Business Analytics & Due Diligence Department	(c)
3.2.4	Corporate Planning & Human Resource Department	(d)
3.2.5	BPO & KPO Department	(e)
3.2.6	Production Planning & Control Department	(f)
3.2.7	Purchase & Procurement Department	(g)
3.2.8	Quality Control & Quality Assurance Department	(h)
3.2.9	Inventory Control & Material Handling Department	(i)
3.2.10	After Sales and Services Department	(j)

Also as per assumption 1 the department hierarchy is also defined depending upon their influence in an organization as given below:-

(a)← (b) ← (c) ← (d) ← (e) ← (f) ← (g) ← (h) ← (i) ← (j) ----------eq. A

{ where ← 'arrow direction' represents that department (a) is the first variable as it develops a business and department (j) is the last variable as it concluded with final installation &commissioning of the product after the product is sold.}

Here as per the concept of First Model we have splitted the deliverables in form of variables into Baseline Foundations and Frontline Business Processes which are categorized again into Lower Limit and Upper Limit in reference to the concept of calculus integration. This can also be illustrated with the help of a table shown below :-

Table 3: Conceptual study of Second Model referring Fig. 2

Concept	Deliverable(s)	Leads to/ Results In
Lower Limit (related to Baseline Foundations)	(f), (g), (h), (i), (j)	Summation of variables lead to Interaction with outside world and Branding
Upper Limit (related to Frontline Business Processes)	(a), (b), (c), (d), (e)	Summation of variables lead to Interaction with third party agencies and Healthy Relationships

Now combining the two concepts mentioned in Table 3 we get the flow of processes from lower limit to upper limit as:

(a), (b), (c), (d), (e) [Upper Limit]
↑ ----------eq. B
(f), (g), (h), (i), (j) [Lower Limit]

{Which itself is the resemblance of a definite integration (calculus) process}

Also,

(a) + (b) + (c) + (d) + (e) = Interaction with outside world &Branding ----------eq. C

(f) + (g) + (h) + (i) + (j) = Interaction with Third party agencies & Healthy Relationships -----eq. D

Moreover,

(a) = customer interaction {refers to Marketing & Survey Department, first variable}

&

(j) = customer interaction {refers to After Sales & Services Department, last variable}

Therefore, (a) = (j) ----------eq. E

Putting the values from equation E to equation A we see that the complete hierarchy as per equation A changes to a closed loop or a cyclic order as shown in the Fig. 3.

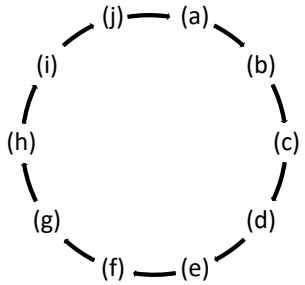

Fig. 3: A closed loop formed showing each and every variable as equal entity.

As shown in Figure 3 as a resultant of equation A and equation E, every variable is equal entity and has its own

importance which on connection with other variable gives consistency and thus sustainability. This closed loop (Fig. 3) forms the basis of cyclic integration process with respect to the Second Model (Fig. 2) and upon taking these variables from lower limit to upper limit a definite integration is formed (as per equation B and Fig.3). This cyclic integration with sustainability is known as Integrated SSCM.

In this way the Second Modelling approach and concept is formulated and thus correlated with respect to Fig. 2. Here the hypothesis of the concept is correlated with calculus.

4. Results and Discussion

Based upon current Research Methodology and techniques adopted here in bringing the concept in the form of model-based approach, correlation of the outcomes of current models is made based on manufacturing organization processes. The benign and archaic approach thus help the future researchers in turning around the concepts into mathematical studies as well.

The First Model (Fig. 1) is characterized as a Generic type model where simple explanations are needed to explain the whole SCI concept. Here the evolving of Baseline foundations (lower limit for second model) lead towards the Basic Supply Chain Management concept that as a result gives rise to collaboration and interaction with vendors & suppliers as well as third party agencies in order to promote the feasibility of processes further, thereby enhancing business of one's organization thus maintaining reliability. Next evolving of Frontline Business Processes (upper limit for second model) lead towards Quality Management concept that as a result gives rise to collaboration and interaction with business partners through Branding, Consortium and Joint-Ventures in order to achieve Customer satisfaction and market goodwill in the eyes of stake holders.

So together both the Baseline foundations and Frontline Business Processes gives rise to Integrated Supply Chain Management with a consistency which we may call as sustainability. Thus we may define this collaboration of sustainability and integration in Supply Chain Management as, "A well organized and well developed principles of standard processes and various department verticals in an organization combined for planning, executing and working constantly and continuously while focusing upon Customer and Vendor Satisfaction."

This togetherness of both the Baseline foundations and Frontline Business Processes is referred to as the fusion which enhances Integrated SSCM and is also directly proportional to Total Quality Management. Thus we can further enhance the current hypothesis in having a sound correlation or equivalence of Integrated SSCM and TQM.

Also, with this approach and in perception to our definition above we can nomenclate this methodology as ISSCM (Integrated Sustainable Supply Chain Management). The term which can be used widely in order to carry out the research work progress further.

The Second Model (Fig. 2) is considered as an Analytical type model where a mathematical expression of calculus is used to define a complete model along with a circular ring which covers a complete cyclic process among various department verticals thus maintaining sustainability. Here also both the lower limit and upper limit consisting of baseline foundations and frontline business processes evolve as a numerical sum of the different departments consisted under them, the different departments marked from (a), (b), (c), (d), (e),……. (j) act like variables, whose minute performance matters to the sustainability and integration of supply chain management. The upper limit variables sum (a) + (b) +(c) + (d) + (e) = Results in Interaction with outside world and Branding. Similarly the lower limit variables sum (f) + (g) + (h) + (i) + (j) = Results in Interaction with Third party agencies in order to develop healthy relationships among vendors as well as suppliers so that joining hands on hands will make the overall process consistent and constant which will lead to sustainability. Likewise the upper limit variables sum also lead to sustainability through branding and developing a sense of security among the customers.

Moreover, in industrial modernization every associated entity in any form with any vertical of the organization is treated as a stake holder. As what we have quad erat demonstrandum from problem formulation that in Second modelling approach the variable (a) is associated with customer interaction which is the first department of a manufacturing organization i.e. Marketing and Survey Department where forecasting happens depending upon the customer's response on a particular product in the market. This hierarchy of operations continued till the last departmental vertical which is After Sales & Services Department marked as variable (j) which is also associated with customer interaction. So the first variable (a) from upper limit is correlated with the last variable (j) from lower limit in terms of stake holder interaction which form a closed loop of processes and thus the circular ring of the cyclic integration represents this closed loop which also envisaged towards consistency which we may call as sustainability as in case of First Model.

So finally, " A complete route from lower limit verticals and variables to the upper limit verticals and variables in a closed loop of a cyclic form in order to achieve branding and healthy relationships among stake holders is known as Integrated sustainable supply chain management" , is another definition for ISSCM based on the current analytical modelling concept.

The process involves collecting the data needed for the case study, followed by pre-processing to ensure its quality. Artificial intelligence and Machine Learning

techniques are then used to build models that aim to accurately capture the patterns in the data. After training, the models are validated using various metrics and applied to real scenarios. Continuous improvement through innovation or retraining enables adaptation to changing circumstances. Transparent documentation facilitates peer review and informed decision making by stakeholders.

5. Conclusions

The cloud based solution always put an archaic advantage over traditional information and communication technologies. Cloud-based solutions indeed offer several advantages over traditional information and communication technologies (ICT). Cloud-based solutions revolutionize supply chain management with real-time visibility, scalability, and enhanced collaboration. Leveraging predictive analytics and AI, they optimize operations and anticipate demand, fostering flexibility and agility. By eliminating upfront hardware costs and bolstering security, they offer a cost-effective and secure alternative. With global reach and seamless connectivity, they empower businesses to navigate complex supply chains efficiently. Overall, cloud technology drives competitiveness and growth in today's dynamic global economy.These essential digital and cloud based services with a definite modelling approach caters the need of an organization thus enhancing its business to grow and excel across multi-dimensional ways. The modelling approach gives us an idea to put a correct check over different operating standard processes along various business departmental verticals. This approach witnesses a close communication of organization within their boundaries (intra-departmental) and across boundaries (inter-departmental).Through this the channel partners helps in maintaining the integrated and sustainable supply chain which is only possible through information integration and the outcome of the paper titled, ”Value of information integration to supply chain management roles of internal and external contingencies.

Secondly carrying the study with a modelling approach helps the researcher in drawing out the result more precisely which is also helpful in carrying out the research work further. Modelling approach gives a pictorial idea about the standard processes encompassing for the integration of SSCM. With the aid of Three Figures and Three tables many concepts were made into a detailed study form. Even some statements are defined for Integrated SSCM for clarifying the concepts, as what authors perceived so far in this study. If this study is deemed fit in the perception of researchers then many new approaches will be the outcomes. Thus, a A modeling approach offers a structured method for integrating Sustainable Supply Chain Management (SSCM) practices into standard processes. It involves:

i. Identification of Key Processes: Pinpointing supply chain processes impacting sustainability.
ii. Mapping of Sustainability Objectives: Defining environmental, social, and economic goals.
iii. Integration of Sustainable Practices: Incorporating eco-friendly strategies like minimizing waste and promoting fair labor.
iv. Measurement and Monitoring: Establishing KPIs to track progress on sustainability targets.
v. Simulation and Optimization: Using modeling techniques to optimize processes while considering sustainability.
vi. Scenario Analysis: Assessing potential impacts of market changes, regulations, and disruptions on sustainability.
vii. Stakeholder Engagement: Involving stakeholders to ensure alignment and gather feedback.
viii. Continuous Improvement: Iteratively refining strategies based on data analysis and feedback.

This approach enables organizations to achieve sustainability objectives while enhancing operational efficiency and competitiveness.

6. Future Scope of work

As very less empirical examinations have been done upon problem formulations related to SCI, so a thorough study will generate the efforts of information integration on firms’ operational excellence and other cost optimization through reviewing with empirical examinations.

Modelling approaches should be made which can be analytical or in form of flow process charts in order to bring out potential contingency findings in the benefit of current manufacturing organizations. Even for consultancy type organizations many models can be designed in order to pace the throughput of their deliverables so as to make their final attainments related to their set objectives and targets. These consultancy organizations again behave as the outside and third party agencies in order to cater the needs of many organizations in the development and hence in enhancing the Integrated Supply Chain Management System.

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