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# Investigation In Improvement Of Supply Chain Factors Through Vendor Managed Inventory: A QFD Approach

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## ABSTRACT

Quality delivery of stock-keeping units (SKU) on time in the agriculture sector is anticipated to play a key role in enhancing the efficiency of services rendered to the farmers who are end users of these products. The delivery of the right products in time is a key component of the efficiency of the supply chain process involved in the system. Function (QFD) is a systematic methodology for translating customer needs and expectations into specific technical requirements during product development. It helps gather customer feedback, prioritize requirements, and map them to engineering characteristics. QFD facilitates cross-functional collaboration, ensuring alignment between customer desires and product features. This research article aims to suggest a quality improvement tool that will help organizations enhance their supply chain process in the agricultural sector. QFD enhances product quality, customer satisfaction, and competitiveness by embedding customer-centricity into the development process, fostering innovation, and reducing the risk of costly design changes post-production. VMI plays a pivotal role in the quality improvement of the supply chain process (SCP). VMI can play a vital role in bridging the gap between the expected indicators. VMI is an effective methodology used to optimize the process quality and in turn, maximize the overall satisfaction of end users from the process. Adopting an integrated approach to VMI and QFD, companies can achieve sustainable improvements across key areas, ultimately positioning themselves for long-term success in the competitive marketplace.

## KEYWORDS

QFD, VMI, SCP, SKU. AGRICULTURE

## 1. INTRODUCTION

The Indian agriculture sector is one of the major players worldwide and is the primary source of livelihood for nearly 55% of India’s population. India has the world's largest cattle herd (buffaloes), the largest area planted for wheat, rice, and cotton, and is the largest producer of milk, pulses, and spices in the world. It is the second-largest producer of fruit, vegetables, tea, farmed fish, cotton, sugarcane, wheat, rice, cotton, and sugar. The agriculture sector in India holds the record for second-largest agricultural land in the world generating employment for about half of the country’s population. Thus, farmers become an integral part of the sector to provide us with a means of sustenance. India's Consumer spending will grow in 2021 after the pandemic-led contraction, expanding by as much as 6.6%. The Indian food industry is poised for huge growth, increasing its contribution to world food trade every year due to its immense potential for value addition, particularly within the food processing industry. The Indian food processing industry accounts for 32% of the country’s total food market, one of the largest industries in India. It is ranked fifth in production, consumption, export, and expected growth. With the competitive advantages of agricultural manufacturing units, quality is an important part of any product or service. The price and quality of the raw material supplied are the utmost characteristics of the agricultural organization. The present industry lacks the application of QFD. In the present paper application of Quality Function Deployment (QFD) on VMI (Vendor Managed Inventory) is described in the context of the supply chain process of the organization. Supply chain processes form the intricate web that connects manufacturers, suppliers, distributors, and retailers, ensuring seamless flow from raw materials to end consumers. Efficient coordination and optimization in sourcing, production, inventory management, and distribution are paramount to meet demand, minimize costs, and enhance customer satisfaction. In today's globalized economy, continuous monitoring and adaptation to market dynamics are essential for agile and resilient supply chains. Effective supply chain management improves efficiency and reduces costs (Prasad, Subbaiah, &Rao, supply chain design through QFD-based optimization, 2014). Supply chain management has become a pivotal part of any industry (Prasad et al., 2016).

## 2. ORGANIZATIONAL INVENTORY SYSTEM

This case study explores a multifaceted organization which is a group of agricultural manufacturing product supply chains catering to the needs of our Indian farmers which is the backbone of the Indian economy. The organization is working with a traditional supply chain. The process starts with different requirements generated by the concerned departments and configured accordingly through a very lengthy process and current inventory and stock sales. The system often creates overstock because it is controlled manually and leads to wastage due to time overrun. The unit has 45000 SKUs out of which nearly 30000 are non-movable and lying unused and 15000 movables. The present inventory management system of the unit comprises three major categories (A, B, C) of the organization of movable SKUs only. The main problem with the present system is that it leads to inconvenience to the supplier (Disney & Towilln, 2003). The main inventory system of the organization is working on the continuous supply of the raw materials used in production and other departments. This research paper will address how vendor-controlled inventory can improve the quality of the supply chain process, and how QFD can assist in unifying process requirements and resource availability on a single platform. The first section of this paper discusses what the management expects from the VMI initiative.

## 3. INFLUENCERS IN THE SUPPLY CHAIN PROCESS

Agricultural organizations face complex of challenges in their supply chain processes, which are critical for the efficient and timely delivery of food and agricultural products to consumers. One major challenge is the unpredictability of weather and environmental factors, which can significantly impact crop yields and harvest times. Sudden droughts, floods, or extreme temperatures can disrupt the entire supply chain, leading to shortages and increased costs. Another challenge is the increasing complexity of supply chains due to globalization. As agricultural organizations expand their operations to serve a broader market, they must contend with longer and more intricate supply chains, making it challenging to monitor and manage each step effectively. This complexity also introduces risks related to transportation, storage, and quality control. Regulatory and compliance issues add another layer of difficulty. Complying with various food safety and quality standards and international trade regulations can be a significant challenge for agricultural organizations. Failure to meet these standards can result in costly recalls and damage their reputation. Labor shortages and workforce management are persistent challenges in the agricultural supply chain. Finding and retaining skilled labor for harvesting, processing, and transportation can be difficult, especially during peak seasons. Agricultural organizations must navigate various challenges in their supply chain processes, ranging from environmental factors to global expansion, regulatory compliance, and workforce management. Successfully addressing these challenges is crucial for ensuring a stable and sustainable supply to consumers.

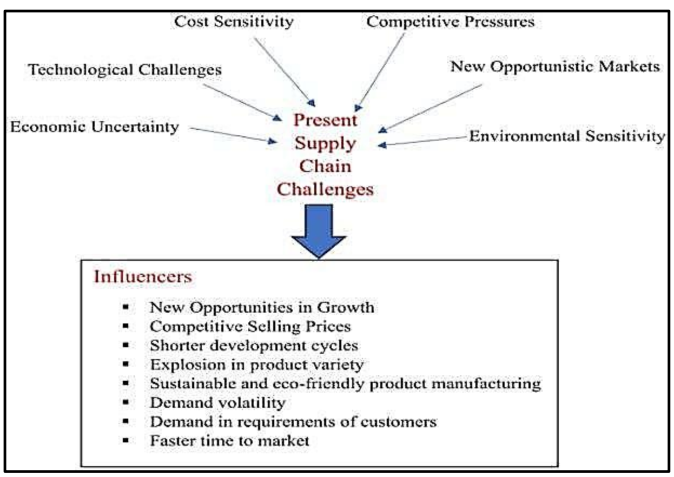


**Fig 1: shows different influences in the supply chain process.**

## 4. LITERATURE REVIEW

The pivotal aspect of the supply chain must be chosen carefully because a service provider's performance plays a crucial part in attaining the goals of the outsourcing process. The supplier selection problem is classified as a multi-criteria decision-making problem because it requires a trade-off between competing tangible and intangible factors to identify the most suitable supplier. This trade-off is impacted by multiple competing factors. Previous researchers used analytic hierarchy process. goal programming, analytic network process, activity-based costing, neural network, rough sets theory, and quality function deployment. Some researchers combined at least two of the above techniques for supplier selection is summarized in table 1 shows various techniques for single sourcing and multiple supplier selection sourcing.

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| Sr. No | Vendor selection techniques | Authors/Researchers |
|---|---|---|
| 1. | **Agency Theory** | Zu and Kaynak (2012) |
| 2. | **AHP** | Hou and Su (2007), Liu and Hai (2005), Chan and Chan (2004), Akarte et al. (2001) |
| 3. | **ANY** | Gencer and Gürpinar (2007), Bayazit (2006), Sarkis and Talluri (2002), Nydick and Hill (1992) |
| 4. | **Case-based reasoning** | Choy and Lee (2002), Cook (1997) Cluster analysis Zenz (1981) |
| 5. | **Conjoint analysis** | Boer, Labro, and Morlacchi (2001) |
| 6. | **DEA** | Braglia and Petroni (2000), Forker and Mendez (2001), Karpak, Kumcu and Kasuganti (2001), Talluri, Narasimhan, and Nair (2006), Talluri and Baker (2002) |
| 7. | **Decision Analysis** | Friedl and Wagner (2012) |
| 8. | **e-constraint method** | Buffa and Jackson (1983) |
| 9. | **Expert Systems** | Wei, Zhang, and Li (1997) |
| 10. | **Fuzzy set theory** | Sarkar and Mohapatra (2006), Florez-Lopez (2007), Chen, Lin, and Huang (2006), Shu and Wu (2009) |
| 11. | **Genetic algorithm** | Vokurka, Choobineh, and Vadi (1996) |
| 12. | **Goal programming** | Karpak, Kumcu, and Kasuganti (2001) |
| 13. | **Linear programming** | Talluri and Narasimhan (2003), Ng (2008) |
| 14. | **Mathematical programming** | Talluri, Wadhwa& Ravindran (2007 |
| 15. | **Mixed integer linear programming** | Hong et al. (2005) |
| 16. | **Mixed Integer nonlinear programming** | Ghodsypour & O'Brien (2001) |
| 17. | **Multi-objective programming** | Narasimhan, Talluri, & Mahapatra (2006) |
| 18. | **Neural networks** | Ding, Benyoucef, and Xie (2003) |
| 19. | **Outranking** | Mummalaneni, Dubas, and Chao (1996), de Boer, van der Wegen, & Telgen (1998) |
| 20. | **Path analysis** | Lo, Sculli, and Yeung (2006), Li et al. (2012) |
| 21. | **Simple weighting** | Dobler and Burt (1996) |
| 22. | **Six Sigma** | Wang, Du, and Li (2004) |
| 23. | **SMART** | Barla (2003) |
| 24. | **Total Cost of Ownership** | Monczka and Trecha (1988), Smytka and Clemens (1993), Degraeve and Rood Hooft |
| 25. | **Uncertainty analysis** | Hinkle, Green, and Green (1969) |
| 26. | **Linear programming** | Talluri and Narasimhan (2003), Ng (2008) |

## 5. FACTORS AFFECTING PRESENT ORGANIZATION PERFORMANCE

Supplier selection in agricultural manufacturing organizations is a critical process that can significantly impact operational efficiency, product quality, and overall business performance. Key factors that play a crucial role in determining the selection of vendors/ suppliers in agricultural manufacturing organizations are:

1. **Quality and Consistency of Supply:** Agricultural manufacturing organizations rely heavily on the consistent supply of raw materials, components, and equipment. Suppliers must demonstrate a track record of providing high-quality products that meet the organization's standards consistently.
2. **Price and Cost**: Cost considerations are vital in supplier selection. Agricultural manufacturers often operate in highly competitive markets with tight profit margins. Suppliers offering competitive pricing while maintaining quality are preferred.
3. **Reliability and Dependability**: Reliability in terms of delivery schedules, product availability, and responsiveness to issues is crucial, and there must be dependable partners capable of meeting production timelines and responding promptly to urgent requests or changes in demand.
4. **Technical Capabilities and Innovation**: Suppliers with strong technical expertise and a commitment to innovation can offer agricultural manufacturers access to the latest technologies, processes, and product improvements. This factor is particularly important in industries where technological advancements drive competitiveness.
5. **Compliance and Certification**: Suppliers must adhere to regulatory requirements and industry standards relevant to agricultural manufacturing. Compliance with food safety regulations, environmental standards, and ethical sourcing practices is essential to ensure product quality and mitigate risks.
6. **Geographic Proximity and Logistics**: Proximity to the manufacturing facility can impact transportation costs, lead times, and overall supply chain efficiency. Suppliers located closer to the organization's facilities may offer logistical advantages and reduce the risk of disruptions.
7. **Financial Stability and Business Continuity**: Assessing the financial stability of potential suppliers is crucial to mitigate the risk of supply chain disruptions due to bankruptcy or financial insolvency. Stable suppliers with a strong financial position are more likely to maintain consistent supply and support long-term partnerships.
8. **Sustainability and Social Responsibility**: Increasingly, agricultural manufacturers are prioritizing sustainability and social responsibility in their supply chains. Suppliers that demonstrate commitments to sustainable practices, ethical sourcing, and corporate social responsibility initiatives may receive preferential treatment.
9. **Relationship and Communication**: Building strong relationships with suppliers based on trust, transparency, and effective communication is essential for long-term success. Open communication channels facilitate collaboration, problem-solving, and the resolution of issues that may arise during the supplier relationship.

**10 Scalability and Flexibility:** Suppliers should have the capacity to scale their operations in response to fluctuations in demand or the organization's growth. Flexibility in production capabilities, order sizes, and contract terms allows agricultural manufacturers to adapt to changing market conditions and business requirements.

## 6. APPLICATION OF QFD IN AGRICULTURE’S SUPPLY CHAIN

The advantage of Quality Function Deployment (QFD) in the agricultural sector offers several benefits. Mainly, it aligns product development and supply chain processes with the specific needs and preferences of farmers, distributors, and consumers, leading to higher satisfaction and loyalty. It also helps to identify and prioritize improvement areas within the supply chain, such as farming practices, transportation, and storage, ultimately enhancing efficiency and reducing costs. Additionally, by involving cross-functional teams and suppliers in the QFD process, organizations foster collaboration and innovation, leading to the development of more sustainable and environmentally friendly agricultural practices. OFD tool incorporates the joint efforts of multiple departments and gives a comprehensive picture of the Company's (customer's) requirements. (Maewall & Dumas, 2012). OFD enables agricultural organizations to deliver high-quality products that meet market demands effectively, while also driving continuous improvement and competitiveness in the industry. It improves the competitive presence of an organization in the market and lowers the cost of services being given to the organization. Many research papers have been published on QFD through which researchers have integrated various methods with QFD. However, research on the combination of QFD and VMI, a supply chain tool that enhances SCM performance overall, has not been explored yet. This study demonstrates how QFD may be applied with the VMI tool to enhance the organization's supply chain process performance.

**What’s and How’s**

This explores customer needs and expectations. It assists in accomplishing the organization's objective and fortifies the organization to strengthen its weak points (Chan, Chan, & Chan, 2002). Below given table 1 represents the expectations of organizational management and attributes of VMI expectations.

**Table 1: Organizational Management's Expectations &Technical Criterions**

| Sr No | Organizational Management's Expectation | (WHA | Max/Min | Organizational Management's Expectations | From VMI (HO |
|---|---|---|---|---|---|
| 1. | Order Filling Rate (OFR) | | Maximum | Optimization of SKU through real-time data. | |
| 2. | Number of Stock out (NSO) | | Minimum | Availability of real-time SKU to the supplier | |
| 3. | Lead Time (LT) | | Minimum | Slack the replenishment order time | |
| 4. | Response Time (RT) | | Maximum | Vendor's response to fill orders | |
| 5. | Inventory Holding Cost (IHC) | | Minimum | Moving SKU from the customer to supplier | |
| 6. | No of head counts in SCM | | Minimum | Reduction in operational and clerical jobs through real data access. | |
| 7. | No of suppliers | | Minimum | Contract management with suppliers. | |
| 8. | Suppliers' liability | | Minimum | Reducing of supplier's contract management. | |
| 9. | Turnaround time of products | | Minimum | Maintaining required stock at supplier's place | |
| 10. | Operational Efficiency | | Maximum | Maximum workforce, working hours | |

**What No 1:** Total inventory cost refers to the overall expenses associated with storing and managing inventory within the organization that typically includes various components such as cost of goods sold, carrying costs, ordering costs, stockout costs, cost of capital.

**How No 1**: Allowing the suppliers through the internet inventory management access will help them to manage real-time data. Suppliers /vendors will monitor the level of stock and manage the optimal SKU level at the same time at both ends.

**What No 2:** Minimum headcount should be maintained in the supply chain department to save organizational costs.

**How No 2:** The use of more technology in the supply chain will help the organization to manage the SKU more effectively thereby reducing human involvement and efforts.

**What No 3**: The rate at which the orders are replenished, must be optimized for the customer so that customer satisfaction is maximized.

**How No 3:** The key organizational management goal of management and stock position planning and forecasting can help achieve it. It can also be helpful to demonstrate the stock or SKU inventory position using real-time data or through organization.

**What No 4:** The critical performance indicator of the organizational supply chain is the minimum number of stock-outs of any item of inventory.

**How No 4**: The Utilization of actual/ real-time data for the warehouse and individual departments, suppliers may effectively manage inventory and avert stock-out situations.

**What No 5**: Turnaround time is the amount of time needed to finish a task from the point of generation and must be minimal for an effective system.

**How No 5**: This can be completed in two stages i.e. the ideal stock level at the vendor's location, and the ideal stock level within the organization by the supplier.

**What No 6**: A minimum number of suppliers results in a streamlined workflow and uniformly high-quality SKUs that are delivered to the organization.

**How No 6**: Contract management for crucial factors like quality, logistics services delivery prices at the company location will help to manage the suppliers' minimum.

**What No 7**: Reduction in financial costs to the organization can be achieved either through optimization inventory cost or through mini suppliers' liability.

**How No 7:** Contract management can help to optimize the good no of suppliers and suppliers must stick to terms and conditions of contract management.

**Table No 2: Shows matrix of technical criteria against expectations of organizational management and vendors**

| How's / What's | Moving SKU's from customer to supplier | Transferring tasks/jobs through real time data process | Redesign SKU stocks level by time data process | Assessment of real time SKU's to suppliers for stocks | Assure min stock at Suppliers end | Design contract Management approval with suppliers | Min supplier and contract management | Management brain storming and approval | Min manpower hours and work hours | Min stock out/ TAT/ Supplier liability/ Max OFR |
|---|---|---|---|---|---|---|---|---|---|---|
| Inventory Holding Cost (IHC) | | | | | | | | | | |
| No head counts in SCM | | | | | | | | | | |
| Order Filling Rate (OFR) | | | | | | | | | | |
| Number of Stock out (NSO) | | | | | | | | | | |
| Turnaround time of products | | | | | | | | | | |
| No of suppliers | | | | | | | | | | |
| Suppliers' liability | | | | | | | | | | |
| Lead Time (LT) | | | | | | | | | | |
| Operational Efficiency | | | | | | | | | | |
| Response Time (RT) | | | | | | | | | | |

**What No 8:** Agricultural enterprise has several similar kinds of products for consumers and cause hassle to the inventory process. Variety in products must be minimized for better inventory management.

**How No 8:** Product codification and Standardization can help to resolve this issue. Management decided to use the product code and brand in the organization for every category after brainstorming.

**What No 9**: Operational efficiency refers to the ability of an organization to deliver goods or services to customers with minimal waste of time, effort, and resources

**How No 9:** The efficiency of the department will be optimized when the supply chain is free from the clerical tasks and the same can be utilized to work on some other productive tasks.

**What No 10:** A sequence of processes in managing the inventory of the supply chain lengthens the total lead time of goods and thus affects overall process efficiency.

**How No 10:** Enhancement in TAT, OFR, Lead Time, accuracy, Min No of stock will help to optimize the cause.

**Quality Function Deployment Matrix and Process**

Quality Function Deployment (QFD) is a structured approach used to translate customer needs and expectations into specific engineering characteristics and requirements. It helps prioritize design features and ensures alignment between customer desires and product design, leading to enhanced quality and customer satisfaction through graphical representation. This matrix is categorized into two phases in which columns show

**What's and How's**. The analysis helps to figure out the strengths and weaknesses of the competitors in the matrix. The roof of the analysis(matrix) shows a correlation between expectations and parameters that represents strong, medium, and weak relationships on a scale of 1-10.

**PHASE 1: CUSTOMER'S REQUIREMENT (VOICE OF CUSTOMER)**

The voice of management is represented in this step which involves gathering management expectations through a questionnaire survey. Ten (10) criteria/ parameters are shortlisted based on a survey of 25 employees of the organization who are directly involved in management. Few of them are at the Top, Middle, and bottom levels managers. The rest are Executive-level managers, General Managers, and Directors who are part of the BOG (Board of Governors) and have the authority to make decisions to achieve organizational objectives.

| | |
|---|---|
| **Optimization of Supply Chain Process** | Inventory Holding Cost (IHC) |
| | No head counts in SCM |
| | Order Filling Rate (OFR) |
| | Number of Stock out (NSO) |
| | Turnaround time of products |
| | No of suppliers |
| | Suppliers' liability |
| | Lead Time (LT) |
| | Operational Efficiency |
| | Response Time (RT) |

**PHASE 2: CUSTOMER'S IMPORTANCE RATING**

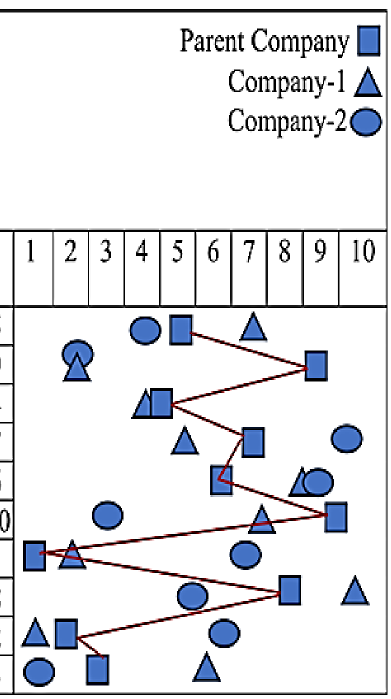
At this level, indicators are rated according to their significance. These scores are derived from an organization-wide poll that takes the sample average. 1 is assigned the factor that is the most significant, and 10 is assigned which is the least.

| | | |
|---|---|---|
| **Optimization of Supply Chain Process** | Inventory Holding Cost (IHC) | 5 |
| | No head counts in SCM | 9 |
| | Order Filling Rate (OFR) | 4 |
| | Number of Stock out (NSO) | 7 |
| | Turnaround time of products | 6 |
| | No of suppliers | 10 |
| | Suppliers' liability | 1 |
| | Lead Time (LT) | 8 |
| | Operational Efficiency | 2 |
| | Response Time (RT) | 3 |

**PHASE 3: CUSTOMER'S RATING FOR COMPETITOR**

The analysis aids in providing and understanding a picture of strengths and weaknesses, which in turn, helps an organization to work on its core weaknesses. This is carried out based on a questionnaire survey.

| Sr No | | | |
|---|---|---|---|
| 1. | Lead Time (LT) | Minimizing | 5 |
| 2. | Operational Efficiency(OEE) | Optimizing | 9 |
| 3. | Order Filing Rate (OFR) | Optimizing | 4 |
| 4. | Inventory Holding Cost (IHC) | Minimizing | 7 |
| 5. | Supplier Liability (SL) | Minimizing | 6 |
| 6. | Head Counts (HC) | Minimizing | 10 |
| 7. | No of Stock out (NSO) | Minimizing | 1 |
| 8. | No of Suppliers (MNS) | Minimizing | 8 |
| 9. | Turnaround Time (TT) | Minimizing | 2 |
| 10. | Response Time (RT) | Minimizing | 3 |




**PHASE 4: TECHNICAL CRITERIONS/ PARAMETERS (PROCESSES VOICE)**

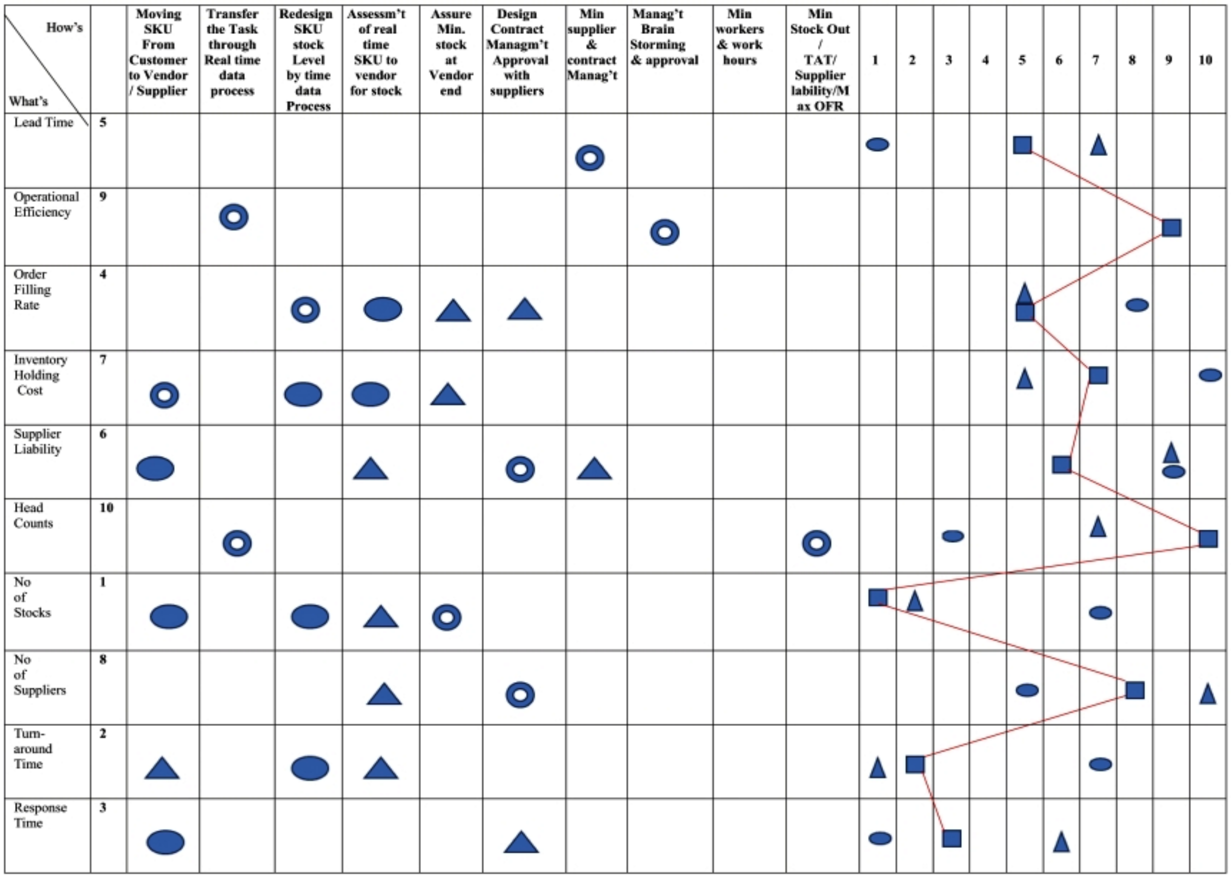
The compiled analysis and ranking of the technical parameters, the management's expectations, the parameter ranking, and the competitor analysis are displayed in this table. Technical Parameters (Processes Voice) are quantifiable statements that evaluate the desired performance of the processes or systems under study. The complete at a glance of construction of **HOQ (House of Quality)** is elaborated below.

| How's / What's | | Moving SKU From Customer to Vendor / Supplier | Transfer the Task through Real time data process | Redesign SKU stock Level by time data Process | Assessm't of real time SKU to vendor for stock | Assure Min. stock at Vendor end | Design Contract Managm't Approval with suppliers | Min supplier & contract Manag't | Manag't Brain Storming & approval | Min workers & work hours | Min Stock Out / TAT/ Supplier lability/Max OFR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lead Time | 5 | | | | | | | | | | | ● | | | | ■ | | ▲ | | | |
| Operational Efficiency | 9 | | | | | | | | | | | | | | | | | | | ■ | |
| Order Filling Rate | 4 | | | | | | | | | | | | | | | ▲ ■ | | | ● | | |
| Inventory Holding Cost | 7 | | | | | | | | | | | | | | | ▲ | | ■ | | | ● |
| Supplier Liability | 6 | | | | | | | | | | | | | | | | ■ | | | ▲ ● | |
| Head Counts | 10 | | | | | | | | | | | | | ● | | | | ▲ | | | ■ |
| No of Stocks | 1 | | | | | | | | | | | ■ | ▲ | | | | | ● | | | |
| No of Suppliers | 8 | | | | | | | | | | | | | | | ● | | | ■ | | ▲ |
| Turn-around Time | 2 | | | | | | | | | | | ▲ | ■ | | | | | ● | | | |
| Response Time | 3 | | | | | | | | | | | ● | | ■ | | | ▲ | | | | |

**PHASE 5: RELATIONSHIP MATRIX**

The above matrix explores the correlation between management's expectation indicators and technical parameters with competitor analysis. In an alignment between strategy and operations, which is so important to the success and survival of any company, the correlation may well be crucial; it enables management's expectation indicators to meet technical parameters. Expected outcomes of management often include performance, efficiency, and innovation targets. These are the indicators that leads to technical parameters like system reliability, engine efficiency and advancement of technology. Having high level of correlation ensures technical capabilities support business objectives, and eventually give rise to coherent grow. Mismatches diminishes performance and potential; this argument amplifies the need to combine managerial familiarity with technical knowledge as a powerful tool for maximal organizational competitiveness. It is represented by a matrix showing Strong, Weak, and medium relationship symbols. The relationship matrix, or House of Quality, visually links customer requirements (WHATs) to technical specifications (HOWs) in agricultural manufacturing. This matrix translates key customer needs like product quality, cost efficiency, and sustainability into specific technical requirements for vendors. This process helps manufacturers communicate expectations clearly, select appropriate vendors, and prioritize technical needs based on customer importance. The structured approach enhances collaboration, ensures alignment with customer expectations, optimizes the supply chain, reduces costs, and improves product quality in agricultural manufacturing. Mapping out the various relationships of parameters, QFD process allows agricultural manufacturers to clearly communicate expectations to their vendors. Thus, it helps in selecting the right vendors who can meet the desired types of SKU and its technical specifications, ensuring the required quality as inputs to the organization. This matrix helps in prioritizing technical requirements based on their importance to customer needs and thus helps in guiding vendors on where to focus their efforts. This structured approach not only enhances communication and collaboration between manufacturers and vendors but also ensures that the end products are aligned with customer expectations. Consequently, QFD and its relationship matrix help in optimizing the supply chain, reducing costs, and improving overall product quality in agricultural manufacturing.

| | |
|---|---|
| ◎ | **STRONG/HIGH** |
| ● | **MODERATE/MEDUIM** |
| ▲ | **WEAK/LOW** |




## PHASE 6: CHALLENGES OF PROCESS

This step explores the challenges of technical factors(variables) in the given matrix which aids in understanding parameters and the process's complexity.

| How's / What's | Moving SKU's from Customer to supplier | Transferring task through real-time data process | Redesign SKU stock level by Time data process | Assessment of real-time SKU to suppliers for stock | Assure minimum stock at suppliers end | Design contract M' ment approval with suppliers | Min supplier and contract management | Management brain storming and approval | Min manpower hours and work hours | Min stock out/ TAT/ Supplier liability/ Max OFR |
|---|---|---|---|---|---|---|---|---|---|---|
| Inventory Holding Cost | | | | | | | | | | |
| No head counts | | | | | | | | | | |
| Order Filling Rate | | | | | | | | | | |
| Number of Stock out | | | | | | | | | | |
| Turnaround Time | | | | | | | | | | |
| No of supplier | | | | | | | | | | |
| Suppliers' liability | | | | | | | | | | |
| Lead Time | | | | | | | | | | |
| Operational Efficiency | | | | | | | | | | |
| Response Time | | | | | | | | | | |
| **Process Difficulty rating** | **9** | **1** | **2** | **4** | **10** | **7** | **6** | **3** | **5** | **8** |

## PHASE 7: TECHNICAL ANALYSIS

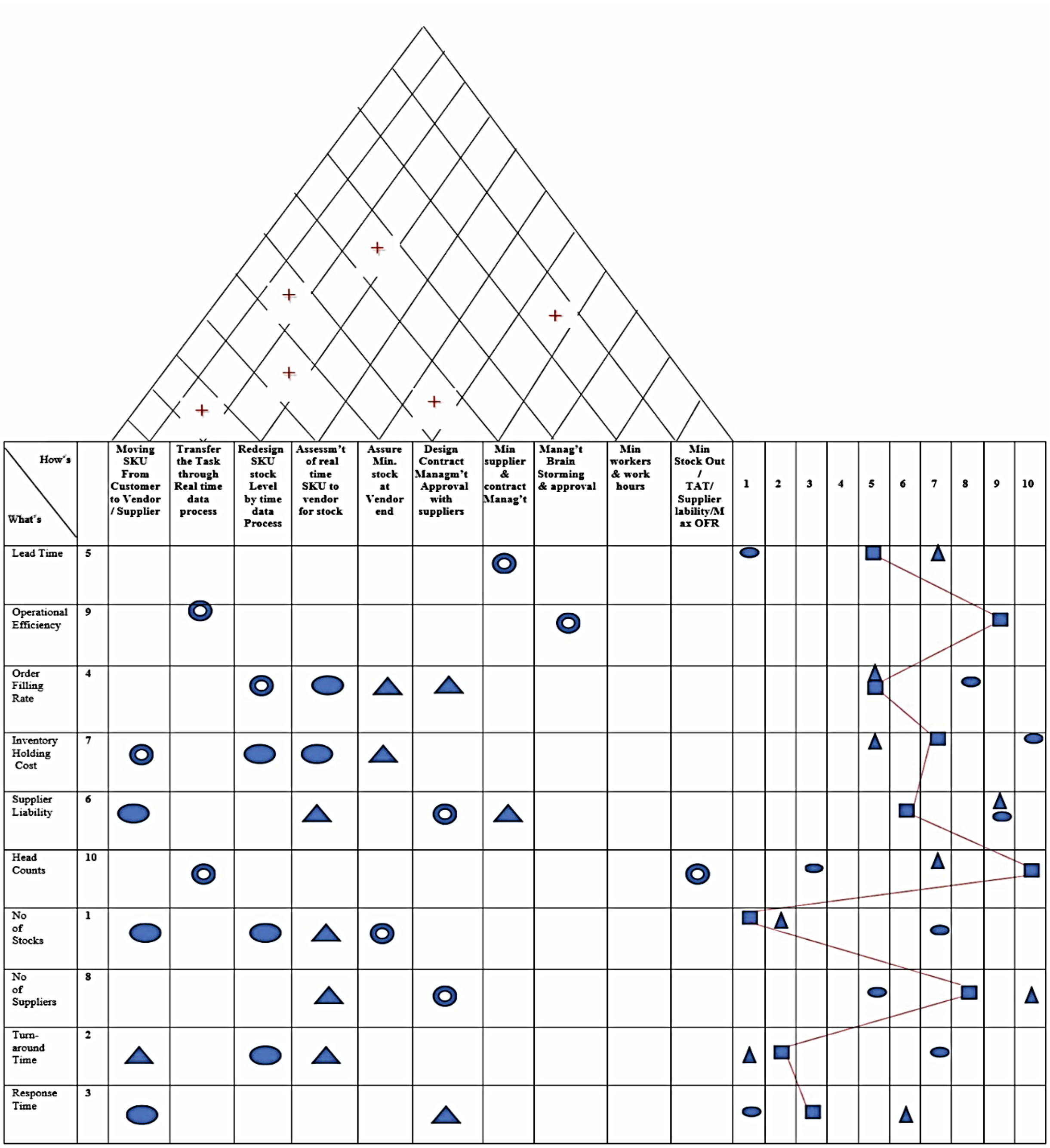
This stage reflects a thorough investigation of the importance rating of the house of matrix. The relevance of each parameter in each technical analysis is represented by the roof of the home. The process of assigning a significance rating involves evaluating every need about every technical characteristic that indicates the level of importance, partial importance, and no importance within the roof box. If the box is empty, it indicates that the requirement is not important about technical characteristics; if it is in the center, it indicates partial importance; and if it is in the box that is in opposition to the demand, it indicates full relevance.

## PHASE 8: HOUSE OF QUALITY

In this step, a complete representation of the house of quality (HOQ) is mentioned in which competitor analysis, ranking, its weights are explored. The main purpose of this research is to construct a house of quality that aids in understanding all the parameters and expectations of management and end users.

## 7. DISCUSSIONS

The integration of Vendor Managed Inventory (VMI) with Quality Function Deployment (QFD) significantly advances supply chain operations in the present study and great impact on product quality. As a wholistic approach, VMI allows suppliers to manage and replenish inventory based on customer demand and inventory levels, minimizing stockouts and excess inventory for a more efficient supply chain. QFD translates customer needs into detailed engineering specifications, ensuring customer requirements are met throughout product development, thereby enhancing quality and satisfaction. Research has demonstrated the benefits of combining QFD and VMI in various sectors like food, automotive, wood, and healthcare. In the automotive industry, for example, QFD incorporates customer preferences into design and manufacturing, while VMI ensures component availability, reducing delays and costs. However, the agricultural manufacturing industry remains largely unexplored in terms of VMI and QFD application. A case study on a Public Sector Undertaking (PSU) in the agricultural industry investigates key factors to enhance the supply chain process. This study identifies stockouts, lead time, and response time as critical areas of concern. By integrating VMI with QFD and applying scientific methods, the study demonstrates significant efficiency improvements in the supply chain. The primary finding is that VMI and QFD integration helps eliminate stockouts by allowing vendors to manage inventory based on real-time data and customer demand, leading to a more reliable supply chain with continuous production. The study also emphasizes the importance of reducing lead times and improving response times to meet customer demands and maintain flexibility and resilience in the supply chain. Overall, this study highlights key factors influencing the supply chain in the agricultural manufacturing industry and shows how VMI and QFD integration can streamline operations, reduce costs, and improve product quality. This approach enhances customer satisfaction and competitive positioning, offering a valuable contribution to the field and a foundation for further research. With incorporation and integration of these statistics proven methodologies, companies can optimize and streamline their operations or process to reduce costs, and improve product quality, ultimately leading to higher customer satisfaction and a more competitive position in the market. This case study serves as a valuable contribution to the existing body of knowledge and provides a foundation for further research in this underexplored area.




From the above final HOQ figure, the final weightage of each parameter calculated and presented in the below table: -

| How's / What's | Moving SKU From Customer to Vendor or Supplier | Transfering Task through Real time data process | Redesign SKU stock Level By time data Prcoess | Assessment of real time SKU to vendor for stock | Assure Min. stock at Vendor end | Design Contract Mang't Approval with suppliers | Min supplier & contract mang't | Mang't Brain Storming & approval | Min worker & work hours | Min Stock Out / TAT/ Max OFR |
|---|---|---|---|---|---|---|---|---|---|---|
| **Process Difficulty Rating** | **9** | **1** | **2** | **4** | **10** | **7** | **6** | **3** | **5** | **8** |
| **Weightage** | **3.50** | **2.70** | **3.60** | **3.30** | **3.40** | **2.2** | **4.10** | **3.3** | **3.80** | **3.70** |

## 8. CONCLUSION

This study assists in identifying the key technical characteristic that satisfies management expectations as well as the most significant expectation of management. The paper's processes all led to the conclusion that the most crucial management expectation is to reduce the number of stockouts, and all the metrics are rated by this finding. The Final level/stage involves building a high-quality, fully functional home with all the necessary technical and anticipated specifications or criteria. It displays a competitive analysis that aids in understanding the market's potential and strength. Every organization has its flaws and those are highlighted, which aid them in comprehension and productivity optimization. Finally, briefly, the goal of the study is to optimize the supply chain process's overall operational efficiency inside an organization. With the building of the HOQ (House of Quality), the SCM process is optimized. This study will assist n exploring the organization in meeting and exceeding management's expectations through the use of the supply chain tool Vendor Managed Inventory,

## 9. FUTURISTIC DIRECTIONS AND CHALLENGES

The agricultural industry is progressing in a significant transformation, driven by technological advancements and changing consumer(farmers) demands. To adapt to this evolving landscape, agricultural organizations are recognizing the importance of shifting the mindset of their workforce. This drift involves embracing new technologies, adopting innovative practices, and fostering a culture of continuous improvement. The strategic contributions to achieve Overall Equipment Effectiveness and increasing market share lie in empowering the workforce with the necessary skills and knowledge. This further involves investment in training programs to upskill employees and keep them abreast of the latest developments in the industry. By fostering a learning culture, agricultural organizations can ensure that their workforce is equipped to operate modern equipment and leverage advanced technologies effectively. This involves implementing data-driven decision-making processes and leveraging analytics to identify areas for improvement. By analyzing performance metrics and identifying bottlenecks, agricultural organizations can streamline their operations, minimize downtime, and maximize efficiency. Additionally, enhancing collaboration and communication within the organization is crucial for driving performance improvements. By breaking down silos and encouraging cross-functional teamwork, agricultural organizations can leverage the collective expertise of their workforce to identify innovative solutions and drive continuous improvement. Fostering a culture of innovation is essential for staying ahead in today's competitive agricultural landscape. Encouraging employees to think creatively, experiment with new ideas, and embrace change is key to driving organizational growth and maintaining a competitive edge.

In Nutshell, the researcher concludes that the changing mindset of the workforce is essential for achieving OEE and increasing market share in the agricultural industry. By adopting and urging the whole employee to intensify their efforts in or propelling the growth, a data-driven approach to decision-making, and fostering collaboration and innovation, the organization can position itself for long-term success in a rapidly evolving market.

**POINT OF CONFLICT**: Authors do not have any conflict inside and outside the organization.

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