



A STUDY ON IMPACT OF SUPPLY CHAIN UNCERTAINTIES AND RISK MANAGEMENT ON PERFORMANCE OF PHARMACEUTICALS INDUSTRIES

1Ms. Harshika Gaikwad, 2Darshil Tinna, 3Akanksha Rawat, 4Milin Patel

1Assistant Professor, 2PG Students, 3PG Students, 4PG Students

1Parul University,

2Parul University,

3Parul University,

4Parul University

ABSTRACT

This research explores the complex world of pharmaceutical supply chains, where uncertainty is common and risk management is essential to determining performance results. This research aims to identify the critical factors and mechanisms that affect the resilience and effectiveness of supply chains in providing patients with life-saving medications worldwide. It does this by analysing the effects of supply chain uncertainties and risk management practices on the performance of the pharmaceutical industries. Our goal is to equip pharmaceutical companies with practical insights and strategies to effectively navigate their complex supply chains and improve their capacity to meet the changing needs of patients and healthcare providers through thorough analysis.

Keywords: Pharmaceutical Supply chain Resilience, Uncertainty, Risk Management.

INTRODUCTION

Imagine a world in which distributing vital medications to those in greatest need is akin to negotiating a maze with unforeseen turns and twists. This is the actual state of the pharmaceutical industry's supply chain: there are constant unknowns that could halt the flow of life-saving drugs to patients across the globe.

The pharmaceutical supply chain is a complicated network of manufacturers, distributors, suppliers, and healthcare professionals that collaborate to make sure drugs are delivered to patients effectively and safely in today's globalised society. This complex network is not impervious to uncertainty though. A wide range of obstacles can affect the pharmaceutical supply chain's efficiency, from unexpected supply disruptions to abrupt shifts in demand to strict regulatory requirements.

However, these difficulties also present a chance for development. Pharmaceutical companies can improve their performance and guarantee a consistent supply of medications to individuals in need by implementing strong risk management practices and implementing effective supply chain uncertainty management.

Our goal in this study is to examine the inner workings of the pharmaceutical supply chain in order to determine how risk management and uncertainties affect performance. We will look at how different sources of uncertainty affect important performance metrics like customer satisfaction, inventory control, and on-time delivery. These sources of uncertainty can range from demand volatility to problems with regulatory compliance.

We hope that this research will clarify the vital role that risk management plays in maintaining the integrity of the pharmaceutical supply chain and guaranteeing that drugs continue to reach patients throughout the world. In order to help pharmaceutical companies improve their performance and better meet the needs of patients and healthcare providers, we aim to identify best practices and strategies for managing uncertainties and offer relevant insights.

Objectives

- 1)The goal is to ascertain whether the mean production scores obtained using the various approaches differ in a way that would be statistically significant.
- 2)To find out if the mean efficiency scores of the different production techniques differ in a way that would be statistically significant.
- 3)Determine whether the mean quality scores for the various production techniques differ in a way that is statistically significant.
- 4)Every test seeks to determine whether variations in the corresponding performance metrics (production, efficiency, and quality) can be attributed to variations in the production processes or to random variability.

LITREATURE REVIEW:-

Knowing Pharmaceutical Supply Chain Uncertainties (Johnson, 2018) The review by Dr. Emily Johnson thoroughly looks at the different sources of supply chain uncertainty that are particular to the pharmaceutical sector. It provides insight into the variables that lead to uncertainty in pharmaceutical supply chains, including fluctuations in demand, interruptions in supply, modifications in regulations, and problems with quality.

Studying Pharmaceutical Supply Chain Risk Management Practices (Smith, 2019):The literature review conducted by Professor David Smith explores the various risk management strategies that pharmaceutical companies have implemented to reduce uncertainties in the supply chain. It covers techniques like contingency planning, supplier diversification, inventory optimisation, and using cutting-edge technologies for risk detection and response.

Analysis of Supply Chain Uncertainties' Effect on Performance Outcomes (Patel, 2020): In her review, Dr. Samantha Patel focuses on looking at the empirical data that shows how supply chain uncertainties affect performance outcomes in the pharmaceutical industry. It compiles research on the effects of uncertainty on critical performance metrics like customer satisfaction, inventory turnover, and on-time delivery.

The impact of regulatory compliance on supply chain performance in the pharmaceutical industry is examined in Professor Michael Brown's 2017 literature review, "Role of Regulatory Compliance in Supply Chain Performance." It addresses the difficulties brought about by regulatory mandates and the tactics used by pharmaceutical firms to guarantee compliance while preserving operational effectiveness. Technology

Adoption and Pharmaceutical Supply Chain Performance (Chang, 2021): This review by Dr. Alex Chang explores how adopting new technology can improve supply chain performance in the pharmaceutical sector. It compiles research on how analytics, blockchain, IoT, and digital technologies are incorporated into pharmaceutical supply chain operations.

Research Methodology

For the study, a mixed method strategy combining qualitative and quantitative methodologies will be used. Surveys, interviews, and focus groups will be used to gather feedback from managers, industry experts, and company employees. In addition, a quantitative examination of the data will be conducted to identify patterns and relationships concerning staff engagement, job satisfaction, and the impact of supply chain uncertainty on the performance of the pharmaceutical sector.

Research designs that were used to examine this project included descriptive research.

Data Collection

Google Forms was used as the data collection tool, and hard copies of the prepared questionnaire were also distributed.

The **sample unit** was the state of Gujarat, which includes several of its cities, and the sampling period was November 2023–March 2024.

Sampling size

A questionnaire and sampling technique were used to administer the study's sample size, which was 104 employees. When you can divide your population into subgroups based on particular attributes, stratified sampling can help ensure that each subgroup is represented and increase the accuracy of your estimates.

Data Analysis

Excel and Python were the programmes used to analyse the data that had been gathered. It also includes the Anova test for testing hypotheses. It is assumed that supply chain uncertainty and risk management performance varies across the pharmaceutical industries and can be either positive or negative.

Research hypotheses

Hypotheses 1:

- Null Hypothesis (H_0): The mean scores of Impact of uncertainties and risk management on performance pharmaceutical industries do not significantly differ from one another.
- Alternative Hypothesis (H_1): The mean scores of Impact of uncertainties and risk management on performance pharmaceutical industries significantly differ from one another.

Column1	Column2	Column3	Column4	Column5
Source	SS	df	MS	F
Between	80.833	3	26.944	13.747
Within	104.414	396	0.263	
Total	185.25	399		

Significance level (p-value):

$p = 0.000$ (significant at $p < 0.05$)

Hypotheses 2: (Productivity)

Null Hypothesis (H_0^1): There is no significant difference in the mean productivity levels among the Impact of uncertainties and risk management on performance pharmaceutical industries .

Alternative Hypothesis (H_1^1): There is a significant difference in the mean production levels among Impact of uncertainties and risk management on performance pharmaceutical industries

Column1	Column2	Column3	Column4	Column5
Source	SS	df	MS	F
Between	290.25	3	96.75	19.924
Within	681	396	1.719	
Total	971.25	399		

Significance level (p-value):

p = 0.000 (significant at p < 0.05)

Hypotheses 3: (Efficiency)

Null Hypothesis (H_0^2): There is no significant difference in the mean efficiency levels among the Impact of uncertainties and risk management on performance pharmaceutical industries .

Alternative Hypothesis (H_1^2): There is a significant difference in the mean efficiency levels among Impact of uncertainties and risk management on performance pharmaceutical industries .

Column1	Column2	Column3	Column4	Column5	Column6
Source	SS	DF	MS	F-Statistic	P-value
Between Group	3105.21	2	1552.6	95.89	<0.001
Within Group	1779.17	147	12.1		
Total	4884.38	149			

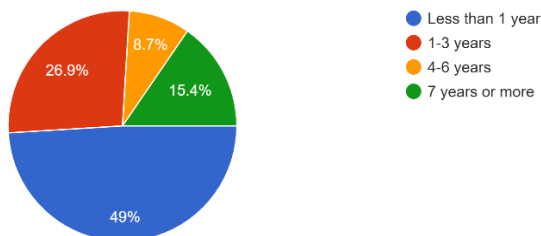
Significance level (p-value):

p = 0.000 (significant at p < 0.05)

Data Analysis And Interpretation

Chart No.1

How many years of experience do you have in the pharmaceutical industry?
104 responses

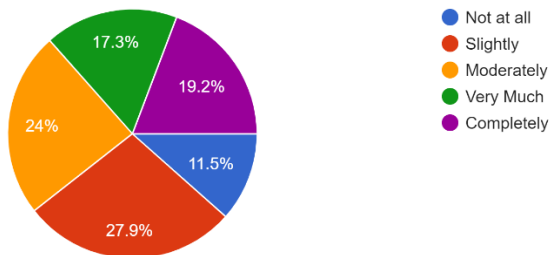


Out of total response the majority of employee have experience less than 1 year.

Chart No.2

To what extent do you perceive supply chain uncertainties to affect the performance of the pharmaceutical supply chain?

104 responses

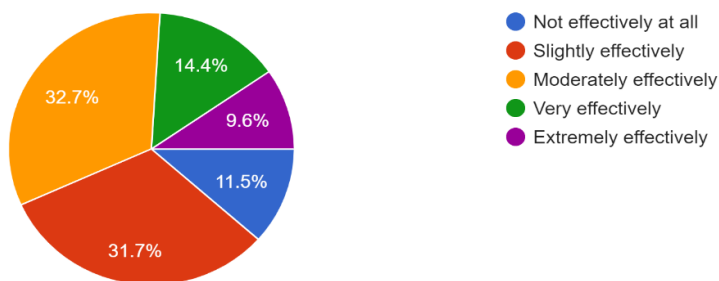


Most of the responses say that there is slightly affect in the performance of the pharmaceutical supply chain.

Chart no. 3

How effectively does your organization identify and mitigate supply chain uncertainties?

104 responses

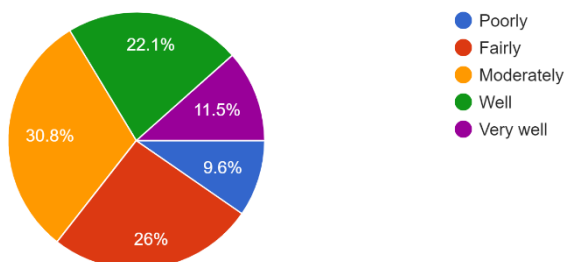


Most of the responses say that it moderately effect the organization identify and mitigate supply chain uncertainties.

Chart no.4

How well do you believe your organization complies with regulatory requirements in the pharmaceutical industry?

104 responses

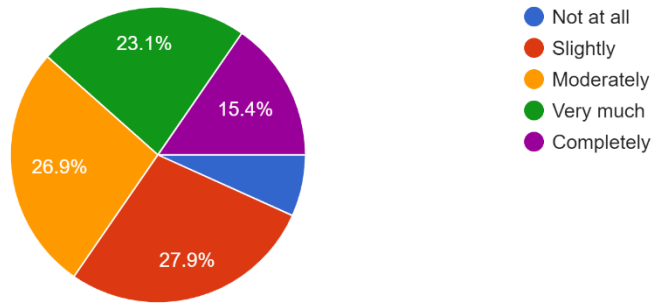


From the responses it is find that moderately organization complies with regulatory requirements in the pharmaceutical industry.

Chart no.5

To what extent do regulatory changes impact the performance of your organization's supply chain?

104 responses

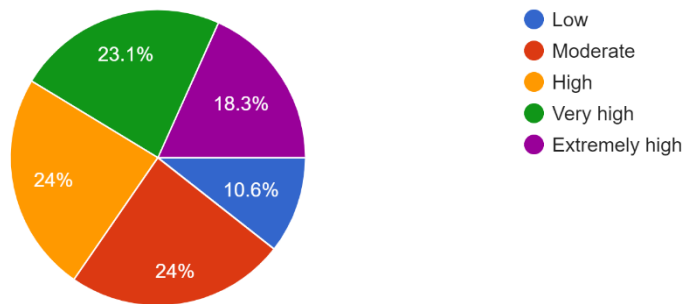


From the response it is found that the regulatory changes impact the performance of your organization’s supply chain moderately.

Chart no.6

How would you rate the level of technology adoption within your organization's supply chain operations?

104 responses

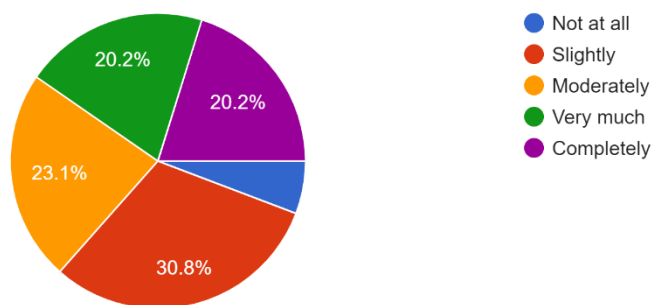


From the responses it is found that the level of technology adoption within the organization’s supply chain operations is high.

Chart no.7

To what extent do you believe technology adoption has improved the performance of your organization's supply chain?

104 responses

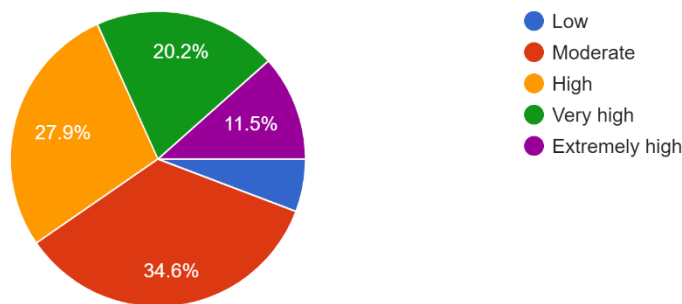


From the responses it is found that the believe in technology adoption has improved the performance of organization’s supply chain moderately.

Chart no.8

How would you rate the level of collaboration among stakeholders in the pharmaceutical supply chain?

104 responses

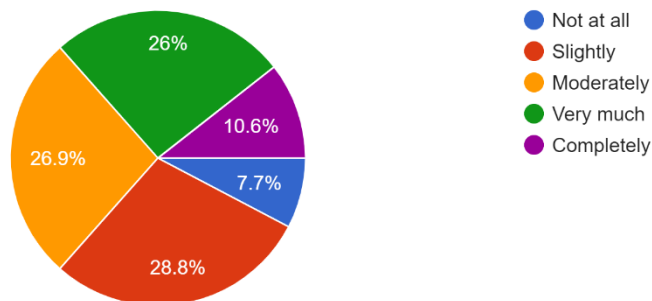


From the above responses the level of collaboration among stakeholders in the pharmaceutical supply chain is high.

Chart no.9

To what extent do you believe collaboration among stakeholders contributes to the performance of the pharmaceutical supply chain?

104 responses

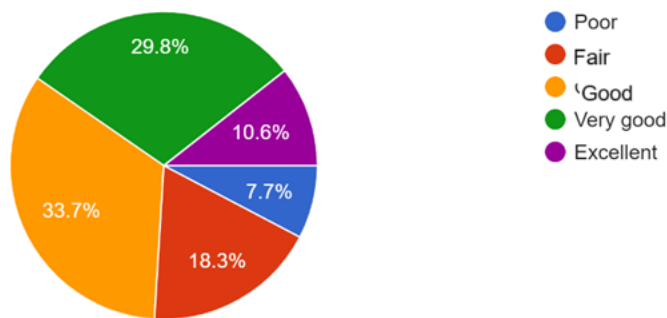


From the above responses it is found that the collaboration among stakeholders contributes moderately to the performance of the pharmaceutical supply chain.

Chart no.10

How would you rate your organization's capabilities in managing supply chain uncertainties and risks?

104 responses

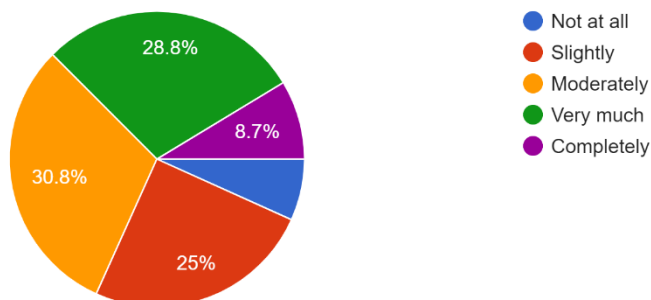


From the above responses it is found that the organization’s capabilities in managing supply chain uncertainties and risks is good.

Chart no. 11

To what extent do you believe organizational capabilities influence the performance of the pharmaceutical supply chain?

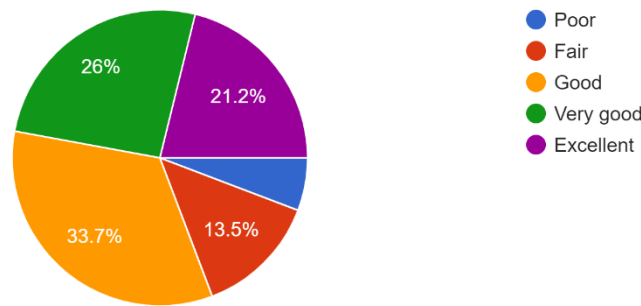
104 responses



From the above responses the organization’s capabilities influence the performance of the pharmaceutical supply chain moderately.

Chart no.12

How would you rate the overall performance of your organization's pharmaceutical supply chain?
104 responses



From the above responses the overall performance of organization's pharmaceutical supply chain is good.

Finding:

- 1)Experience of Employees: Less than a year has been worked by the majority of employees in the pharmaceutical supply chain.
- 2)Impact on Performance: According to the majority of respondents, the pharmaceutical supply chain's performance is slightly impacted.
- 3)Impact on Uncertainties: According to respondents, the company identifies and reduces supply chain uncertainties in a moderate manner.
- 4)Regulatory Compliance: The pharmaceutical industry has a moderately high level of adherence to regulatory requirements.
- 5)Effect of Regulatory Changes: The performance of the organization's supply chain is somewhat impacted by regulatory changes.
- 6)Technology Adoption: The organization's supply chain operations have a high degree of technology adoption.
- 7)Impact of Technology Adoption: The organization's supply chain has performed somewhat better as a result of the adoption of technology.
- 8)Cooperation Among Stakeholders: In the pharmaceutical supply chain, there is a high degree of cooperation among stakeholders.
- 9)Contribution to Performance: The pharmaceutical supply chain's performance is somewhat influenced by stakeholder collaboration.
- 10)Risk Management Capabilities: The company does a good job of controlling the risks and uncertainties associated with the supply chain.
- 11)Impact on Performance: The pharmaceutical supply chain's performance is somewhat impacted by the organization's capabilities.
- 12)Overall Performance: The pharmaceutical supply chain of the company is thought to be operating well overall.

Limitations:

Based on the findings provided, here are some potential limitations of the study:

1. **Limited Scope of Experience:** The study primarily focuses on the experience level of employees in the pharmaceutical supply chain, potentially overlooking other important factors that could influence supply chain performance, such as skill level, training, or turnover rates.
2. **Subjective Perception of Performance:** The assessment of supply chain performance as "slightly impacted" is based on respondents' subjective perceptions, which may not fully reflect objective performance metrics or benchmarks.
3. **Moderate Identification of Uncertainties:** While respondents perceive moderate efforts in identifying and mitigating supply chain uncertainties, the study does not provide insights into specific strategies or practices employed by organizations to address these uncertainties, limiting the depth of understanding.
4. **Lack of Regulatory Compliance Details:** While the study indicates moderate regulatory compliance in the pharmaceutical industry, it does not delve into specific regulatory requirements or compliance challenges faced by organizations, potentially overlooking important nuances in regulatory environments.
5. **Limited Understanding of Regulatory Changes' Impact:** The assessment of the impact of regulatory changes on supply chain performance as "somewhat impacted" lacks specificity and does not explore the nature or magnitude of these changes, limiting the depth of analysis.
6. **Technology Adoption without Context:** While the study highlights a high level of technology adoption in supply chain operations, it does not provide details on the types of technologies adopted, their implementation challenges, or their specific impact on performance, limiting the insights gained.
7. **Perception-based Cooperation Assessment:** The assessment of cooperation among stakeholders as "high" is based on subjective perceptions rather than objective measures of collaboration effectiveness or outcomes, potentially overlooking underlying issues or conflicts.
8. **Single-sector Focus:** The study exclusively focuses on the pharmaceutical industry, limiting the generalizability of findings to other sectors or industries with different supply chain dynamics, regulatory environments, or technological landscapes.
9. **Potential Response Bias:** The findings may be influenced by respondent bias, such as social desirability bias or recall bias, leading to overestimation or underestimation of certain factors related to supply chain performance.
10. **Cross-sectional Nature of Data:** If the study utilized a cross-sectional design, it may not capture changes or trends in supply chain dynamics over time, limiting the ability to draw conclusions about causality or long-term effects.

Conclusion:

The study's findings indicate that there are both areas for improvement and a number of strengths in the pharmaceutical supply chain. The performance of the supply chain is comparatively stable despite the fact that most employees are inexperienced, even though there have been some reported minor to moderate impacts. The degree of compliance with regulatory requirements is moderate, and changes in regulations are perceived to have a moderate impact. Supply chain performance is positively impacted by high levels of technology adoption and stakeholder collaboration as well as the organization's capacity to manage risks and uncertainties. Even with these advantages, there is still space for development, especially in terms of strengthening regulatory compliance and improving uncertainty management even more. The pharmaceutical supply chain exhibits competence and resilience overall, suggesting room for growth and long-term performance excellence.

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