COVER PAGE AND DECLARATION

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1. Action Research Topic

Supply Chain Management Practices and Supply Chain Performance Effectiveness in the BULK industrial Gas field in the kingdom of saudi arabia

2. Abstract

Saudi Arabia has recently adopted supply chain management. Establishing the appropriate groundwork is essential for managers to effectively operate a prosperous supply chain by implementing its procedures and principles. Saudi Arabia has recently initiated a number of enhancements in infrastructure and the economy, which are expected to greatly benefit supply chain management. Nevertheless, developers who are unaware of the challenges may overlook opportunities to enhance aspects of the supply chain cycle.

The bulk supply chain in the industrial gases sector encompasses all the processes and operations required to transport gases in large quantities from production facilities or suppliers to storage facilities at client sites, whether they are located outside or inside. It especially encompasses the activities of procuring products, dispatching them, transporting them, and managing the associated assets such as vessels and vehicles. The items in question include liquid air gases such as nitrogen, oxygen, and argon, as well as liquid carbon dioxide and hydrogen in either liquid or gaseous states. According to this concept, the bulk supply chain accounts for roughly 30% of the total expenditures associated with industrial processes.

A well-optimised supply chain can not only reduce operational costs but also improve customer satisfaction, which ultimately contributes to increased revenue.

This paper examines the fundamental principles and tactics involved in optimizing supply chains, emphasizing how firms can utilize this strategy to effectively fulfill their aim of maximizing profits.

The Tech Research Report states that the size of the Saudi Arabia Gas Market is projected to be USD 2201.26 billion in 2022, with an expected growth rate of 4.96% during the forecast period. Industrial gases find use across diverse industries like healthcare, electronics, aircraft, energy, and construction.

Industrial gases, including oxygen, nitrogen, carbon dioxide, argon, hydrogen, and lithium, are utilised for various applications due to their distinct characteristics. It is specifically designed for utilisation in saturation diving, ballooning, MRI, NMR, and various other applications.

Moreover, the rising expenses associated with manufacturing and producing gases are causing a corresponding increase in the selling price of industrial gases. In addition to these factors, stringent government regulations regarding the storage, transportation, and production of gases are increasing the cost price. Consequently, these factors are significantly affecting buyers and hindering the market growth of industrial gases in Saudi Arabia during the forecast period.

The market is split into tonnage, gassessous bulk, cylinders, and packaged based on the manner of distribution. The forecast period anticipates that tonnage and gsessours would dominate the market, capturing a significant market share of 48.62% in 2023. The cryogenic tanker is employed to securely transport large quantities of oxygen, nitrogen, and argon at low temperatures from the air separation unit plant to the customer site for gas generation purposes.

The distribution mode and supply chain have a significant influence on this subject and present a viable option for future advancement.

3. Rationale for the Research

3.1 Background

Supply Chain Management encompasses the assortment of resources, means, methods, tools, and procedures that are specifically developed to optimize the efficiency of the global supply chain and accomplish strategic objectives. This resource is designed for individuals who possess a comprehensive grasp of industrial gas operations and are seeking possibilities to enhance efficiency.

The objective of the research is to provide a comprehensive analysis of the existing techniques employed in the large-scale distribution network of industrial gases in Saudi Arabia. Additionally, the study aims to formulate and delineate recommendations for enhancing the efficiency and cost-effectiveness of the supply chain through improved planning, forecasting, and optimization strategies.

This research was conducted by doing a comprehensive literature review of prior studies, drawing on my extensive practical expertise in the industry, consulting with experts in the industrial gas supply chain field through a review and meeting process, and subjecting the interim papers to peer review.

The primary focus of the study will provide a comprehensive analysis of the BULK industrial gases sector in Saudi Arabia. It will outline the specific challenges encountered by the supply chain management (SCM) members, the intended strategy, methodologies, tools, and the technological advancements' influence on the industry.

Keywords:

- SC : Supply Chain
- SCM : Supply Chain MAnagement
- SCMP : Supply chain management performance
- BSC : Bulk Supply chain
- KPI : Key performance indicator
- FMS : Fleet management system
- Telemetry : is the automatic measurement and wireless transmission of data from remote source
- ERP : Enterprise resource planning
- Tank : Vessel to store the bulk industrial Gases or any other product in the oil gas field

4. Research aim, objective and questions

4.1 Research objective

This research aims to give an overview of the current status of the supply chain, such as the organisation, tools, and approach used to manage the supply chain from sourcing until delivery of the goods to the end user (the customer). On the other hand, the research provides guidelines and best practices regarding the organisation and management of the bulk supply chain but does not provide a detailed description or explanation of its nature.

It is intended for people with a general knowledge and understanding of industrial gas operations who are looking for efficiency improvement opportunities.

.   4.2 **Research topics and question**

This work has utilized quantitative analysis to demonstrate how the context can be observed, quantified, and comprehended.

The deductive strategy, which involves establishing facts and testing hypotheses, was chosen as the research method for this study. The information required from participants can encompass knowledge, attitudes, views, conduct, and qualities (Taylor and Marshall, 1996). This study incorporated the five primary procedures for formulating the questionnaire during its production.

Frazer and Lawley (2001) state that the initial step in the five processes is to identify the necessary information and data needed to achieve the study objectives. Furthermore, oversee the implementation of the questionnaire. Next, generate an initial version of the questionnaire. Next, conduct a preliminary assessment of the questionnaire and make necessary modifications to prevent errors, unsuitable phrasing, or ambiguous inquiries. Ultimately, evaluate the dependability and internal accuracy of the research's questionnaire. The design of the questionnaire took into account the sorts of questions and the administration methods. The methodology employed is a combination of quantitative and qualitative techniques, utilizing a survey and semi-structured interviews.

The areas that are covered by the survey and interveiws are as follows

- Challenges faced in the supply chain activity,
- Organization of the SCM and its structure :
- KPIs and the Technology
- Supply Chain Flexibility and Adaptation, Communication, Structure
- Supply chain performance and management

5. **Literature review**

In the current company landscape, characterized by intense competition, the use of efficient supply chain management (SCM) strategies can effectively tackle these competitive problems. SCM, as defined by the Council of Supply Chain Management Professionals (CSCMP),

encompasses the strategic planning and efficient management of all activities related to sourcing, procurement, and conversion. It also includes logistics planning and management, as well as the coordination and collaboration among partners within the supply chain.

Saudi enterprises encounter obstacles in the international market in terms of their competitive advantage, and these obstacles might inherently impact a company's success. Hence, in order to guarantee long-term viability, Saudi enterprises must preserve a competitive edge. An excellent approach for a corporation to preserve a competitive advantage is to uphold a proficient supply chain management system (SCM). Supply chain management (SCM) is composed of discrete functional units that carry out their responsibilities in a manner that facilitates the provision of resources and information to all components of the supply chain (SC). This enables management to accomplish their objectives while ensuring a seamless flow throughout the entire chain. Supply Chain Management (SCM) encompasses a range of methods that can enhance the performance and advantages for all parts of the supply chain, such as suppliers, manufacturers, distributors, and customers (Chopra & Meindl, 2001).

Both academic scholars and corporate managers have recently shown a growing interest in supply chain management practices (SCMPs) (Croom, Romano, & Giannakis, 2000; Li, Rao, Ragu-Nathan, & Ragu-Nathan, 2005; Tan, Kannan, & Handfield, 1998).

Consequently, numerous companies now regard SCMPs as a crucial element in establishing and sustaining a competitive edge in the market (Jones, 1998; Li et al., 2005). Hence, although it is acknowledged that Supply Chain Management Practices (SCMPs) influence a company, it is imperative to accurately assess their impact on the company's performance (Green, McGaughey, & Casey, 2006).

Based on interviews with various supply chain managers and buying managers, it has been observed that Saudi companies face an issue where top management lacks awareness of the effects of diverse practices on supply chain performance. Additionally, they do not possess a clear understanding of which practices have the most impact on supply chain performance. Although SCMPs have gained more attention, there is a lack of study specifically focused on SCMPs in emerging countries, such as Saudi Arabia. Moreover, there have been contradictory conclusions regarding the influence of various techniques on company performance.

A multitude of researchers have extensively examined different aspects of supply chain management, including performance, integration, information technology, e-SCM, organizational

structure, coordination, and green supply chain management (Wu and Chang, 2012; Wu, Chuang, and Hsu, 2014; Kumar, Mukherjee, and Adlakha, 2015; Saldanha, Mello, and Knemeyer, 2015; Wang, 2015).

These parts of the supply chain are interrelated and have a strong correlation with both individuals and the local culture. Hence, the efficiency of the supply chain can differ across various regions worldwide (Fawcett, Magnan, and McCarter, 2008; Zhao et al., 2008). Given its nascent stage, supply chain management in Saudi Arabia encounters distinct problems in comparison to supply systems in Western countries and other regions. Supply chain management strategies in Western countries have seen significant evolution and development through practical application and academic research in recent decades. This paper examines and uncovers the lack of understanding and research on supply chain management obstacles in rising markets for supply chain management, such as Saudi Arabia. This study examines the obstacles to supply chain performance in Saudi Arabia as it transitions from being a novice in practice-based contemporary supply chain management to becoming a proficient performer and eventually a leading international nation. This study will make a valuable contribution to the existing body of knowledge on supply chain management and supply chain performance.

Supply chain management is a crucial focus for various firms, regardless of whether they are managing internal or external connections between different entities. It plays a crucial role in situations where two or more organizations engage in business transactions, since a strong relationship between them can result in a competitive advantage and ultimately increased profitability. The integration of the organization's operations with upstream or downstream enterprises in the supply chain is ineffective without efficient information sharing.

Accurate and valuable information significantly contributes to the efficiency and production of worth for an organization. Potential advantages of valuable information in supply chain activities include: enhanced supplier control, streamlined communication, improved responsiveness to customers, precise forecasting, increased productivity, and reduced inventory levels.

Information technology advancements are improving the efficiency of information movement inside the supply chain structure. Various technologies are accessible to assist firms in managing the continuous flow of information and interactions throughout the whole supply chain. Supply chain technologies are regarded as tools that may effectively integrate the many departments inside an organization, as well as external stakeholders. Various technical solutions are accessible

to efficiently facilitate supply chain operations. These systems provide support at varying degrees and possess distinct capacities. For instance, they can offer assistance in operational aspects such as transportation management systems, as well as in strategic aspects such as collaborative planning systems.

The present study aims to investigate the potential obstacles encountered while using supply chain technology, while considering its advantages. Identifying the potential obstacles encountered when implementing the service industry in Saudi Arabia helps alert organizations to develop their risk management plan, taking into account the suggestions of the present study.

One of the technologies that will be utilized in the supply chain is fleet management. The fleet management system encompasses the administration of vehicle operations, including cars, trucks, heavy trucks, and commercial vehicles, on a wider scale. Fleet management encompasses the procedures employed by fleet managers to oversee fleet operations and make informed choices regarding asset management, dispatch and routing, and vehicle procurement. Transportation-dependent businesses employ fleet management to effectively manage expenses, productivity, fuel usage, and regulatory compliance. Hence, fleet managers bear the responsibility of managing expenses, optimizing profitability, and mitigating hazards associated with fleet vehicles. Additionally, it encompasses the aspects of securing funds for vehicles, overseeing driver operations, and utilizing vehicle telematics for various modes of transportation such as watercraft, aviation, commercial vehicles (light and heavy), and railways. Furthermore, fleet management provides financial oversight, improved safety for both vehicles and drivers, and operational efficiency through the use of real-time monitoring of fleet tracking data. The majority of fleet managers utilize fleet management software to enhance fleet safety and customer service, as well as to enhance visibility and profitability through effective process management and research.

The global market is experiencing growth due to various factors, including increasing concerns about fleet safety, government regulations mandating vehicle maintenance and tracking, the necessity for operational competency in fleet management, and the rising adoption of wireless technology due to its low cost and widespread availability. Nevertheless, the market's expansion worldwide is impeded by cost sensitivity among local participants and a deficiency in consistent and smooth internet connectivity. Furthermore, the expansion of the market during the projected period is facilitated by various factors, including advancements in transportation within the

logistics industry, the implementation of intelligent transport systems, and the enhancement of communication networks.

The latest analysis conducted by the IUC reveals that the worldwide fleet management market has a value of $19.47 billion in 2020 and is expected to grow to $52.50 billion by 2030, with a compound annual growth rate (CAGR) of 10.6% from 2021 to 2030.

Major accidents in Saudi Arabia have recorded a decrease by 6.8%, recording about 17,000 accidents, compared to 2021, when it reached more than 18,000 accidents, the Ministerial Committee of Traffic Safety announced.

The committee's announcement came while revealing, in an infographic, the results of the traffic safety file for the year 2022.

The indicator showed that the percentage of deaths resulting from car accidents recorded a decrease by 2.1%, amounted 4.5 thousand in 2022 compared to 2021 when it reached 4.6 thousand. While the number of damaged vehicles following an accident has witnessed an increase by 28%, recording 1.8 million accidents in 2022, compared to 1.4 million in 2021. The committee said that the number of injuries resulting from car accidents recorded a decrease by 2.7% in 2022, recording 24,000 injuries, compared to 2021, when it reached more than 25,000 injuries.

Road Traffic Accident Results (2018-2020)		
Year	Total Deaths	Total Injuries
2018	5,787	30,579
2019	5,754	32,910
2020	4,618	25,561

According to the General Authority for Statistics, there were *11,569* heavy truck accidents in Saudi Arabia in 2015, accounting for *2.4%* of the total traffic accidents[2]. The main causes of heavy truck accidents in Saudi Arabia are *overspeeding, distracted driving, and fatigue*[13].Other studies carried at WW scale shows that the poor safety culture in the company and cartier management are the main cause of the road safety accidents.

6. Methodology

The data for the present study was acquired via:

- a survey (questionnaire) conducted among three service-oriented organisations, such as transporters, suppliers, manufacturers, and gas companies, in the Kingdom of Saudi Arabia (KSA).
- Conducting semi-structured interviews with professionals and executives involved in the supply chain of service-oriented enterprises.

The selection of KSA in the current research was based on its significant business relevance in the area. Moreover, there is a high likelihood of applying the findings of the ongoing research in Saudi Arabia and other Gulf countries, given the resemblances and interconnections of their economic markets. The poll specifically targeted organisations with offices or headquarters located in Riyadh, Dammam, and Jeddah.

In order to ensure the data's completeness and accuracy, the sample firms were meticulously chosen, as the dependability of the data and the seriousness of the responses are typically concerned during the data collection procedure in the Kingdom of Saudi Arabia (KSA). The primary impediments lie in the fact that the majority of firm personnel are prohibited from divulging any information to external parties, owing to concerns about potential competitors. The second hindrance is to the absence of earnestness in furnishing the data for any investigation. In order to address these difficulties, I employed a rigorous approach by carefully selecting the sample size and leveraging my network to effectively engage with the respondents. The participants were engaged in the supply chain management (SCM) procedures within the specified organizations. An extensive examination of the existing literature has established a foundation for redefining the objective of the research and solidifying the research question. Driven by the goal of identifying potential obstacles encountered by the service industry in Saudi Arabia during the implementation of supply chain technology, a primary research question was formulated:

TABLE I. Sample size according to the propose categories of organisations and companies

Category	Sample size	Percentage
Suppliers of the industrial gases and LPG	5	22%
Transporters of the industrial gases, oil and GAS	8	35%
GAS companies : Producers and distributors	10	43%
Total	**23**	

TABLE II. Sample size according to the propose categories of person interviewed

Category	Size	Position description/ Role	Percentage	Category type
Operation management	85	Production manager, Quality manager, production engineer Operation manager	46%	B, C
supply chain management	75	Distribution manager, supply chain manager, warehouse manager, dispatcher Logistics manager, procurement manager	40%	B, C
Management	25	CEO, COO, VP, CFO, GM	14%	A
Total	**185**			

6.1 Questionnaire design

In this work, quantitative analyses have been utilized to demonstrate how the context can be seen, quantified, and comprehended. The deductive methodology, known for establishing facts and testing hypotheses, was chosen as the research strategy for this study. The information required from participants can encompass knowledge, attitudes, views, conduct, and qualities (Taylor and Marshall, 1996). This study incorporated the five primary procedures for formulating a survey in the production of the questionnaire.

Frazer and Lawley (2001) state that the initial step in the five processes is to identify the necessary information and data needed to achieve the study objectives. Next, oversee the

implementation of the questionnaire. Next, generate an initial version of the questionnaire. Next, conduct a preliminary assessment of the questionnaire and make necessary modifications to prevent errors, improper phrasing, or ambiguous inquiries. Lastly, evaluate the dependability and internal accuracy of the research's questionnaire.

The questionnaire design took into account the sorts of questions and the administration processes, ensuring that the questions were meticulously crafted to meet the study objectives. The questionnaire's ultimate iteration included five items. The primary divisions of the categorised inquiries are as follows:

Section One - Demographic questions, which are attribute questions. This section includes the participant's position, number of employees in the organisation, the age of the organisation in business, Fleet sizing (number of trucks, vehicles) , number of employers dedicated in the SCM department, number of deliveries points (customers), number of drivers,

 Section Two – The organisation and structure of the Supply chain

These are also attribute questions. In this section, participants were asked to state the type of the operations and outputs that are produced in their organisation, whether pure goods, pure services, or a mix of products and services together. the type of SCM organisation (managed centrally at national level, regional, or local),type of function and list of the jobs description in the SCM department (supply chain manager, transporter manager, dispatcher, maintenance, Quality..), the company is certified ISO (1400 nd 9002,)

Section Three – Supply chain responsiveness, which are belief and opinionated questions. This section required the participants to state their opinions and judgements on the supply chain responsiveness of their organisation. Their responses were measured using a 5-point Likert scale, anchored at one end by 1 highly disagree and at the other by 5 highly agree.

Section Four - Supply chain flexibility and adaptation, which are also belief-related and opinionated questions. This section required the participants to state their opinions and judgements on the supply chain flexibility of their organisation and its ability to adapt changes. Their responses were measured using a 5-point Likert scale, anchored at one end by 1 highly disagree and at the other 5 highly agree.

Section Five – Supply chain performance, which are attitude-related and opinionated questions. It measures the output performance of the organisation's supply chain activities which covered sales, order fulfilment rate, JiT deliveries, customer satisfaction, and delivery lead time. Their responses were measured using a 5-point Likert scale, anchored at one end by 1 very bad and at the other by 5 very good.

Section Six : Supply chain technology, which are attribute questions. This section includes : is there any ERP system, or tools to manage the forecasting and delivery schedule such as telemetry, is there a fleet management system and their opinion about the current system used

Section Seven : Supply chain management KPIs and indicators , which are attribute questions. This section includes, the current KPIs used to measure the performance of the SCM, the sort of reporting used

Section Eight : Communication, training : The questions related to the training are attribute questions. This section includes, What is the last training related to supply chain members, i.e. there any yearly training plan, is there any qualification process for employees and mainly for the driver ?

 Section nine : communication process the questions are attitude-related and opinionated questions. It measures the output performance of the communication of the supply chain team with customers and other departments, mainly the sales , finance department and operation team. Their responses were measured using a 5-point Likert scale, anchored at one end by 1 very bad and at the other by 5 very good.

7. Data Analysis & Presentation of Results of Findings

According to the outcomes of the researc's questionnaire and interview performed with different companies, here is an overview about the details which lead us to have 3 type, small, medium large and their categories are articulated and based on size number of employees, the SCM team, fleet, turnover, share market, delivery points (customers).

Table 1

Category	Type	#	Employees	Fleet	SCM members	Sales per year in MSAR	Share market %	Delivery points
Small	Mix service and goods	12	> 100 employees	< 20 trucks	<=3	< 50 M sar	10% and less	< 200
Medium	Mix(service and goods	7	<100 and > 500	> 50 and < 100 trucks	> 2 and <7	< 150 M sar	20%	>200, < 500
Large	Mix	4	> 1000 employees	> 150 trucks	> 10	> 300 M sar	70%	> 600

Table 2 shows and provide an overview of structure of supply chain and its composition into different companies in KSA

Category	Type of the PL	Description of SCM structure	More details and finding
Small	1PL / 2PL	Only dispatchers and reporting to the operation manager	The service is called the logistic department and only contains dispatchers and drivers.
Medium	2PL/3PL	There is structure in place such logistic manager and dispatcher and reporting to the operation	There is a logistics department which includes the head plus the dispatcher and drivers, the dispatcher is managing fleet and driver and the

		manager or sales manager	department is reporting to the operation manager or sales manager . No dedicated person to manage the fleet or maintenance or Safety
Large	2PL/3PL	There is a clear structure called Logistics department or supply chain	The supply chain or logistic department include the head of the department, dispatcher, fleet supervisor, and the supervisor to follow the road safety The sourcing is under the procurement and the procurement is under the supervision of the CFO or COO Rarely we found that the sourcing is under the supply chain

Table 3 provides the AS IS picture of the delivery type and approach used for the forecasting of the product to the customers.

Type of delivery	Delivery %
Systematic deliveries	30%
Deliveries based on customer orders	65%
Forecast deliveries (based on previous deliveries)	10
Forecast deliveries (based on telemetry)	5%

The above mentioned table shows that the technology information is not used well to perform the forecasting. More than 80% are using the basic approach such as systematic deliveries and deliveries based on customer order and this can have an impact on the customer delivery and performance.

Table 4 shows and provides an overview of the KPIs, ERP and FMS (fleet management system) used in different companies covered by the questionnaire and interview.

Item	Item Description	Details	Details and finding
KPIs	Key performance indicators	Operational and Financial KPIs such $/Km and $/Kg.. Performance KPs Quality indicators	● As per the study, the KPIs used by the company covered by are very basic and mainly related to Kms travelled or number of delivery per trip. ● The financial KPIs and quality KIs are mainly used by Medium and LArge company structure but not frequently reviewed
FMS	Fleet management system	Technology system to monitor the behaviour of the driver while driving on the road	● The FMS used by almost of the company are basic FMs : GPS for localisation and the overspeeding ● The advanced FMS are mainly used by a few Medium and large companies and cover all topics such basic GPs, geofencing, Driver fatigue management, and other driver's behaviour such harsh braking, harsh corning, abstraction..
ERP system	Enterprise resource planning	Information system to cover the SCM process and flow	● The RPS is system is used by almost the company mainly for generation delivery note and invoicing, inventory management ● There is a lack of reporting, CRM, assets management,

Table 5 provides the detail and percentage of the use of the KPIs, FMS and ERP

	KPIs	FMS		ERP
Company Category	KPIs	Basic	Adance	Cover the process of the SCM cycle
Small	10%	100%	0%	5%
Medium	40%	60%	40%	70%
Large	50%	30%	70%	100%

Table 6 shows the description of variables used in this research and reports the means and standard deviations.

Variable		Variable description	Mean	St.d	Min	Max
Supply Chain performance						
P1	Order fulfilment	Company order fill rate	3.1	0.89	1	5
P2	Just-in-time deliveries	On time deliveries	2.65	1.08	1	5
P3	Customer satisfaction	Satisfy and to fulfil the customer requirement	3.3	0.78	1	5
Supply Chain Flexibility and Adaptation, Communication, Structure and organisation						
A1	New products or services	Flexibility to introduce new products or new services in the market	2.89	0.98	1	5
A2	Production level	Ability to change the level of production volumes	3.41	0.79	1	5
A3	Right customer	Flexibility to deliver the required product or services to the right customer	3.01	0.91	1	5
A4	Reporting and internal review	Type of reporting and frequency of performing the internal review with sales and operation department	1.2	0.4	1	3
A5	Technology system (FMS)	The respondents asked to provide the feedback about the current technology system used for the fleet management system	1.16	0.65	1	3
A5	Flexibility to change task	Flexibility of employees to change tasks	2.23	0.23	1	5
A6	Tank sizing and customer storage	The respondents asked to provide the feedback about the current technology system used for the fleet management system	1.56	0.97	1	3
A7	Costing	Involvement to identify and to provide the Cost related to the supply chain	1.23	0.93	1	3
Supply Chain Responsiveness						

C1	Demand variations	Capability to react and sustain the various demands of the market	2.22	0.89	1	5
C2	Poor manufacturing performance	Capability to react and sustain the periods of low manufacturing	3.2	0.79	1	5
C3	Poor supplier performance	Capability to react and sustain the periods of low supplier 3.48 .96 1 5	2.87	0.96	1	5
C4 C5	Poor delivery performance	Capability to react and sustain the periods of low delivery	2.96	0.89	1	5
C5	Responding to new markets	Capability to react and sustain new products, new markets, new	3.09	0.94	1	5

Table 7 shows and provides an overview of the SCM's main challenges faced by the organisation

Category of organisation	Null Hypothesis	Alternative hypothesis
Transporters	The New regulations and rules imposed by the local authority in the field	Change in the regulation is not the main
	Employee mindset towards safety and cost optimisation	SAfety and cost reduction mindset is nt the main challenge
Gases Companies : producers and distributor	The reliability of the BULK gases sources	Reliability is not the main challenge in bulk industrial gases
	Resistance to the change in adoption to the new technologie and information system	Resistance is not the main challenges to adopt the new technology
	Employee mindset towards safety and cost optimisation	SAfety and cost reduction mindset is nt the main challenge
	Competition	Competition is not the main challenge
Supplier	The increase of cost related to the raw material plus the maintenance	Cost increase of raw material is not the main challenge

	Competition and market-base	Competition is not the main challenge

8. Discussion, recommendation, and conclusion

"**You cannot manage what you cannot measure**". Performance measurement can facilitate inter-understanding and integration among the supply chain members and process. It also provides insight to reveal the effectiveness of strategies and to identify success and potential opportunities. It makes an indispensable contribution to decision making in SCM, particularly in redesigning business goals and strategies, and re-engineering processes.

Based on the outcomes of this study, it was clear that the GAP and areas for improvemnet identified should be addressed to reach the target, and open the door for further research and studies.

8.1 Recommendation

- Setting up the right organisation and structure of the supply chain with clear function and job description. The following functions must be covered within the Bulk Supply Chain :
  - ➔ Bulk Supply Chain Management;
  - ➔ Sourcing Management;
  - ➔ Dispatch Management;
  - ➔ Transport & Fleet Management;
  - ➔ Vehicle Maintenance Management;
  - ➔ Bulk Asset Management.

This breakdown is applicable to the national / cluster team handling the Bulk Supply Chain.Except for the Sourcing, Fleet and Bulk Asset Management responsibilities it should be replicated in all individual distribution centres. Whenever possible, these functions should be kept separate to prevent potential conflicts of interests and promote personnel specialization.If the size of the operation (national or local) does not allow a complete split of those functions, and no convergence can be achieved with neighbouring countries, the following regrouping can be considered:

➔ The Bulk Logistics Manager may act as the Dispatch Manager and/or the Transport & Fleet Manager;

➔ The Sourcing and Dispatch Management functions may be combined;

➔ The Dispatch Management and Operations Analysis functions can be regrouped.

be combined with any other Bulk Supply Chain function because of the intrinsic opposition of their respective goals. It may also be assigned to the Customer Installation maintenance team or outsourced.

● Establish KPIs and conduct monthly analysis and benchmarking. This is critical for optimizing and ensuring supply chain effectiveness.

➔ Here an example of the operational KPIs and its relationship
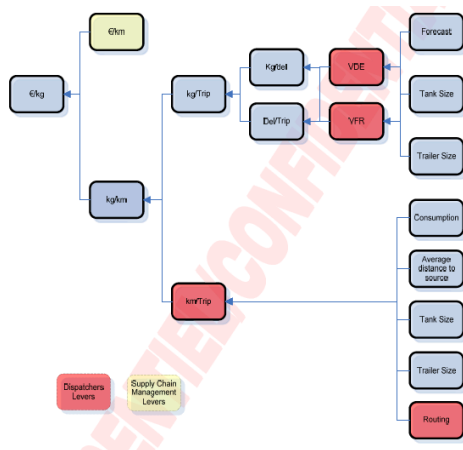
➔ Quality indication : Run out (The point at which the customer's process is inoperative due to lack of product supply)

➔ Performance indicator

● Communication: ensure that internal communication is set with all departments, mainly with the sales team, quality, and finance.

➔ Establish a monthly business review between sales and supply chain team to gather the customer requirement and discuss the logistic tissues

➔ Offer review : Involvement of the SCM steam before providing the final solution to the customer (defining the size of the tank)
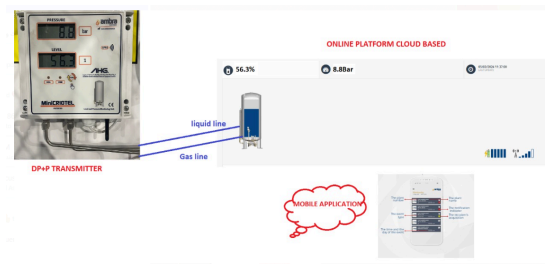
- Safety :

➔

➔ Enhance the safety mindset of the employees

➔ Ensure that road safety process and procedures are in place

➔ Ensure about the contractors' and drivers' qualifications, and make sure the appropriate training program is in place.

- Technology System: Supply chain management is currently a central area of emphasis in the field of developing technologies. Below are a few examples of technological system tools (not limited to)

➔ Telemetry system : for the data collection and forecasting

➔ **ERP** : Communication flows, better management of the inventory, and reporting for better decision

➔ **CRM** : setting up the CRM solution to satisfy the customer requirement stratification

➔ **FMS** : to monitor the fleet and enhance the safety and operation KPIs

➔ **Tool for vessel tank sizin**g : the tool is very helpful to better understand the customer requirement and to setup the respective tank sizing to avoid the

premature delivery or Mik trip wich can enhance and Operational KPIS and reduce the transportation cost
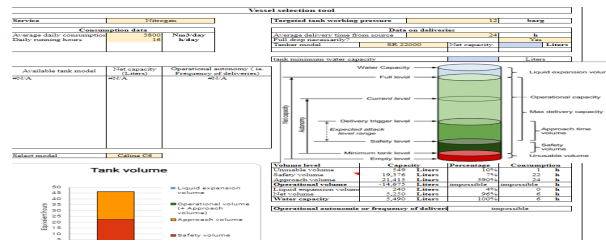
8.2 Conclusion

The research had significant hurdles in designing the study, collecting data, and conducting analysis due to the absence of past research of a similar nature in the Kingdom of Saudi Arabia (KSA). Nevertheless, the study team successfully carried out this investigation. The research and discussion revealed the predominant issues encountered by the service industry in the Kingdom of Saudi Arabia.

By categorising the analysis, we attempted to verify the results from several perspectives. The investigation results indicate that various firms encounter significant obstacles in the form of inadequate supply chain structure, technology, and communication. The analysis in the debate can provide comprehensive information on various categories, sizes, and operation widths for further detail.

Examination. Future Research Prospects: The current research outputs have paved the way for investigating goal selection strategies to address the issues in the field of IT.

Adoption of practices in the service industry in the Kingdom of Saudi Arabia. In the subsequent phase, further investigation can be undertaken to ascertain the factors that are most conducive to accomplishing the objective of mitigating the obstacles associated with IT adoption.

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