SCOR Implementation for Improved Efficiencies in Automotive Industry of Pakistan

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Abstract

This study aimed to streamline the adoption of the SCOR (Supply Chain Operation Reference Model) in the Automotive Industry. It is noteworthy that this model had not been previously implemented in the context of the Pakistan Automotive Industry, making it relatively unfamiliar among professionals in the sector. The study was designed to assess various facets of Supply Chain processes, focusing specifically on inbound supplies such as CKD parts, material handling, and the logistical packing of received CKD lots. The investigation identified several prevalent issues within the automotive industry's Supply Chain processes. Building upon these upstream challenges, the study established its objective and subsequently developed a research methodology. Consequently, an As-Is model of the existing Supply Chain procedures was constructed, with particular emphasis on the receipt of raw materials, encompassing CKD packing, unboxing, and addressing the issue of missing parts in CKD lots. The qualitative data analysis tool was employed to collect both current data and historical trends related to the identified problem. Additionally, the SCOR model was implemented to analyze processes directly linked to the problematic aspect of the study, specifically within the Plan and Source phases. This strategic application of the SCOR model aims to enhance and streamline these critical processes. A To-Be model has been formulated to meet the new requirements and fine-tune all supply chain activities in accordance with the proposed model. Subsequently, post SCOR implementation to discern differences between current and previous results will be checked. This approach aims to measure the effectiveness and evaluate the performance of the model, thereby identifying improvements in the processes.

Keywords: SCOR; Efficiency; Automotive

Introduction

Supply Chain Council (SSC) introduced Supply Chain Operation Reference Model (SCOR) with the help of two consulting firms in Boston. It aims to formalize and standardize the Supply Chain activities and all business activities that are linked with all stages of fulfilling customer demand. It is a tool that helps companies to figure out their supply chain into different processes

and then evaluate these processes. It can help companies quickly improve their processes by looking after the entire activities of the supply chain. The SCOR model binds together processes, metrics, best practice and technology to create better communication and greater efficiency across the supply chain. It is constantly evolving and, in this study, latest SCOR version 12.0 is used (Supply chain council, 2017)**.** In order to describe both simple and complex supply chains, the SCOR model is built around six management processes that are applicable to all business. The management processes are Plan, Source, Make, Deliver, Return and Enable. Please refer to Figure 1.

Figure 4: SCOR Model

It involves identifying the resources, needs and linkage among the process so that it can be aligned with the business objectives. It is usually employed to develop best practices for the efficiencies in Supply Chain. This process ensures the fulfillment of aggregate demand and supply by developing a plan that can meet the business objectives. The Planning process must align the Supply Chain Plan with company financial plan. This process finds the requirements, collect information about the resources available and then finds the planned capabilities by balancing requirements with resources. This will help in identifying the gaps between demand and resources and finding out corrective actions to fill those gaps. Companies usually monitors demand vs supply variation to avoid Bullwhip effect. It involves acquiring materials and services to meet actual market demand. It describes the ordering or scheduling as well as acquisition of material and services. Purchasing, goods receipt, supplier relationship etc. are the key elements of this process. It also discusses the procedure that are used to make payments to Supplier, receiving and verification of goods. It involves the production processes that converts raw material into finished goods and make it ready for supply in market. It describes all the activities that are linked with the transformation of raw material. It defines when order needs to be placed, make to stock etc., keeping BOM in consideration. Examples of Make process are Assembly, repair, overhaul and any other material conversion process. It includes activities related to the delivery

of finished goods or order fulfillment to meet the customer demand. The examples of such activities are delivery order scheduling, distribution management, i.e. picking, packing, shipment and invoicing to the customer. The scheduled deliveries are also related with warehousing and transportation. Product life cycle, finished inventories, export and import requirements are also part of this process. This step provides a competitive advantage to any industry as just being able to produce and make timely delivery of a product. This process involves the defected product that comes under warranty either from customer or suppliers. The activities involve after sale customer service, specifically warranty claim services. It describes the activities related with reverse flow of material returned from customers. It involves return identification need, decision of disposal, return scheduling, shipment and receiving of the return goods. Industry should make a system to receive return of shipments, defective products and packaging from customers to ensure satisfactory customer service. This process is associated with the management of the supply chain which includes management of business rules, performance management, data, resources, contacts, supply chain network, regulatory compliance, and risk management.

Problem Statement

The purpose of this project is to Implement SCOR framework in Automotive Industry to improve Performance in different Supply Chain activities and performance, increase responsiveness and increased customer satisfaction. Currently, Supply Chain processes and activities follows the normal conventional method that is less efficient, ineffective that results in loss of both time and cost. There are a lot of gaps in current process of procurement, warehousing, line supplies, inventory management etc.

Below are the challenges that we faced in Supply Chain daily operation.

- **CKD packing is one of the major issues in supply that resulted in parts damage during handling. (Ref: Figure-4, Figure-5)**

- **Missing parts in CKD supply result in crippling which ultimately result in down time.**

Packing Condition			
Part #	**Before Lot 81**	**After Lot 82**	**Issue**
6103010-CJ01, 6103020-CJ01 6203010-CJ04, 6203020-CJ04			
Part Name			
Door Glass FR RH / FR LH / RR RH / RR LH			
Model			
X7	Wooden Packing with nails	Wooden Packing with screws	Scratch issues. Nails are still being used Along with the screws so the operator has to use clawbar to unpack the case which can result in damage to the part.

Figure 5: Door Glass Packing Condition

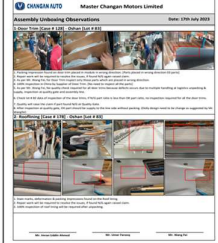# Roof Headlining Packing Change & Observation Summary

Figure 6: Roof Headlining Packing Condition

The Supply Chain of the Automotive Industry has been studied extensively but still automotive business is really complex and needs a model that is systematic and able to cover the entire sector. It includes standardized process that is well defined and KPI for measuring the performance. It also does comparative analysis of the complete Supply Chain rather than just internal operations. SCOR models outlined the procedures and recommendations that are intended to implement in Supply Chain processes of Automotive industries. Then, a number of advantages of application of using this framework in Automobile Industry needs to be discussed in light of case studies and, in particular, the interviews with various supply chain experts and

professionals. We will compile the summary of all hindrances and challenges faced prior to and during implementation of this model. As Humphrey and Memedovic (Memedovic, 2003) have revealed that, the automotive sector encompasses a wide range of networks and is usually highly valued investment with in-house developments viability due to greater no. of orders. (Casotti, 2008)H was supposed to develop and innovate new technology and promote management, along with the major modification in industrial production processes (C. R. Vaz, 2017)

There are many types of models that have been employed for business analysis. The SCOR model has gained fame and has been widely applied by the professionals. This model finds a step-by-step approach to identify, evaluate and monitor the Supply Chain performance. This model not only provides an opportunity to check how the businesses operates but also a common framework and language across the supply chain.

Research Questions

Below is the Research question that is intended to fill the gaps in challenges describe in above paragraph.

- Redesign and try out different packaging techniques for CKD packing.

Research Objective

- Improve Supplier Packing Techniques
- Improve Parts handling mechanism while transporting

Literature Review

In the contemporary and technologically driven market environment, an in-depth understanding of supply chain performance has become imperative due to its dynamic nature (Malkawi, 2017). This subject has garnered substantial attention from both practitioners and researchers involved in the execution of processes. Close coordination among network members is essential, demanding effective collaboration in every business relationship. In a manufacturing network, for instance, it encompasses all the necessary capabilities to acquire and deliver customer requirements (Dissanayake & Cross, 2018). Hence, the existing conventional standards of the supply chain prove ineffective in the current business scenario due to their limited scope and inability to encapsulate the broader spectrum of activities that are demanded. Consequently, traditional performance evaluation metrics for significant business processes fail to adequately explain their efficiencies and effectiveness (AL Al-Khasawneh, Malkawi, Nazem NM, AA AlGarni, 2018). The automotive industry in any country serves as a significant driver of economic growth,

being recognized as a leading sector that profoundly influences other manufacturing domains such as plastic, steel, finance, and more (Ume Rubaca, Munir, & Munir, 2022). Manufacturing industries, especially in the developing world, are grappling with formidable challenges posed by both local and global competitors. Manufacturers are striving to understand their customers' demands in order to align their supply chains for enhanced customer satisfaction. The conventional supply chain practices in the automotive industry are proving to be increasingly challenging in terms of acquiring a competitive edge (Chen, Preston, & Swink, 2015). The SCOR model is characterized by its flexibility, efficiency, and notable effectiveness in assessing supply chain performance compared to other methodologies. SCOR plays a pivotal role in enhancing responsiveness and productivity within business processes (Ganji Jamehshooran, & Norehan, 2015).

The SCOR model stands as a robust tool employed for the assessment and improvement of supply chain processes. It integrates various elements such as processes, metrics, best practices, and technology to enhance overall communication and efficiency throughout the supply chain. This study specifically utilizes SCOR version 12.0 (Supply Chain Council, 2017). While many performance measurement frameworks often focus on individual links within the supply chain, emphasizing the necessity for comprehensive empirical analysis and case studies (Beekman, 2008). Within the automotive market, the attributes of quality, reliability in final product delivery, and cost are accorded significant importance, with innovation, encompassing both radical and incremental changes, being perceived as the least crucial performance indicator (Ambe, 2014). In the automotive industry of developing nations, the intricate environment mandates a continual analysis of supply chain practices from a contemporary and practical standpoint (Bhattacharya, 2014). The growing emphasis on measuring supply chain performance, particularly leveraging business analytics, has emerged as a valuable approach to enhance efficiency and secure a competitive edge (Ganji Jamehshooran, 2015). The automotive industry, a prominent manufacturing sector characterized by intricate supply chains, is compelled to adjust to environmental and social priorities in addition to economic considerations. This adaptation necessitates the incorporation of advanced techniques, information technology (IT), and collaborative strategies (Ćurovac). Research on the supply chain of the automotive industry has traditionally concentrated on component production. However, there is a recognized need for a comprehensive model that addresses the entirety of the complex and uncertain supply chain (Lemghari, 2018). The automotive industry's advantages and environmental challenges are fueling a heightened interest in sustainable development (Fouad, 2021).

Amidst global expansion, supply chains are confronting heightened complexity propelled by emerging technologies and Industry 4.0, thereby presenting challenges for decision-making.

This circumstance underscores the need for customized supply chain models(El,Kihel,2023). The assessment of supply chain performance for competitiveness is crucial, and for this purpose, the SCOR model and the streamlined SCOR Racetrack methodology developed by APICS are widely employed (E.Kusrini, 2023) To enhance supply chain performance in the automotive industry, it is recommended that car manufacturers consider the direct procurement of raw materials for their suppliers, thereby eliminating handling fees (Nurmala,2023). This article assesses segmental variations in supply chain performance within the Indian automobile industry and examines their influence on overall firm profitability. The findings underscore the importance of an effective and profitable supply chain integration (Talukder, 2023).

SCOR Structure

The aim of this reference model is to define a process architecture that matches with key business activities and objectives. It refers to how process interact and perform and what is the configuration of their process and what skills are required for the staff who is operating the process. There are 4 major sections elaborated below.

Performance

It is a standard metric that defines the performance of the process as well as defining strategic goals. It focuses on the net result of Supply Chain process execution. A well-defined method to assess Supply Chain performance consists of three elements i.e. Performance Attributes, Metrics and Process maturity. Brief description of these elements are as follows.

Performance Attributes

It prioritizes and align Supply Chain performance with the business strategy.

Metrics

It is a discrete performance measure that consists of connected level of hierarchy.

Process Maturity

How well Supply Chain processes and practices execute best practice models and leading practices.

Processes

It describes the standard description of management processes and their relationship. Through categorizing and characterizing process flows, companies can focus on quality and cost efficiency of manufacturing and delivery processes. It defines the activities that many companies perform to execute their Supply Chain.

Practices

It defines the practices of the management which produces significantly better process performance. Any process can be configured in a unique way which is called Practice. There are several types of processes exist within any organization.

- Emerging Practice (BP.E)
- Best Practice (BP.B)
- Standard Practice (BP.S)

SCOR classifies established practices based on feedback from Industry practitioners and experts.

People

It defines standard definition for skills that are needed to perform Supply Chain processes. These skills are specific to the Supply Chain. The skills are defined by standard set of definitions that expresses the experience, training and competency level. There are total five competency levels (Novice, Beginner, Competent, Proficient, Expert). There are specific coding in this section i.e. all people's elements starts with the capital letter **H** followed by a capital letter that represent the element e.g. S for Skills, E for experiences and T for training.
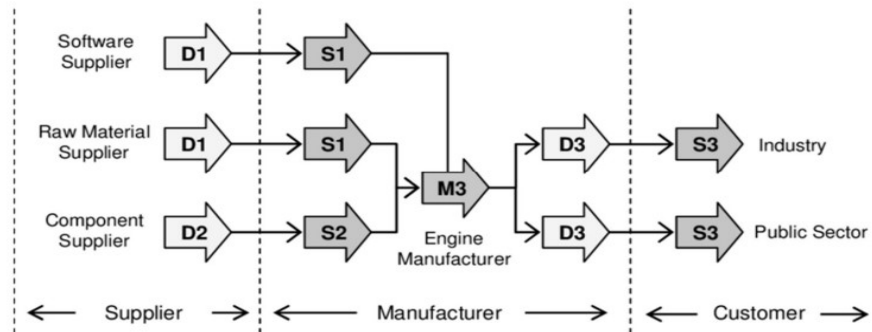

Figure 7: SCOR Structure

Figure 8: Thread Diagram

SCOR Model Metrics and Performance Measurements

Supply Chain performance can be measured by three levels. These levels are set as standard to benchmark supply chain performance metrics to evaluate against any business. There are more than 250 SCOR frameworks that are categorized against five performance attributes i.e Reliability, responsiveness, agility, cost and asset management. Organization utilizes these attributes to develop requirements for the Supply Chain to identify which performance attribute can be given priority and what are those which can operate at average pace. Here are some details of those levels.

Level 1

It contains scope, geography, segment and context. Focus is on the main six process from Plan to enable at this stage. These metrics are diagnostic for the overall health of Supply Chain. These are strategic metrics and Key Performance Indicators (KPI). They help to establish realistic targets that support strategic objectives.

Level 2

It includes configuration of the Supply Chain, segment, geography and products. At this level, metrics are at high level, and they will be evaluated across multiple SCOR processes. They serves as the diagnostic for level 1 metrics. It helps to identify the root cause in the performance gap.

Level 3

It identifies the main business activities within a Supply Chain at the process element details. It serves as the diagnostic of level 2 metrics.
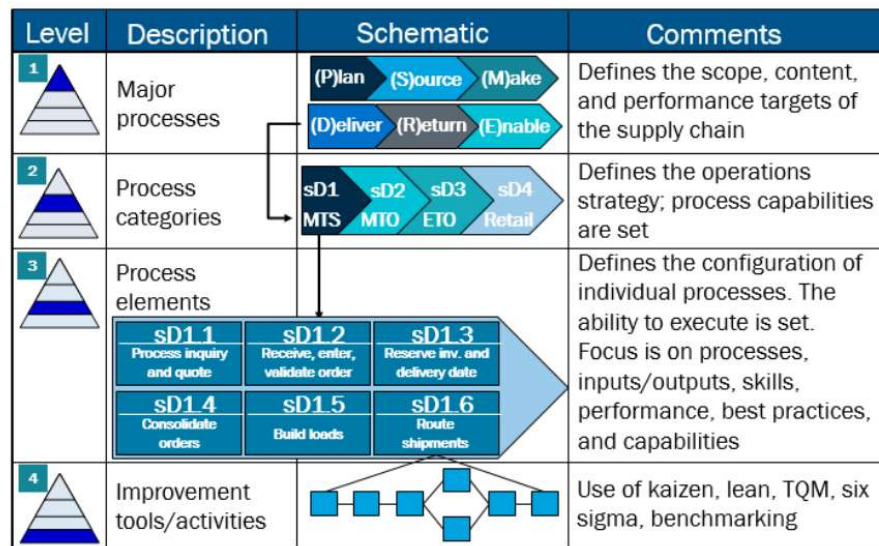
Figure 9: SCOR Process Hierarchy

SCOR Attributes

Reliability

It defines the capability of performance any tasks as demanded. It mainly focuses on the potential outcome of any process. The metrics for this attribute are On-time delivery, right quantity and right quality. It is a customer focused attribute.

Responsiveness

It defines the speed at which any task is performed. It mainly focuses on the speed at which Supply Chain make delivery of the product to the customer. The example is cycle-time

Agility

It is the capability to respond to external influences. It mainly focuses on the ability to respond to market changes to get competitive advantage. It includes adaptability and Overall value risk.

Costs

It defines the cost of operating the Supply Chain processes. It mainly includes labor, raw material and transportation cost. Example of this attribute is COGS i.e Cost of Goods sold.

Asset Management

It is the ability to efficiently utilize assets. Asset management strategy includes reduction in inventory and outsourcing. Example of this attribute is Inventory days of supply and capacity utilization.

Supply Chain of an Automotive Industry

The Supply Chain of Automotive sector is quite complex because of very different and complex nature. There are thousands of parts in a car and absence of one of those parts slow down the production or even stop the production line (Lemghari, 2018). The Automotive sector is highly globalized and there are many players who are in competition around the world. These companies want to improve their value chain in order to remain competitive. There are number of vendor companies involved in the Supply Chain who are responsible to manufacture and supply the parts to Original Equipment Manufacturer. As (Humphrey, 2003) have pointed out, the automotive sector is global and specified as a capital-intensive industry with vertical integration and economies of scale. He was responsible for the development of technological innovation and management, as well as the original major change in industrial production processes.
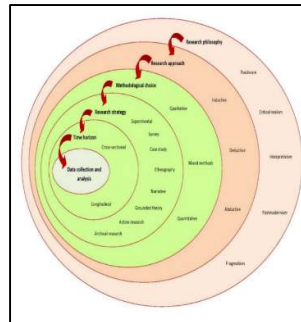
Figure 10: Research Onion

Research Methodology

It refers to the techniques and process of data gathering that is been used in research-based projects which develops confidence and validity for the readers regarding the research being carried out. The study should also specify tools and techniques used for sampling. Research Onion provides the layer wise concept which represents different stages of the research. These layers include philosophy, approach, strategy, time horizons, data collection methods, techniques and procedures and research limitation.

Research Philosophy

It contains two basics measures i.e Ontology and Epistemology. The former deals with the basic nature of a phenomenon and its relationship with the surrounding entities. The later deals with the study of knowledge and belief. In this project, the available data and practices related to SCOR are linked with Ontology.

Research Approach

It tells about the approach adopted for the research project. There are two types of approaches, i.e Inductive and deductive. The former one is based on purely new sets of theories rather than based on some available data to proceed further. The later one is the approach with available set of information which is used in study to analyze and draw conclusion. In this project, deductive approach is used with set of information already available and for the remaining analysis, qualitative analysis technique i.e Focused group discussion has been utilized.

Research Strategy

It tells how research can be conducted to get the purpose of study. It includes qualitative, quantitative, surveys, mix and match of any of them.

Time Horizon

It deals with the time frame for the collection of data. We opted "Cross-Sectional Time Horizon" where time frame is bounded with in specified period of time.

Sampling Technique

Purposive sampling technique is used where data is gathered from the relevant group of people engage in the process of handling and transporting CKD lots.

Sample Size

The target sample size is three functional departments which includes Import Planning, Warehouse and Production.

Questionnaire Development

Develop questionnaire to conduct Focused Group Discussion to discuss the cases of missing parts and damages cases.
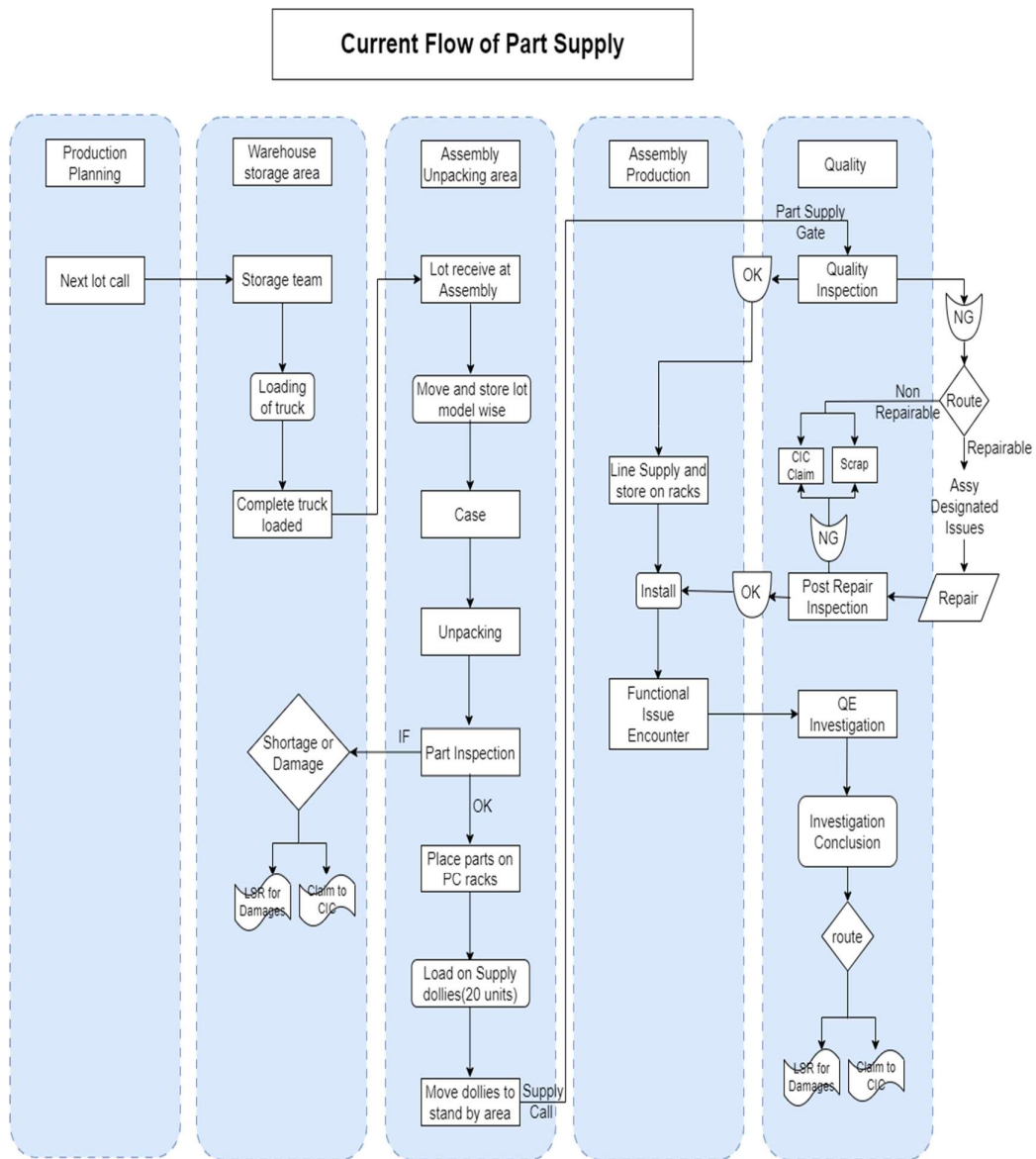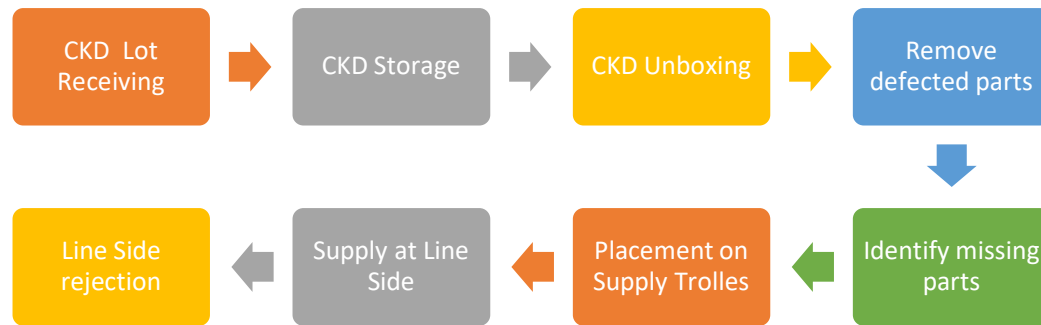
Figure 11: As-Is Model

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┌──────────────┐     ┌──────────────┐     ┌──────────────┐     ┌──────────────┐
│  CKD  Lot    │ ──► │              │ ──► │              │ ──► │   Remove     │
│  Receiving   │     │ CKD Storage  │     │ CKD Unboxing │     │ defected     │
│              │     │              │     │              │     │ parts        │
└──────────────┘     └──────────────┘     └──────────────┘     └──────────────┘
                                                                       │
                                                                       ▼
┌──────────────┐     ┌──────────────┐     ┌──────────────┐     ┌──────────────┐
│  Line Side   │ ◄── │ Supply at    │ ◄── │ Placement on │ ◄── │ Identify     │
│  rejection   │     │ Line Side    │     │ Supply       │     │ missing      │
│              │     │              │     │ Trolles      │     │ parts        │
└──────────────┘     └──────────────┘     └──────────────┘     └──────────────┘
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Figure 12: As-Is Model of Parts Supply Cycle

Industry Background

Master Motors Corporation Pakistan has signed a joint venture agreement with Changan Automobile China. They have set a passenger car manufacturing plant in Karachi, Pakistan. The venture started its operations in 2018. The product portfolio of the company includes Light Commercial Vehicles (LCV), Multi-Purpose Vehicle (MPV), Passenger Vehicles, and now started Sport Utility Vehicles – SUV. Changan is among the top category brand in China and they recently achieved the top selling domestic Chinese brand in automobile sector. The brand has been in existence in China since last 153 years. Changan has more than 32 years of experience in car manufacturing business in China.

The company is located at Bin Qasim Industrial Estate and operates in a single shift with employee workforce of around 1000 people. The company has achieved 50% market share in MPV segment where it disrupted the market of Bolan. Similarly, In Sedan and SUV category, it has launched Alsvin that competes with Toyota Yaris and Honda City. The company has also launched Oshan back in Feb-2022 that competes with KIA Sportage, Hyundai Tucson, Cherry Tiggo, Proton X70. In all segments, it has disrupted their competitor market and gain momentum in sales by providing low cost and reliable quality products in all categories. The company has nationwide dealership network across major cities of Pakistan to reach out to customer at a shorter distance. They serve Sales and After Sales operations for the company and plays an important role in company business growth.

Supply Chain Network

The company fulfills its production demand through various local and international supplier networks. 80% of the raw materials requirement are fulfilled through international supplier who is the shareholder as well while rest of the demand is fulfilled through local sources

with manufacturing duly approved by the principle. Company is facing difficulties in their supplies from the principle. Like in many cases, there are cases of wrong shipment. ,missing parts, defective parts etc. that results in not only waste of resources in sorting but also having severely on Assembly production line. The case study revolves around these issues, and they are planned to sort these issues with the implementation of SCOR framework. The SCOR provides measurement metrics, best practices and benchmarking that can be adopted to improve supply chain network of any industry.

Results

The data was gathered through focused group discussion, and the problem statement was discussed with them in detail. In the step-by-step approach of SCOR implementation, As-Is was developed by studying the existing working model and then performance attributes of SCOR were analyzed based on the data taken from history of receiving lots, ERP oracle, warranty claims and returns etc. Through the study of available data, gaps were identified and analyzed, and it is identified that Reliability attribute is the major point of concern where accuracy in delivered items and quantity was greatly compromised. There were also many cases of defected supplies and wrong shipment that reduced the percentage of order fulfillment under Reliability attribute of SCOR framework. The remaining performance attributes like Responsiveness, Agility, Cost and Asset Management were not directly related to the scope of study because order fulfillment was the key factor under study which came under the attribute of Reliability. Then To-Be model was developed that cop up the gap identified above, and it was decided to place one representative at principal premises that was held responsible to inspect CKD parts during loading and inspect detailed packing list and must ensure that all parts are properly placed in cases as well in the right quantity.

Door Glass

Status after Packing Change	Packing Observation in Lots														
	Lot 81	Lot 82	Lot 83	Lot 84	Lot 85	Lot 86	Lot 87	Lot 88	Lot 89	Lot 90	Lot 91	Lot 92	Lot 93	Lot 94	Lot 95
Inspection Quantity / lot	235	240	124	179	240	220	180	168	221	240	240		239	202	240
OK Parts	221	216	111	157	229	208	178	163	214	234	229		7	200	236
N/G Parts	14	24	13	22	11	12	2	5	7	6	11		4	2	4
Defective %	6%	10%	10%	12%	5%	5%	1%	3%	3%	3%	5%		2%	1%	2%

Table 8: Door Glass

5.2 Roof Headlining

Status after Packing Change	Packing Observation in Lots													
	Lot 82	Lot 83	Lot 84	Lot 85	Lot 86	Lot 87	Lot 88	Lot 89	Lot 90	Lot 91	Lot 93	Lot 94	Lot 95	Lot 96
Inspection Qty. / Lot	59	60	60	60	60	50	60	60	60	60	60	60	20	50
OK Parts	50	43	27	0	6	0	0	3	6	26	23	7	11	4
N/G Parts	9	17	33	60	54	50	60	57	54	34	37	53	9	46
Defective %	15%	28%	55%	100%	90%	100%	100%	95%	90%	57%	62%	88%	45%	92%

Table 9: Roof Headlining

Performance Attribute	Level-1 Metric	Level-2 Metric	Level-3 Metric	Actual Values	Target Value
Reliability	RL1.1: Perfect Order Fulfillment	RL 2.1: Percentage of fully delivered orders)	RL 3.33: Accuracy of Delivered Item	95%	100%
			RL 3.35: Accuracy of Delivered Quantity		
		RL 2.2: Accuracy of documentation	RL 3.31: Compliance documentation Accuracy	97%	100%
			RL 3.50: Accuracy of Shipping Documents		
		RL 2.3: Perfect Condition	RL 3.24: Percentage of damaged free order / lines	96%	100%
			RL 3.35: Warranty & Returns		
Responsiveness	NOT IN SCOPE				
Agility					
Cost					
Asset Management Efficiency					

Table 10: Analysis of Performance Attributes

| Lot #	Short Shipment	Missing Shipment	Wrong Shipment	Defective Parts	Packing Issues
Lot # 81	1,083	-	3	5	RR Door Glass Assy found in wooden case should be converted into the iron case.[Oshan]
Lot # 82	120	860	240	23	Nails found in all windshield cases. [Oshan]
Lot # 83	1,080	-	-	70	Impressions of the support on rooflining case F14, Case # 178]
Lot # 84	484	-	-	84	Nails found in all cases of the Sunroof [Oshan].
Lot # 85	265	1,320	-	51	The hinges collide to the engine hood inside the case and cause dents.[Case # B034].

Table 11: Details of Lots inspection

Conclusion & Recommendation

It is recommended to take the data of post implementation of To-Be model and analyze the results to get the effectiveness of proposed To-Be Model. The study was specific for some issues highlighted in problem statement however, there are further many areas related with this CKD handling and transportation that needs further detailed study.

Mapping Research Objectives, Research Questions and Research Method Used

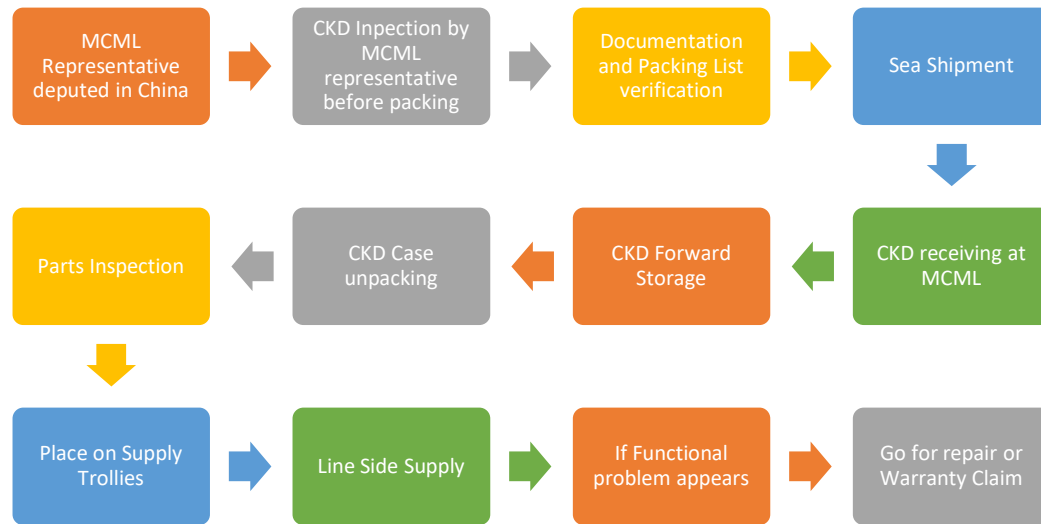| Research Objective		Research Questions	Research Method Used		Result
Redesign and try out different packaging techniques for CKD packing		Improve Supplier Packing Techniques	Focused Group Discussion		Some cases that have bulky parts and were transported in carton were shifted to the metallic case
		Improve Parts handling mechanism while transporting .			
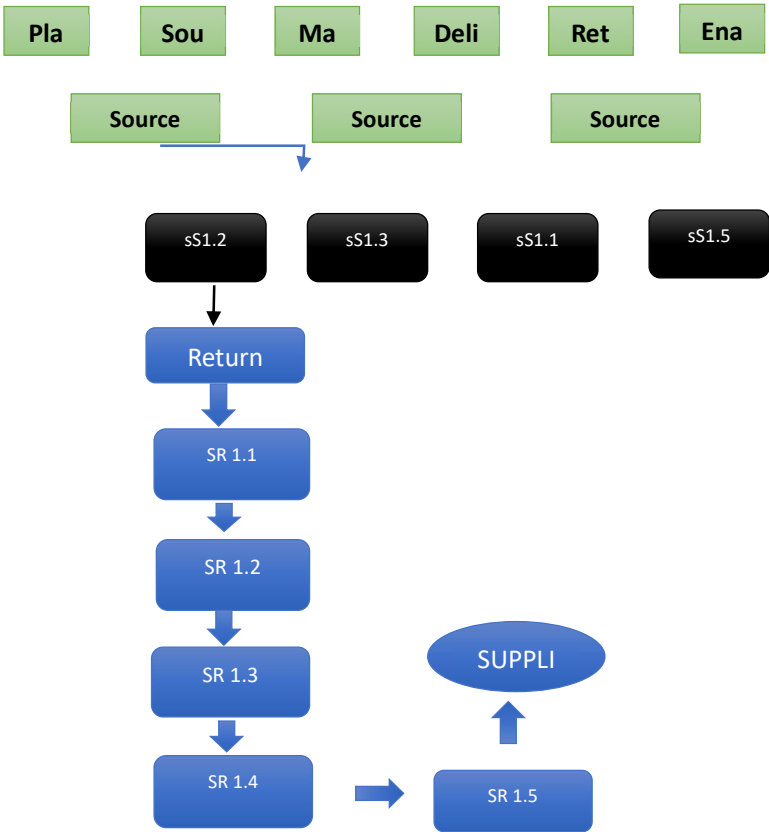
Figure 13: To Be Model

Conclusion & Further Research

The body of knowledge of SCOR Model is very large. The development of model theory and its practical application have gained attention of many scholars and professional from Businesses. Keeping basic theory of SCOR model, all process levels are applied. We chose Automobile Industry as object of research to carry out fundamental analysis. But lack of authenticity of data from the businesses, the study did not go that deeper, therefore future research should focus on practical implementation of SCOR model.

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