Supply Chain Analysis of Huawei Mobile Phones

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Abstract: Since Apple's first iPhone in 2007, the smartphone industry has boomed, with Apple, Samsung, and Huawei at the forefront. In 2019, 1.371 billion smartphones were shipped globally, with the top 5 vendors accounting for 70.56%. In China, Huawei, Xiaomi, OPPO, and Vivo are major players. The industry's core competitiveness lies in product development, marketing, and supply chain management. Huawei, a leading global company based in China, excels globally but faces supply chain and inventory challenges. Its global supply chain, with suppliers worldwide, is complex. Rapid product changes and diverse product lines make demand forecasting hard. To counter these, Huawei uses advanced supply chain theories and tech for digitization, transparency, and responsiveness. As a key player in the smartphone supply chain, Huawei orders based on customer demand, plans production, and negotiates with suppliers for quality components. This paper analyzes domestic and foreign inventory management, examines Huawei P40's inventory, and offers improvements. Huawei's P40 faces demand-supply uncertainty, inventory control, rational management, liquidity, and supply chain coordination. Huawei's customer-centered supply chain uses advanced tech to ensure efficient product design-to-delivery, aiming for a stable and reliable system. It has long-term supplier partnerships and uses DAP for better communication and resource sharing. Through the S&OP mechanism, Huawei balances resources across departments for quick market response. Market research led to an innovative triple-fold screen phone's success. For inventory, Huawei uses ABC classification, VMI, and JIT, sharing info and analyzing demand to cut inventory costs and risks. In summary, Huawei's supply chain management, covering supplier, S&OP, and inventory, shows great results with advanced methods.

Keywords: Huawei; supply chain management; inventory management

1. Background

1.1. Current State of the Smartphone Industry

Since Apple released the first iPhone in 2007 and HTC launched the first Android phone in 2008, the smartphone industry has become increasingly competitive. Over the past decade, the market has evolved into a three-way competition between Apple, Samsung, and Huawei [1]. According to IDC, global smartphone shipments reached 1.371 billion units in 2019, with the top five manufacturers (Apple, Samsung, Huawei, Xiaomi, and OPPO) accounting for 70.56% of the total in Table 1. Chinese manufacturers like Huawei, Xiaomi, OPPO, and vivo have performed exceptionally well, contributing 35% of global shipments in 2019.

Table 1. Different Mobile Phone Brands and Target Groups.

Brand of Mobile Phone	People in Need
Huawei	Mid-to-high-end market consumers
Apple	Users who care about user experience and ecosystem integrity

Samsung	Users who demand high quality and a personalized experience
Xiaomi	Young consumers and people looking for value for money
Oppo	Young and fashionable group

Chinese smartphones have a firm footing in the global market. In the smartphone industry, supply chain management is as crucial as R&D and marketing. A phone has numerous parts from thousands of upstream industries. Most manufacturers focus on R&D and marketing, outsourcing parts procurement [1]. So, the technical level and supply of upstream core components impact market distribution. Apple and Samsung can develop their own chips, while among Chinese manufacturers, only Huawei has its Kirin chip; others rely on imports, placing them at a supply chain disadvantage, especially in core components in Table 2 Huawei, a leader in China's smartphone industry, shipped 240 million smartphones in 2019, ranking third globally.

Table 2. Different Mobile Phone Models and Their Prices.

Brand of Mobile Phone	Difference in Price
Huawei	A good balance of performance and features, priced between 4000 and 7000 HKD.
Apple	The prices are on the high side, with some flagship models priced at over 10,000 HKD.
Samsung	Price between 3000 and 5000 HKD
Xiaomi	The price is very affordable, suitable for users with a limited budget, and ranges from 1000 to 3000 Hong Kong dollars.
Oppo	A good balance of performance and design, priced between 2500 and 4000 yuan.

1.2. Huawei's Mobile Phone Supply Chain Management Features

Huawei's mobile phone supply chain is global, with component suppliers worldwide, including the U.S., Japan, South Korea, and China. These cover key components, and Huawei issues purchase orders to over 200 suppliers annually. Managing this large network is complex. The decentralized suppliers make information sharing hard, leading to potential inaccurate demand forecasts and production shortages or surpluses. Also, suppliers' capabilities and supply cycles vary. U.S., Japanese, and South Korean suppliers have longer cycled due to advanced tech, while domestic ones are shorter.

1.3. Rapid Product Iteration and Demand Uncertainty

Huawei releases over 20 mobile phone series yearly, showing strong R&D and market adaptability. But rapid product iteration and multiple series challenge its supply chain management. Predicting demand for each model is tough due to an uncertain market, diverse customer needs, and differences in demand among customer groups.

According to the Figure 1, Huawei needs to predict market demand six months in advance, and then use sales forecasts to derive a production plan, which is used to derive a procurement plan for parts and components based on production plans and inventory. In practice, Huawei uses market research and data analysis to predict the design and development direction of future products, and it also cooperates with channels to make forecasts. However, due to the large number of product models and the difficulty of forecasting, the uncertainty of customer demand further reduces the accuracy of the forecast, which causes great trouble for production and procurement supply chain management.
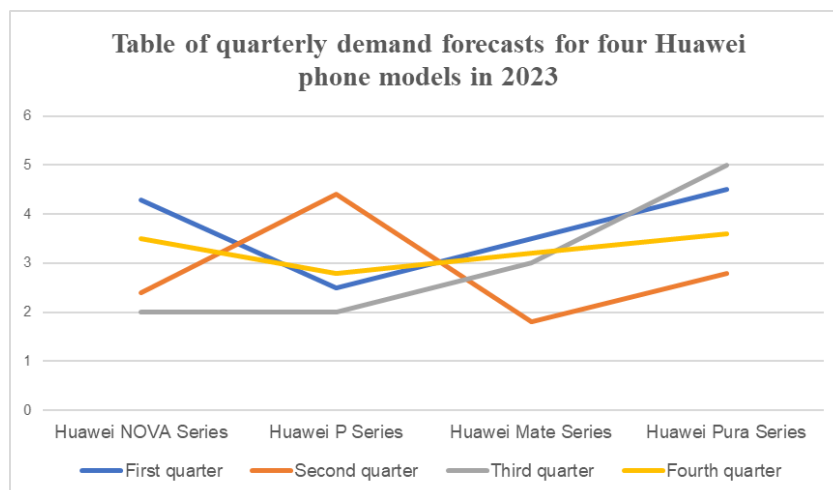
Figure 1. Quarterly Demand Forecasts for Four Huawei Phone Models in 2023.

1.4. Inventory Management and Supply Chain Collaboration

Huawei's inventory management faces the risk of high inventory. In order to meet the needs of different customer groups, Huawei has adopted a multi-series, multi-model strategy in product design and development, resulting in poor component versatility. For example, in addition to electronic materials such as inductors and blockers, core components such as platform chips, cameras, and housings are mostly special-purpose devices that can only be provided for each model. When market demand fluctuates, some parts are prone to becoming slow-moving inventory, while other parts suppliers are unable to meet deliveries in time, leading to a mismatch between production and sales.

In order to reduce inventory risk, Huawei needs to establish a unified supplier collaboration platform, which can help suppliers more accurately grasp Huawei's actual needs and reduce the amplification of demand and long-whiplash effect caused by information asymmetry. Therefore, Huawei needs to further promote the digitalization of the supply chain and improve the transparency and responsiveness of the supply chain [1].

Facing these challenges, Huawei has explored various aspects of supply chain management and inventory control. Firstly, Huawei has introduced advanced supply chain management theories such as lean production, MRP (Material Requirements Planning) and JIT (Just in Time) to optimize production and procurement processes. Secondly, Huawei has increased its investment in the digitalization of the supply chain, and has implemented systems such as ERP (Enterprise Resource Planning) and SCM (Supply Chain Management) to achieve comprehensive monitoring and management of the supply chain. In addition, Huawei has also used big data and artificial intelligence technology to establish sales forecasting models and continuously improve the accuracy of forecasts to reduce inventory pressure. Through these measures, Huawei has not only maintained its competitiveness in the current market environment, but has also laid a solid foundation for sustainable development in the future.

2. Supply Chain Management's Case Study

2.1. Overview of Huawei's Supply Chain

Huawei's mobile phone supply chain management is customer-oriented, adopting advanced supply chain management technologies and methods to ensure that the entire process from product design, raw material procurement, production and manufacturing to delivery to customers can be efficiently completed while meeting their basic needs [2]. To meet the requirements of the global market, Huawei has always been committed to building a stable, reliable, and efficient supply chain system, and improving the overall efficiency of the production chain.

2.2. *Huawei's Supplier Management*

With the development of the times, the popularity of smartphones is becoming increasingly widespread. As one of the leading figures in the world mobile phone market, Huawei has established long-term and fixed relationships with many suppliers [2]. Supplier management is a key factor in the success or failure of Huawei's implementation of supply chain management. The core suppliers of Huawei smartphones are shown in the following Figure 2.
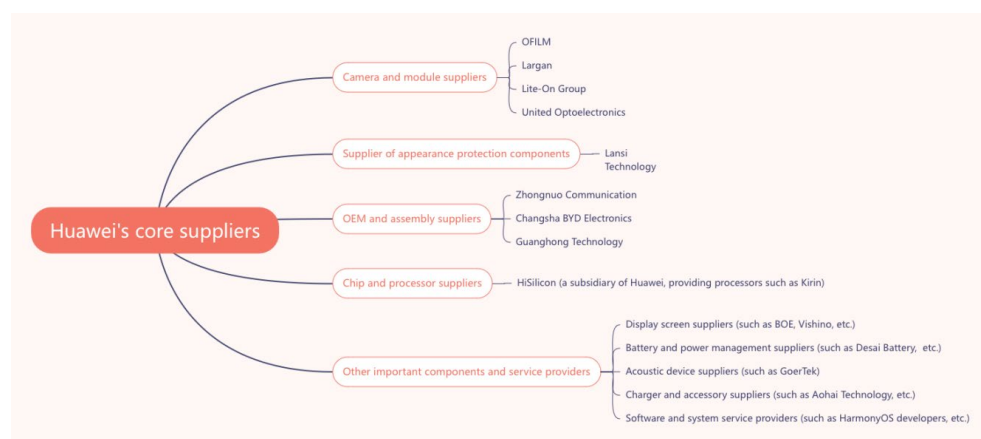

Figure 2. Core Suppliers of Huawei Smartphones.

Maintaining stable supplier relationships in Figure 2 is crucial with the aforementioned suppliers. To ensure that all suppliers meet the company's requirements and standards, and to maintain their loyalty to the enterprise, Huawei has implemented Dynamic Strategic Alliance in the Process (DAP), which not only strengthens communication with suppliers, achieves resource sharing, but also improves the efficiency of its cooperation with suppliers.

2.2.1. Dynamic Strategic Alliance in the Process (DAP)

Dynamic Strategic Alliance in the Process (DAP) is a cooperative economic entity that utilizes information technology to quickly respond to market opportunities and temporarily form different enterprises into a computer network connected entity that operates under the command of a single enterprise. This form breaks through the tangible boundaries of non-interference between enterprises towards their respective goals, extends the functions of enterprises, fully utilizes external resources, reduces investment risks, maximizes profits, and accelerates the achievement of market goals [2].

2.2.2. Huawei Adopts the Characteristics of DAP

Huawei's DAP is formed based on the market demand at that time, and different strategic alliances will be formed according to subsequent changes in market demand. Its formation is temporary, and the composition of members is flexible and variable [3]. At the same time, resources within the alliance are shared and risks are jointly borne. Under the unified command of Huawei, alliance members share their resources to improve production efficiency, maximize benefits, and jointly face market risks while achieving win-win outcomes.

2.2.3. Huawei's DAP Case Study

Huawei mobile phones have cooperated with global telecom operators, established strategic cooperation relationships, and organized various enterprises to jointly develop 5G technology to meet customers' high requirements for Internet quality while the Inter-

net is developing at a high speed. This cooperation has established Huawei's leading position in the 5G field. While improving Huawei's technical level and market competitiveness, advanced 5G technology has also become one of the main reasons why Huawei mobile phones occupy the market.

2.3. The S&OP Operation Mechanism of Huawei Smartphones

The S&OP (Sales and Operation Planning) of Huawei phones is implemented internally within the company, which comprehensively manages and balances resources in various aspects such as sales planning, procurement planning, and execution [4]. By analyzing the market, the plans of each department are revised, and inter departmental coordination and combat are strengthened to achieve the overall business strategic goals. While strengthening communication between internal departments of the enterprise, ensure quick response to market changes and improve customer satisfaction. The operational flowchart is as follows shown in Figure 3.
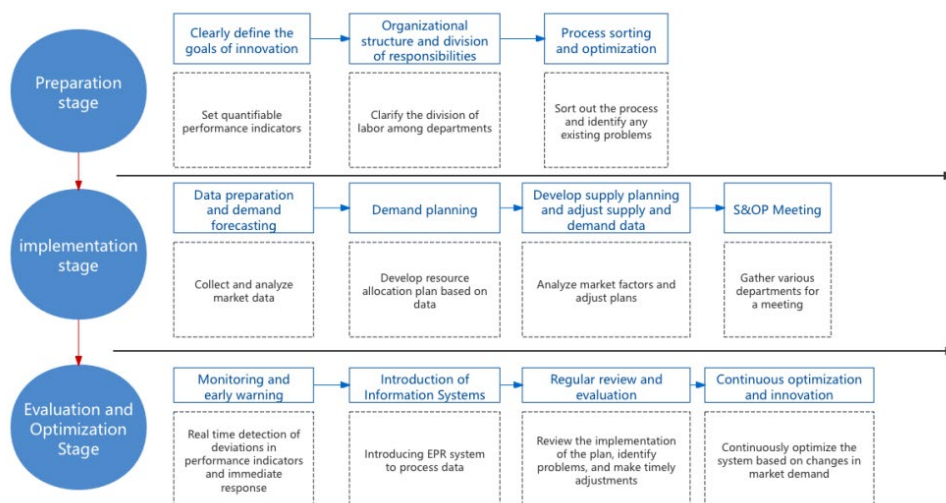

Figure 3. Huawei S&OP Mechanism Flow Chart.

Under the S&OP operation mechanism in Figure 3, Huawei has reduced the impact of uncertainty on its supply chain management. A tight and orderly communication chain has been formed between various departments. By analyzing market data, changes in market demand can be detected in a timely manner. When deviations from the plan are discovered, which affect the company's performance, quick responses can be made to avoid losses. As the income of the consumer group increases, there are higher requirements for the appearance of mobile phones. After market research, Huawei withdrew from the three-fold screen mobile phone [4]. This innovative design meets the comprehensive needs of consumers for large screens and portability, and once released, it received widespread attention from the market and achieved great success.

2.4. Inventory Management of Huawei Smart Phones

To strengthen inventory management, Huawei adopts the ABC classification method to dynamically adjust and continuously improve the inventory of various products [5]. It adopts different management methods for different materials through the ABC classification method, as shown in the Table 3 below.

Table 3. Characteristic of Huawei Smart Phones.

	Characteristic	Amount proportion	Quantity proportion
A	Few categories, high value	70%	20%

C	High categories, few value	10%	50%
B	Between A and C	20%	30%

As Table 3 shows below, this method greatly enhances Huawei's management efficiency of various material inventories, avoiding the cost increase caused by inventory backlog. In order to further reduce inventory costs, Huawei has also optimized its procurement model to control inventory. Adopting a combination of VMI and JIT.

For materials with poor universality and large volume, JIT (Just in Time) procurement mode is adopted to purchase materials in small batches according to the production plan consumption progress, reducing factory inventory backlog.

For materials with high value and stable demand, such as chips, VMI (Vendor Managed Inventory) is adopted, where multiple suppliers manage the required materials themselves [6]. Based on the shared inventory consumption situation of the enterprise, suppliers proactively complete replenishment according to consumption trends and replenishment strategies. Sharing information between enterprises and suppliers, analyzing market demand, reducing supply quantity errors, and minimizing inventory backlog or shortage risks [7,8].

In summary, Huawei's supply chain management involves multiple aspects: supplier management, S&OP operation mechanism, and inventory management. Among them, supplier management is an important factor affecting Huawei's supply chain management. Therefore, the following analysis is conducted to evaluate suppliers and identify the important factors that affect Huawei's suppliers.

Based on the calculation method of analytic hierarchy process (AHP) and combined with the supplier factors mentioned in Table 1, a site selection hierarchical analysis model with 4 standard layers and 12 factor layers is constructed in Table 4.

Table 4. Supplier Evaluation Index System.

Primary indicator	Secondary indicator
A1 Quality factor	Quality Management System A11
	Product excellence rate A12
	Manufacturing process control A13
A2 Technical factor	The application and introduction of new Technology A21
	Design capability A22
	Failure analysis capability A23
A3 Responsiveness factor	Delivery term A31
	Flexible capability A32
	Order fulfillment A33
A4 Financial position factor	Debt servicing capacity A41
	Operation capability Plant management level A42
	Cashflow A43

Firstly, the authors establish a clear database based on the specified values listed in Table 2. The rating data are organized in a series of Tables 2 to 6, facilitating better analysis and comparison. In this process, by carefully considering the weight ratio coefficient of each factor in the target measurement, a factor weight set is constructed to quantify the influence weight of each factor on the supplier, as shown in Table 5. This weight set not only reflects the subjective judgment of experts on the importance of each influencing factor, but also incorporates objective factors relevant to actual operations, thereby ensuring comprehensive and scientifically grounded decision-making in Table 6. Finally, 18 customers from different backgrounds were invited to participate in the evaluation process shown in Table 7, where they provided in-depth scores and assessments of multiple supplier-influencing factors.

Table 5. The Provision of Quantified Values for Comparison between Indicators.

Factor i over factor j	Quantized value
Equally important	1
Slightly important	3
Stronger importance	5
Strongly important	7
vital	9
The median of two adjacent judgments	2, 4, 6, 8
Count backwards	$a_{ij} = 1/a_{ij}$

Table 6. Standard Layer Judgment Matrix.

Huawei mobile phone supplier evaluation indicators A	Quality factor A1	Technical factor A2	Responsiveness factor A3	Financial position factor A4	
Quality factor A1	1	1/4	2	1/3	0.0566
Technical factor A2	4	1	8	2	0.2265
Responsiveness factor A3	1/2	1/8	1	1/5	0.4088
Financial position factor A4	3	1/2	5	1	0.3081

Table 7. Index Layer A1 Judgment Matrix Table.

Quality factor A1	Quality Management System A11	Product excellence rate A12	Manufacturing process control A13
Quality Management System A11	1	1/3	2
Product excellence rate A12	3	1	5
Manufacturing process control A13	1/2	1/5	1

The maximum characteristic value is obtained according to formula (1), and the RI in Table 8 coefficient is determined by referring to the Table 7 and then substituted into formula (2) and (3) for consistency test. If the final value is greater than 0.1, the unreasonable evaluation test fails; if the final value is less than 0.1, the test passes. According to Table 9, it is found that the CR value of standard layer and each index layer is less than 0.1, and the test passes Table 10. And make a ranking diagram for the weights of each indicator layer in Table 11.

$$\lambda_{max} = \sum_{i=1}^{n} \frac{[AW]_i}{n\omega_i} \tag{1}$$

$$CI = \frac{\lambda - n}{n-1} \tag{2}$$

$$CR = \frac{CI}{RI} \tag{3}$$

Table 8. RI Determination Coefficient Table.

matrix Rank	1	2	3	5	6	7	8	9	10
RI	0	0	0.58	1.12	1.24	1.32	1.41	1.45	1.49

Table 9. Index Layer A2 Judgment Matrix Table.

Technical factor A2	The application and introduction of new Technology A21	Design capability A22	Failure analysis capability A23
The application and introduction of new Technology A21	1	4/5	4/5
Design capability A22	5/4	1	1
Failure analysis capability A23	5/4	1	1

Table 10. Index Layer A3 Judgment Matrix Table.

Responsiveness factor A3	Delivery term A31	Flexible capability A32	Order fulfillment A33
Delivery term A31	1	5	7
Flexible capability A32	1/5	1	2
Order fulfillment A33	1/7	1/2	1

Table 11. Index Layer A4 Judgment Matrix Table.

Financial position factor A4	Debt servicing capacity A41	Operation capability Plant management level A42	Cash flow A43
Debt servicing capacity A41	1	1/2	1/5
Operation capability Plant management level A42	2	1	2/5
Cash flow A43	5	5/2	1

According to Table 12 and Figure 4, the delivery tern has the highest weight. When managing suppliers, priority should be given to the delivery tern issue in order to avoid losses as much as possible and maximize profits. While ensuring the delivery deadline, product excellence and other issues should also be considered.

Table 12. Indicator Layer Weight Data.

Target layer	Criterion layer	Index layer	weight	Comprehensive weight
Huawei mobile phone supplier evaluation indicators A	Quality factor A1	Quality Management System A11	0.2299	0.6902
		Product excellence rate A12	0.6479	1.9485
		Manufacturing process control A13	0.1222	0.3667
	Technical factor A2	The application and introduction of new Technology A21	0.2222	0.6667
		Design capability A22	0.3333	1
		Failure analysis capability A23	0.4445	1.3333
	Responsiveness factor A3	Delivery term A31	0.7380	2.2370
		Flexible capability A32	0.1676	0.5041
		Order fulfillment A33	0.0944	0.2837

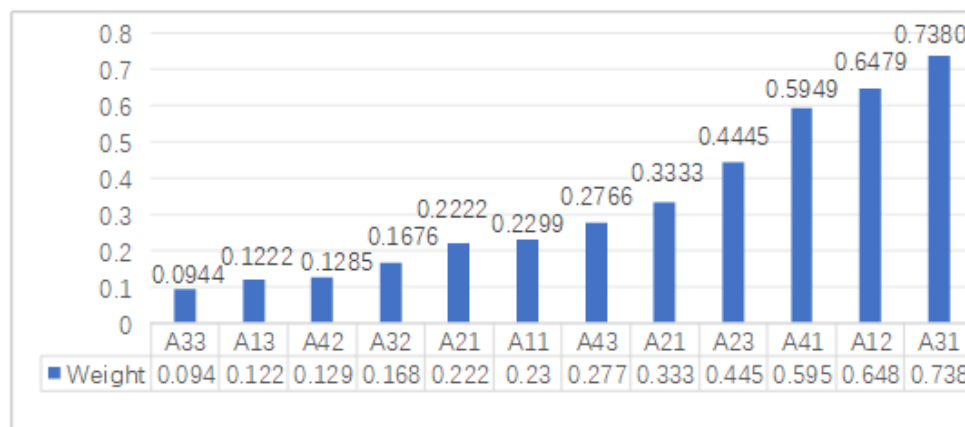|			
	Debt servicing capacity A41	0.5949	1.7906
Financial position factor A4	Operation capability Plant management level A42	0.1285	0.3858
	Cash flow A43	0.2766	0.8311

Figure 4. Weight Ranking Diagram.

3. Conclusion

Since Apple released the first iPhone, the smartphone industry has risen rapidly, forming a three-way competition between Apple, Samsung and Huawei. Global smartphone shipments reached 1.371 billion units in 2019, and the top five vendors accounted for 70.56% of the market share, with Chinese vendors such as Huawei, Xiaomi, OPPO and vivo occupying an important position in the global market. The core competitiveness of the smartphone industry lies not only in product development and marketing, but also in supply chain management.

Huawei's smartphone supply chain management is global, involving suppliers from many countries and regions, which increases the complexity of management. Faced with challenges such as rapid product iteration and demand uncertainty, Huawei has introduced advanced management theories and technologies such as lean production, MRP, and JIT to improve the transparency and response speed of the supply chain. At the same time, the uncertainty of supply and demand is also one of the main challenges facing Huawei, which needs to improve the accuracy of sales forecasting through big data and artificial intelligence and other technologies to reduce inventory pressure. Huawei has established long-term and stable cooperative relationships with suppliers, and strengthened communication and resource sharing through the Dynamic Strategic Alliance (DAP) to improve cooperation efficiency.

Huawei's S&OP mechanism is implemented within the company to comprehensively manage and balance resources in various aspects such as sales, procurement and execution to ensure rapid response to market changes. Huawei continues to innovate. Through market research and data analysis, Huawei successfully launched an innovative threefold screen mobile phone, which meets consumers' comprehensive demand for large screen and portability, and reflects its strong market insight and innovation ability.

In terms of inventory management and optimization strategy, Huawei adopts the ABC classification method for differentiated management of materials with different values to improve management efficiency and reduce inventory overstocking costs. Huawei's innovation also includes procurement model innovation, digital transformation and other aspects.

After this study, our team deeply felt Huawei's excellent ability and continuous innovation efforts in smart phone supply chain management. As one of the leaders in the global smartphone market, Huawei has not only made remarkable achievements in product research and development and marketing, but also demonstrated strong competitiveness in supply chain management. In the face of the complex and changing global supply chain environment, Huawei has effectively improved the efficiency and response speed of the supply chain by building stable supplier relationships, implementing Dynamic strategic alliance (DAP), adopting S&OP operation mechanism, and refined inventory management. In particular, Huawei's inventory management strategy, through the combination of ABC classification, VMI (vendor managed inventory) and JIT (just-in-time production) and other advanced methods, has not only greatly reduced inventory costs, but also improved inventory turnover efficiency and reduced risks caused by supply and demand uncertainties. This refined inventory management method undoubtedly provides valuable reference for other enterprises. In addition, Huawei's investment in supply chain digitization is also commendable. By introducing systems such as ERP and SCM, Huawei fully monitors and manages the supply chain, improving the transparency of information and the accuracy of decision-making. This digital transformation not only enhances Huawei's competitiveness, but also points the way for the future development of the industry.

To sum up, Huawei's successful experience in smart phone supply chain management is not only reflected in its global layout, the application of advanced theory and technology, the improvement of supplier management and evaluation systems, and the refinement of S&OP operation mechanism and inventory management, but also in its continuous innovation spirit and keen insight into the market. Facing the future, Huawei will continue to optimize the supply chain management process, strengthen supply chain collaboration, improve the transparency and responsiveness of the supply chain, bring better products and services to consumers, and contribute to the sustainable development of the industry.

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