Airbus A320neo Fuselage Supply Network

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Introduction

A fuselage is the central portion of an airplane's body, designed to accommodate the crew, passengers, and cargo. The fuselage includes structural frames, skin panels, bulkheads, stringers, floor beams, windows, doors, and attachment points for wings and tail assemblies. Its design and size vary according to the aircraft's function (NASA, 2024)

Airbus, is a global leader in aerospace manufacturing, renowned for its innovation and engineering excellence, having its headquartered in Toulouse, France. The A320 family has set benchmarks for single-aisle jetliners, known for its comfortable cabin adaptable to various configurations. Typically accommodating 140 to 170 passengers, it can seat up to 180 in its maximum layout, making it a leading aircraft for short- and medium-haul flights. (Airbus, 2023)

One of its flagship models, the Airbus A320neo (New Engine Option), is a next-generation narrow-body aircraft celebrated for its fuel efficiency, reduced emissions, and passenger comfort. It builds on the success of the A320 family by incorporating advanced engines, aerodynamic improvements, and cutting-edge materials. The fuselage of the Airbus A320neo plays a critical role in its performance. Made from advanced aluminium alloys and reinforced composites, it is lightweight yet durable, ensuring aerodynamic efficiency and safety. Its modular design facilitates seamless integration with other components, supported by a global supply chain network to ensure precise assembly and high-quality materials. (Composites World, 2023)

Figure 1: Airbus A320 neo Structure(Aviation Voice ,2016)

This project examines the supply chain management of the A320neo fuselage, focusing on the upstream supply chain, from raw material sourcing to assembly and distribution. It highlights

the challenges and strategies employed by Airbus to ensure timely and cost-effective production while maintaining quality standards. The research emphasizes Airbus' inbound supply network for the A320neo fuselage, exploring its complexity and innovation

Business, Market and Supply Chain Characteristics

The Airbus A320neo's fuselage plays a critical role in meeting modern aviation demands, balancing efficiency, sustainability, and safety. Its design adheres to stringent regulatory standards while leveraging advanced materials and engineering to optimize performance. Its fuselage, manufacturing processes, and supply chain exemplify Airbus's commitment to innovation and operational excellence. However, market conditions, supply chain challenges, and evolving airline requirements continue to shape its production and global demand.

Internal Environment

Product Characteristics

The fuselage is an important structural component of the A320 Neo, designed for system integration, fuel consumption, and aerodynamics:

- **Material Composition:** The use of advanced composites and lightweight aluminium alloys helps to save weight and improve aerodynamics and structural strength. Modern insulation improves the soundproofing of the cabin to enhance the comfort of passengers.
- **Modularity:** Maintenance, repairs, and logistics are simplified because the fuselage has a modular structure comprising components – the nose, the centre, and the tail.
- **Safety and Aerodynamics:** Better aerodynamics are compatible with engines such as the Pratt & Whitney PW1100G and CFM LEAP-1A. Each component is subjected to a rigorous safety assessment under a variety of conditions.(Airframe,2016)

Manufacturing Processes

The start of design and through the end of maintenance Airbus applies modern manufacturing philosophies:

- **Automation:** To improve accuracy and minimize the lead time, robotic systems carry out riveting and drilling operations.
- **Digital Twins:** Virtual duplicates of realities help to prevent quality issues in manufacturing and assist to monitor the construction.
- **International Cooperation:** Major sections of the fuselage are made by Spirit AeroSystems (USA), Premium Aerotec (Germany), Stelia Aerospace (France). Airbus brings these elements together at its sites in Tianjin, Mobile, Hamburg and Toulouse.(Airframe,2016)

Supply Chain Configuration

The supply chain for the fuselage manufactures is a well carved out chain, running across boarders:

- **Supplier Network:** A tiered structure further ensures that specialized skills are even spread across echelons as the lowermost tier's specialty applies to individual components.
- **Transportation:** Voluminous parts are transported to the compatible assembly lines by ocean freight and Beluga XL aircraft.(Airframe,2024)
- **Just In Time (JIT):** Deliveries are planned and executed with great accuracy, thus attaining production efficiency while minimizing inventory costs.(Airframe,2016)

Operational Challenges

The main challenges of the Airbus despite having a solid supply chain are:

- **Rising Demand:** Large order backlogs causes strain on production and quality.(Airframe,2024)
- **Material Shortages:** The insufficient amount of composites and aluminium, coupled with supplier capacity constraints, causes delays.(Airframe,2016)
- **Pandemic Effect:** Thanks to COVID-19-induced disruptions of operations and logistics, Airbus increased supply chain robustness.(Airframe,2016)

Services and Continuous Improvement

Airbus improves its supply chain procedures as follows:

- **Supplier Cooperation:** Quality compliance and improvement are enhanced through ongoing training and audits.(Airframe,2016)
- **Use of Technologies:** The use of AI, IoT, among other Industry 4.0 tools minimizes errors and delays by providing insights in real time.(Airframe,2016)
- **Being Green:** Resources use optimization and better logistics decrease the supply chain's carbon footprint.(Airframe,2024)

External Environment

Regulatory Compliances

The Airbus A320neo fuselage complies with stringent international aviation safety and performance standards set by regulatory bodies like the European Union Aviation Safety Agency (EASA),The Federal Aviation Administration (FAA) and International Civil Aviation Organization (ICAO). These certifications ensure the fuselage meets requirements for structural integrity, durability, pressurization, and crashworthiness(EASA, 2024).

Market Conditions

1. **Economic Indicators:**

   The Airbus A320neo fuselage significantly contributes to economic efficiency by integrating advanced materials such as composites and aluminium alloys, which reduce aircraft weight and enhance fuel efficiency, leading to lower fuel costs for airlines. The materials' durability and corrosion resistance also decrease maintenance frequency and intensity, further cutting operational expenses. Its aerodynamic design optimizes fuel economy, allowing for more cost-effective operations on extended routes. However, economic variables such as fluctuating material prices, inflation, and currency exchange rates directly affect production costs, influencing Airbus's pricing and profitability. Despite these challenges, the A320neo remains highly attractive to airlines due to its operational savings, alignment with sustainability targets, and ability to offer favourable cost-benefit outcomes in a competitive market (Airbus, 2024).

2. **Competitive Landscape:**

   The Airbus A320neo's fuselage design competes indirectly with that of Boeing's 737 MAX series. While Airbus benefits from strong demand for the A320neo, supply chain constraints in fuselage production, such as delays in the availability of lightweight composite materials and aluminium alloys, have limited its ability to ramp up manufacturing. These challenges mirror the broader competitive pressures in the aerospace industry, where production efficiency is critical. Demand for the Airbus A320neo has surged, surpassing pre-pandemic levels and outperforming competitor aircraft like the Boeing 737 MAX. Increased deliveries and passenger travel growth highlight robust market demand for the A320neo(Aviation File, 2023).

FEATURE	AIRBUS A320NEO	BOEING 737 MAX
Fuel Efficiency	15-20% improvement over A320ceo	14-15% improvement over 737 NG
Engines	CFM LEAP-1A or Pratt & Whitney PW1100G	CFM LEAP-1B
Range	Up to 3,400 nautical miles (A320neo); 4,700 nautical miles (A321neo XLR)	Up to 3,550 nautical miles (MAX 8)
Passenger Capacity	140-244 (A320neo family)	138-230 (737 MAX family)
Cabin Width	12 ft 1 in (wider seats)	11 ft 7 in
Noise Levels	Lower cabin noise	Slightly higher cabin noise
Safety Record	Strong, with no major incidents	Initially grounded due to MCAS issues, recertified in 2021
Operational Cost	Low, designed for fuel and maintenance efficiency	Competitive, though MCAS-related training may add cost
Popular Markets	Europe, Asia	North America, some Asian markets
Notable Airlines	IndiGo, China Southern, easyJet	Southwest, American Airlines, Ryanair

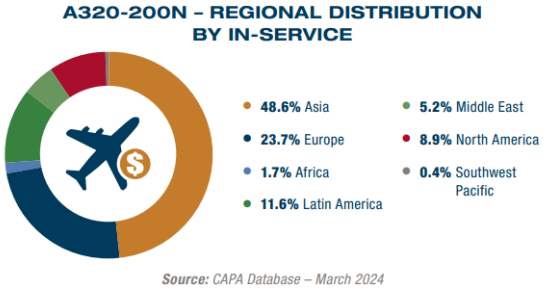
Table 1: Market comparison of Airbus A320 neo and Boeing 737 MAX(Aviation File,2023)

Figure 2: Comparison of Boeing 737 MAX and Airbus A320 neo (Aviation Looks,2024)

Engine-Related Challenges (PW1100G):
Pratt & Whitney's PW1100G engines face issues due to contaminated powdered metal, potentially causing turbine component cracks. Inspections of 600–700 engines are planned from 2023 to 2026. With 40% of the A320neo fleet using these engines, 11% are currently grounded, increasing demand for spares. Despite these challenges, A320neo market values remain strong. Delays in resolving issues could impact future confidence, but by Q1 2024, CMV surpassed BV, reflecting sustained demand and market recovery (Cranky Flier, 2023).

Demand Characteristics
The Airbus A320neo is globally popular among lessors and airlines. As of February, it has received 4,124 orders, delivered 1,929 aircraft, and holds a backlog of 2,195. Strong demand and a seven-to-eight-year waiting period highlight its appeal, driven by enhanced fuel efficiency, environmental performance, operational flexibility, and fleet commonality. Key

operators include Indigo with 192 aircraft and China Eastern Airlines with 105 in Asia, and Spirit Airlines (87) and Frontier Airlines (82) in North America. Its design supports regional airlines and low-cost carriers, meeting growing demand in emerging markets with limited airport infrastructure (Acumen Aero, 2024).



A320-200N - Top 10 Operators by Current in Operation		
Operator	**Region**	**# of Aircraft**
Indigo	Asia	192
China Eastern Airlines	Asia	105
Spirit Airlines [USA]	North America	87
Frontier Airlines	North America	82
Vistara Airlines	Asia	53
Air China	Asia	53
Azul Linhas Aereas Brasileiras	Latin America	49
China Southern Airlines	Asia	49
Flynas	Middle East	49
Goair	Asia	49

Figure 3: Regional Operators and Consumers of the Airbus A320 neo(Acumen Aero,2024)

Supply Network Configuration and Mapping

The increase in demand in the aerospace industry over the recent years have created the need for effective supply chain management. Airbus has more than 20 manufacturing facilities engaged in production and/or assembly of aircraft components and relies on several suppliers worldwide, who produce roughly 80% of the aircraft before it is shipped to the Airbus plants (Airbus). Due to the multinational operational structure distributed across several stages, from production to assembly (MOCENCO, 2015), Airbus has adopted a global joint venture supply chain strategy based on multiple levels. The several levels of suppliers participating the development of the fuselage can be classified as:

- *Airbus (OEM)* – responsible for design and assembly of large aircraft components and supply the final product to the customers.
- *Tier 1 Suppliers* – manufacture and assemble the major and sub-sections of the fuselage such as front, centre, and rear fuselage parts.
- *Tier 2 Suppliers* – supply manufacturing products or raw materials obtained from their own production lines to the tier 1 suppliers.

Airbus has formed strategic partnerships with its first-tier suppliers across the globe and outsourced work packages to them (Li, 2018). Airbus's global cooperation is built on the concept of "global network of regional design and engineering centres" (Airbus), having a "build-to-print" (Li, 2018) trading relationship with its suppliers, and hence it is usually only

involved in the designing, engineering, and testing of the major components of the fuselage along with its final integration to the main aircraft. Whereas the tier 1 suppliers manage their own networks of suppliers and carry out the necessary R&D, production, and component assembly. This joint venture strategy with high level outsourcing not only reduces the costs and delivery time components (MOCENCO, 2015), but also reduce the initial investment and R&D risks of the OEM through a risk-sharing partnership with the tier 1 suppliers (Li, 2018). The representation of the supply chain of fuselage in Figure 4 illustrates that the information flows from the design and engineering offices at Toulouse in France, Getafe in Spain, UK, Russia, and 2 facilities in Germany to the Tier 1 suppliers (Airbus). The product flow includes raw materials from Tier 2 suppliers, major fuselage sections from the Tier 1 suppliers comprising outsourced suppliers and in-house facilities of Airbus, structural assembly of fuselage sections at Hamburg in Germany, and lastly the fuselage is transported to the final assembly lines in Toulouse, Hamburg, Tianjin, and Alabama via the Airbus's Super Transporter 'Beluga' (Airbus). The tier 1 supplier involved are:

1. **Spirit AeroSystems** - Spirit AeroSystems builds the wing leading and trailing edge elements of all the A320 family of aircraft at the company's plant in Prestwick, Scotland. The components for these narrow-body jets are shipped to Airbus' three A320 assembly lines in Toulouse, France; Mobile, Alabama; and Tianjin, China. (Spirit Aero, n.d.)
2. **Premium AEROTEC** - manufactures fully assembled fuselage sections from the shells and the floor structure. The company's capabilities range from the pressure hull right through to the rear fuselage. Thanks to its comprehensive expertise in the assembly of sections, the company is one of the most important tier-1 suppliers for aircraft manufacturers and supplies fuselage sections for A320 and A330 families, as well as for the A350 XWB. In manufacturing complete sections, Premium AEROTEC brings its expertise in design and production to bear to the maximum benefit of its customers **(**Premium AEROTEC, 2024)
3. **RUAG Aerostructures** - Manufacturing all assembly parts for the last 11 meters of the fuselage – the tail section with all the electrics and supply lines, they provide the rear fuselage section ("section 18/19" and "section 19.1") as well as the floor, the rear bulkhead and the side fuselage panels for the middle section of the fuselage for the Airbus A320 family. They also integrates the entire Section 19.1 Tail Cone for the A320 family, per design requirements defined by RUAG engineering and utilizing an international supply chain for detail parts and systems (RUAG Aerostructures, n.d.).
4. **Turkish Aerospace Industries** – In 2023, they produced their first A320neo 18/19 fuselage sections, "consisting of the rear pressure bulkhead, aft pressure floor, and aft pressure shell" at their Ankara facility (Ranabhat, 2023).
5. **Hamburg, Germany** – The production of centre fuselage parts of Airbus A320 family
6. **Saint Nazaire, France** – "structural assembly, equipping and testing of front and central fuselage sections for the entire Airbus family" (Airbus)(Rodgers, 2022)

The Tier 2 suppliers involved are:

1. **Constellium** – supply "advanced aluminium rolled products for airframes… such as aero-sheets for fuselage panels". They aim to support Airbus in reducing inventories in the supply chain and the "ramp-up" of A320neo by "increasing the buy-to-fly ratio by developing and implementing near-net shaped and pre-machined products." (Aerospace, 2016)

2. **Hexcel Corporation** – supplies composite materials for the A320neo airframe and engine options, such as materials for fuel saving Sharklet wingtip devices manufactured from "Hexcel's HexPly® M21 and M21E carbon fiber/epoxy prepreg" (Hexcel, 2016)

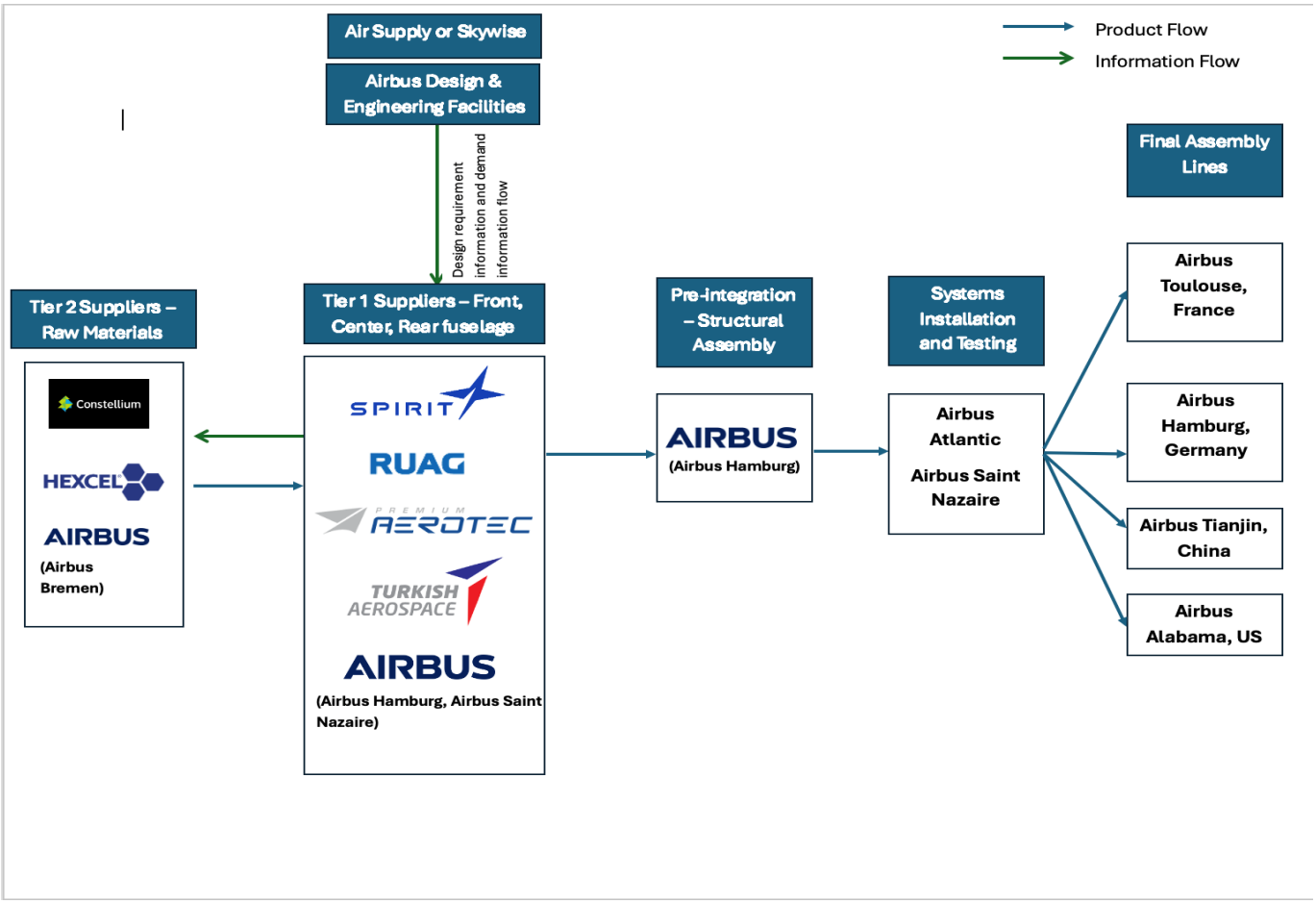


Figure 4: Supply Chain Mapping

Supply Chain Planning and Management Processes and Technologies

Key Distinctive Issues in Supply Chain

1. Production Complexity

The complexity of Airbus production lies in the assembly of one million individual parts per aircraft, 80% of which are sourced from external suppliers. Coordinating more than 3,000 suppliers weekly requires the involvement of 1,700 employees spread across 10 locations, managing a total of 11 million parts. This intricate supply chain is challenged by the need to maintain high-quality standards and to avoid delays that could disrupt production **(SupplyOn, n.d.)**.

2. The Impact of the Pandemic and Labor Issues

The COVID-19 pandemic and associated labor shortages have significantly disrupted Airbus's production processes. In the short term, the assembly of aircraft and critical components, such as engines and fuselage parts, experienced substantial slowdowns. Additionally, Airbus was

forced to adjust its monthly production rates in 2020, reducing A320 production from 60 to 40 units per month (Airbus, 2020).

3. Backlog Growth

The combined effects of the pandemic and labor shortages resulted in a significant backlog increase. Airbus's order backlog rose by 20%, from 7,139 to 8,579 aircraft, underscoring the challenges faced by the aerospace supply chain during global crises **(Simple Flying, n.d.)**.

Boeing 737 MAX orders and deliveries[1]

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
Orders	**150**	**914**	**708**	**891**	**410**	**540**	**774**	**662**[a]	**−136**[b]	**−529**[c]	**375**[d]	**561**	**883**	**244**	**6,447**
Deliveries	–	–	–	–	–	–	**74**	**256**	**57**	**27**	**245**	**374**	**387**	**234**	**1,654**

Figure 5: Orders and Deliveries of Boeing 737MAX

A320neo family orders and deliveries by year (distributive)[1]

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
Orders	A319neo	–	26	19	–	2	1	5	−22	22	−18	7	2	15	1	−4	**57**
	A320neo	30	1,081	378	387	824	540	269	416	149	−295	−305	−84	330	402	−79	**4,043**
	A321neo	–	119	81	341	183	346	287	532	360	965	561	526	425	1,286	623	**6,794**
	A320neo family	**30**	**1,226**	**478**	**728**	**1,009**	**887**	**561**	**926**	**531**	**652**	**263**	**444**	**770**	**1,689**	**540**	**10,894**
Deliveries	A319neo	–	–	–	–	–	–	–	–	–	2	–	2	6	7	6	**23**
	A320neo	–	–	–	–	–	–	68	161	284	391	253	258	246	247	198	**2,096**
	A321neo	–	–	–	–	–	–	–	20	102	168	178	199	264	317	306	**1,554**
	A320neo family	**–**	**–**	**–**	**–**	**–**	**–**	**68**	**181**	**386**	**561**	**431**	**459**	**516**	**571**	**510**	**3,673**

Figure 6: A320neo family orders and deliveries by year

Supply Chain Technologies

1. The 'AirSupply' System

Visualize software capabilities for optimizing supply chain and business processes Features are aggregated by current modules and planned releases, illustrating improved workflows and supplier engagement. The legend distinguishes between implemented (blue) and planned (orange) features, which facilitate tailored processes and enhance supplier relationships. **(Airbus, n.d.)**.

The main sub-modules includes demand forecasting, order management, ASN, transportation, goods receipt and invoice processing (P2P) covering key stages of supply chain from planning to payment. We also have Vendor Managed Inventory (VMI) and Self Billings etc.

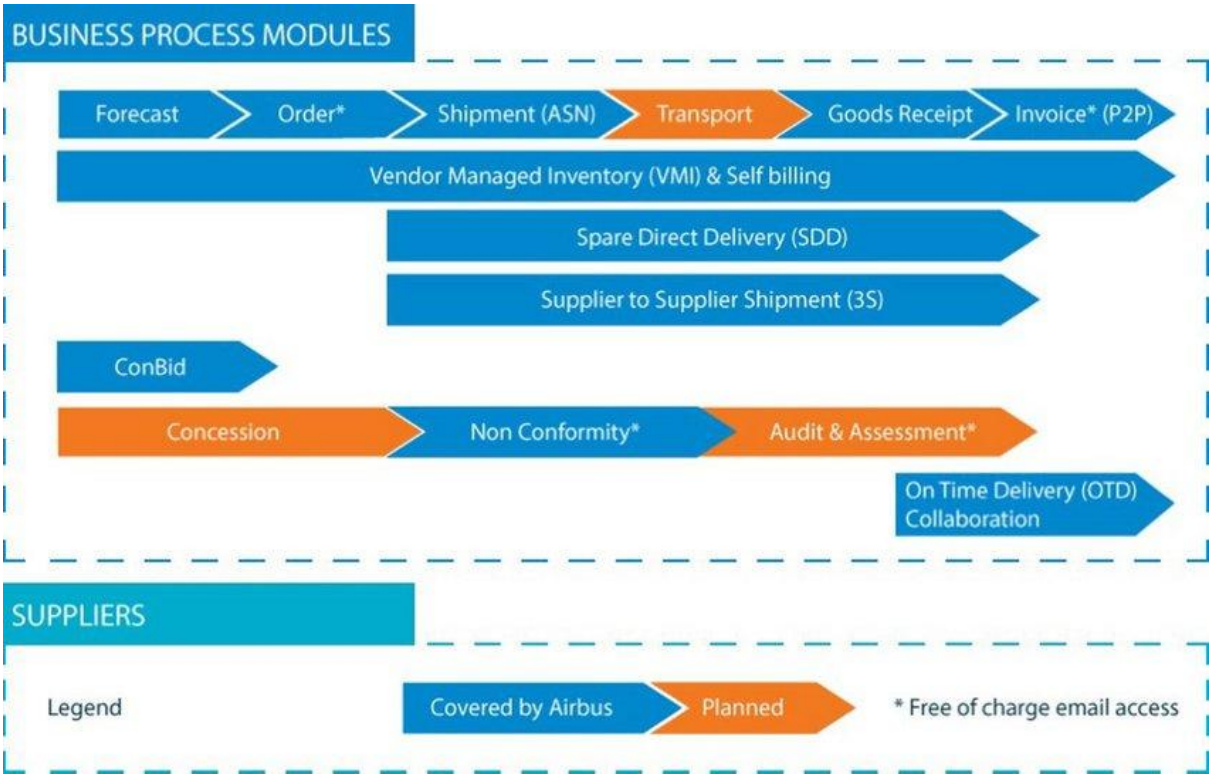


Figure 7: Business Process Modules

A. Main Function

A.1 Procurement and Invoice Management（P2P）

The two prime solutions to optimize global sourcing are Smart Procurement and Central Procurement Hub. Smart Procurement provides clean interfaces to manage procure-to-pay processes across organizational demand drivers. The Central Procurement Hub integrates procurement processes among disparate SAP ERP and S4/HANA systems. Moreover, SupplyOn's ERP-integrated invoice management seamlessly links with P2P processes, digitizing and automating them in compliance with country-specific regulations while also reducing effort and errors in the validation and processing of invoices **(SupplyOn, n.d.)**.

A.2 Advanced Shipping Notification (ASN)

The SupplyOn Advance Shipping Report (ASN) gives youinsight into what your suppliers are delivering, when and where, and in what quantity. Dispatchers get all required data and documents before the shipment goes to the driver, which allows for better preparation. The identification of deviations or missing information occurs early, enabling corrective actions on time.

A.3 Vendor Managed Inventory (VMI)

A Vendor-Managed Inventory (VMI) system is integrated with ERP systems and provides real-time insight into warehouse stock levels. The solution helps in maintaining adherence to defined minimum and maximum limits, and facilitates synchronized planning through daily data refreshes. Automatic alerts notify both parties of emergencies like inventory shortages,

enabling swift action. In doing so, it lowers the likelihood for inventory bottlenecks by promoting transparency and assisting suppliers to manage changes in demand.

A.4 Transparency in Complaint Management and Production Planning

With the 8D | 9S method, messy complaint management is a thing of the past with SupplyOn: the parties involved in the solution process are informed at all times until everything has been sorted out completely and measures are in place. It reduces risks with visibility into supplier production and matches customer demand with supplier planning for maximum efficiency, productivity, and twinkle bottleneck solution.

B. Strategic Importance of AirSupply

Airbus developed a four-pillar model to enhance operational efficiency, with AirSupply from SupplyOn as a central component. This digital transformation streamlined procurement and supplier collaboration processes, improving transparency and reducing complexity. The initiative achieved significant results, earning Airbus a spot as one of the three finalists for the German Logistics Award 2019 **(SupplyOn, n.d.)**.

C. Summary and Benefits

The implementation of AirSupply in 2017 played a pivotal role in stabilizing and improving Airbus's production capacity. Between 2017 and 2019, the delivery of Airbus A320neo series steadily increased, culminating in 391 units delivered in 2019. Despite the production challenges posed by the COVID-19 pandemic, Airbus maintained stable production levels without major reductions. Rapid recovery followed, with 516 and 571 units delivered in 2022 and 2023, respectively **(Wikipedia, n.d.)**.

By contrast, deliveries for Boeing's 737 MAX were slow, with the company delivering just 27 737 MAX aircraft in 2020. “The prompt recovery in production by Airbus demonstrates the efficiencies which can be gained from AirSupply, providing better visibility and maintenance management to alleviate the risk of a global crisis. **(Wikipedia, n.d.)**.

2. Skywise System in Airbus’s Supply Chain Management Practices

Launched by Airbus in 2017 at the same time as Palantir Technologies, Skywise is an intelligent open data platform capable of helping the aerospace firms enhance supply chain management, work efficiency, and predictive tools. This acts as a central source of truth, aggregating live data from multiple partners, enabling collaboration and data-driven decisions. This thrust is very important for the complex supply chain of one of Airbus's most popular aircraft models, the A320neo, which has had thousands of orders.

Skywise serves as the central digital support for Airbus and its suppliers, bringing together data from manufacturers and airlines. It’s purpose is to give practical data to cut costs, streamline processes, and prevent supply chain disruptions. For A320neo fuselage production Skywise connects data from more than 100 suppliers across multiple tiers, providing 'maximum visibility' into the sup23:10 March 2024. The platform helps manage resources better and cuts down on common inefficiencies in global production by joining these data together.

Skywise is also a critical component that enhances supply chain visibility. Airbus and its suppliers are now all working from a common data platform, giving them the ability to catch

issues early. For instance Based on the Airbus Supply Chain Insights **(Airbus Supply Chain Insights, 2023)**show that the Skywise platform has enabled supply chains to achieve an 18% improvement in on-time delivery and a 15% reduction in quality issues. This accomplishment has noticeably accelerated the speed with which the A320neo production process seems to respond.

Skywise also strengthens collaboration among Airbus and its supply chain partners. Dispatch Logistics's need in this regard helps suppliers manage supply and demand over it like the smooth operation of the final assembly line, reducing supply chain inertia and achieving this goal by balancing the mismatched information between production and final assembly line **(Airbus, 2018)**. This makes the entire supply chain more efficient as it makes sure all parties are working towards the same goals.

Skywise also offers another key benefit in its predictive analytics. The system analyzes both historical and live data to discover potential risks such as supply bottlenecks, transport delays or quality issues. It once flagged a risk of delayed fuselage panels from a German supplier after it received a sudden surge in orders, for example. With this heads up, Airbus was able to reallocate orders, catching issues before they reached the assembly line. This foresight reduces lead times and strengthens the supply chain.

Skywise has also led to big cost savings and efficiency boosts across the supply chain. Airbus introduced the Skywise platform to its suppliers to improve the how reliable, high-quality, and efficient the supply chain is. By linking key suppliers to the platform, Airbus made significant advancements, improving overall performance in the aerospace industry**(eTurboNews, 2018)**.

Skywise is good but has had challenges implementing it. The problem is that different suppliers have different technical capabilities and IT systems, and the data must be standardized. Moreover, nerves about data security and intellectual property sharing have left some partners skittish about fully participating. Airbus has announced its Digital Transformation strategy **(Airbus, 2023)** that aims to invest €50 million in training and upgrading supplier technology by 2025 to address these issues.

Conclusion

The fuselage is a core component of an aircraft that balances the efficiency and stability and uses advanced materials and engineering. With the multinational production structure of the Airbus A320neo's fuselage and the rising demand for aircrafts, the need for an effective supply chain management has increased. This study highlights that in order to mitigate investment risks, reduce costs and delivery time, Airbus has adopted a global join venture supply chain strategy comprising of multiple tiers of suppliers, and they directly engage with the Tier 1 suppliers to obtain the front, centre, and rear fuselage parts. They also use technological systems such as AirSupply and Skywise to optimize the supply chain and businesses. Despite these efforts, there are still challenges faced by the supply chain network such as not being able to keep up with the rising demand and the impact of pandemic and labour issues, as highlighted in the study.

To optimize the Airbus A320neo's fuselage supply chain, several strategic recommendations can be implemented. Airbus should establish alternative suppliers for critical materials like

composites and aluminium alloys to reduce dependency on a limited number of sources, this would minimize the impact of bottlenecks and supply shortages, ensuring smoother production timelines. Secondly, Work with Pratt & Whitney to accelerate inspections and repairs of the PW1100G engines and ensure a robust spare parts supply, it will resolve engine issues promptly will boost airline confidence, reduce fleet downtime, and sustain market demand for the A320neo.Thirdly,using TapRooT® software for root cause analysis (RCA) in the Airbus A320neo assembly plant can significantly enhance the efficiency and reliability of the production process by analysing defective components or assembly failures using customizable checklists and visual diagrams for identifying defects in fuselage integration, wing assembly, or avionics systems. Additionally, TapRooT® software can be used to trace causes of delays in receiving critical parts such as fuselage sections from Premium AEROTEC or wing spoilers from Spirit AeroSystems (ChatGPT ,2024).

Appendix

ChatGPT Prompts:

1. *"What regulatory standards does the Airbus A320neo fuselage comply with, and which organizations govern these standards? Provide details on safety, structural integrity, and aviation performance certifications."*

2. *"Explain the economic impact of advanced materials like composites and aluminum alloys in the Airbus A320neo fuselage"*

3. *"What are the specific issues associated with Pratt & Whitney's PW1100G engines used in the Airbus A320neo, and how are these challenges impacting aircraft operations and market confidence?"*

4. "*Airbus A320neo Fuselage tier 1 supplier"*

5. *"Who are the tier 1 suppliers for airbus a320neo fuselage and mention the sources from where the information is obtained "*

6. *"What is the supply chain network of manufacturing and assembling airbus a320neo fuselage and who are the suppliers involved in each stage. Add the sources from where the information is obtained*

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