General Motors: Selecting the Right Supplier for EV Growth

Jorge Villatoro, Hamed Al-Shibi, and Lily Grice

Portland State University

Daniel Wong: GSCM 749 HB1 | Global Supply Chain Strategy and Sustainability Management

February 5th, 2025

Table of Contents

Problem Statement

General Motors must select a strategic supplier for brake components to support its EV production over a five-year period starting in 2018, ensuring cost-effectiveness, reliability, and scalability. The sourcing decision must also consider geopolitical risks, tariffs, transportation costs, and lead times to optimize supply chain resilience and minimize disruptions.

Analysis

To accurately assess the total landed cost per unit for each vendor, we conducted a comprehensive cost analysis incorporating all known factors that impact pricing. This included base unit costs, transportation expenses, tariffs, software development, hardware installation, and integration costs. By breaking down these cost components, we calculated the true per-unit cost for each supplier, factoring in geopolitical risks and trade policies that could influence long-term financial viability. For transportation, we accounted for ocean freight, air freight contingencies, and domestic trucking costs, ensuring a realistic and adaptable logistics strategy. Additionally, suppliers requiring software and hardware investment were evaluated separately, incorporating these upfront expenditures into the total cost of ownership over the contract period. The results provided a clear comparative analysis of vendor pricing, allowing for a data-driven sourcing decision that balances cost efficiency, supply chain stability, and future scalability.

Link to See Cost Per Unit and NPV Comparison GSCM 479_CASE 2_GROUP 1_ DATA

Competitive Analysis

Bosch (Germany)

Robert Bosch GmbH is a global supplier of technology products based in Germany, offering security systems, motor vehicle technology, and business process management, among others. The company's strengths lie in its strong and passionate commitment to research and development, consistently pushing the boundaries of innovation with a forward-thinking approach. Additionally, Bosch benefits from a vast and well-integrated operational network, boasting an impressive 470 subsidiaries worldwide.

The company's weaknesses include concerns over accidents and safety issues at their factories, which have led to poor corporate social responsibility evaluations. Furthermore, Bosch is at risk of increasing competition, particularly due to the rise of counterfeit production in the market. They also face high production costs and potentially high tariff costs when entering the U.S.

Continental (Germany)

Continental AG is a leading motor vehicle company based in Germany that specializes in the manufacturing and sale of various motor components and systems, including electronics, infotainment solutions, and brake systems. Two key strengths largely drive the company’s success: its commitment to innovative research and development and its strong market position in emerging automotive technologies.

With a dedicated R&D team that continuously challenges the status quo, Continental AG actively expands its presence within its market, solidifying its status as the world's leading automotive OEM supplier.

However, the company faces challenges due to its reliance on major clients such as BMW and Ford, which limits its control over its economic future. Additionally, while they lead in OEM part production, the rapid evolution of the automotive industry and shifting market demands present a challenge. To maintain its competitive edge, the company must continue to adapt and innovate.

Delphi (U.S.)

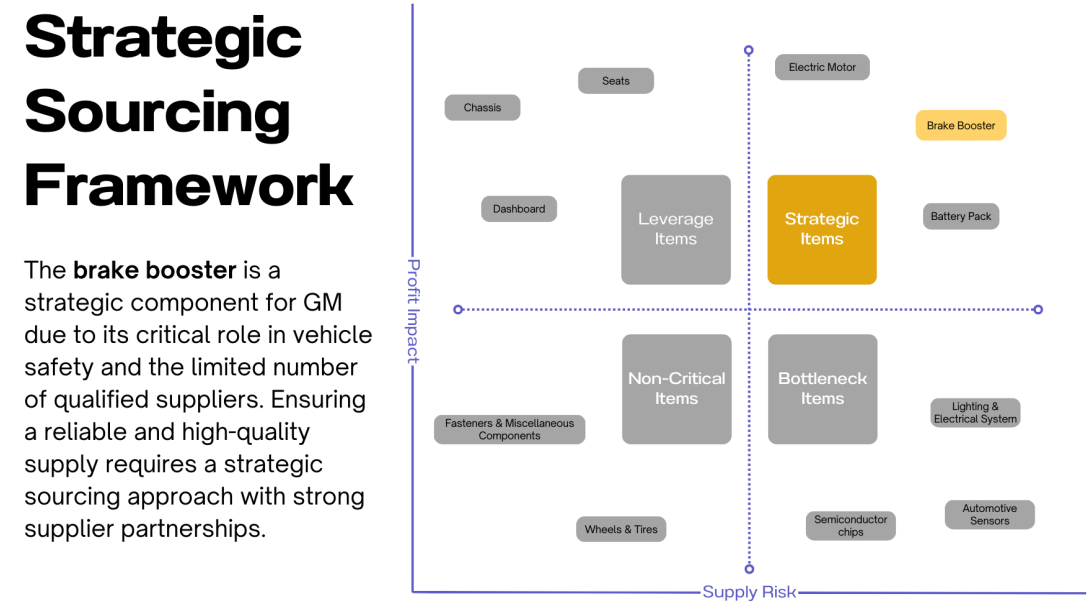
Delphi Technologies was acquired by BorgWarner in 2020. Previously a division of General Motors, Delphi specialized in developing industry-leading propulsion products and systems for hybrid and electric vehicles. Under BorgWarner, the company continues to expand its power electronics portfolio, strengthening its capabilities and scale within the evolving automotive market.

BorgWarner's strengths lie in its robust research and development efforts and strong operational performance. However, compared to competitors such as Bosch and Continental, its R&D capabilities are not as extensive. The company has experienced significant growth through multiple acquisitions, positioning the Delphi Technologies division to drive continued innovation in cutting-edge automotive solutions with adequate funding.

Despite its strengths, fluctuations in raw material prices impact production costs, presenting an ongoing challenge. However, as a U.S.-based company, BorgWarner benefits from lower tariffs, shorter lead times, and improved communication channels. Additionally, domestic production helps maintain more stable pricing by minimizing the risk of unforeseen supply chain disruptions.

The Brake Booster

The brake booster was initially considered a bottleneck component due to supply constraints, geopolitical risks, and limited sourcing options. Its high supply risk and critical function in vehicle safety posed a threat to production stability, making it a vulnerable point in the supply chain. However, through



strategic partnerships, GM can transform the brake booster into a strategic component, ensuring supply reliability, tariff protection, and long-term cost predictability. By diversifying suppliers across domestic and international markets, GM can mitigate potential disruptions while maintaining the flexibility to scale production. This proactive sourcing strategy secures a competitive advantage in the EV market, reinforcing GM's position as an industry leader in supply chain resilience and innovation.

Angela Hanna and Supplier Analysis

Angela Hanna, GM's commodity buyer, is responsible for evaluating supplier proposals and making a strategic recommendation to the company board. One critical consideration is U.S. Customs and Border Protection (CBP),which regulates international trade and will be a key stakeholder if GM selects Orbitty, Elroy, or Rosie as suppliers. If GM sources from Orbitty or Rosie, Incoterms must be considered since ocean freight will be the primary shipping method. For minimal shipping responsibility, GM could opt for Delivered Duty Paid (DDP), shifting logistics and customs costs to the seller. Conversely, Ex Works (EXW) would provide GM with full control over shipping, customs handling, and supply chain oversight, mitigating risks of delays or inefficiencies. Given GM's existing experience with U.S. Customs, handling customs independently under EXW may be a viable option.

R.U.D.I. is a trusted prototype supplier with strong customer service and a new state-of-the-art manufacturing facility. Their experience with GM makes them a reliable choice, but concerns exist regarding production capacity due to recent high-volume contracts. Their refusal to share IP is a major drawback, as it conflicts with GM's goal of technological ownership. Rosie Automotive, an experienced EV supplier, offers a low-cost solution but faces high import tariffs and requires a long-term contract, reducing GM's flexibility. They also refuse to share IP, limiting GM's ability to modify and control braking technology. Elroy, while not a traditional brake supplier, acquired Cogswell Braking Systems, gaining relevant expertise. They are the only supplier willing to share IP, aligning with GM's strategic priorities. Their Mexican location reduces logistics costs, but dependence on Orbitty for hardware introduces risk. Orbitty, a leader in automotive engineering, produces advanced AV e-boost systems and has prior GM partnerships. While they offer IP access, it comes at a cost, making full technological independence difficult. Additionally, their poor customer service and geopolitical risks related to Germany's economic instability and potential EU trade tariffs could introduce long-term challenges.

Supply Chain Perspectives

GM's strategic presence in Silicon Valley provides significant advantages in innovation, supply chain agility, and supplier relationships. The region's advanced technology ecosystem, specialized talent, and robust logistics infrastructure enable GM to rapidly develop and scale its electric vehicle (EV) technology. Additionally, being based in the U.S. mitigates risks related to geopolitical instability and trade restrictions. Partnering with local suppliers in California offers advantages such as shorter lead times, lower transportation costs, and tariff avoidance, all of which enhance supply chain efficiency and reduce production risks. By focusing on regional suppliers, GM strengthens its supply chain resilience, ensuring it can meet market demands while maintaining stable operations.

Despite only four manufacturers in the market, GM has opted not to produce specialized brake components in-house due to high capital investment requirements, complexity, and quality control challenges. Instead, the company leverages the expertise of established suppliers, particularly those based in California, ensuring a steady supply of high-quality components while avoiding costs and risks associated with foreign sourcing. This buy strategy allows GM to focus on its core competency—EV

technology innovation—while maintaining cost efficiency, timely delivery, and long-term sustainability in the competitive EV market. By fostering strong supplier relationships, GM can scale EV production more flexibly without the burden of manufacturing complex components. While in-house production would offer greater control over quality and intellectual property, it would require substantial investment, making it viable only if the brake module becomes a key differentiator. Ultimately, outsourcing these components aligns with GM's strategic focus on innovation and efficient resource allocation.

Solutions

Least Likely - R.U.D.I and Rosie

The partnership between R.U.D.I. and Rosie with an 80/20 supply split is one of the most expensive options, with a landed cost per unit of $96.71 over five years, including the 60% tariff. The initial investment is already factored into the five-year per-unit cost, and while this option benefits from minimal software and hardware expenses, it also provides access to Rosie's intellectual property (IP). However, despite these advantages, the high tariff costs make this option financially burdensome compared to alternatives.

With tariffs already included in the price, increasing Rosie's share beyond 20% would further inflate costs, exposing GM to greater financial risk. Additionally, China's designation as a strategic competitor raises concerns about trade restrictions, export bans, or further tariffs, introducing significant supply chain instability. While this option provides IP access and avoids additional software costs, the unpredictability of U.S.-China relations makes it too volatile for a sustainable sourcing strategy.

Most Comprehensive - R.U.D.I and Elroy

GM could establish a strategic partnership with R.U.D.I. and Elroy to protect short-term revenue while minimizing upfront investment costs. The total initial investment for this partnership would amount to $1.505 million, which is lower than the cost of partnering with Orbitty. While this may seem appealing due to Elroy's geographical proximity to the U.S., it is essential to consider the potential geopolitical tensions between Mexico and the United States. The 80/20 per unit cost over five years for this partnership is $93.70 per unit, making it a more expensive option despite Elroy's logistical advantages.

Given the uncertain trade environment, working with Elroy poses a significant risk of incurring a 25% tariff on production in Mexico. Although President Trump and Presidenta Claudia Sheinbaum have reached a temporary resolution to delay tariffs for one month, there is no guarantee that tariffs will not be reinstated in the future. While partnering with Elroy may not present the same level of risk as working with Rosie in China, it still introduces uncertainty and potential supply chain disruptions for GM. The key question remains: Is it better to pay less now and risk major financial setbacks later? Locking GM into a potentially volatile trade situation could lead to unexpected tariffs and long-term operational challenges. A strategic sourcing decision should prioritize long-term stability over short-term cost savings to safeguard GM's supply chain and overall profitability.

Most Likely - R.U.D.I and Orbitty

The most effective investment and supply partners for General Motors (GM) in sourcing e-booster brakes are R.U.D.I. and Orbitty, with an 80/20 split favoring R.U.D.I. While this solution comes at a premium cost of $104.49 per unit over five years, it offers strategic advantages by avoiding Mexico's potential 25% tariff and China's 60% tariff, safeguarding GM's bottom line from geopolitical risks. R.U.D.I., manufactured in the U.S., provides tariff protection, while Orbitty, based in Germany, benefits from stable trade relations. Though this partnership requires a $4 million software investment, it ensures supply chain stability and prevents e-boosters from becoming a production bottleneck, allowing GM to maintain operational efficiency in a competitive market.

A key downside to Orbitty is its lead time, with ocean freight requiring approximately one month. In urgent cases, air freight is an option but would increase costs from $104.49 to $127.95 per unit due to shipping expenses rising from $3 to $113 per unit. Despite the cost, this provides flexibility to address supply chain disruptions. Additionally, if R.U.D.I. faces production constraints, GM can adjust sourcing allocations—a 50/50 split would increase costs to $119.25 per unit, while an 80% Orbitty reliance would raise costs to $134.02 per unit (both splits are truck and ocean transport). Though more expensive, this flexibility mitigates supply risks and ensures uninterrupted production, making it a premium but strategically sound investment for GM's long-term supply chain resilience.

Table.1. Flexibility For Most Likely Option

Scenario	R.U.D.I. Share (%)	Orbitty Share (%)	Cost Per Unit ($)	Transport
80/20	80	20	$104.49	Truck/Ocean
50/50	50	50	$119.25	Truck/Ocean
20/80	20	80	$134.02	Truck/Ocean
80/20 (Air Freight for Orbitty)	80	20	$127.95	Truck/Air Freight

NPV Comparison

The NPV analysis of R.U.D.I. and Orbitty across different sourcing scenarios highlights the trade-offs between cost efficiency and supply chain flexibility, applying a 10% discount rate to reflect the prime rate of 7% plus an additional 3% to account for uncertainties. An 80/20 split favoring R.U.D.I. results in the lowest NPV at $18.41M, making it the most cost-effective option while maintaining tariff protection and domestic manufacturing advantages. A 50/50 split increases NPV to $21.01M, reflecting higher costs due to Orbitty's required $4 million software investment and extended lead times. The 20/80 split, with Orbitty as the primary supplier, raises NPV to $23.61M, making it the most expensive option due to higher per-unit costs and increased exposure to long lead times associated with ocean freight from Germany. Additionally, in an 80/20 scenario using air freight for expedited shipping, the NPV cost increases further as logistics expenses drive the per-unit price from $104.49 to $127.95. While sourcing more from Orbitty offers greater supply chain redundancy, the significant cost increase and lead time risks make it a less viable long-term strategy. Ultimately, the 80/20 R.U.D.I. and Orbitty model presents the best balance of cost, risk mitigation, and operational stability for GM's e-booster supply chain.

Should GM Manufacture Their Own E-Boosters?

Justifying a minimum cost of $104.49 per unit when GM's target price was $43 per unit (excluding software and hardware costs) is difficult and raises an important question: Should GM manufacture this product themselves to eliminate reliability and pricing issues? At first glance, it may seem like producing the part in-house could help GM reach its $43 target price, but this assumption is deeply flawed.

Bringing production in-house would be a colossal mistake, requiring significant investments in manufacturing facilities, R&D, workforce expansion, and engineering expertise—all within an unfeasibly short timeline. The complexities and risks involved go far beyond pricing, making this an unrealistic option. Before GM considers manufacturing its own brake boosters, it must carefully evaluate its Bill of Materials (BOM). Below is a breakdown of the total production cost for the Chevy Bolt EV, which highlights why this decision would not make financial or strategic sense. For in-house production to be worthwhile, a component must be both high-cost and high-impact—the brake booster is neither. Given its relatively low cost and impact on the overall vehicle, manufacturing it internally would not be a logical or cost-effective move for GM.

Table.2. Bill of Materials

Component	Cost ($)	Fasteners	$500.00
Battery Pack	$8,700.00	Miscellaneous Small Parts	$500.00
Electric Motor	$3,449.00	Shocks	$500.00
Vehicle Frame	$1,500.00	Control Arms	$500.00
Body Panels	$1,500.00	Steering System	$500.00
Factory Assembly	$1,000.00	LED Headlights	$500.00
Factory Operations	$1,000.00	Taillights	$500.00
Workforce Costs	$1,000.00	Electrical Wiring	$500.00
Seats	$500.00	ABS	$500.00
Dashboard	$500.00	Alloy Wheels	$400.00
Infotainment	$500.00	All-Season Tires	$400.00
HVAC	$500.00	E-Boosters	$250.00
Sensors	$500.00	Braking Components	$250.00
Cameras	$500.00	Total	$21,149.00

Above is a table displaying the Bill of Materials (BOM) for GM. The parts highlighted in green represent approximately 80% of the total value of the vehicle. If GM were to manufacture any components in-house, it would make the most sense to focus on these high-cost, high-impact parts.

The yellow-highlighted section represents the average price for two brake boosters per vehicle. As shown, their cost is insignificant relative to the total vehicle cost, making in-house production

financially unjustifiable. Given its low impact on the overall BOM, manufacturing the brake booster internally would not be a strategic or cost-effective decision for GM.

Supply Chain Risks

GM's supply chain, while optimized for efficiency and cost-effectiveness, faces several inherent risks that must be carefully managed. Geopolitical risks, such as trade restrictions or political instability in key manufacturing regions like China or Mexico, could disrupt the flow of critical components and raise costs due to tariffs. Supply disruptions are another concern, mainly if GM relies heavily on a single or limited set of suppliers. Natural disasters, labor strikes, or unforeseen events could cause delays and impact the company's ability to meet production targets. Additionally, cost fluctuations (from raw material prices to transportation expenses) pose challenges, especially when sourcing internationally. Exchange rate volatility can also affect the financial predictability of importing components. Finally, quality control risks from suppliers, especially if manufacturing is outsourced, can lead to product inconsistencies or defects, jeopardizing GM's reputation and customer satisfaction.

To mitigate geopolitical risks, GM should avoid over-reliance on high-risk suppliers, such as those in China, where trade restrictions or tariffs could disrupt supply. Instead, GM should establish First Right of Refusal agreements with preferred suppliers and adopt a multi-sourcing strategy across Germany, Mexico, and California to reduce disruption risk. GM should also negotiate buyout options with strategic domestic suppliers to secure exclusive capacity in times of volatility. Strengthening supplier relationships, especially with California-based manufacturers, through long-term contracts and joint investment in production efficiency ensures priority fulfillment. Additionally, GM must limit dependence on any single offshore supplier, monitor trade policies, and establish performance benchmarks and fixed transportation contracts to maintain supply chain resilience.

Roll-out Plan

Table.3. Roll Out Pan

Year	Description	Total Units	R.U.D.I. (80%)	Orbity (20%)	Actions
1	Setup & Pilot Production	2,000	1,600	400	● Finalize contracts with R.U.D.I. & Orbitty ● Discuss Incoterms ● Set Up Production Plans ● Validate Supplier Quality Standards
2	Full-Scale Launch & Quality Optimization	60,000	48,000	12,000	● Begin full-scale production ● Monitor supplier performance (delivery time efficiency, quality) ● Optimize logistics & supply chain efficiency
3	Focusing on Supplier Relationships	60,000	48,000	12,000	● Explore cost reduction strategies with suppliers (shipping costs) ● Strengthen relationships and negotiate future expansion and cohesion
4	Refined Production	60,000	48,000	12,000	● Evaluate risk mitigation strategies for supply chain disruptions ● Strengthen relationship with Orbity (IP Share)
5	Sustainability Innovation with R&D	60,000	48,000	12,000	● Focus on innovation & R&D ● Planning for future expansion or transition

Forecast

Table.4. 80% R.U.D.I (Truck) and 20% Orbitty (Ocean)

Year	1	2	3	4	5	Total From All 5 years
R.U.D.I Number of Units	1,600.00	48,000.00	48,000.00	48,000.00	48,000.00	
Orbitty Number of Units	400.00	12,000.00	12,000.00	12,000.00	12,000.00	
Total Cost	$210,723.42	$6,321,702.64	$6,321,702.64	$6,321,702.64	$6,321,702.64	$25,286,810.55
Total Per Unit Cost						**$104.49**

Table.5. 50% R.U.D.I (Truck) and 50% Orbitty (Ocean)

Year	1	2	3	4	5	Total From All 5 years
R.U.D.I Number of Units	1,000.00	30,000.00	30,000.00	30,000.00	30,000.00	
Orbitty Number of Units	1,000.00	30,000.00	30,000.00	30,000.00	30,000.00	
Total Cost	$240,497.55	$7,214,926.59	$7,214,926.59	$7,214,926.59	$7,214,926.59	$28,859,706.37
Total Per Unit Cost						**$119.25**

Table.6. 20% R.U.D.I (Truck) and 80% Orbitty (Ocean)

Year	1	2	3	4	5	Total From All 5 years
R.U.D.I Number of Units	400.00	12,000.00	12,000.00	12,000.00	12,000.00	
Orbitty Number of Units	1,600.00	48,000.00	48,000.00	48,000.00	48,000.00	
Total Cost	$270,271.68	$8,108,150.55	$8,108,150.55	$8,108,150.55	$8,108,150.55	$32,432,602.20
Total Per Unit Cost						**$134.02**

Although allocating 80% of production to Orbitty would result in lower costs for GM, prioritizing lead time efficiency over cost savings is a more strategic approach. Faster lead times enable greater production flexibility, allowing GM to scale production as needed without delays. In contrast, relying heavily on Orbitty in Germany would require highly accurate demand forecasts to prevent capacity constraints and supply chain disruptions. While this presents a manageable challenge, GM benefits from having a reliable and capable secondary supplier in RUDI to mitigate risks.

Shipping from RUDI is conducted via truck, ensuring shorter transit times and lower logistics complexity. In contrast, shipments from Orbitty require ocean freight, with a built-in cost of $3 per unit to account for potential variances. If RUDI is unable to meet demand requirements, GM has the flexibility to incorporate air freight, which increases shipping costs but does not significantly impact overall expenditures. For example, in an 80/20 supply split, total costs would be $25,286,810.55, while in a 20/80 split, costs would rise to$55,136,602.20, factoring in an air freight charge of $113 per unit. This supply chain strategy balances agility, timeliness and reliability, ensuring GM can maintain uninterrupted production while mitigating risks associated with longer international lead times.

Logic & Reasoning

While this investment may appear costly upfront, it ensures long-term financial stability by avoiding significant tariff risks from China (60%) and Mexico (25%), making a $4 million investment in domestic and German suppliers a strategic cost-mitigation decision that prevents substantial revenue losses and protects profit margins. Beyond financial stability, strengthening supplier relationships today secures a competitive advantage in the rapidly expanding EV market, where supply chain resilience will be a key differentiator. Partnerships with RUDI and Orbitty position GM to navigate supply constraints more effectively and reinforce its role as an industry leader in EV manufacturing. While RUDI is expected to be a reliable primary supplier, concerns regarding future capacity limitations necessitate a buyout contingency plan to safeguard GM's investment in e-booster brakes. This approach ensures continued supply stability, protects critical components, and enhances scalability. By prioritizing supplier relationships, mitigating tariff exposure, and securing long-term production capabilities, GM protects its profitability and operational efficiency in an increasingly competitive and volatile global trade environment.

Recommendation

We recommend designating R.U.D.I. as the primary supplier (80%) and Orbitty as the secondary supplier (20%), prioritizing risk mitigation, supply chain stability, and intellectual property (IP) access. R.U.D.I.'s U.S.-based manufacturing eliminates tariffs and international shipping delays, reducing lead times and supply chain risks. The company is expanding with a state-of-the-art production facility and workforce growth, reinforcing its long-term stability. While R.U.D.I. is not currently offering immediate IP access, the partnership presents an opportunity to negotiate access in the future. Additionally, R.U.D.I. requires no upfront software or hardware investments, ensuring cost stability compared to Elroy, Rosie, or Orbitty.

Orbitty was selected as the secondary supplier due to its strong reputation in automotive innovation and relatively lower tariff exposure (7.5%). However, a key drawback is its lead time, with ocean freight adding up to a month in delays. Expedited air freight is an option but raises costs from $104.49 to $127.95 per unit. While Orbitty provides IP access, it comes at a premium, reflected in both the per-unit cost and a required $4 million software investment. Despite its higher cost, this partnership enhances supply chain flexibility, reduces bottlenecks, and supports GM's long-term EV strategy in an increasingly competitive market.

References

Continental AG. (2024). *In Global Markets Direct SWOT Reports.* GlobalData Ltd. Retrieved from https://link-gale-com.proxy.lib.pdx.edu/apps/doc/AAA000068771/GBIB?u=s1185784&sid=bookmark-GBIB&xid=91b5b467

Harvard Business Publishing Education. (n.d.). *Harvard Business Publishing.* Retrieved from https://hbsp.harvard.edu/download?url=%2Fcourses%2F1247264%2Fitems%2FW17300-PDF-ENG%2Fcontent&metadata=e30%3D

Haw, J. (2022, October 14). *Everything you should know about contract manufacturing and production pilot runs.*OpenBOM. Retrieved from https://www.openbom.com/blog/everything-you-should-know-about-contract-manufacturing-and-production-pilot-runs

Politico. (2024, November 15). *European Union reacts to Trump tariffs.* Retrieved from https://www.politico.com/news/2024/11/15/european-union-trump-tariffs-00189639?utm_source=chatgpt.com

Robert Bosch GmbH. (2024). *In Global Markets Direct SWOT Reports.* GlobalData Ltd. Retrieved from https://link-gale-com.proxy.lib.pdx.edu/apps/doc/TAHGGQ126253009/GBIB?u=s1185784&sid=bookmark-GBIB&xid=e36b2160

The White House. (2025, February). *Fact sheet: President Donald J. Trump imposes tariffs on imports from Canada, Mexico, and China.* Retrieved from

https://www.whitehouse.gov/fact-sheets/2025/02/fact-sheet-president-donald-j-trump-imposes-tariffs-on-imports-from-canada-mexico-and-china/?utm_source=chatgpt.com

Associated Press (AP). (2025, February). *China tariffs, Trump policies impact global trade.* Retrieved from https://apnews.com/article/china-tariffs-trump-shein-temu-023aaee8f043605e62a614eaa5134f62