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Strategic Resilience: Rethinking China's Supply Chain in Anticipation of a Future Conflict

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Strategic Resilience: Rethinking China's Supply Chain in Anticipation of a Future Conflict

Major Anonymous

STRATEGIC RESILIENCE: RETHINKING CHINA'S SUPPLY CHAIN IN ANTICIPATION OF A FUTURE CONFLICT

In recent decades, China has emerged as a global economic powerhouse, driven by the success of its supply chain[1] infrastructure and innovative ecosystem. Supported by significant human resources, government involvement, and a vast access to raw materials, this supply chain has been emulated across numerous continents and elements can be seen in almost every industry worldwide. Their ability to successfully implement Just-in-Time (JIT)[2] delivery has revolutionized e-commerce, logistics, and production methods altogether.

In today's geopolitical climate, however, the possibility of a long-term conflict between China and Taiwan, coupled with the threat of a naval blockade, poses a significant challenge to China's current supply chain model. This presents a critical need for China to reevaluate its supply chain practices to ensure continuity and resilience in the face of such a threat. Using an age-old naval strategy, China's enemies could severely reduce its access to essential resources and supplies, underscoring the urgent need for Beijing to take immediate preparatory action. With decades of innovative experience, China possesses the knowledge, infrastructure, and resources to make significant changes that will ensure it maintains a significant logistical advantage throughout a large-scale conflict. In addition, as a leading technological innovator, China may just have the technological prowess to use Artificial Intelligence (AI) to address some of the issues associated with operating supply chains throughout a sustained conflict.

China's strategic vision when it comes to Taiwan is clear, however without a robust, resilient, and versatile supply chain, the efficacy and duration of any military engagement could be severely compromised, rendering such an ambitious military endeavor far more complex and potentially untenable. This essay will argue that China's ability to prepare its supply chain for a coming conflict in the indo-pacific will be determined by its ability revolutionize its current tools, systems, and processes to mitigate logistical challenges associated with a naval blockade.

Assumptions and Scope

To help focus this paper, a few assumptions have been made. The first assumes that a US-led naval blockade will be established from the outset of the announced conflict. Its exact position, whether it is located within the first or second island chain, is irrelevant to the thesis however its impact is of a greater importance. Assuming this blockade, China will see an immediate reduction in importable materials, notably its fuel supplies[3] as well as raw materials

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[1] A functional network structure that centers around the core enterprises, starting from the raw materials and supporting parts, development of the intermediate and final products, and delivery of the product to consumers. (Cao, Y., & Jiang, H. (2021). Study on Jingdong company's emergency supply chain in the context of unconventional emergency of novel coronavirus pneumonia. *E3S Web of Conferences*, *235*, 03026, pg. 1)

[2] "Business model which relies on daily deliveries of most supplies. Supplies are closely monitored and quickly altered to meet changing demands, and small and accurate resupply deliveries must be made just as they are needed. Facilities wholly dedicated to the JIT concept require a logistics staff to schedule production, balancing product demand with plant capacity and availability of inputs." (Britannica, accessed 02 May 2024)

[3] 90% of China's oil is imported via sea routes (Clocktower Group. (2021). China's Three Traps & Macro Trilemma. *All Along the Clocktower, Vol. 2,* pg. 3).

that make up a large percentage of its hard technology[4] sector. Second, it is assumed that the conflict will be significant, resource-intensive, and sustained for a significant amount of time. A short-lived conflict would not test the effectiveness or resiliency of China's supply chain to the same extent. It is therefore important to assume a lengthy engagement, which provides the ability to examine how China's current tools, systems, and processes would need to change or improve.

Lastly, this paper assumes that virtually all global supply chains will be affected by this conflict, as many of the world's economies rely on Chinese imports and exports. In fact, China has the unique ability to send "real shocks"[5] throughout the entire global market. While these shocks remain real and important, any impacts to *external* supply chains are outside the scope of this paper. Naturally, this paper outlines a few critical dimensions of the issue but only scratches the surface of the intricate dynamics at play, highlighting the importance of further comprehensive analysis and strategic planning to navigate the challenges ahead.

Background

China's world-leading supply chain model is characterized by a vast network of suppliers, manufacturers, and logistics providers, allowing for efficient production and distribution of goods worldwide. The country's supply chain infrastructure, which includes extensive transportation networks, advanced logistics capabilities, and modern ports, plays a crucial role in supporting its low-cost export nature. In fact, China's development model has been oriented towards an "export-oriented growth model"[6]. Its supply chain management system is known for its efficiency and scale, with the country being a global manufacturing hub. China's internal logistics network, covering all cities and counties,[7] is extremely effective[8]. It's ability to scale both human and land resources give it a significant advantage when it comes to improving these networks even further. The availability of low-cost labor has been a key driver of China's manufacturing dominance in recent decades, attracting companies from around the world to establish production facilities in the country. This, combined with robust infrastructure and a vast network of suppliers, has enabled China to offer competitive production costs and fast turnaround times. In addition, China's strategic geographic location and government support for export-oriented industries have further strengthened its position as a global leader in supply chain management.

[4] "Tangible components that can be purchased and assembled into assistive-technology systems" (Britannica, accessed 02 May 2024)
[5] Chen, L., Lu, Y., & Zhao, R. (2019). Analysis and application of modern supply chain system in China. *Modern Supply Chain Research and Applications*, *1*(2), pg, 106.
[6] Chen, L. et al., pg. 106.
[7] Chen, L. et al., pg. 109.
[8] By example, Jingdong Logistics has 100% distribution capacity in mainland China, with 88% of districts and counties available within 24 hours (Cao, Y. 2020, pg. 2)

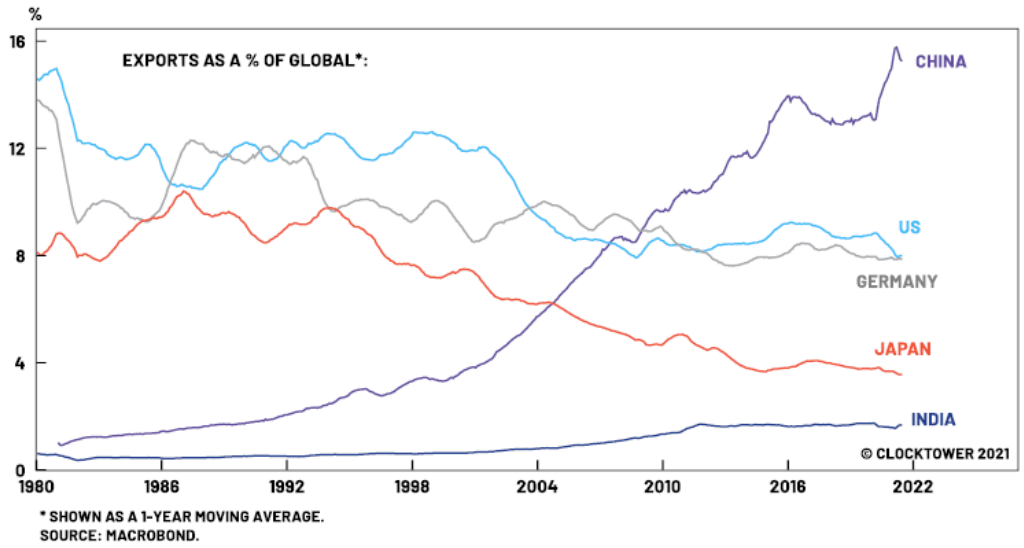

Figure 1 - China's World-Leading Export Status (Clocktower, 2021)

China has a growing addiction to fuel from the Middle East[9]. Driven through the Straight of Hormuz to its ports, China's oil supplies are extremely dependent on sea travel. In a conflict with Taiwan, it is estimated that China has merely 100 days of fuel reserves within its borders[10]. This heavy reliance on Middle Eastern oil exposes China to various risks in its supply chain. Any shift in the region's political instability, economic fluctuations, or conflicts can disrupt oil shipments and lead to immediate supply shortages. These disruptions would have cascading effect on China's industries, transportation sector, and overall economic stability. To mitigate these risks, China has been diversifying its energy inputs by investing in alternative sources of energy, forging partnerships with other oil-producing regions, and enhancing its strategic oil reserves.

[9] Clocktower Group, pg. 3.
[10] Clocktower Group, pg. 3.

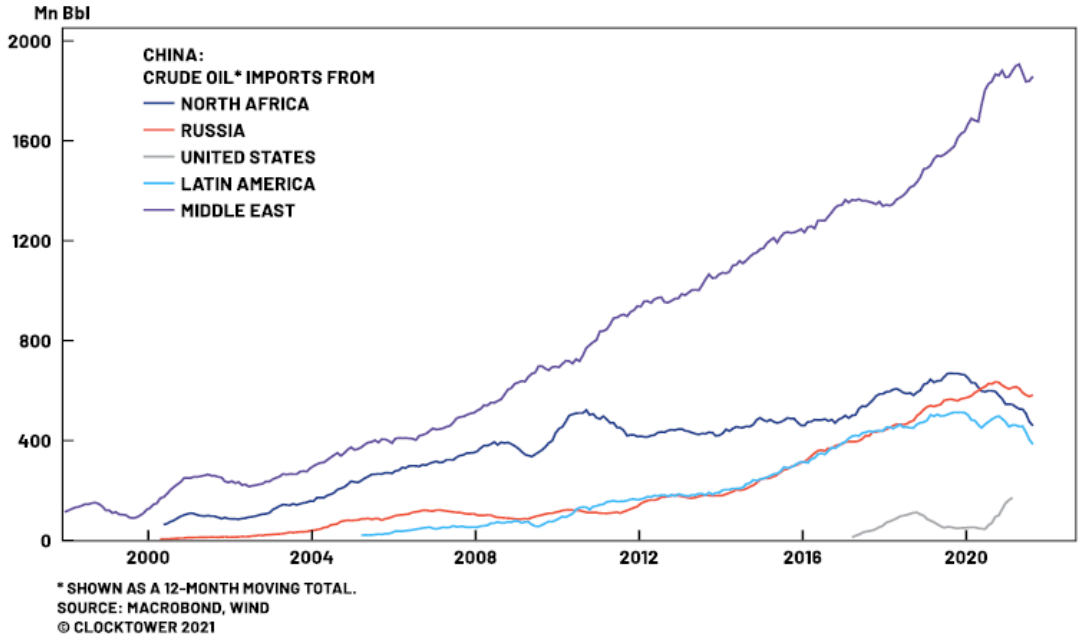

Figure 2 - China's growing addition to Middle East Oil (Clocktower, 2021)

A driving factor behind China's evolution has been its focus on innovation and technological advancement. Chinese companies have made significant strides in developing cutting-edge technologies, such as 5G networks, autonomous logistics vehicles, and e-commerce platforms, which have gained international recognition and market share. These advancements have helped further establish itself as *the* significant player in the global supply chain. The country's tech industry encompasses a wide range of sectors, including telecommunications, e-commerce, artificial intelligence, semiconductors, and more. As Chinese tech companies continue to expand their reach and influence, their impact on global supply chains is expected to grow even further in the coming years. An essential driver of this technological production in China is its ability to harvest critical minerals.

China's position as the leading producer of critical minerals[11] can be attributed to several factors. One key factor is the abundance of natural resources within China, which has enabled the country to establish a strong foothold in the global supply chain for these minerals. Additionally, China's investments in mining operations, refining capabilities, and processing facilities have further solidified its control over critical mineral supply chains. The implications of China's monopoly on critical minerals are multifaceted. On one hand, China's dominance allows the country to influence global prices, production levels, and availability of these essential materials[12]. This substantial economic and strategic leverage can be used in diplomatic negotiations, allowing China to exert influence not only in trade policies but also in broader international relations. On the other, it encourages other countries to explore alternative options to reduce their dependency on China and leaves irreversible environmental impacts.

[11] China remains the top source for 26 of 50 critical minerals. (Ferrari, J. & Rosenblatt, M. (2024). Preparing Supply Chains for a Coming War. *American Enterprise Institute,* pg. 4)
[12] Technology Trade Controls and US–china competition. (2023). *Strategic Comments*, *29*(6), pg. 31.

Considering China's access to raw materials, critical minerals, vast fuel supplies, and low-cost labor, combined with its thirst for innovation and vast supply chain infrastructure, it is no surprise that China's sits atop the logistical leaderboard. These systems and processes have been refined over decades, however many of the same advantages China benefits from may prove disadvantageous in a conflict setting, leaving China isolated and helpless.

Anticipated Logistical Challenges of a Naval Blockade

A naval blockade[13], such as the one China is expected to face in a large-scale conflict over Taiwan, creates a complex array of logistical challenges, chief among them being the disruption to supply chains and the restricted flow of essential materials. With its supply chains compromised and raw materials in short supply, China will face significant constraints in its operational flexibility. With logistical constraints that were once foreign to the Chinese industry, military leaders and businesses alike must begin to prioritize resource allocation, optimize supply chain management, and make strategic decisions to mitigate the impact of disruptions. Despite a significant rise in the number of logistical warehouses in recent years[14], China is not accustomed to stockpiling resources. Considered a world-leader in JIT delivery, its systems are oriented towards receiving just enough raw materials and resources for expected output. In fact, this very system is part of the reason its military procurement system operates at a snail's pace and is unable to provide the People's Liberation Army (PLA) with timely equipment.[15]

A naval blockade would also have significant implications for China's Belt and Road Initiative (BRI). The BRI relies heavily on maritime trade routes to facilitate the movement of goods, resources, and investments between China and countries participating in the initiative. China's manufacturing centers also sit at the heart of the Yangtze River Delta and the Pearl River Delta[16]. While conveniently located in close proximity to its sea routes, a naval blockade could quickly disrupt these critical sea lanes, impeding China's ability to transport goods and materials essential for BRI projects. This disruption could lead to delays, increased costs, and potential suspension of various infrastructure development projects and trade agreements associated with the BRI. Moreover, a naval blockade could also hinder China's access to key resources and energy supplies required for the implementation of BRI projects. In order to mitigate these adverse effects, China would need to begin to divest both interest and resources away from additional BRI projects. Using alternate supply routes, suppliers, or energy options are all suitable methods to improve the system's redundancy and reduce any sole-source reliance[17].

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[13] Defined as "a belligerent operation to prevent vessels and/or aircraft of all States, enemy and neutral, from entering or exiting specified ports, airfields, or coastal areas belonging to, or occupied by, or under the control of an enemy State." (Fink, M. (2022). Naval blockade and the Russia–Ukraine conflict. *Netherlands International Law Review*, *69*(3), pg. 418)

[14] Kong, J. (2023). Research on Supply Chain Management of Jingdong with SWOT model. *Advances in Economics, Management and Political Sciences*, *44*(1), pg. 188.

[15] Scobell, A., & Nathan, A. J. (2012). China's overstretched military. *The Washington Quarterly*, *35*(4), pg. 141.

[16] Qi, N., Zhang, A., & Zhu, Q. (2023). Evolutionary game of Vertical Cooperation and innovation between civilian and military enterprises: A civilian-military integration supply chain system with Chinese characteristics. *Complexity*, *2023*, pg. 9.

[17] China has begun to make significant investments in sustainable energy and alternate forms of energy production to combat its reliance on oil and natural gas. (Clocktower Group, pg. 5)

No Easy Feat

An invasion of Taiwan by China would pose significant logistical challenges due to the geographical factors involved. Taiwan is separated from mainland China by the Taiwan Strait, which presents a natural barrier to any large-scale military operation. The need to transport troops, equipment, and supplies across this body of water would require extensive planning and coordination. Moreover, Taiwan's mountainous terrain and developed defense infrastructure, including missile defenses and underground bunkers, would further complicate the logistics of an invasion. Securing supply lines and ensuring troop mobility in the face of a potential counteroffensive by Taiwanese forces would also be key logistical challenges for any invading force. China is not an expeditionary force, and has not exercised its industrial supply chains to the extent that they would be required during a conflict. If practice makes perfect, it will need to start to practice. Only through execution will it uncover the supply chain gaps and stress the system enough to identify additional areas worthy of investment.

In the context of China and a potential conflict with Taiwan, the Supply Chain Dependence Gap[18] becomes a significant concern due to Taiwan's critical role in the global semiconductor supply chain. Taiwan is home to TSMC (Taiwan Semiconductor Manufacturing Company), one of the world's largest and most advanced semiconductor manufacturers. TSMC plays a crucial role in producing chips for a wide range of industries, including electronics, automotive, telecommunications, and more. Many companies worldwide rely on TSMC for their semiconductor needs, making Taiwan a lynchpin in the global supply chain for advanced technology products. This over-reliance has the ability to draw in more stakeholders to an ongoing conflict than China can anticipate or is prepared for, further straining its logistical capacities.

The country's focus on developing its own semiconductor industry and reducing reliance on foreign suppliers intensified in recent years, driven by initiatives such as the "Made in China 2025" plan. This strategic plan aims to bolster China's self-sufficiency in semiconductor manufacturing and reduce dependence on foreign technology. In recent years, China has intensified its efforts towards self-reliance in semiconductor manufacturing and AI development through investments in research and development, talent acquisition, and domestic production capacities. The government has introduced policies to support indigenous innovation, foster domestic talent, and build a robust ecosystem for technology development. These efforts aim to strengthen China's technological independence, enhance national security, and reduce vulnerabilities associated with reliance on global supply chains. Additional programs will be required to further engage the Chinese technological industry.

A conflict would also have long-lasting economic repercussions on the Chinese economy and would be felt instantly. It can be presumed that China is learning from the ongoing war in Ukraine, and is continually assessing the domestic impact of foreign-applied sanctions. Sanctions against China would further necessitate financial resilience as well as technological innovation

[18] Supply Chain Dependence Gap refers to the vulnerability that arises when a country or industry relies heavily on a single source for essential components or materials in their supply chain. (Technology Trade Controls and US–china competition. (2023). *Strategic Comments*, *29*(6), vi–viii)

and self-sufficiency.[19] The country's economic growth and technological advancement in recent decades have been significantly fueled by access to foreign markets, which can be severed at any moment. With little options to turn to, its fiscal decision-making and priorities will need to be revisited.

Resiliency is Key

Supply chain resilience can be defined as:

> "the capability of a supply chain to cope with unforeseen, disrupting events and to recover quickly to its original level of performance or to a new level required to maintain the expected operating, financial and market performance"[20]

To be effective, supply chains need to be resilient to interference, sabotage, and other system-created actions (delays, bottlenecks, etc…). China has realized how important their supply chains are and has considered the "resilience and security of the industrial supply chains"[21] one of the goals laid out in the Communist Party of China (CPC) annual report. This accompanies others, such as improved civil-military cooperation, aimed at integrating civilian enterprises into the military supply chain network.[22] Initiatives such as these will be essential if China expects to engage in such a lengthy[23] conflict.

Employing a JIT system, however, provides little resiliency. In such a system, output depends heavily on the various preceding levels or production and transportation, of which there are typically many. Each of these "nodes" is a vulnerable part of the system and any delays, gaps, or breaks can have drastic consequences on output. The more a system is stretched, the more vulnerable it becomes, and the less resilient it is.

To demonstrate China's supply chain resilience, consider the COVID-19 pandemic, which forced it to adapt quickly to environmental changes to maintain global production levels. Despite this resiliency, however, it is unlikely that a long-term conflict against one (or more) world superpowers would allow for the same outcome. During the pandemic, global industry was oriented towards a common enemy, which allowed for unity of effort and mutual support. The same will not be true following a large-scale invasion. In response to the pandemic, China's supply chain network became more robust than usual. Defined as using "strategic emergency inventory, standby suppliers, and emergency procurement"[24], a robust supply chain network will be required to support ongoing military operations.

Along this line, it is common for many countries to develop robust emergency supply chain networks to respond to various disasters. Exemplified by its response to the COVID-19 pandemic, China is no exception. While it may be easy to associate emergency supply chain

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[19] Department of Defense (2023). Annual Report to Congress. *Military and Security Developments involving the People's Republic of China, pg. 16.*
[20] Modgil, S., Singh, R. K., & Hannibal, C. (2021). Artificial Intelligence for Supply Chain Resilience: Learning from covid-19. *The International Journal of Logistics Management*, *33*(4), pg. 1250.
[21] Qi, N. et al., pg. 1.
[22] Qi, N. et al., pg. 2.
[23] Assumed by author.
[24] Cao, Y., pg. 2.

management with military conflict, and even suggest that the two be used interchangeably, they are some key differences. Emergency supply chains surge a large amount of resources in a short time to responds to crises. This puts tremendous strain on the logistical networks and therefore makes them untenable for long-term use. In such operations, speed is favored over long-term viability of the system. While the initial surge in resources makes emergency supply chain networks effective, they are often not efficient, allowing precious resources to waste over time.[25] To this end, simply suggesting that China use its robust emergency supply chain system to support a large-scale conflict is perilous. In reality, it is far more likely that the two systems will be used in parallel, further exacerbating the need for adequate priorities and resource sharing.

Civil-Military Fusion

China's supply chain ecosystem has gone through drastic changes in the past few decades, improving its ability to deliver consumer products in a timely manner, and honing a resilient internal network. Logistics companies have thrived in this environment, with China boasting over 700,000 registered logistics companies[26]. One such example is Jingdong Logistics, which has consumed a significant part of the logistics market in China. Expanding to 1,500 warehouses in 2023[27], its ability to deliver consumer products is unrivaled. Jingdong uses advanced AI systems, creating intelligent supply chains that are able to operate faster and more efficiently than human-operated supply depots. During the COVID-19 pandemic, the company was instrumental in delivering medical supplies throughout the country using its nearly-autonomous transportation network. However, as argued earlier, relying on a company that specializes in JIT delivery, is not conducive to the supply chain network required to support military operations.

Military supply chains typically require a delicate balance between maintaining stocks and warehouses for immediate access to resources and transitioning towards leaner, more efficient operations. The traditional approach of stockpiling supplies and establishing warehouses ensures that critical resources are readily available in times of need, especially during emergencies or conflicts[28]. These stocks and warehouses act as a safety net, offering a sense of security and reliability in unpredictable (or, in this scenario, predictable) situations. However, the shift towards leaner organizations emphasizes streamlining processes and reducing excess inventory, ultimately aiming for increased efficiency and cost-effectiveness. Lean practices focus on optimizing workflows, minimizing waste, and improving responsiveness to changing demands. Integrating civilian enterprises with military operations is a viable option to solving the equilibrium conundrum. Combining the supply chain expertise and innovative automation of companies such as Jingdong with the rigidity afforded by military stockpiles and decision making may allow China to improve its logistical effectiveness and resiliency. In a resource-constrained environment, such as the one created by a regional conflict, this civil-military integration can "stimulate the innovative vitality of military enterprises, [reducing the]

[25] Cao, Y., pg. 2.
[26] Chen, L. et al., pg. 113.
[27] Kong, J. (2023). Research on Supply Chain Management of Jingdong with SWOT model. *Advances in Economics, Management and Political Sciences*, *44*(1), pg. 186.
[28] Ferrari, J., pg. 19.

production costs of weapons and equipment, and promote the synergistic development of the military and civilian economy."[29]

China must also address the various procurement issues that have plagued its military logistics system since the mid-1990s.[30] While it has taken several initiatives to date, notably the 2015 Military-Civil Fusion (MCF) strategy[31], the government struggles to provide timely equipment to the PLA. Considered the first step in the supply chain, China's production facilities are typically government-owned and autocratic processes prevent them from bidding, accepting payment, and executing orders in an equitable and effective manner. While the MCF attempts to drive some of the required change, more technological advancements and policy changes are required to allow for effective equipment production and distribution. AI can be leveraged to improve their network, which has typically been prone to cyberattacks, protect intellectual property[32], and improve their online interface which is used for the majority of the bidding process.[33] With too many stakeholders involved in the entire process, conflicting priorities are also pulled in every direction. A centralized department should be established to focus government spending, coordinate with the PLA, and act as the focal point for civil-military cooperation with other supply chain partners to improve production and distribution timelines.

Due to the competitive dynamics and nature of the Chinese industrial base, achieving successful civil-military integration will require significant government investment and intervention. It is common to have both state-owned enterprises, collective-owned enterprises, and private-owned enterprises, each with their own agendas, all fighting for a portion of the market share[34]. In addition, the Chinese supply chain network is made of formed clusters, each vying for market dominance.[35] The availability of alternate clusters drives competition but also increases substitution, leading to further market shifts. Fluctuations to both supply and demand in anticipation of a conflict will require companies to adapt to new pricing strategies, force government intervention in the form of subsidies or market caps, and force stakeholders to consider changes to risk management policies[36]. Industry-wide changes such as these cannot happen overnight and need time to develop the level of trust required of civil-military cooperation. In other words, China needs to act now to ensure success into the future.

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[29] Qi, N. et al., pg. 2.
[30] Evron, Y. (2021). China's Military-Civil Fusion and Military Procurement. *Asia Policy, Vol. 16, No. 1,* pg. 24.
[31] Evron, Y., pg. 25
[32] This can be done by incorporating blockchain technology to protect data, which uses both a private and public key to disaggregate information and make the information only available to the owner. (Lu, Xu, & Le, pg. 916).
[33] Evron, Y., pg. 31.
[34] Qi, N. et al., pg. 110.
[35] Chen, L. et al., pg. 111.
[36] Qi, N. et al., pg. 20.

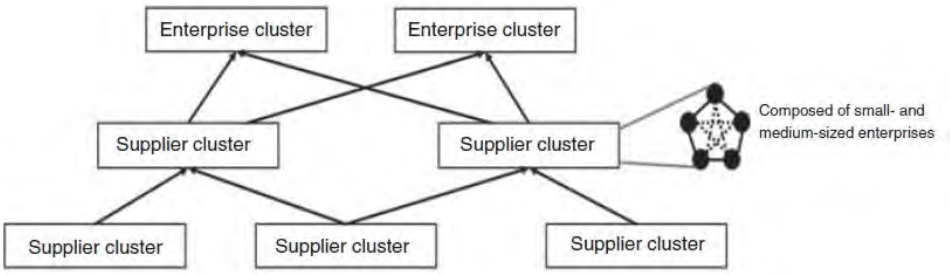

Figure 3 - Clusters within China's Supply Chain Model (Chen et al., 2019)

The Role of AI in Overcoming Logistical Challenges

Within the realm of supply chain management, AI emerges as a transformative force. Hailed as "the best perceptible solution for the supply chain"[37], AI can enhance decision-making, improve efficiency, and reduce vulnerabilities through predictive analytics, automated decision systems, and dynamic rerouting of logistics networks. By way of example, Jingdong Logistics has made impressive advancements in "intelligent supply chain services based on AI-driven and intelligent planning".[38] China's advancements in AI applications for civilian industries provide a foundation for military logistics applications, suggesting a potential for significant impact.

China does not need to be convinced about the prospective benefits of AI. With hundreds of initiatives already at play, China is intent on "nurturing an AI ecosystem"[39] intended to assert itself as a top user of innovative industrial technologies (i.e. intelligent supply chain and autonomous vehicles). Indeed, the use of AI can significantly enhance China's ability to adapt and fortify its supply chain in preparation for potential conflicts. AI can revolutionize various aspects of supply chain management and operations, making them more resilient and efficient under challenging conditions such as a naval blockade. AI can analyze vast amounts of data to forecast potential disruptions in supply chains. These predictions can be based on geopolitical developments, military movements, decision making probabilities, weather conditions, or changes in global markets. This would enable pre-emptive actions to mitigate upcoming risks. Algorithms can also dynamically adjust shipping routes and methods in real-time to avoid disrupted areas or to minimize risk and cost. This includes rerouting ships, optimizing air freight routes, and even determining the best use of overland routes, something which is critical to maintaining logistical freedom of movement during a conflict wherein logistical assets are often priority targets.

Because conventional military operations require significant stockpiling, AI can be used to help optimize inventory levels by predicting future supply needs and recognizing changing

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[37] Cao, Y., pg. 3.
[38] Kong, J. pg. 188.
[39] Wu, F., Lu, C., Zhu, M., Chen, H., Zhu, J., Yu, K., Li, L., Li, M., Chen, Q., Li, X., Cao, X., Wang, Z., Zha, Z., Zhuang, Y., & Pan, Y. (2020). Towards a new generation of artificial intelligence in China. *Nature Machine Intelligence*, *2*(6), pg. 313.

patterns in supply and demand. This can help prevent stockpiling inefficiencies or shortages of crucial materials.

In 2017, China released its AI strategy, entitled *Next Generation Artificial Intelligence Development Plan (NGAI),* aimed at highlighting the state's proactive plans to "serve socioeconomic development and national security".[40] China is considered a major first mover in the industry and this strategy effectively builds upon its strengths in the sector. The strategy contains several initiatives to transform various industries, improve distribution through the creation of intelligent logistics[41], and enhance civil-military integration. AI is expected to revolutionize the way that production and distribution is conducted throughout various industries.[42]

Potential Barriers to Employing AI Effectively

The employment of such technological solutions, however, is not without its own set of challenges. Limitations in data accuracy, the vulnerability of AI systems to cyber threats, and the dynamic nature of military conflict pose significant obstacles. Moreover, the fluid international environment, characterized by possible sanctions and restrictions, could further complicate the deployment of AI and other advanced technologies. These challenges would necessitate an agile and resilient supply chain management system capable of adapting to rapid changes and constrained conditions. In such a scenario, AI could play a pivotal role in identifying alternative supply sources, optimizing scarce resources, provide better decision-making assistance, while ensuring the continuity of logistics operations.

To be effective, AI systems depend on large volumes of high-quality data. In a conflict scenario, the ability to continuously gather and process accurate, real-time information might be compromised. Successfully integrating AI into logistical operations requires not only technological capability and proficiency but also effective coordination with military strategies and operations, which can be challenging to achieve in practice. To do this, China must build on its existing innovation ecosystem. Government support to corporate Research & Development, joint civil-military think tanks, and policies encouraging AI modernization are some ways to improve collaboration.

Strategic Adaptation

China's ability to adapt its systems, tools, and processes to the unique logistical demands of military operations is critical. This will not only require technological innovation but also strategic foresight, civil-military cooperation, and perhaps most critically, increased resilience throughout its existing supply chains and infrastructure. China has significant manufacturing

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[40] Department of International Cooperation & Ministry of Science and Technology (MOST). (2017). Next Generation Artificial Intelligence Development Plan. *China Science & Technology Newsletter, No. 17, pg. 2.*

[41]"Intelligent Logistics is a integrated logistics system supported by modern information technologies to realize functions of system sensing, overall analyzing, real-time processing, optimization decision-making, system supporting, automatic correcting, timely feedback, etc. The information technologies in Intelligent Logistics are extensively adopted in storing, transporting, packaging, loading and unloading, distributing, and information processing. (Wu, Xingze et al., (2020) Concept and Key Technologies of Intelligent Logistics. *Journal of Physics: Conference Series.* No. 1646, pg. 1)

[42] Department of International Cooperation & Ministry of Science and Technology., pg. 3.

capabilities but it must have the capacity to stockpile necessary materials and products in anticipation of supply chain disruptions. In a major shift from the status quo, the tech industry must adapt to some extent by prioritizing domestic resources and innovation to mitigate any impact of a blockade.

To mitigate a reduced flow in energy resources, China could look to third parties to help supply it with oil and other critical production resources. Land-based routes via neighboring Russia or Kazakhstan are also viable options[43]. To reduce its reliance on oil as its primary fuel source, China must continue its investments into "green" or renewable energies[44]. By harnessing renewable energy such as solar, wind, hydro, and geothermal power, China can diversify its energy mix, enhance energy security, and mitigate any risks associated with sustained supply disruptions. Investing in renewable energy will not only reduce China's dependence on imported oil but also promote sustainable development and help mitigate environmental pollution. Through technological innovation and strategic partnerships, such as its *Race to Zero*[45] initiative, China can position itself as a global leader in the renewable energy sector, further driving its economic growth.

China's current supply chain models are not conducive to military operations. Using distribution models that "shorten the time consumption of goods in the logistics stage, enabling the vast majority of goods to be delivered on the same day or the next day,"[46] does not provide that level of resilience required to support demanding military operations in a time of war. Nuanced, tailored methods will need to be developed, supported by civil-military decision-making, to rebalance both speed and security.

It is also important to note that supply chain logistics are extremely reliant on good communications networks and infrastructure. With hundreds of thousands of logistics operators within its borders alone, each with multiple networks (Jingdong Logistics has six core operating networks and a 3-layer management system[47]), there is a vast internal network that is now vulnerable to disruption. By introducing competing military priorities (commensurate to a large-scale conflict) that differ from those of industry, increasingly scarce raw materials, and depleting fuel reserves, there is a chance that China's supply chain industry slows to a halt.

To add further redundancy to its supply chain, China must accelerate the development of alternative technologies or methods to circumvent supply chain challenges[48]. Relying on a continued inflow of raw materials and fuel supplies throughout a long-standing conflict is unrealistic. This dependence holds true for global networks, such as the semiconductor industry, where a significant dependence gap can leave it stranded. Building on its innovative ecosystem, China should look to AI for alternative methods of warehouse management and distribution. In fact, with support from the NGAI, notably its commitment to Experimental Zones and

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[43] Mirski, S. (2013). Stranglehold: The context, conduct and consequences of an American naval blockade of China. *Journal of Strategic Studies*, *36*(3), pg. 392.
[44] Clocktower Group., pg. 4.
[45] Clocktower Group., pg. 22.
[46] Kong, J., pg. 188.
[47] Kong, J., pg. 187.
[48] Mogdil, S., pg. 1246.

experimental policy development[49], many of the typical barriers of entry plaguing AI experimentation are absent.

Lastly, China must also take preemptive measures to ensure that its supple chain is protected. In the context of modern warfare and improved cyber capabilities, the vulnerability of its supply chain remains at the forefront of its ability to sustain military operations. While AI and other technological advancements can provide amazing benefits, they must be carefully employed so as not to introduce further points of vulnerability to the system.

Conclusion

China has been the beneficiary of significant economic growth and prosperity in recent decades, propelling it atop the list of production countries and a strategic lynchpin in the global supply chain. This pursuit of excellence, however, has caused China to focus on leaning out its own supply chain, relying heavily on human and land resources, and adopting processes that directly support a rapidly evolving, just-in-time supply chain. In a significant conflict with Taiwan, however, it is expected that China will lose immediate access to its fuel supplies and raw materials due to a robust naval blockade. These actions will expose the true vulnerabilities of its supply chain, forcing it to modify and adapt its tools, systems, and processes to sustain the long-lasting conflict. Its dependence on a lean, export-centric model, which has enabled its rise to world-leading industrial status, is not appropriate for military operations and will hinder its ability to effectively execute its strategic vision.

With an invested interest in AI, however, China possesses the knowledge to adapt its processes and "compete at the highest international level".[50] Throughout the COVID-19 pandemic, it also learned critical lessons that will further propel its innovative capacity. The integration of AI into military logistics and supply chain management represents a significant opportunity to address these unprecedented challenges. However, the success of such endeavors will ultimately depend on a complex interplay of technological capability, strategic planning, and international dynamics. While China's tech industry undoubtedly possesses the raw potential to support significant advancements in supply chain management under duress, converting this potential into practical solutions will test the limits of China's innovation ecosystem. The ability to navigate these challenges will play a crucial role in determining the feasibility and success of any military objectives concerning Taiwan, underscoring the intricate relationship between technology and geopolitics in the 21st century.

In closing, it is important to understand that this research only scratches the surface of the many ways China can and should adapt its supply chain to overcome the logistical challenges associated with a blockade. While it is evident that some change *is* required, the detailed changes within each of the various industries and their associated strategic costs require a far greater analysis.

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[49] Wu et al., pg. 313.
[50] Wu et al., pg. 312.

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