

US – China: Geopolitical Rivalry and Technology War

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Abstract

The US and China are engaged in a geopolitical and technological rivalry. This rivalry is analogous of prior historical rivalries that have occurred between a dominant hegemonic nation and a rising challenger each with differing strategic objectives, policies, and political motivations. (Kegley & Wittkopf, 2005; Kennedy & Lim, 2018). China's rapid ascendance as a global technological leader, growing influence as a major international investor, and well-established dominance in global manufacturing represents an international competitive threat to US technological and economic hegemony and to its national security interests (Gavekal, 2018). This mounting threat has caused the US to engage in counterbalancing measures against China and to dramatically increase its own science & technology (S&T) investments and programs (Gavekal, 2018; Kennedy & Lim, 2018). China views the US's counterbalancing initiatives and escalations of its technological and military development as a threat to the Communist Party of China's (CPC) sovereignty, regional and national security, and its geopolitical ambitions. Complicating matters is the escalating development of dual use and leapfrog technologies and each nation's leaders growing suspicions regarding their counterparts' true intentions (USCC, 2019). These factors are all contributing to a downward spiraling action – reaction cycle and a high-tech driven security dilemma (Kania, 2019a).

Introduction

The US and China are engaged in a geopolitical technological rivalry. This rivalry is analogous of prior geopolitical rivalries that occurred between a dominant hegemonic nation and a rising nation each with differing strategic objectives, policies, and political motivations. This is affecting the established global balance of power and is creating a growing security dilemma threat (Kegley & Wittkopf, 2005; Kennedy & Lim, 2018). China's rapid ascendance as a global technological leader, growing influence as a major international investor, and well-established dominance in global manufacturing represents a significant international competitive threat to US economic hegemony and to its national security interests (Gavekal, 2018). US foreign policy and national security analysts agree that the US and China are already engaged in a long-term strategic competition over technological, economic, and military dominance that transcends anything the US has previously experienced (Kennedy & Lim, 2018). This mounting threat to US economic and national security is largely causing the US to engage in counterbalancing measures against China and to dramatically increase its own science & technology (S&T) investments and programs (Gavekal, 2018; Kennedy & Lim, 2018).

Adding to the problem is each nation's senior leadership¹ perceptions regarding their counterparts' true intentions concerning the development of dual use and emerging leapfrog technologies². Leadership, from both countries, have started to perceive the other nations escalating dual use S&T research and product / service development as a growing threat to its long term economic and military stability (USCC, 2019). The US believes that China's true ambitions are to surpass US technology, the backbone of its economic growth and military dominance and eventually challenge US global hegemony. China views the US counterbalancing initiatives and escalations of its technological and military development as a threat to the

Communist Part of China's (CPC) sovereignty, China's regional and national security, and its geopolitical ambitions to improve its position in the international order, all of which contributes to a downward spiraling action – reaction cycle and a high tech security dilemma (Kania, 2019a).

The focus of this research is to determine to what degree a US and China rivalry is occurring and how advanced technologies contribute to the rivalry, assess how the development of dual use and leapfrog technologies accelerate those contributions, discover how the integration and use of these technologies generates levels of complexity for each nation's senior leadership who are ill-prepared to comprehend, and evaluate how their perceptions influence the policies that get created which exacerbates the rivalry. I argue that the US and China are engaged in a S&T rivalry and race for technological power which will be used to bolster each nation's economic growth and develop advance modern militaries. This increases distrust and tensions among each nation's senior leadership and results in strategies and policies designed to strengthen each nations material power and national security. The result of these actions is a new form of complex security dilemma that is becoming too difficult for each nation's leadership to adequately comprehend due to the complexity of the technologies, their large-scale integration capabilities, rapid pace of advancements, the technologies potential and threats, and the perceptions / misinterpretations of each nation's intentions and priorities.

This paper is structured as follows: Part 1 discusses how the US – China rivalry are products of defensive realism theory. Part 2 assess the geopolitical, regional and domestic impacts of a US – China rivalry and how technology and leadership perceptions play vital roles. Part 3 assesses the global economic and trade entanglements and explains how technology is the underlying cause behind the trade war. Part 4 will evaluate the military power component. Finally, Part 5 will describe the causes behind high-tech rivalry and ensuing security dilemma.

Defensive Realism Theory, Material Capabilities, and Security Dilemma

The technological rivalry between the US and China both resides within and is a catalyst for a broader geopolitical rivalry developing between the two nations. This greater rivalry is the product of a shift in the global balance of power that occurs when a dominant hegemon is confronted by a rising challenger with differing political / strategic goals and ideologies (Kegley & Wittkopf 2005; Kennedy & Lim, 2018). These events are occurring within a defensive realism theory framework³ with both nations determined to preserve and/or enhance their political, economic, and national security positions within the anarchic international order (Waltz, 1979, 126). The dominant nation (United States) perceives the emerging nation (China) as a threat to its geopolitical comparative advantage and to the material power or material capabilities⁴ it requires to remain the global hegemony (Gilpin, 1981; 157, 168-169).

In the case of the US-China rivalry the most relevant material capabilities are each nation's technological advancements and economic resources. These are latent material powers and play a more prominent role in the modern geopolitical environment than does military power. In prior eras, military power, a direct material power, was considered to have the greatest effect on the balance of power. The reason being that military power is subject to direct counterbalancing measures and in the current era, it has also become increasingly reliant on advanced technologies and strong economies to build the expensive contemporary militaries that shape modern warfare (Wohlforth, 1999; Roland, 2009).

Technological power, primarily in the form of new innovations or advances to existing weapons systems have become so important that it literally defines modern warfare, drives its changes, and has become more central to advancing military capabilities than any other factor (Roland, 2019). Consider that modern militaries are comprised of platforms such as planes,

drones, ships, submarines, tanks, missiles, etc. all integrated with high tech computers, GPS guidance systems, internet technologies, cloud access, and most recently AI. Without these technologies, and the ongoing innovations they provide, a nation's warfighting capability is less effective, and confrontations regulated to asymmetrical warfare (Dixit, 2010; Roland, 2019).

Economic power, and the financial resources it provides, are also vital to each nation since it affords the funding requirements for technology development, military modernization, and other elements necessary for ensuring national security. Leadership in both the US and China are convinced that retaining or achieving global economic dominance is the best course of action to secure a prominent position in the international order. They also realize that strong economies assist nations to become robust international competitors, garner geopolitical influence, improve domestic socioeconomic conditions, and support political / ideological positions (Ward, 2019: para 35; Cordesman, 2016: 56).

To maintain its unipolar hegemony and stave off a potential rivalry, the dominant nation will seek to both develop its own material capabilities and use counterbalancing measures to stem the technological and economic growth of the rising nation (Wohlforth, 1999). Neither the dominant nation nor the challenger is interested in outright military confrontation or in regional conquest since the benefits rarely, if ever, will outweigh the consequences of a protracted military campaign, the economic losses associated with the campaign, or the long-term costs of subjugating and occupying another nation (van Evera, 1999: 163-165). Since the modern international order doesn't reward aggressive or expansionary actions, defensive realism theory looks to material factors or structural modifiers to better explain expansionary proclivities and/or assess the likelihood of conflict occurring in the international system. These structural modifiers include technological development / progress, military capabilities, raw material access,

geographic proximity, international and domestic pressures / influences, and leadership perceptions (van Evera, 1999: 7-8; Taliaferro, 2000: 131, 137). Structural modifiers are the sources or underlying casual mechanisms behind aggression and rivalry between nations (Lobell, 2010: 3).

Structural Modifiers – Technological & Leadership Perceptions

In the case of a US-China rivalry the most relevant structural modifier in the modern context is each nation's technological progress followed by their senior leadership's perceptions. What separates technological development or progress⁵ from the other structural modifiers are its dual use capabilities, synergies derived from dual use technologies, and its multiplier effect (Bonjnec, 2015; European Commission, 2017). Dual use technologies are derived from basic, applied, and development research process⁶. The process can take years and all three forms of research are crucial. Dual use technologies benefit a nation in several ways; it adds to the future generations of products and services that contribute to a nation's long-term economic growth; and it generates the advanced weapons platforms that expensive modern militaries rely on to assure a nation's national security (Sirkin, 2017; Gavekal, 2018).

China's leadership believes that China must become a dominant global power in S&T R&D and a high-tech manufacturer. Remaining a global manufacturer of low-value goods and services of questionable quality will no longer be enough to maintain its economic growth rates or secure China's long-term regional ambitions (Eloot, Huan & Lehnich, 2013). China enjoys several advantages that have helped it transition into and accelerate its technological progress. China can quickly "acquire" and incorporate current technology advances from already innovative nations like the US while simultaneously developing its own STI indigenously from technologies previously acquired from foreign companies that do business in China and are

subject to technology transfer agreements in exchange for market access (Kennedy & Lim, 2018).

China also benefits from direct control over its large number of state-owned S&T R&D programs and its state directed S&T central planning processes. The CPC's governing body, in this case, specifically the Central Committee⁷ can force compliance from any of China's state owned enterprises (SOEs), private sector large and medium size enterprises (LMEs), and rapidly growing number of innovative startup companies, at any time to engage in research and product development according to the needs of Party and Peoples Liberation Army (PLA). In addition, the Central Committee can actively expand and coordinate China's university STEM programs, incentivize student enrollment and participation, and guide students towards dual use technology fields. These advantages allow China to streamline and better control S&T R&D and innovation processes. (Veugelers, 2017).

These Central Committee STI directives combined with S&T strategic initiatives and policies enacted over the last few decades have allowed China to catch up to and even surpass many of the technologically advanced developed nations in emerging dual use technology fields (i.e. space and satellite systems, cyber platforms, quantum computing, automated systems, AI, etc.) (Nouwens, 2018). China's significant progress in dual use and emerging digital technologies R&D and industry development has increased tensions among the US and other nations which are growing more suspicious of China's motives and no longer believe China is only trying to become an international STI competitor or is simply engaging in defensive measures to protect national security interests while improving its position within the international order, as its leadership has claimed (Freeman, 2017a).

The US has managed to sway the other regional technologically advanced developed nations (i.e. Japan, South Korea, India) into agreeing that China has been engaged in coercive gradualism in order to incrementally attain global S&T R&D dominance and make major advances in dual use technologies “under the radar.” There was growing consensus that these actions were not just for commercial purposes and economic growth but were also being purposed for China’s modern militarization strategy and for advanced weapons development to eventually secure regional hegemony (Bhatia, 2018: 25; Freeman, 2017a). Coercive gradualism is defined as an incremental and subtly aggressive pursuit of one nation’s geopolitical interest at the expense of another nation(s). Coercive gradualism is a rational tool generally used by a strong or emerging nation to avoid engaging in outright or surprise acts of aggression that would be subject to repercussions (Bhatia, 2018: 25).

The US Trump administration responded to these activities by packaging specific counterbalancing measures aimed directly at China’s advancing S&T R&D and its technological progress (The White House, 2018b; Noonan, 2019). These measures were included as part of a broader counterbalancing strategy designed to curtail China’s unprecedented economic growth which the administration attributes to unfair trade practices, foreign technology transfers, and intellectual property theft. These strategies included: reinvigorating US technological progress, strengthening US military primacy, and utilizing international/regional policies and/or multilateral enforcement tools. These multilateral tools included: strengthening regional alliances, tariffs on key Chinese exports, restricting access to US companies and their technologies, and reducing US FDI to China. These actions have caused China to react in a similar fashion initiating their own set of technology restrictions and tariffs directed at the US and its exports (Tayal, 2019; Borzykowski, 2018). Both nations fully understand that

technological progress is a main catalyst for economic growth and securing their national security. They also realize that their governments must harness the benefits that STI provides or “fall by the wayside” to other technologically advanced developed nations. What is also becoming clear is that the structural modifier - technology development, especially dual use technologies with cutting-edge leapfrog capabilities, are a rising source of underlying tension and potential conflict between the US and China (Schaaper, 2012: 7-8). Leapfrog technologies are new technologies under development that enable countries to skip the technological evolution process and move straight to R&D of state-of-the-art technologies where prior adoption has yet to occur, thus leapfrogging the competition (Fong, 2009: 1).

The other structural modifier that is very significant to the growing US-China rivalry is each nation’s leadership perceptions. Leadership perceptions and beliefs concerning balance of power, a nation’s position in the international order, and potential external threats, can lead a nation’s senior leadership to perceive an exaggeration of threats requiring a mobilization of their material capabilities and resources. This type of behavior in turn adversely affects the leadership perceptions of neighboring nations. These perceptions can be factual or contrived, but the results are generally the same, they cause a nation’s leadership to respond in irregular and unpredictable ways which intimidates other states. (Wohlforth, 1993; Christensen, 6; Schweller, 2006: 37, 47-48).

Mounting perceptions of distrust and hostility among the US and China’s senior leadership has occurred across multiple levels of each nation’s interactions (Jervis, 1999; Jalil, 2019). The Trump administration, under advisement by its intelligence agencies, consider China’s rapid development of dual use technologies, unfair trade practices to elicit trade imbalances, and unscrupulous acquisition of intellectual property as an “unprecedented threat” to

US national and economic security, and an outright attack on the US industrial base (Gavekal, 2018). The Trump administration's perception of China's senior leadership is that it routinely favors political objectives over sound economic principles and that it directs its large government subsidies towards overproducing goods, intentionally dumping those goods into new markets, and effectively manipulating its currency, all to gain unfair access into global markets and supply chains (McBride & Chatzky, 2019). The administration also believes that China's intention is to continue penetrating US and global markets and creating large trade deficits with its trading partners. These actions are driven by China's senior leadership's desire for economic leverage over other countries. US senior leaders view these successful but unfair practices as key to China's rapid ascension as a global economic power, but this success comes at the expense of the US and other technologically advanced developed nations' industries and manufacturing sectors (The White House, 2018b; McBride & Chatzky, 2019).

The Trump administration and key US congressional representatives from both political parties also perceive that China's move from low-wage, low value-added manufacturing towards high value product development and high-tech manufacturing represents another threat to US technological and economic hegemony development (McBride & Chatzky, 2019; Motohiro, 2019). This additional challenge to US STI dominance, considered the backbone of the US economy, has risen alarms among its S&T and foreign policy advisors who warn the administration that this will further spur the rapid development of China's dual use technologies. US defense and intelligence analysts' assert that these actions transcend China's technological development and economic growth ambitions or its goal of securing China's sovereignty. These analysts and the administration believe that China's long-term plan is to utilize China's already vast economic resources to finance an increasing number of dual use S&T R&D programs, retool

parts of China's industrial sector for high-tech high value manufacturing, incrementally develop a broad array high tech product / service lines with a focus on emerging leapfrog technologies, and use the assets to modernize China's overall military power so that it could one day challenge US military hegemony (McBride & Chatzky, 2019). This conversion of economic power to military power could be used to modify certain elements of the international order towards China's favor while retaining many of its core tenants. In essence, reform the liberal international order to better fit its objectives as rather than outright restructuring it (Farley, 2018). These perceived threats to US high tech manufacturing superiority are used to justify US retaliatory measures against China's technological and economic growth in order to preserve US national security interests (Champion, 2019).

China's senior leadership have a different perspective. They believe that China's STI and industrial strategies and policies are necessary for China to become an international competitor in fast-paced dynamic global markets (Olson & Prestowitz, 2011: 5, 8). Without refocusing its efforts towards high value production and exports, China will become ensnared in the middle-income trap⁸ and not be able to support the growth of its growing middle class or increase the incomes of the Chinese people which are far below developed world standards. To accomplish this, China's Politburo⁷ believes China must develop its own indigenous high-tech R&D and manufacturing, reduce its reliance on US technology, and restrict access to its markets, or it will be at the mercy of ongoing restrictive Western counterbalancing measures already being put in place (McBride & Chatzky, 2019). The Politburo Standing Committee (PSC)⁷ states that they are only imitating what the other technologically advanced developed nations have already successfully accomplished. They also claim that China has a sovereign and legitimate right to develop emerging new technologies and to pursue a high value productivity economy and a

modern military capable of protecting China's regional interests, and most important to the CPC, the Party's political security and regime's survival (Kania, 2019a).

In its 2019 Defense White Paper titled *China's National Defense*, China's senior leadership both believed and accused that it is the US, and not China, that is "engaging in technological and institutional innovation in pursuit of absolute military superiority," and that China is only attempting to gain prominence in S&T R&D and become a global manufacturer in high-tech product / service lines in order to remain internationally competitive (SCIO, 2019: 6; Kania, 2019a). The 2019 White Paper also claims that China is only modernizing an outdated military for national security reasons as many other nations have already done, and not for offensive purposes (Kania, 2019a).

China's senior leadership have also publicly stated that the US is unjustly counterbalancing against China, and Beijing believes that the real purpose is to stifle its economic growth, threatening its legitimate right to political sovereignty and national security, and that the US is using China as an excuse to ramp up defense spending and dual use STI development under the guise of preserving national security. (McBride & Chatzky, 2019). What becomes clear is that the differences in the leaders perceptions have become numerous and systemic, and despite the claims that each nation is simply acting defensively and only seeks to protect their nation's security, their actions say differently and are increasing insecurity and the likelihood of conflict (Van Evera, 1998: 6).

What is evident is that each of these structural modifiers has become a source of tension and conflict. Each round of counterbalancing and/or multilateral enforcement measures triggers a further action - reaction cycle and reinforces leadership perception that their counterparts are purposely engaged in hostile actions with dual use technological development as a central

impetus. This is creating an ideal condition for a downward spiraling effect of distrust and tension between the two nations leaders and the emergence of complex technologically driven security dilemma (Tang, 2009: 601-603, 612; Kennedy & Lim, 2018).

Strategic Objectives, Political Ideologies, and Philosophical Differences

In addition to the structural modifiers, each nation's strategic objectives, political ideologies, and philosophical differences can affect both the broader US-China rivalry and the S&T rivalry. The US strategy is to retain technological, economic, and military hegemony. This strategy is rooted in the country's founding principles: freedom, private property rights, limited representative government, power which emanates from the electorate, and the US Constitution. Geopolitically, the US uses its hegemony to expand democracy, promote free market principles, and maintain a rule based international order which the US helped establish and greatly benefits from (Kania, 2019a). The Trump administration's 2017 National Security Strategy (NSS) states that "economic security is national security" and to ensure US economic dominance the White House must commit to expanding its competitive advantages garnered from STI, especially on research lines focused on dual use technologies that are capable of revitalizing US manufacturing sectors and advancing military capabilities (Almond, 2018).

In contrast, China's strategic objectives are to preserve its sovereignty and advance its regional development goals. China's strategy is to use technological progress to continue to grow its economy, modernize military power, and spread its influence throughout Southeast Asia and eventually to much of the world. However, the underlying reason for technological progress, economic growth, and military modernization will always be to preserve the political security and regime survival of the CPC leadership (Kania, 2019a). The CPC officially proclaimed in 2009 that China's core interests consist of promoting state security, state sovereignty, regional

territorial protection, and the development of the Chinese economy. China's Central Committee members often invoke these core interests when engaged at any level of foreign relations and negotiations. They have often stated openly that these interests are not open to compromise and must be respected if foreign countries and their businesses wish to pursue international treaties or trade agreements with China (Zhou, 2019). Prior US administration's and their policymakers have not adequately understood or have chosen to ignore just how important political security and Party sovereignty are to China's leadership. Any threat of regime changes or potential alterations of communist party ideology is unequivocally intolerable to the CPC (Kania, 2019a).

Aggravating CPC concerns is the differences in political ideologies and the Western world's expectation that China would eventually transform into a modern democratic society. This expectation of political transformation alone is enough to create distrust and reinforce the Central Committee's concerns that the US and other Western nations ultimately have hostile intentions aimed at China's regime stability (Kania, 2019a). CPC members at every level of leadership regularly proclaim loyalty to and strictly adhere to the Constitution of the People's Republic of China. The PRC's Constitution categorically states that "the Communist Party of China is the sole leadership of the country," what this ultimately means is that the CPC leadership completely controls the entire country of China through the Party organization, its ideology, and its influence over the government's structural system (en.people.cn, 2004; Zhou, 2019). This has allowed China's senior leadership to define China's national security in exceptionally expansive terms. In addition, China's National Security Law grants the Central Committee the right to "maintain its ideological domination" with political security as its foremost requirement in all domestic and foreign interactions (Kania, 2019a). The fundamental

problem at the center of all this is that China and the US care about their national security in fundamentally different ways (Kania, 2019a; Zhou, 2019).

China's senior leadership understands why the Trump administration is engaging in counterbalancing measures such as a resurgence in US material capabilities, new trade policies, and restrictions to US foreign investments and technology access. They view these measures as attempts to protect US security interests and hegemony by restraining China's technological and economic growth, or as attempts to outright contain China's regional and global interests (Kennedy & Lim, 2018; Dong, 2017). China's senior leadership did attempt to mitigate US fears by responding to what they believe are unnecessary incursions by proposing a "new type of great power relationship" and intellectual framework to address the century-old problem of whether an establish power confronted by rising power can break away from a cycle of conflict and an eventual security dilemma (Dong, 2017).

This framework involves the US and China forging an unprecedented relationship based on "interdependence," where both nations mutually strive to overcome major political obstacles since the economic benefits of a productive relationship override any impediments perceived or actual. China proposed that the US and China work together towards a greater symmetry in global governance and focus on and ensuring complementary economic expansion rather than the asymmetrical and confrontational relations (Zhongying, 2013). However, the Trump administration's policy advisors seriously doubted the sincerity of the proposed "great power relationship" citing China's three major strategies for national rejuvenation: The Belt and Road Initiative (BRI), Made in China (MIC) 2025, and the PLA's military modernization program, as programs designed to ensure China reaches its goal of becoming a dominant world power with little consideration of US interests. The US's senior leadership has chosen to focus instead on

winning the technological, economic, and military contest they perceive China has already engaged in (Panda, 2019).

Adding to the growing hostilities and the strategic and ideological difference between the two countries is President Xi Jinping's desire to return China to the old, highly centralized Maoist system, despite the reoccurring failures of communism over the past century. Xi Jinping's successful attempt to consolidate power and make his presidency a lifelong appointment has raised alarms throughout the western world (Zhou, 2019). In the 19th Party Congress (October 2017) he proclaimed dozens of times that China will return to a "great power" highlighting as examples the China's military buildup, creation of artificial islands in the South China Sea, and the long overdue technological modernization of China's military and combat readiness (Fontaine, 2017). Of equal concern to western nations is how Xi Jinping speaks openly of "preparing to fight and win wars," and how he appears more ready to develop high-tech weaponry and prepare for confrontation than has any other PSC leader since Mao Zedong (Panda, 2019). Whether this actually comes to pass or is blustering to garner internal favor among hawkish Party members only time will tell, but so far, no outward acts of aggression have occurred considering that China has much to lose with its economy completely engrained in the global economy (Hass, 2018; Chafuen, 2019).

President Xi Jinping has also categorically stated that any serious efforts by the US to promote "western constitutional democracy" will be considered an attempt to undermine China's unilateral party leadership, system of governance, and its "ideological sphere" (Kania, 2019a). To address potential hostile intentions aimed at CPC regime security, Xi Jinping references a communiqué circulated by the Central Committee's General Office titled, "Document 9." This document warns against seven "political perils" that the CPC currently faces. These "political

perils” involve the promotion of: Western Constitutional Democracy, Western “universal values” that could weaken CPC leadership, Neoliberalism attempts to alter China’s Economic system, “civil society theory” that proclaims how individual rights should supersede CPC directives, nihilistic views that distort CPC history, Western beliefs regarding “freedom of the press” and how journalists’ should not be subject to Party discipline, and questioning China’s reform process and/or the very nature of socialism. Xi Jinping and the Central Committee have used “Document 9” as a source to crack down on any dissenting independent voices, media outlets, academic institutions, and foreign human rights lawyers and NGOs (ChinaFile Editors, 2013).

Due to the relentless threats and hostilities that China’s senior leadership perceive are coming from western democratic ideologies, President Xi Jinping and the PSC have often proclaimed that it is up to the PSC to strengthen the Party’s resolve on the “ideological battlefield” (Kania, 2019b). The PSC has long believed that anti-Chinese westernized forces led by the US have tried to infiltrate China’s “ideological sphere” by influencing or confusing the CPC and every level of its leadership with westernized ideas and propaganda designed to weaken and/or divide the Party and its regime security from within (ChinaFile Editors, 2013). The PSC is also deeply concerned with the potential influx of US principles like freedom, democracy, and similar foreign concepts coming through the Internet, which the PSC views as threatening to communist party ideals and political regime security. For the US to pacify China’s senior leadership’s perceptions regarding its security, regime survival, and the preservation of its “ideological sphere” would require ideological compromises unacceptable to US founding principles. This is one of the greatest impasses between the two nations (Kania, 2019a).

Another major issue contributing to a growing US – China rivalry are the philosophical differences between the US and China and the lack of understanding as to what each nation

considers important. The US demonstrates no sensitivity for Chinese philosophy and culture. Honor and status still play a prominent role for over 90 million CPC members. This is evidenced by how a state-level honor system was created in 2015 to meritoriously award citations, honorary titles, and metals for “service to the Party, the country, and the people”. China’s social credit system expanded upon these guidelines to include a ranking of all Chinese citizens based off social credit score determined by behavior and Party support (Xuejie, Zhao & Yuanyuan, 2015; Ma, 2018). China’s pursuit for status or ranking in the geopolitical arena has been a consistent pursuit of the Central Committee. This is especially evident in China’s foreign policy and trade negotiations. Dual use STI development and military modernization may actually have has much to do with keeping up with the other technologically advanced developed nations than in engaging in military buildup for national security purposes (Wolf, 2017).

Differences between the US and China’s strategic goals and political / ideological beliefs remain unresolved and, in some cases, incompatible. These factors increase distrust among each nation’s senior leadership and threaten their national, political, and ideological security interests. They can also cause instability between the two nations and contribute to regional and global tensions (Kania, 2019a).

Domestic and International Pressures

Domestic and International pressures are another underlying cause behind the growing rivalry between the US and China. One of CPC’s biggest domestic concerns is civil unrest or disorder among its 1.4 billion citizens that could escalate into uprisings and fragmentation (Vicenzino, 2019). China’s senior leadership has determined that western democratic ideals or propaganda will be the most likely cause of civil unrest and have sought to erect “the Great Firewall of China” to curtail any western ideological influences (Mozur, 2015). In November

2016, the Cyberspace administration of China (CAC) was ordered to create new series of cybersecurity laws and regulations designed to protect China's citizenry from unwanted foreign influence and thus preserve CPC political sovereignty. The new laws and regulations were to use digital technologies to monitor for unauthorized western ideologies and "protect" netizens (citizen internet users) from ideologically harmful information coming from western "terrorist sources" (en.people.cn, 2017). The PSC took these measures further and endorsed the creation of the new Security – Industrial Complex which consists of the Ministry of Public Security combined with China's rapidly growing private sector security tech industries, LMEs, and small enterprises. The PSC believes that increases in high tech security spending will provide an acceptable layer of security necessary to restrict dissenting ideological viewpoints through a variety of surveillance and interception processes (Weber, 2018).

The 2019 Defense Intelligence Agency (DIA) report *China Military Power* describes China's senior leadership's primary threat perceptions as consisting of sovereignty and domestic security issues which if left unchecked could potentially undermine CPC rule (DIA, 2019). Randall Schweller explains that threat perceptions by a nation's leaders can be actual, potential, or imagined, and are usually comprised of estimated capabilities and estimated intent. These perceptions or estimations can cause a nation's leadership to unduly inflate threats, mobilize military resources, and/or overprioritize domestic concerns, especially when elite consensus is present (Schweller, 2006: 38, 47-48). China's growing domestic security concerns have resulted in just such a scenario with its senior leadership instituting widescale electronic surveillance programs designed to track dissenting viewpoints. China has invested over \$200 billion in security surveillance programs which have been successfully installed and utilized in over 20 provincial bureaus and 300 cities. China currently has over 200 million surveillance cameras and

new AI-embedded facial recognition capabilities are being installed. Personal computers and electronic SMART device (TV's, DVD players, video game consoles) have internet monitoring technologies that are constantly being installed, updated, and their features expanded (Lentino, 2019).

The ultimate purpose of these surveillance programs is to use technology to track all Chinese citizens movements and set up a massive "social credit system" where citizens are rewarded or punished according to their assigned "scores," The program is currently monitoring tens of millions of people, ranking acceptable/unacceptable behavior, and providing Chinese citizens with "social credit" scores which determines whether they can fly, use trains, go to the best schools, get the best jobs, and determine their internet access and connection speeds. Critics to the programs state this is also being used to monitor and score citizens according to their acceptance of CPC doctrines. (Ma, 2019). The programs are also suspected of targeting "key individuals," those suspected of dissenting against Party ideals, religious followers, drug addicts and petty criminal offenders. These individuals are added to police databases for future scrutiny (Dirks & Cook, 2019).

Another major problem contributing to the US-China rivalry is the growing tension among China's senior leadership over US influence in Southeast Asia. China's leadership considers the South China Sea as a territorial extension of mainland China and the starting point from which it will one day control the Western Pacific theater, shift the balance of power in the Indo-Pacific, and ensure China's sovereignty and regime survival in the 21st century (Kaplan, 2019). The PSC strongly believes that the escalating US military presence in the South China Sea and its renewed counterbalancing efforts to re-enforce old alliances with Japan, South Korea, and the Philippines are being orchestrated to limit China's rise as a regional hegemonic power

(Browne, 2014). To counter these alliances, their countervailing pressures, and compensate for US “freedom of navigation operations (FONOPs), China’s senior leadership are developing new weapons technologies and using “lawfare” or legal warfare and escalated long term investments in dual use technologies. Lawfare was used successfully to override the 2016 international tribunal ruling and claim ownership of four subterranean continental shelves, their archipelagos, and any natural resources within their proximity. These shelves comprise much of the contested South China Sea. China has justified its use of gradual militarization and island building within the region to protect these claims (Bursick, 2017; Kuok, 2018).

China has also increased dual use R&D investments with an emphasis on high-tech military weapons systems development directly applicable to the South China Sea region (Browne, 2014; DOD, 2019: 93, 96). China’s leaders realize the PLA cannot successfully compete against US air and naval assets should a regional conflict occur, so they are focusing instead on specific types of dual use leapfrog technologies to compensate for superior US forces (Kaplan, 2019). Examples of these leapfrog technologies include China’s ~~development of~~ high precision medium to long-range hypersonic strike missiles, new generation of advanced naval ships with advanced high-tech weaponry, and high-end multifaceted cyber-attack systems (Browne, 2014; Fontaine, 2017).

US foreign policy analysts and military commanders consider these escalations a serious threat to local US bases, to US and ally ships patrolling the region, and to the regional territorial claims of its regional partners (Browne, 2014; Fontaine, 2017). In response to these threats (perceived or factual), US senior leadership devised a series of “military doctrines” aimed at the South China Sea region. A few of these doctrines go so far as to call for large-scale preemptive military strikes against China’s medium to long-range conventional and hypersonic missile

launchers, those capable of targeting the US or ally ships across hundreds of miles. The US has also increased production of its own dual use technologies targeting advanced mid-range hypersonic weapons systems as a counter to China's missile systems. These missiles are capable of Mach 5 or greater speed that are virtually non-interceptable. These doctrines are being initiated along with a ramp up S&T R&D for future leapfrog technologies useful in the region (Muspratt, 2018; Zhao, 2019).

This escalation of advanced military hardware by both sides and the growing fear of a military confrontation (accidental or intentional) adds further fuel to a security dilemma that is centered around advanced dual use technologies (Browne, 2014; Pandya, 2019). The emerging high-tech security dilemma could lead to a cold war 2.0 and redefine the geopolitical environment, global markets and supply chains, and possibly the international order (Champion, 2019). These international pressures also contribute to another concern, should the US and/or China decide to intensify the trade war to the point where each country no longer considers the other a viable trading partner and their economies become less interdependent upon one another, the chance of de-escalating tensions from unintentional or unforeseen conflict is lessened (Browne, 2014).

Thus far, I have discussed the causes contributing to a US – China rivalry and growing security dilemma. This next section will assess the effects of the rivalry on both nations, to the East and Southeast Asian regions, and to the international order. I will provide a description of the broader US - China rivalry and its geopolitical impact first since it sets the foundations for the S&T rivalry, then assess STIs contributions towards the greater rivalry and its own unique regional and global impacts for each of the following sections: geopolitical, trade, military, and technology integration.

Geopolitical, Regional, and Domestic Impacts

There is a growing consensus among analysts that increasing distrust between the US and China beginning in 2009 has the two nations set on a “strategic collision.” This collision is impacting each nation's economic and national security interests and is having a significant impact on geopolitical and regional (East and Southeast Asia) affairs and global markets. Underlying this distrust is an emerging security dilemma, one that is being triggered by a number of factors that have already been presented but has its roots primarily in S&T development and economic growth (Dong, 2013). This rivalry looks to be a multi-decade affair between China, the emerging authoritarian superpower, and the US, the democratic global hegemon. Both countries successfully utilize and benefit from a market economy approach but to differing degrees. The rivalry is ultimately about an international competition for global technological and economic dominance with military advancement and ideological political influence as the sought-out end products (Jalil, 2019; Panda, 2019).

Defensive Realism and the Geopolitical Environment

Defensive realism theory can be used to explain the actions and behaviors of the US and China rivalry relative to their security interests and the rivalries' impact on geopolitics and the international order (Alfarsi, 2017). China is not aggressively seeking global hegemony (at least not yet). Instead, China is a state that seeks security rather than the aggressive pursuit of power and hegemony. Proof of this statement is as follows: Since the fall of the Soviet Union, China has not displayed any revisionist tendencies nor is it attempting to espouse revolutionary rhetoric or support communist insurgencies in surrounding nations or the developing world. China is also not engaged in overt actions of aggressive behavior towards its neighbors, nor is it pursuing rapid material power maximizing strategies, choosing instead to incrementally increase its

technological and economic power, and has only recently looked to modernize its outdated military (Tang, 2003; Jalil, 2019: 57). China's senior leadership claim that military modernization efforts are long overdue and are not for expansionary purposes, but are instead necessary to maintain China's national security, protect its regional interests, and bolster its international status as a technologically advanced developed nation (2017 USCC, 2018a: 201; Jalil, 2019: 58).

Another indicator that China is not interested in aggressive behavior is demonstrated by its numerous memberships in international organizations (UN, WTO, etc.), multilateral institutions (Asia-Pacific Economic Cooperation (APEC), ASEAN Regional Reform (ARF), etc.), International Nongovernmental Organizations (INGOs), and numerous bilateral and multilateral free trade agreements and treaties. China has also chosen to support international free trade, global capitalism, and all its associated institutions (Jalil, 2019: 50, 52). These engagements are all indicators of China's willingness to operate within and contribute to the Western dominated international order and not to seek to actively challenge, disrupt, or revise the current international system which it has benefitted so greatly from. (Odgaard, 2013; Jalil, 2019: 41).

Instead of pursuing aggressive actions, China has generally chosen to engage in soft power, or "charm offensive" (Jalil, 2019: 54). China uses its vast economic wealth to establish trade agreements and entice promises of infrastructure development to promote its diplomatic, political, and ideological influence throughout the East and Southeast Asian region and eventually across the world with the advent of the BRI (Baltensperger & Dadush, 2019; Wuthnow, 2019). The rise of China's economic and geopolitical influence across the world is raising concerns among the Trump administration's foreign policy advisors and economic

analysts who fear that the years of US's calculated disengagement approach has allowed China to supplant US influence in key strategic regions throughout the world (Kranz, 2017).

China has also repeatedly demonstrated that it values the international status quo. Since the death of Mao Zedong, China has worked hard to attain a respected position in the international order. Any attempts to modify the international status quo will most likely occur through one of China's strategic initiatives and will be done "incrementally" with care (Zhao, 2016). China is not interested in outright replacing or destabilizing the international order it benefits so greatly from, nor does it want a direct conflict with the West over this matter (Li, 2014).

The final indicator that China's strategies and policies ~~that~~ are rooted in defensive realism is China's pursuit of cooperative security arrangements with neighboring countries. China has even sought out friendly relations with its traditional rival India despite ongoing border disputes. There have been a few minor standoffs over the Doklam plateau, but Indo-China relations have improved to the point that both nations are engaged in occasional joint military exercises. China has also resolved long-term border disputes with six other nations through negotiations and without incidents of conflict (Jalil, 2019: 49). China's senior leadership is arguably pursuing security over an aggressive pursuit of power and hegemony. However, the under-handed and deceptive manner in which China has pursued its economic and national security interests, strategic initiatives, and policy goals have alarmed and created distrust among many of the technologically advanced developed nations. (Whitehouse, 2018).

China's Vision of Victory and Strategic Initiatives

The CPC's "China's Vision of Victory provides a clear illustration of China's long-term ambitions and why those ambitions could be perceived by leaders of other nations as potentially

threatening. The Vision of Victory foresees China gradually ascending to the top of every high-tech industry with the world's nations and their markets interlinked with China at the strategic center (Panda, 2019). In addition to the blatant goal of global economic dominance this vision proposes, it also calls for the modernization of China's military through the use of advanced high-tech technologies. China's leaders have declared that these aims are necessary to ensure China's economic and national security interests against western fears of a rising China and US led counterbalancing measures (Ward, 2019: para 87). The Vision of Victory and President Xi Jinping's China Dream (objectives are synonymous) are about "the great rejuvenation of the Chinese nation" and eventually establishing China as the preeminent player in the international order by 2049. These ambitions are considered unacceptable to the US and other western nations as it represents a major challenge to US global hegemony and raises doubts to how China would alter the international order if it chose too (Allison, 2017; Panda, 2019).

In addition, to China's Vision of Victory are its strategic initiatives: the BRI, MIC 2025, and Military Modernization Program. These strategic initiatives are long-term strategies designed to redefine globalization and economic integration under China's terms (Investki, 2013). China's senior leadership is selling its BRI as a "fundamental safeguard for peace and stability." China's leaders claim that the international growth the BRI will provide via infrastructure development projects throughout the developing world will disempower terrorist sources, ease regional tensions, foster trust between nations, help establish security partnerships, and enhance economic development (Wuthnow, 2019). The land belt portion will run from China throughout Central and South Asia into the EU. The maritime road component will connect China to Southeast Asian, Indian, East and North African and Mediterranean coastal cities (Magneir & Gan, 2019).

The US believes this strategic initiative was purposed to not only connect China to the rest of the world, but to allow China to become an influential and coercive power over partnering developing nations through its economic dominance and conditional promises of future infrastructure and economic development (Freeman, 2018). The NSS and Department of State both describe China as providing infrastructure loans that created massive debt obligations to developing world nations. They accused China of engaging in “debt diplomacy” to leverage developing countries into siding with China over controversial geopolitical issues, granting China access to their natural resources (U.S. Department of State, 2019; Wuthnow, 2019). China is also supplementing the BRI’s infrastructure development with widescale communication networks including 5G fiber optic cables, cellular structures, e-commerce links, etc. all to be constructed throughout the developing nations. The Council on Foreign Relations (CFR) has raised alarms that Chinese telecommunication firms will install “backdoor mechanisms that could increase intelligence and propaganda operations in BRI partner countries”. This would allow China easy access to those nation’s personal, government, and business “big data” and provide China with a broad array of electronic surveillance capabilities to monitor their activities (Chandran, 2018: para 4)

The MIC 2025 is another strategic initiative established to ensure China’s economic rise. MIC 25 is concentrated on China becoming a dominant high-technology producer and exporter. It is central to China’s goal to use innovative manufacturing technologies (smart manufacturing) to become a high-tech manufacturing superpower. Its implementation will coincide with new high-tech industrial policies designed to guarantee China a dominant position in the fourth industrial revolution of digitization and key producer of advanced networks and smart hardware / applications (Wubebeke, et all, 2016). China’s senior leadership envision China as an early

leader of the fourth industrial revolution, where the emerging high-tech digital technologies (advanced semiconductors, artificial intelligence (AI), 5G, big data access, quantum computing, and networked cloud computing) are thoroughly integrated throughout China's high-tech industries, manufacturing, and supply chains. China's goal for this strategic initiative is to reduce its dependence on foreign technologies, tech transfers, and FDI all while developing its own indigenous STI. MIC 2025 is also part of the CPC's broader long-term goal to shift the economy out of the old model of regional resource extraction and low value-added commodity manufacturing and exports which currently comprises over 50 percent of China's economy, towards a producer and exporter of high-tech high-value goods and services (McBride & Chatzky, 2019).

China's senior leaders realize that China is already in the grips of the "middle-income trap" where growth rates plateau as middle-class wages increase and demand for better products rise. China is also suffering from severe unsustainable environmental and pollution problems attributed to decades of unregulated manufacturing practices. Beijing believe the only way to successfully avoid this trap is to shift towards high quality growth, high value production / exports, and its less environmentally damaging manufacturing processes (Kishore, 2018).

China's senior leadership believe that MIC 2025 will increase centralization of S&T policymaking and allow for better coordination across China's government research institutes and SOEs, private sector LMEs and startup companies, and academic institutions (McBride & Chatzky, 2019). The MIC 2025 strategy requires China's leadership to: set explicit public goals and call for both state-owned and private sector companies to shape their priorities around those goals; establish large-scale and rapid mobilization of the MIC 2015 strategy priorities; increase direct government subsidies and funding for targeted high-tech industries; reduce taxes and

provide low interest rate loans for private sector industries; encourage state owned and private sector Chinese companies to engage in foreign investment and acquisition strategies directed at other nations innovative high-tech companies (especially promising startups); and boost the number of forced technology transfer agreements and joint ventures between Chinese SOEs and private sector companies with foreign companies who are trying to access the Chinese market (ISDP, 2018; McBride & Chatzky, 2019).

Development of advanced dual use and emerging technologies are to play a principle role in MIC 2025. These technologies represent a real worry and challenge to US national security personnel. Technologies such as facial recognition software, virtual reality interfaces, 3D printing, driverless vehicles, and so on, have already been introduced into US and Chinese civilian markets while at the same time are actively being developed for military systems (McBride & Chatzky, 2019). US and foreign intelligence agencies are growing increasingly concerned as to how China ‘acquires’ these technologies which they assert are not coming from China’s indigenous S&T R&D initiatives at levels China senior leadership have claimed. Instead, these agencies claim that cutting-edge technologies are being ‘acquired’ from an increasing array of sophisticated methods involving espionage and intellectual property theft, outright acquisition of companies that are making major breakthroughs, and the recruitment of prominent foreign scientists and engineers already successful in their fields and who have experience working in technologies that China covets (Bennet & Bender, 2018; ISDP, 2018).

At the geopolitical level China’s MIC 2025 model will operate in conjunction with the BRI to control regional supply chains and raw materials sources that will ensure plentiful access to China’s manufacturing needs. S&T and foreign policy analysts agree that if China is successful in both the BRI and MIC 2025 the entire global innovation system and international

markets could be threatened and eventually redefined to suit China's strategic ambitions (UKTI, 2018; McBride & Chatzky, 2019).

China's leaders are betting that in addition to the strategic initiatives, China's S&T policies and its new Industrial Policy which are focused on advanced leapfrog technologies will all position China as an early adopter and leader in those fields they believe will revolutionize commercial trade and national defense (Panda, 2019). This has raised additional alarms in US and EU circles as to whether China will actually develop these new technologies on their own as its leadership claims or will continue to 'acquire' them through methods previously discussed. There is also growing concern among the technologically advanced developed nations as to whether China should be allowed to catch-up or surpass them in these sensitive fields. If China were to become the dominant manufacturer in these emerging fields as it did with low value products / services, it could overwhelm markets and render other nations incapable of being internationally competitive (Daniels, 2017; Panda, 2019).

The Trump administration has grown increasingly suspicious of China's long-term ambitions and recently tasked the Committee on Foreign Investment in the United States (CFIUS) to review China's foreign investments and acquisition strategies, identify Chinese companies that threaten US economic and national security interests, and block deals between those Chinese countries and their US counterparts that are developing dual use technologies for PLA purposes (Klima, 2019; Panda, 2019). This was followed by the House intelligence committee investigations and accusations that some of China's largest high-tech MNCs were using their networks to spy on US citizens or were sabotaging US commercial interests. The Commerce Department in turn restricted the ability of these Chinese companies to contract with private sector US companies, government agencies, and/or to sell any of their products / services

to the US government and the public. EU countries have also called for an EU wide investigative body to review Chinese trade infringements and issue restrictions on Chinese foreign investments that results in China 'acquiring' sensitive high technologies (McBride & Chatzky, 2019).

The US and China's conflicting strategic objective are diminishing each nation's senior leadership's trust of their counterparts' and their intentions. They are increasing geopolitical tensions China and the West, weakening economic prospects, and contributing to the increasing likelihood of a long drawn out rivalry and security dilemma (Lee, 2019; Kania, 2019a).

Domestic Pressures

Despite China's vast economic resources and significant advances in STI, China faces formidable domestic problems that could become exaggerated or blossom into geopolitical issues capable of drawing other nation's into potential conflict. These domestic concerns comprise of growing problems with ethnic minority groups such as the Uighurs which have garnered international attention for alleged human rights violations and intrusive electronic surveillance; ~~and~~ China's widescale environmental devastation which current technology may be unable to mitigate (Freeman, 2017a; Custer, 2014).

Domestically China faces several major challenges. China's detainment of an estimated 1 million Muslim's in the Western Xinjiang province has given rise to growing international condemnation. UN and human rights organizations are accusing China of subjecting the Uighurs to prolonged psychological and physical abuse. China's President Xi Jinping has stated that the re-education campaign is required if China hopes to stamp out the region's Islamic terrorism. He also declared that the UN and international activist groups should stay out of Chinese affairs (Tisdal, 2018). International condemnation over the Uighurs is escalating a domestic matter into

a serious foreign policy problem. Accusations that China is criminalizing an entire ethnic group comprising nearly half of the Xinjiang province's population does not sit well with the ideals of Western nations nor does it present the BRI in a positive light. The BRI will pass through numerous Islamic nations in-route to Europe and international accusations of Muslim discrimination could restrict China access to heavily populated Muslim countries. This would reduce China's chance of establishing network links and creating large economic development projects throughout central and southern Asia which is vital to the BRI's mission (Auslin, 2019).

The Australian strategic policy Institute has identified 28 re-education camps in Xinjiang province that Chinese officials at first denied existed, then confirmed, stating that they were part of China's "de-radicalization" policies (Auslin, 2019). Uighurs returning from these "re-education" sites have claimed they were really sent to internment camps to be indoctrinated with CPC dogma, required to learn how to speak Mandarin, and ordered to use "self-criticism" to correct unproductive thinking. Those that refuse or fail to comply are removed and many have been sent to prisons. The rest of the Uighur population has been subjected to ever-increasing electronic surveillance measures and their children and neighbors are encouraged to inform officials on nonconforming family, friends, and associates (Tisdale, 2018).

The US has responded to these allegations by declaring that if repressive Chinese government policies and continuing reports of oppressive treatment in "re-education" camps do not improve, the US will blacklist Chinese organizations and companies suspected of contributing to the abuses (Lynch, 2019). The US Commerce Department has identified as many as 28 entities it believes are implicated in "China's campaign of repression, mass arbitrary detention, and high-technology surveillance against Uighurs, Kazakhs, and other members of Muslim minority groups" (BBC, 2019). Foreign policy analysts speculate that the move is not

just about protecting disenfranchised ethnic minorities but slowing China's technological growth. Many of the companies targeted are some of China's largest high-tech companies involved in multitudes of global S&T projects. (BBC, 2019). This has taken China's by surprise; US threats cannot be summarily dismissed without potential consequences as has been done with many international institutions such as the UN. China leaders were hoping that events in the Xinjiang province would go largely unchallenged by the international community in a fashion similar as to what occurred with Tibet's brutal repression, but with Trump Administration, this no longer appears to be the case (Tisdale, 2019).

Arguably the most damaging domestic pressure facing China is the decades of unsustainable industrial manufacturing taking place in China. This has released massive amounts of greenhouse gas emissions, air and water pollution, and environmental damage from soil contamination. The environmental damage has not only been inflicted upon China but on its surrounding neighbors as well (Freeman, 2018). Between 2000 - 2016 China contributed roughly 30% of all global CO₂ emissions and healthcare costs from air pollution alone were estimated in 2015 at US\$1.4 trillion roughly 7.8% of GDP (CRS, 2019a). China's water polluted costs are estimated at more than 2.3% of GDP and almost 50% of its freshwater is unfit to drink. In total, pollution and exposure to soil contamination are responsible for the second greatest number of deaths in China, estimated at between 1.8 to 2 million per year (Yan, 2017; Asia Society, 2019).

To compensate for the rising costs of healthcare China's senior leaders have enacted a series of policy initiatives that have provided temporary improvements for both air and water quality indices but with China's growing population additional policies and technological advances are needed (Asia Society, 2019). In addition to these plans, President Xi Jinping has called for the 2030 Agenda for Sustainable Development. This Agenda outlines a new era in

innovation, coordination, green technology development, and transparency all needed to address the growing environmental crisis (Newsroom, 2018). The Agenda will require increased pollution and soil contamination regulations and combine China's STI development strategies with its new green development initiatives. It also identifies STI as the principle mechanism necessary for attaining China's sustainable development and pollution reduction goals. Technologies under consideration for development include cloud computing for big data access and storage, algorithm monitoring of regulatory frameworks, AI modeling for complex processes, and automating cumbersome time-consuming tasks. In addition to digital technologies new generations of robotics and drones can be utilized for real-time sampling and monitoring of ecosystems and logistics functions (SAP, 2018).

The aforementioned geopolitical impacts and domestic pressures if allowed to continue unabated have the potential to escalate into a new cold war between the US and China. In this case an economic and technologically driven cold war 2.0 comprised essentially of two worlds in a state of perpetual tension. One dominated by China in the east, with a tightly controlled and surveilled society, high-tech SOEs and LMEs subject to CPC wishes, and a controlled and monitored internet. The other by the US in the west, with a free and open society, high-tech MNCs subject to free market principles, and an open internet (Champion, 2019). The focal point of this competition will not reside primarily in military power or territorial expansion as the previous cold war between the US and USSR did. The current rivalry and the modern levers of material power are now comprised of technological advances, international trade and supply chains, and the global rules and standards of the international order (WEF, 2018).

The US and China's ability to develop new technologies, especially high-tech digital dual use technologies will define their relationship and is fast becoming the driving force of their

future international influence (Lewis, 2018). Even if a cold war 2.0 does not fully materialize, the US-China S&T rivalry for international high-tech supremacy will be enough to redefine the world's geopolitical, economic, and national security landscapes. This rivalry is not exclusively negative in its connotations, the competitive lengths both sides are pursuing could very well stimulate innovation to the point where decades of anemic global economic growth comes to an end (Wu, Hoenig & Dormido, 2019; Tasker, 2019).

Global Trade, Markets, and the Trade War

The US-China trade war and the potential decoupling of the two largest economies represents a serious threat to the world economy and could have drastic long-term impacts on international trade and the free market system. Should a full-blown trade between the two nations become a reality, other nations will likely be drawn into the fray, the outcome of such events would be a sweeping downturn of global economic growth that would affect much of the developed and developing world (Morrison, 2019; Rudd, 2019). With both sides at a seeming impasse, the US – China rivalry will likely continue to generate further policies and regulations that continue to decouple the US from China both economically and technologically (Pei, 2019a). This decoupling of the world's two greatest economies (40 percent of global GDP) has already disrupted global trade agreements, dismantled some regional and global supply chains, and stands to bifurcate technology standards (Pei, 2019a; Pei, 2019b).

There is agreement among US economic analysts and policy advisors that China's rise represents the biggest long-term economic and national security risk the US will face over the coming years (Pena, 2018; Pei, 2019a). US Senior leadership realize that an economic decoupling will be costly and politically damaging, but to continue to feed China's economic growth through unfair trade practices that create massive US trade deficits or to allow China to

continue to benefit from unreciprocated technology transfers and intellectual property theft at the US's expense is outright suicidal (Pei, 2019a).

China's leadership on the other hand, claims that their economic and technological development is not intended to threaten the US, but rather to make China a strong and a viable international competitor (Cheng, 2019). China's leadership understands that China has grown overly dependent on US FDI, technology, and markets, and must significantly reduce its dependence on the US. To maintain economic growth rates China has grown accustomed to, it will have to become a high value producer / exporter, and should an economic decoupling occur in earnest, this will become exceedingly difficult and Beijing will have to find additional trade partners (Motohiro, 2019; Pei, 2019a).

China's economic rise and subsequent challenge to the US hegemony has been derived from decades of successfully enacted pro-growth economic policies. The policies have allowed the Chinese economy to experience growth rates exceedingly twice that of the global economy. As of 2018, China comprises 15 percent to 18 percent of global GDP, accounts for one quarter of global industrial output, and in 2017 was responsible for one third of global economic growth (Manning & Engelke, 2018; Monier, 2019). China also has four in ten of the world's "unicorns", including three of the five largest. These comprise the 262 privately held startup companies with valuations over US\$1 billion. Unicorns are exceedingly rare comprising only three out of every five million startups. They are generally the first to market with a new idea or concept, experience accelerated growth rates, and are disruptive to their industries. They are a clear indicator of a successful innovative business model (republic.co, 2019). In addition, China is also responsible for over 42 percent of global e-commerce and projections are that this number will rise (Manning & Engelke, 2018).

China's principal means of economic growth has come from the manufacturing and exporting of low-priced low value goods throughout the world, and herein lies some of China's biggest problems. In 2006, Chinese exports had grown to 37 percent of its GDP; however, the Great Recession of 2008 drastically reduced demand from China's major customers especially those in the US and Europe (Friedman, 2017). By 2016 exports had declined to 19 percent of GDP and even though China's internal consumption had risen substantially it could not offset the decline in global demand (Friedman, 2017). Equally problematic was mounting export competition from neighboring countries that were providing low cost low value goods / services. These countries were often able to undercut Chinese prices. Another major concern was that global consumers began demanding better quality and safer consumer goods. China found itself trapped between the higher costs of production due to rising global demand for quality products / services, on the one hand, and having to account for a growing middle-income trap and increasing domestic demand from a population that still desired lower prices, on the other, all while still preserving jobs and avoiding layoffs (Friedman, 2017. Morrison, 2019).

Also, during this time period (2015 – 2016), and correlating with policies reforms concentrated in STI development, China became ensnared in several troublesome interrelated economic problems. These included (Freeman, 2017b; Friedman, 2017):

- 1) The global economy had become all but stagnant, experiencing years of anemic growth, which slowed China's export potentials,
- 2) China had grown used to massive balance of payments trade surpluses, but demand for imports began rising at a faster pace than its exports,
- 3) China's unprecedented growth rates have for a generation allowed it to develop a growing resource intensive middle class. However, despite its large domestic consumer base, its

population was not able consume all the low value products / services it manufactures and could not offset export losses,

4) The population, and more importantly its emerging middle class was not only growing larger, but also more prosperous, and began demanding higher quality products / services than China's resource base could indigenously extract. This meant China had to search internationally for access to natural resources to meet the needs of its growing middle class and its industrial base's raw material requirements, and,

5) The CPC derives its current legitimacy almost entirely from its economic growth and should that growth wane China's senior leaders believed they would be vulnerable to civil unrest.

In addition to the economic entanglements, President Xi Jinping and the PSC found themselves just a few short years later confronted by a trade war with their largest single customer. The US had grown less tolerant to China's unfair trade policies and the theft of its trade secrets and intellectual property. US consumption of Chinese low value goods / services had always been the main catalyst of China's growing economy (Rapoza, 2019). However, the massive trade imbalances the US was incurring caused the Trump administration to impose hundreds of billions of dollars worth of tariffs on China who immediately retaliated with their own tariffs. Hence the beginning of the US – China trade war and its detrimental effect on global economic growth and world markets (Gavekal, 2018).

Economists and trade policy analysts worldwide have warned that if the trade war were to continue it would have devastating impact on numerous global production sectors, the most notably technology. A protracted trade war threatens the economic development benefits of globalization and FDI which much of the modern world relies on (Borzykowski, 2018).

In addition to the escalating trade war, the US has recently issued a trade ban against Chinese communication companies like Huawei who the US has long suspected of industrial spying. This ban included advanced digital technologies related to communication networks like 5G, some cutting-edge computing and AI machine learning elements, and is an early indicator of US decoupling measures (Monier, 2019; Tayal, 2019). This ban has had the added benefit for the US of slowing and decreasing the reliability of China's global 5G development since Chinese communication companies are largely reliant on US technology for many of their components, especially microprocessor chips and semiconductors. Opponents to this ban state that it might actually encourage China to accelerate their indigenous development of advanced digital technologies (Tayal, 2019).

Numerous analysts have argued that the economic wide decoupling between the US and China started years ago (Rachman, 2019). It started in the internet, the result of the two countries perceived ideological and political differences. Each nation has vastly different internet content availability, search engine access, regulatory requirements, and in China's case a country wide firewall. This has created two vastly different internet worlds. These same analysts claim that the US bans on Chinese internet communications companies (ICTs) and the imposed restrictions on US universities and government research institutes conducting research on advanced dual use technologies are the logical next phase of decoupling (Rudd, 2019). The Trump Administration justifies these decoupling measures by citing that China's true ambitions are no longer solely commercial but are now posing a threat to US national security. The Administration fears that the dual use capabilities of these advanced technologies will be used for gathering intelligence against the US government, exploiting gaps in the military-industrial complex's supply chains, and for cyber operations to acquire technology secrets and conduct espionage, all of which will

occur at an increasing rate (Pilotti, 2019). The real question is not when the decoupling began, but when it will end, and how far the decoupling will penetrate into each nation's economies (Rudd, 2019).

With the trade war in place, a growing cadre of developing nations able to undercut China's low value export prices, increasing numbers of Chinese companies and their product lines subject to ban by the US, and a decoupling of the US and Chinese economies already underway, China's senior leadership have decided that China must pursue high-tech high-value exports in earnest and seek out global customers apart from the US to remain globally competitive (Friedman, 2017). China's biggest challenge may be in wooing these new customers. Early attempts to bring on board

EU and northern Asian countries have failed due to a general distrust arising from the same issues that led to the trade war with the US (Kim; 2018; Rapaoza, 2019). In addition, China does not have a reputation for high-value high-quality production. The strategy to move into high-tech high-value exports has thus far proven difficult for Beijing, but China's leaders strongly believe that the task is not insurmountable (Friedman, 2017). They point out that only five years ago China was considered an imitator in almost every technology sector, now it is considered an innovator in several major emerging technologies, but they also realize they still has a long way to go (Bey, 2018).

US – China STI & Technology War

The economic conflict between the US and China may have started as a trade war, but it has now escalated into an all-out technology war (Lynch, 2019). The official reasons for the trade war have already been discussed, but the underlying reason for its advent have more to do with China's accelerated rise as a global technological power and its drive to dominate advanced

dual use and leapfrog digital technologies outlined in the MIC 2025. These technologies, with AI at the fore front, have been determined crucial for China's leadership position in the Fourth Industrial Revolution (Mourdoukoutas, 2019). Economic consulting firms and technology policy analysts agree that competition for advanced technology is now, and has been for years, at the epicenter of the trade war, and even if there is a resolution to the tariffs, the underlying reason will remain (Politi, 2019). "The trade war is more about technology than about trade" and when it comes to the US and China "the gloves are off". (Lynch, 2019).

Each nation's technological power is having a significant impact on global trade and market conditions (Lynch, 2019). Not only is technology one of the primary structural modifiers, it influences and impacts almost every element of commercial and military production, and the scale and scope of technological development has been expanding unchecked (Nouwens, 2018). Technological power can be used to propel a nation towards prominence and even regional hegemony at an accelerated rate. An emerging nation like China can utilize the existing hegemon's technology, improve and enhance it, and simultaneously develop its own advanced technologies and high-tech industries. Eventually, through this process, the emerging nation can rival and even outperform the hegemon. The US and China are at this crossroads (Motohiro, 2019).

China's senior leadership have become anxious regarding their ability to become a high-tech high value producer and exporter before the West's counterbalancing measures effectively slow China's technological progress and its economic growth. Should this occur, China will not only fail to remain internationally competitive, its aging demographics and fast approaching middle-class trap could drain both its economic earning capacity and its ability to adequately

invest in future high value R&D and industry development (McBride & Chatzky, 2019; Motohiro, 2019).

The US, on the other hand, realizes it cannot afford to allow China to gain the upper hand in advanced technology development and is doing everything it can to slow or outright contain China's technological growth (Motohiro, 2019). This is being accomplished through policies, legislation, and regulations designed to: restrict Chinese companies access to their US high-tech suppliers whom provide the majority of their critical technical components; bar Chinese companies suspected of spying, espionage, or stealing intellectual property, from selling or providing services to US companies; and establish commercial contract limitations that restrict the types of advanced technologies US and Chinese companies can develop together (Lynch, 2019). In addition to restrictive policies and regulations, the US is also increasing its investments in R&D and providing industry support for emerging cutting-edge technologies, reducing regulatory barriers for STI programs, and creating apprenticeship programs for the high-tech jobs of the future (Whitehouse, 2019a)

In February of 2019, the 55th Munich Security Conference (MSC) provided an informative forum for how far tensions have grown between the US and China over STI. Vice President Pence warned MSC members in a speech that the Chinese telecom industry now require that all companies and individuals using Chinese telecom services in China or abroad must share their data with those telecom companies (Whitehouse, 2019b). Chinese telecom companies are noted for their widescale data acquisition and collection capabilities and for their direct connections with the China's Intelligence Service and the PLA (Doffman, 2019). The speech went beyond the old rhetoric and accusations of China engaging intellectual property theft, providing industry subsidization, requiring tech transfers for doing business in China,

acquiring US companies specifically for their tech, and cyber-attacks to gain US military technology (Whitehouse, 2019b). Vice President Pence stated categorically that the West must protect its telecom infrastructure and other digital technologies from China. Western countries must also reject large lucrative deals from large Chinese enterprises bent on compromising western communication networks in order to gain better access to vital Western business and national security intelligence (Whitehouse, 2019b; Motohiro, 2019).

Members from China's senior leadership tried to assure the MSC that Chinese companies were not engaged in the disreputable actions such as installing backdoors into their communication technologies or actively collecting corporate or government secrets, activities they have been widely accused of (Motohiro, 2019). These assurances were met with considerable skepticism. The Chinese National Defense Law, Cybersecurity Law, and National Mobilization Law all clearly grant the Chinese government under the direction of the CPC and the PLA the right to order any Chinese telecom company to gather any data of interest from any source for national security reasons (Tanner, 2017; Motohiro, 2019). These laws have gone on to generate significant apprehension and distrust among Western investors and have led to cancelations or postponements of S&T R&D investing in China in a number of high-tech fields (Huifeng, 2018).

What all this boils down to is that the US and China are becoming embroiled in a race to dominate technology, and the prime area of interest is on the new advanced digital technologies. These technologies are being virtually integrated into almost every fabric of modern-day society, they are revolutionizing products / services, enhancing business and manufacturing processes, expanding global trade and supply chain opportunities, and improving intelligence collection and defense capabilities, and they are only in the early adopter phase of the life cycles

(Mourdoukoutas, 2019; Uppal, 2019). The US – China S&T rivalry is really about a competition to dominate these emerging technologies, and this race has just started “heating up”

(Mourdoukoutas, 2019).

China’s senior leadership are determined that China will become a dominant global technological power. Instrumental in achieving this goal will be China’s ongoing development of conventional technologies, combined with an increasing dedication to R&D and manufacturing of dual use technologies, especially those with leapfrog capabilities. China’s senior leadership believe that these emerging technologies will leapfrog or by-pass the conventional high-tech commercial products / services and military hardware already being produced by the other technologically advanced developed nations (Nouwens & Legarda, 2018: 3). To become an early adopter and leader in these emerging fields, China is utilizing a whole-of-system approach combined with strong subsidies and financial support to build world-class state-owned research universities and research facilities controlled through the CAS. Substantial subsidies, financial support, and access to government research facilities are also being provided to China’s private sector enterprises to bolster their cutting-edge research programs (Suttmeier, 2018).

In addition to commercial interests, China’s civil-military integration (CMI) programs have been receiving considerable support from both government and private sector entities to modernized China’s aging weapons systems. The success of prior CMI policies have inspired China’s senior leadership to enact collaborative cross disciplinary research policies and create national multidiscipline research laboratories across all sectors with a special emphasis on dual use and digital leapfrog technologies. Defense-based S&T R&D and a growing number of military equipment platforms have already found their way into commercial product lines (and

vice versa) and China's civilian industries are actively participating in a variety of defense-related projects (Suttmeier, 2018; Uppal, 2019).

China has finally started benefiting from the vast numbers of STEM graduates who have gone abroad to seek out advanced STE degrees and are returning to China's research institutional sectors with experience in cutting-edge research (Suttmeier, 2018). China's senior leadership are resolute in their belief that China will have a larger workforce dedicated to STEM R&D and high-tech manufacturing than all of the other technologically advanced developed nations combined by 2025 (Freeman, 2018).

Despite China's impressive S&T policy achievements and recent technological advances, China's senior leadership has come to the realization that there is simply too large of a gap between China and the other technologically advanced developed nations in conventional S&T R&D and high-tech production. There are too many obstacles impeding China's ability to catch up to the other developed countries in conventional technologies in sufficient time before US counterbalancing measures and the trade war takes its toll (Holland, 2018). All the reports and fanfare over the past few years of how China is: publishing more scientific publications; graduates more STEM graduates; is now the number two investor in S&T R&D, etc. while true, have not actually resulted in the levels of technological power China's leaders had wanted. Nor has it yet enabled China to become "self-sufficient" in attaining its high-tech production and export goals (Holland, 2018; Triolo, 2019a).

The reason for this is as follows: Although China has been able to address many of the blatant problems associated with fraudulent research papers in the 90s and 2000s, most of its publications still lack any scientific value for commercial use. The majority of the 1.3 million STEM graduates China produces each year excel academically at work in major universities but

they seriously lack analytical, communication, and problem-solving skills required by non-Chinese private sector companies. This renders them barely employable by Western standards. Despite all China's investments in S&T R&D the majority of the 1.4 million patents produced each year have no real use in commercial, government, or military applications, and more than 80 percent are still only providing minor incremental changes / modifications to existing product lines (Holland, 2018; Harris 2018). China has managed to substantially increase its high-tech exports; however, this too is misleading, two thirds of these exports come from partnerships with foreign companies using China's lower labor costs and reduced regulatory environment, or from products China produces which consists of mainly foreign high-tech components. Basically, China has still not solved the quality versus quantity problem (Holland, 2018).

To provide an example of the real-world gap that exists between US and China. One of the biggest indicators of STI success is the international income streams a country makes by licensing their technological innovations for royalties to foreign companies/investors. In 2016, the US earned US \$128 billion in intellectual property royalties on existing technologies while paying out US \$48 billion, a net return of over US \$80 billion. China earned US \$1 billion but had to pay out US \$24 billion for STI intellectual property access (Holland, 2018).

China's senior leadership realized that attempting to close gaps such as this one is not going to be possible in a timely manner. As already mentioned, China's leaders have determined that the more productive long-term strategy for China is to maintain its existing profitable conventional production lines while going all in on developing specific cutting-edge dual use and leapfrog technologies (Nouwens & Legarda, 2018: 3). However, even this approach may prove to be insufficient. The US and other technologically advanced developed nations have been

monitoring China's successful S&T strategic initiatives, policies, and activities, and are reaching the same conclusions. (Holland, 2018; Gewirtz, 2019).

The Trump Administration has concluded that trade imbalances, tariffs, or even a trade war are no longer the most strategically significant issues concerning its rivalry with China. The Administration believes that the US is in an S&T race with China to dominate the future of these technologies and near-term trade concessions for temporary political and/or economic benefit are not going to lead to any compromises on these technologies, quite the contrary. From the NSS, to S&T policy advisors, and even the FBI, the mantras are the same; there is "deep concern about American innovation ending up in the wrong hands," and those hands are China's (Abdelhady, 2019). The US has decided it will confront China head on over these emerging technologies. It plans to challenge China's whole-of-system approach and reign in China's access to US technology (legal or unlawful) with a its own "whole-of-government" strategy (Ford, 2019).

This "whole-of-government" strategy entails enacting policies and legal actions that go much further than previously discussed decoupling measures. This strategy is specifically designed to: 1) restrict foreign Chinese access to US tech companies and their technologies, 2) restrict US exports of dual use and digital technologies to China, 3) ban Chinese communication companies from accessing sensitive US ICT government programs, private sector projects, and their supply chains, 4) identify and remove Chinese students, scientists, and engineers involved in "academic espionage" against US research universities, 5) indict and prosecute Chinese government and business officials involved in any intellectual property theft, and 5) enforce all sanctions to the full extent of the law (Abdelhady, 2019; Ford, 2019). Despite these efforts, some US agencies and officials are convinced that China will find ways to circumvent these measures. They also doubt whether current sanctions and tariffs aimed at the MIC 2025 and the

BRI will be sufficient either. To compensate for these concerns, the Administration has laid out specific plans designed to dramatically increase STI investments into dual use and leapfrog technologies. 2018 R&D allocations were increased to \$176.8 billion, a \$20.1 billion or 12.8 percent increase over prior year with much of the new spending dedicated to emerging technologies, and this is only the start (AAAS, 2018).

Whether it is referred to as a S&T rivalry, a high-tech war, or a technology race, one thing is certain, the confrontation between the US and China over emerging cutting-edge technologies has the interest of both nations' senior leadership at the highest levels (Special Report, 2019). The US is currently the leader in most of these fields, but China is striving to catch up and surpass (ganchao strategy) the US and other technologically advanced developed nations ~~in other fields~~ (Joshi, 2019: 4; Special Report, 2019). There are several strategic categories of technologies which are of specific interest to China. These categories were outlined in China's 13th Five Year Plan (FYP) and consists of technologies presented in the MIC 2025, Strategic Emerging Industries (SEIs), national security strategy for dual use technologies, and in policies for advancing digital leapfrog technologies (see Figure 2 page 206) (Koleski, 2017: 9,11; Nouwens & Legarda, 2018: 9-13; Shi-Kupfer & Ohlberg, 2019: 28-34).

There is considerable technology overlap between the categories indicating that China's senior leaders hold some technologies and associated industries in higher regard due to their multiple functions and cross pollination capabilities (Koleski, 2017: 9). In addition, some of the technologies and their respective industries are comprised of and designed to work in conjunction with other technologies. For example, environmental technologies under the SEI category is both comprised of and makes use of big data, cloud computing, and AI for more efficient monitoring of regulatory frameworks, modeling complex processes, and automating

cumbersome tasks. These digital technologies are also used to control a new generation of robots and drones used for real-time sampling and monitoring of ecosystems and logistics functions associated with precision farming (SAP, 2018).

Table 2. China Strategic Technologies & Industries

Made in China 2025 Technologies	Strategic Emerging Industries (SEIs)	Dual Use Technologies	Digital Leapfrog Technologies
<ol style="list-style-type: none"> 1. New Energy Vehicles (NEVs) 2. Next Gen IT & Cloud Computing 3. Biotech – Genome Editing New Drugs 4. Advanced New Material Sciences 5. Aerospace & Satellite Systems 6. High-Tech Ships & Ocean Engineering 7. High Speed Railways 8. Robotics & Automation 9. Power Generation & Equipment 10. Precision Agricultural 	<ol style="list-style-type: none"> 1. Environmental Technologies 2. Next Gen IT & Cloud Computing 3. Biotech – Genome Editing New Drugs 4. High-value Equipment Mfg. 5. New Energy Systems 6. Advanced New Material Sciences 7. New Energy Vehicles (NEVs) 	<ol style="list-style-type: none"> 1. Space Based Assets & Satellite Systems 2. Cyber Warfare & Cybersecurity 3. Quantum Computer & Cryptography 4. Artificial Intelligence (AI) 5. Automated Vehicles & UAVs 6. Commercial & Military Robotics 	<ol style="list-style-type: none"> 1. 5G Networks & Next-Gen IT 2. AI & Big Data Access 3. Quantum Computer & Cryptography 4. Cloud Computing Blockchains, IOT 5. Cyber warfare & Cybersecurity

**Sources - Nouwens & Legarda, 2018: 7-13; Springnut, Schlaikjer & Chen. 2019: 42, 58*

China’s senior leadership are confident that the latter two categories, dual use and leapfrog technologies, present the greatest opportunities, fastest return on investments, and are best suited to meet China’s strategic technological ambitions to become a dominant global technological power (Koleski, 2017: 9,11). Within these emerging technologies China’s leaders have prioritized AI, quantum computing, next-generation ICT and 5G networks, and cloud computing for accelerated support and investments. China has already made substantial investment in each of these technologies and regard these technologies as the primary means of

securing an increase in technological power. These technologies, if fully developed and properly integrated through the commercial and military channels of China, could be enough over the long term to offset the balance of power (Corrigan, 2019).

The Trump Administration is fully aware of China's technological ambitions and in response has outlined its own list of emerging technologies in its 2018 Science & Technology Highlights. These technologies are predominately dual use and digital leapfrog technologies mirroring much of China's last two categories. These technologies include: 5G broadband integration, advanced manufacturing (commercial and defense based), AI applications for the DOD and medicine, advanced transportation (UAVs & automated vehicles), cybersecurity to protect the US digital domain, securing the digital economy and digital trade, environmental technologies that reduce air / water contaminants and greenhouse gases, energy dominance from high efficiency mobile nuclear reactors and shale oil / gas extraction, health and medical improvements in the detection and treatment of disease, precision medicine and gene sequencing, supercomputing with SMART nanoelectronics, accelerated cloud computing networks, national security modernization of warfighting capabilities, ocean sciences for environmental protection and restructuring commercial fishing, Quantum Information Science (QIS) development that redefines computational speeds boundaries, space exploration and orbital asset protection, and nanotechnology integration into existing / emerging technologies (The White House, 2018c).

In a similar vein to China, President Trump and the Office of Science and Technology Policy (OSTP) wanted to take four of these emerging technologies and explore them in greater earnest, essentially creating new industries for each, and allocating new spending for large scale infrastructure development. These industries include: AI, advanced manufacturing (including robotics and automation), QIS, and 5G. With the exception of advanced manufacturing all these

new industries directly consist of digital leapfrog technologies (OSTP, 2019b). Even advanced manufacturing utilizes digital technologies and is growing ever more important to the Trump Administration who wants to see a return of US manufacturing. The Administration also realizes that a transition to new production technologies and expansion of US supply chains will ~~also~~ be necessary (NSTC, 2018). President Trump wants to leverage the full power of the US R&D ecosystem by integrating the Government Laboratories, research institutes, private sector R&D, and research universities, all to guarantee a high degree of product to market success and ensure that global technological dominance remains with the US (OSTP, 2019a).

What all this ultimately means is that the US and China are becoming embroiled in a race to dominate high technology, and the prime area of interest is on the new advanced digital technologies. These technologies are being integrated into almost every fabric of modern-day society, they are already revolutionizing products / services, enhancing business and manufacturing processes, expanding global trade and supply chain opportunities, and improving intelligence collection and defense capabilities, and they are only in the early adopter phase of the life cycles (Mourdoukoutas, 2019; Uppal, 2019). The US – China S&T rivalry is becoming more and more about a competition to dominate these emerging digital technologies and their dual use capabilities, and this race has only started “heating up” (Mourdoukoutas, 2019).

Military Power

The senior leadership from both the US and China understand that technological progress is not only inexorably linked to economic growth but also to modern military power (Motohiro, 2019). President Xi Jinping and the PSC have made advancing China’s STI development in the emerging dual use technology fields a strategic and national security priority. China’s senior leadership has laid out a two-prong strategy designed to make China both a prosperous socialist

state and to modernize China's outdated military (Nouwens, 2018). To meet these objectives, development research programs will be expanded, and manufacturing process efficiencies improved among China's defense related SOE's.

The second prong of the strategy will involve China increasing incentives to the more innovative private sector high-tech LME's and startups via research subsidies, preferential low interest rate loans, export subsidies, and tax breaks. The purpose of these incentives is to entice the private sector to invest in those dual use technologies that specifically meet the needs of the PLA (Nouwens & Legarda, 2018: 3). This two-prong strategy has already proven successful, China has made major accomplishments in several emerging dual use technologies such as advances in cybersecurity, space-based platforms, and AI, and is redoubling its efforts in the others (Schoff, 2019). Each of the emerging fields China is pursuing provide key contributions to both commercial industries and national defense and are considered to be the principal technologies of the fourth industrial revolution (Suttmeier, 2018).

China has the world's largest military with over 2 million active-duty personnel. Despite its large size, annual military expenditures are barely one third of the US. Its old Soviet-style defense model is comprised of large numbers of military weapons platforms of varying quality and has become antiquated and can no longer able to compete against modern militaries like the US. Take for example the PLA Air Force, it is comprised of about 1000 fighter aircraft, approximately 560 are outdated fighters not suitable for modern air combat, 425 are considered fourth-generation J-10s and J-11s (comparable to US F-15s and F-16s), and several new fifth-generation J-20 stealth fighters. The US on the other hand has over 2000 upgraded fourth-generation fighter jets, a large number (classified) of fifth-generation stealth fighters, and a growing number of (classified) super advanced fighter jets like the F-22 or F-35. This provides

the US rapid aerial combat superiority in conflict scenarios (Roblin, 2018). The US dedication to high-tech weapons systems extends throughout its military branches and enables the US to bring overwhelming firepower into any region of the world in short order (Hambling, 2019). China not only intends to modernize its military but would like to have similar forward projection capabilities and a variety of cutting-edge high-tech weapons systems in every branch of the PLA by midcentury (USCC, 2018b: 205).

The first step in achieving this long-term goal was China's 2015 Defense White Paper which laid out China's major national security concerns and the PLA's mission priorities. First and foremost was safeguarding the CPC and preserving the Party's political sovereignty. Followed by defending China's territorial sovereignty, preserving Chinese unification, protecting the new provinces and China's overseas interests, and ensuring that terrorism, separatism, or social instability never gain enough strength to challenge the CPC. Rounding out the remaining priorities are nuclear deterrence, participating in international security cooperation's that helps maintain world peace, and providing support for disaster relief and emergency rescues (USCC, 2018b, 210).

President Xi Jinping on January 4th, 2019 in a meeting with the Central Military Commission (CMC) added to the PLA's mission priorities, warning that China is facing unprecedented geopolitical challenges and risks that will require the PLA to "prepare for a comprehensive military struggle from a new starting point." The purpose of the statement was not to simply re-establish PLA priorities but also to improve training and morale, boost combat readiness, and make better preparations for war (Lau, 2019). Xi Jinping was not necessarily referring to aggressive actions on China's part but to the need to "ensure an efficient response in times of emergency" (Lendman, 2019). The comments came shortly after the US-led Asia

Reassurance Initiative Act (ARIA) which afforded the US an increased military presence in the Indo-Pacific region. This Act and other regional “US provocations” has led China’s senior leadership to perceive that military confrontation in some form with the West may be inevitable and China must be prepared (Lendman, 2019).

Improving training and combat readiness are not the only methods President Xi Jinping believes are necessary to preserve China’s national security and regional interests. For the PLA to become a truly competent modern military force will require adopting the US’s technology – oriented model of warfare, at least in part. Realizing the PLA’s weakness to Western forces, China’s senior leadership have become big supporters of high-tech defense systems and have already started investing and developing their own programs (Roblin, 2018). Xi Jinping personally oversees the national plan designed to fuse China’s military – civil fusion R&D and industrial centers into its CMI strategy (Majumbar, 2018). China will continue to successfully pursue STI policies and industrial reforms to accelerate technological development, create high-value products, and develop dual use and leapfrog technologies in a variety of targeted emerging fields. While this is occurring, China’s military industrial complex will convert commercial sector technologies into military applications. This is instrumental in meeting the PLA’s objectives of modernizing its outdated conventional military and even more importantly using newly developed technologies to leapfrog past US military hardware and war fighting capabilities in the Indo-Pacific theater and beyond (Nouwens, 2018).

China is making great strides in some emerging dual use and digital leapfrog technologies. Beijing’s’ goal in the pursuit of these technologies is to exploit US weaknesses. One major weakness is the reliance US computers and IT systems have on space-based satellites for SMART weapons strikes, air and sea navigation, and intelligence collection operations.

These systems can all be subjected to a wide array of Chinese cyber-attack initiatives (Roblin, 2018; USCC, 2018b: 219-221). The Peoples Liberated Army Navy (PLAN) also knows it cannot go head to head against the US 7th Fleet so it is seeking out technologies that could destroy US aircraft carriers at distance, such as the DF-21D anti-ship ballistic missiles (ASBMs) and ultra-quiet submarines capable of running on batteries for days (Roblin, 2018).

China has also been developing hypersonic missile systems like the DF – 17 and DF-26 and a hypersonic glide vehicle capable of conventional and nuclear payload delivery at ranges between 1800 and 2500 km for long range delivery. In addition to missile systems, Beijing is pursuing counterspace vehicles with energy based weapon platforms, reusable hypersonic space planes and a new scram jet both with reentry and terrestrial hypersonic missile delivery capabilities; unmanned aerial vehicles (drones) including autonomous miniature swarming systems all the way up to unmanned research ships; and electromagnetic rail guns for mounting on new generation naval vessels (USCC, 2018b: 221, 235).

China's CMI, despite its immense size and PSC support, has not proven as effective at merging defense and commercial industries as was originally hoped. In recent years, the large SOEs that make up China's defense industrial complex have in effect cordoned themselves from China's much more productive private sector LMEs and the greater economy. Additional SOE reform is necessary to avoid the CMI shutting out a large number of potentially innovative private sector companies from the defense economy. Even the more innovative large LMEs like Huawei or Baidu, Alibaba, and Tencent (referred to as BAT) and their internal CPC Party committees which are in place to guarantee Party loyalty, have yet to meet CPC expectations in transferring commercial sector S&T R&D and product development into military applications (Laskai, 2018). China is taking measures to compensate for this problem. In 2018, China's senior

leaders created an agency very similar in structure and purpose to the US Defense Advanced Research Projects Agency (DARPA). This agency will be responsible for defense related S&T R&D and prototype development concerning advanced military projects and this agency will actively seek out the assistance of the private sector (Freeman, 2018).

China senior leadership has recently accelerated investments into the PLA's military modernization program and declared worldwide that the PLA will attain a modern military by 2035 and become a "world-class" high-tech military similar to the US by 2050. To accomplish this objective China's leadership know they will have to significantly ramp up investments in emerging dual use technologies and next generation weapon systems (USCC, 2018b: 205). The US Security Review Commission's 2018 Report states that if China is able to modernize its military according to plans, China could contest US naval and air operations not just in the East and South China Seas region by 2035, but throughout the Indo-pacific region and as far out as the "second island chain" (Ogasawara Islands, Guam, Saipan, and Palau) (Huang, 2018). The Report indicates that the Chinese development and deployment of advanced weapons systems could diminish US military superiority in the region. A substantial buildup of PLA Bluewater forces with multi-mission warships combined with medium and long-range hypersonic missile systems, enhance cyber warfare capabilities, and space-based platforms capable electromagnetic disruption could represent a serious threat to US aircraft carriers, surface ships, and bases throughout the region by 2035 (USCC, 2018b: 205, 221-223).

The US and China have different operational needs. The US is geographically isolated and must rely on its network of overseas bases to engage potential adversaries. This requires carrier fleets and amphibious transports; long-range jet fighters and bombers, transport planes, refueling tankers; and mercantile transport vessels for heavy military equipment transfer. It also

requires stable diplomatic relations with nations that will house overseas bases and forward deployment units. This rapid deployment capability combined with forward positioning provides US naval and air forces ready access to almost any region on Earth (Roblin, 2018). China, in addition to modernizing its weapon systems, would also like this forward projection and long-range expeditionary capability and squadrons of fifth generation fighters / bombers for its naval fleet, but currently lacks the military alliances necessary for forward deployed bases. However, successful implementation of the BRI could change that (Fisher, 2018: 8; Roblin, 2018).

Prior to these 2035 objectives, China will continue to use coercive tactics to engage the US just “below the threshold of military conflict” thus avoiding the need for military force to accomplish its regional interests (USCC, 2018b, 206). Should a conflict arise with the US, China would likely resort to an “active defense” strategy to offset superior US forces. An “active defense” strategy is where a large wealthy nation lacking sufficient military capabilities wears down a potential adversary with protracted harassment tactics and the chipping away of its strength, while it builds up its military capacity. In the ~~East and~~ South China Seas, “active defense” would involve China sniping at isolated US warships, conducting staged raids, seeking out and attacking staging areas, and cutting off supply routes, then rapidly falling back to bases or safe locations. Should an US expeditionary force (7th Fleet) be called into the region the PLAN would attack from distance with medium to long range hypersonic missiles followed by submarine torpedoes as the 7th Fleet grew closer. The goal is to have the expeditionary force battered and weakened granting the PLAN better odds should direct confrontation be inevitable (Holmes, 2015).

The Trump Administration is taking these threats seriously and is orchestrating plans to compensate for China’s dual use technology development and military modernization initiatives.

The US National Defense Strategy Commission, the crafters of the National Defense Strategy (NDS), have advised the Trump Administration to significantly increase investments in cutting-edge dual use technologies while protecting its existing innovation base and future high-tech industries from predatory Chinese “acquisition tactics” (Edelman & Roughhead, 2018). The US is keenly aware that any technologies exported to China for private sector purposes could potentially be repurposed towards CMI programs at any time, and that Chinese industrial espionage activities designed to “acquire” US technology are only going to intensify as China strives to catch up with US defense capabilities (Majumbar, 2018). The US has already banned Chinese companies long suspected of these activities and other Chinese companies are under investigation. This trend is likely to continue (Tayal, 2019). In addition, DARPA and Defense Intelligence Unit (DIU) programs are being expanded, receiving additional funding, and their P3 collaborations and integration programs with private sector companies have been granted accelerated approval and support (DIU, 2019).

China senior leadership have started to realize that developing advanced weapons platforms and modernizing its military to be on par with other developed nations versus catching up to the US are two entirely different things. China’s “acquisition tactics” have proven successful in acquiring US weapon systems technology, but the increasing complexity of US state-of-the-art weapons systems makes their replication exceedingly difficult and time-consuming (Cheung, 2013).

The days of a free ride on US dual use S&T R&D and backward engineering weapons platforms is proving to be less effective than it was in the past, by the time China has a combat-ready working model, the US is already testing the next generation platform. (Gilli & Gilli,

2019). Even with China's massive government subsidies, FDI, foreign technology transfers, foreign company acquisition strategies, and its widescale cyber "acquisitions," China's CMI may find it impossible to close the military – technology gap with the US in advanced weapons platforms i.e. fighter jets, naval ships, submarines, and advanced missile defense systems (Cheung, 2013). The reason is because advanced weapons systems require immense amounts of experimentation, prototype generation and testing, quality control requirements, years of dedicated engineering experience, and always incurring greater costs than originally accounted for (Alic, 2016: 17–19; Ben-Ari & Chao, 2009: vii-viii).

Beijing will have to overcome three basic obstacles that increase the complexity of integrating and utilizing military technology. 1) the increasing number and sophistication of components needed for modern weaponry, for example, a combat fighter jet in 2010 had over 300,00 parts. 2) Materials, electronics, engineering requirements, and most recently AI have made weapons systems increasingly sophisticated with multiple levels of integration and redundancy. Consider that one engineering error, a weakened material or component, or a single line of corrupted code could result in a catastrophe for a fighter jet. 3) Modern weapon systems are capable of operating in incredibly diverse and demanding conditions, are exposed to a growing array of environmental stresses, and are subjected to a growing number of potential technical problems and human error. As jet fighters have become more advanced, they have been expected to perform to higher expectations and perform in ever more hostile environments therefore requiring greater quality control (Gilli & Gilli, 2018). All this reduces the effectiveness of backward engineering and replicating advanced weapons systems in a timely manner. Developing advanced weapons systems is something the US is simply good at and copying the US military industrial complex model or "acquiring" sophisticated technologies may not be

sufficient for China to overcome US military superiority (Alic, 2013; Ben-Ari & Chao, 2009: vii–viii).

Despite these obstacles, China's leadership are convinced that developing dual use and digital technologies remains China's best course of action. The reasoning is straight forward, dominating these fields will provide economic wealth. This wealth will be used to modernize China's military (Laskai, 2018). China's leaders believe they will eventually overcome their advanced weapons systems problems (Alic, 2013) If China can remain on the forefront of the emerging cutting-edge technologies like quantum computing and AI integration it will redefine China's military power and potentially altering the global balance of power, (Laskai, 2018). The US will not allow China to dominate these fields especially if it comes at the expense of US technological innovation. This brings us back to the impasse where each nation is locked in a competition for the dominance of advanced technology and the action – reaction cycle gains ~~for~~ in strength. This issue becomes more problematic when elements within both governments are pushing for economic decoupling, ~~in this case,~~ over dual use technologies (Triolo, 2019b).

US – China Tech Rivalry and Security Dilemma

International competition between the US and China is accelerating. Both nations are engaged in strategic and policy adjustments to preserve their own geopolitical and national security interests. US and China's senior leaders are aware of the action – reaction cycle and the negative spiral that is occurring as each nation interprets (perceives) the other nations strategies and intentions as threatening to their interests and engages in their own counter moves (Wulthnow, 2018). China is intent on becoming a global technological power for a multitude of reasons already discussed in prior sections. The US is using counterbalancing measures such as tariffs and export controls, banning Chinese technology companies, restricting US technology

access, and preventing Chinese scientists' access to US visas, all to slow, and where possible contain China's growth. These initiatives have been met with strong condemnation from China and have been followed by their own counter measures (Zheng, 2019).

These escalating conditions have led the US and China headlong into a complex multi-variant security dilemma. The bottom line is that US senior leadership considers China's dramatic technological and economic rise a threat, and China's leadership is convinced that it must accelerate its technological development before US counterbalancing efforts prove successful. The two structural modifiers, technology and leadership perceptions are the real underlying causes behind the security dilemma, and cutting-edge dual use and digital technologies the technological spearhead. These leapfrog technologies have the potential to catapult China ahead of US's technological dominance in a number of individual technologies and taken in aggregate over the long run could represent a real challenge to US military power, and a serious overall threat to US hegemony (Zheng, 2019).

Complicating matters is the vast complexity and the enabling and integrative capabilities of emerging digital technologies. This makes creating appropriate policies difficult and ascertaining their effectiveness complicated requiring entirely new conceptual frameworks (Cetindamar, Lammers & Sick, 2020). There are also a distinct political and ideological differences between the two nations which adds another dimension to the growing security dilemma and further convolutes leadership perceptions. The focus of the CPC is regime survival and political security, and this cannot be understated, and yet US Administrations have constantly done just that. The US's continuing expectation that China will one day be democratized infuriates the CPC and renders negotiations difficult (Kania, 2019a).

As each nation's senior leadership perceives a growing threat in their counterpart's intentions and has engaged in actions designed to predominately bolster their economic and national security, the cascade of action – reaction will continue, and the negative spiral of the security dilemma appears all but inevitable. This downward spiral has escalated into the military realms where China is currently ramping up dual use S&T R&D and developing a small arsenal of hypersonic missile systems capable of destroying US warships. The US is considering preemptive strikes against these missile systems. These actions alone have the potential to take the security dilemma to a whole new level (Kazianis, 2015). This degree of posturing and rhetoric could trigger an accidental exchange between the two nations. It also hinders commercial cooperation and negotiations, and if protracted could lead the other technologically advanced developed nations to question the benefits of technological globalism and its rapid technological diffusion (Zheng, 2019).

The US – China S&T rivalry, tech war, and security dilemma are having another effect on the US and China. They appear to be driving the US and China into the early stages of technological and economic decoupling and if protracted could result in both nations separating into two camps with advanced high-tech digital technologies at the center of the decoupling. This could result in China using the BRI to institute a techno – authoritarian economic environment, while the US offers the world a more liberal laissez-faire approach to global technological development. The split camp could limit the global regulatory capacity to reign in some of the negative attributes associated with emerging dual use digital technologies (Trilio, 2019b).

The practical applications and implications of this research are straightforward, digital technologies with AI leading the way are being integrated throughout society at a rapidly expanding rate. Their dual-use nature makes them extremely useful for a variety of purposes,

many of them capable of enabling an existing technology to become more functional and to be used for military purposes. For reasons already discussed, the US and China will continue to research, develop, and integrate the emerging digital technologies into their commercial and military sectors. The opportunities in the minds of the senior leadership outweigh the potential costs. China feels compelled because it must retain its economic strength which validates its CPC regime security. The emerging digital technologies, especially AI, are the primary means to accomplish this. The US will strive to retain its technological hegemony at almost any cost since STI is one of the few remaining sectors that can still guarantee its economic and military prowess. The two nations are at an impasse with this new form of highly complex security dilemma an almost inescapable reality.

Additional research and a more thorough understanding of this new form of emerging security dilemma is required. Its complexity is beyond the comprehension of the world's leaders and their policy analysts to adequately assess and because of this, the uncertainty that the nation's senior leaders incur is leading to reactive policy decisions that further fuel self-reinforcing, negative feedback loops. It also convolutes leadership perceptions of their counterparts' intentions further increasing uncertainty and all but ensuring an unproductive action - reaction cycle.

Conclusions

The US – China rivalry is best explained through defensive realism theory. The rivalry is about an emerging nation challenging the established hegemon's economic and military prowess. The two structural modifiers at the core of the rivalry are technological power and differences in leadership perceptions. The two nations also have fundamentally different political, ideological, and philosophical differences which exacerbate the rivalry. China, the emerging challenger, faces

numerous regional and domestic problems which require it to evolve into a high value high-tech producer and exporter before it is overwhelmed by domestic and regional problems (McBride & Chatzky, 2019). The US, having long since grown impatient with China's unfair trade practices, espionage, and intellectual property theft views the rivalry largely as a threat to its national security and global hegemony. The two nations find themselves at an impasse, locked in both a trade war and high-tech war, and trapped in the clutches of a highly complex security dilemma neither country truly understands (Bennet & Bender, 2018; Panda, 2019)

The US has lost much of its international political clout with decades of unabated risk taking in its financial sectors, protracted Middle Eastern Wars, and its recent America First policy. China on the other hand, suffers from an international perception of being suspiciously manipulative, of questionable integrity, and is largely distrusted among much of the technologically advanced developed nations. This could set the stage for a future bipolar or multipolar world without either nation as the true hegemony should a serious economic decoupling occur (Freeman, 2017b; Trilio, 2019b).

Some policy advisors in the Trump Administration believe that China may be abandoning its defensive realism and "incrementalism" stance. US senior leadership perceive that China is through "biding its time" and has started to outright challenge the US for global technological leadership, something the current administration will not allow (Motohiro, 2019). The Administration sites President Xi Jinping's increased rhetoric that China should be "preparing to fight and win wars" and openly discussing China's military modernization programs as evidence that China is moving away from its defensive posture. Administration officials are growing ever more suspicious of Xi Jinping intentions, claiming that he appears less reserved in the face of confrontation or less concerned with increasing regional tensions than any other Chinese leader,

save Mao Zedong, and this makes China more unpredictable and the region more insecure (Panda, 2019).

The Trump administration is also aware that the US is largely responsible for China's technological and economic growth. The administration and both political parties have grown tired of Beijing's underhanded and illicit tactics to acquire US technology and ensure endless years of trade imbalances (Motohiro, 2019). The US appears ready to decouple economically from China or at minimum to stop working together on advance dual use and leapfrog technologies (Trilio, 2019b).

The broader US China rivalry is having a significant impact on geopolitical and domestic affairs. The trade war is affecting global markets and world supply chains. The S&T rivalry is threatening to create a decades long fight for dominance of the fourth industrial revolution and a cold war 2.0 over the dual use digital technologies and advanced leapfrog weapons systems (Champion, 2019; McBride & Chatzky, 2019). The world waits to see if the two largest economic nations can resolve their dispute and avoid an economic and technological decoupling that could change the balance of power, establish a multi polar global environment, and potentially redefine the international order (Pei, 2019a, OIES, 2019).

Exacerbating the S&T rivalry is the enormous complexity and highly integrative nature of emerging technologies, especially the dual use digital technologies. This complexity further complicates leadership perceptions and S&T policy making (Cetindamar, Lammers & Sick, 2020). What will be required is an entirely new approaches to overcome these problems before they escalate too far and both nations find themselves in an unresolvable impasse.

Endnotes

1. Senior leadership is defined as each nation's top decision makers at the national level, for example, the US Cabinet or China's Politburo.
2. Dual Use technologies are those technologies that are developed and utilized for both commercial and military purposes whereas leapfrog technologies are new technologies under development that enable countries to skip the technological evolution process and move straight to R&D of state-of-the-art technologies where prior adoption has yet to occur, thus leapfrogging the competition (European Commission, 2018; Fong, 2009: 1).
3. Defensive realism theory assumes that nations strive to maximize their security as opposed to maximize power as offensive realists believe (Mearsheimer, 2001: 10-11). It also claims that aggressive national behavior will be met with balancing actions imposed by the other nations within the international order. Therefore, striving to maintain or gradually improve one's positions within the international order is a far more beneficial course to take (Waltz, 1979: 126). Defensive realism differs from other forms of realism by introducing "structural modifiers" such as military and technological capabilities (i.e. AI-embedded military technologies), geography, leadership perception, and the distribution of aggregate capabilities all of which act as intervening variables between anarchy and conflict (van Evera, 1999: 7-8).
4. Material power or capabilities are the technological, economic, military, and/or geographic resources that a nation controls to ensure its security and position in the international system (Mearsheimer, 2006).
5. Technological development or progress is defined as the application of knowledge and science to continually improve technology and discover better methods for producing goods / services for industry and commerce, or for government applications (CFI, 2015).
6. S&T basic research seeks to expand knowledge in all technological fields and sets the stage for future and/or applied research. Applied research systematically uncovers practical applications for the technology, in this case technologies that can be used for commercial and military purposes. Development research then generates specific products / services for commercial sector industry and market entry and for industries dedicated to weapons development and intelligence collection apparatus (Sirkin, 2017).
7. CPC governing body is comprised of the 2000 plus members of the CPC's Party Congress and is considered China's highest political body and meets once every five years to review the Party's Constitution and elect the Central Committee. The Central Committee's 204 active members and 172 alternates in turn meets once per year to announce and validate the policies or make changes to policies, it is responsible for a greater body of laws than the greater Party Congress (McGovern & Rubio, 2018). Its most important function is to select and elect the 25-strong Politburo. The Politburo is the chief political decision-making arm of the CPC and meets approximately once a month. It selects and elects the Politburo Standing Committee (PSC) from its own ranks. The Politburo's power resides in its members holding the most senior positions in the other branches of the PRC. The seven member PSC meets

once per week and is the recognized top leadership of the CPC and is responsible for all major policy decisions. The General Secretary Xi Jinping is the leader of the Standing Committee and shares the ceremonial title of President (Amebar, 2017; USCBC, 2013).

8. Middle-income trap occurs when growth rates plateau as middle-class wages and demand for better products, and in China's case where severe environmental and pollution problems increase (Kishore, 2018).

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