Paradigm Academic Press
Innovation in Science and Technology
ISSN 2788-7030
AUG. 2022 VOL.1 NO.1

Technology Fog Case Study and Insights

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doi: 10.56397/IST.2022.08.02

Abstract

Science and technology is an essential factor in the contemporary national security system and an important strategic force on safeguarding national security. To ensure that the truth about other countries' science and technology fog is identified, enhance the ability to resolve the risk of fog, and make China invincible in the increasingly fierce international competition, it is necessary to seize the opportunity of a new round of disruptive technological change, vigorously develop science and technology and conduct strategic research. Through the combing and analysis of science and technology fog cases, this paper draws out the characteristics and insights of science and technology fog as a way to propose future efforts to be made in science and technology fog.

Keywords: science and technology fog, national strategy, characteristics, insights

1. Introduction

The current Sino-US game is intensifying, innovation is accelerating and science and technology is rising as the main battleground. A new wave of disruptive technologies is on the rise, leading to a change in the dominance of major powers. In the face of the new situation, there are not only strategic planning and major investment around science and technology warfare (open warfare), but also the release of fog and interference, the construction of science and technology traps, the implementation of strategic deception (dark warfare), so as to induce strategic miscalculation in China, achieve to miss strategic opportunities, choose the wrong direction of development, and implement the wrong governance policy and other purposes, which is extremely detrimental to national security and development. Moreover, at present, China has not yet formed a holistic, systematic, synergistic and linkage system design and policy supply geared towards breakthroughs in key core technologies and the improvement of the science and technology innovation chain. The disadvantage of long-term dependence on imports of key core technologies is magnified in the context of counter-globalisation, leading to greater difficulties in the development of China's high-tech industries, strategic emerging industries and future industries (Chen Jin, Yang Zhen & Yin Ximing, 2021). Therefore, it is significant to generalize the concept and strengthen the research on the characteristics and trends of science and technology fog to cope with realistic and major fog problems.

2. The Current State of Domestic and International Research on Technological Fog

There is a paucity of research on technology fog overall, with the United States leading the way. Jacob W. Kippet al. 2001 first introduced the concept and analysed the causes of technology fog in terms of technological uncertainty; Nobuhide Matsumoto et al. 2019 redefined technology fog in terms of military science and analysed the new challenges posed to the US by China and Russia using technology fog in the era of Industrial Revolution 4.0; Michael S. Chase and others in 2018 analysed China's response to US conventional military forces, saying that the US should continue to deter and confuse China. In addition, authoritative US think tanks such as the RAND Corporation, the Center for a New American Security, and the Center for Strategic and Budgetary Assessments (CSBA) have published several in-depth reports on technology fog strategy, intelligence research, and analysis of China's strategic information. In October 2020, CSBA President Thomas G. Mahnken issued a

report that once again recommended that the US, in an era of great power competition, incorporate a combination of real and imaginary. The report recommends again that the United States incorporate a combination of real and imaginary information disclosure strategies into its defence strategy in an era of great power competition.

In comparison, only a few representative research institutions such as the National University of Defence Technology and the Academy of Military Sciences are conducting research in China. There are very few studies with key words such as “technology fog”, “technology trap” and “technology deterrence”, and there is no unified and clear concept and definition. There are a few case studies related to strategic intelligence in sub-sectors such as marine science, nano-science and cyber-security, but they focus on intelligence collection and analysis, and lack of attention to the analysis of the authenticity of intelligence.

3. Technology Mist Case Study

3.1 Technology Fog Case Sorting

3.1.1 Technological Mist Events in Different Historical Periods

① In 1984, the U.S. developed a classified program for the B-2 bomber, for which it added personnel and security facilities and paid an additional cost of 10-15% to delay an effective Soviet response (WU Zhengen,1989).

② In January 1985, the United States announced the Strategic Defense Plan for Anti-Ballistic Missile Defense, a plan to attack enemy intercontinental missiles and spacecraft in outer space by various means to prevent nuclear strikes by enemy nations against the United States and its allies, commonly known as “Star Wars” programme. The United States conducted four homing stack tests to test the defensive capabilities of missile interceptors, and in the fourth test, declared success by illuminating the interceptor target in advance to increase the chances of locating it with the interceptor’s infrared sensors, in a sort of “deception”. Deterred by this, the Soviet Union invested heavily in a protracted space arms race under enormous economic pressure, exacerbating the structural deformities of its domestic economy until it collapsed. The Soviet Union made a strategic misjudgement of this US initiative and invested heavily in the Star Wars programme, which ultimately accelerated the collapse of the Soviet Union. The US, on the other hand, used the Star Wars programme as an opportunity to boost the nation’s steel, machinery, electronics, new materials, electronic information and other industries (Li Changjiu,2001).

③ In 1991, the US secretly developed the F-117 attack aircraft with stealth capabilities, which is a successful example of the use of secrecy-based technology fog. Stealth technology was the key technology that allowed the US military to break through Soviet air defence systems and conduct air strikes. Subsequently, the F-117 attack aircraft successfully achieved an air strike against Saddam in Gulf War in 1991, but was shot down and recovered in 1999 during an air strike on Kosovo, demonstrating the strategic advantage of concealing this technology and the loss of advantage when it is exposed (Yun Tian, 1999).

④ In 2010, the US hit a bottleneck in long-range air-to-air missiles at beyond visual range, but still claimed to the public that the latest AIM-120D missile would have a dual-pulse engine as propulsion, meaning that the US air-to-air missile would be highly advanced in range. The claim, perhaps for reasons of strategic deterrence, may be another fog of intent. The constant announcements of “successful test firings” of the AIM-120D by the US have put other countries under great pressure to build their defence (REN Miao, LIU Jingjing, ZHAO Hongyan, et al.,2016). However, the successful test-launch of an air-to-air missile project in late 2015 broke through a bottleneck that the US military itself had not been able to grasp. As a result, a technological fog that has been a drain on human, material and financial resources has surprisingly contributed to the technological progress of other countries.

⑤ In 2011, Iranian forces claimed to have captured the outpost RQ-170 drone, a claim that was implicitly confirmed by the US media. US President Barack Obama stated that he demanded the return of the drone. However, in this case, there is still controversy over whether Iranian forces captured the US drone. There are even two popular theories that have been derived to explain the possible ways in which the RQ-170 drone was captured by Iranian forces. These two arguments are analysed in terms of both signal attacks and technical failures, but both show that we need to be aware of security issues in wireless communication (QIAO LIUyuan, 2020).

⑥ In August 2017, the US DARPA proposed “mosaic warfare”, and has continued to deepen its research. “Mosaic warfare” and other intelligent warfare concepts are theoretically novel and advanced, but there is also a certain amount of technological fog and pitfalls (Li Lei, JIANG Qi & Wang Tong, 2019). Specifically, firstly, from the information disclosed by the US Department of Defense, the US military is still in the initial stages of researching intelligent warfare concepts, and is still in a phase of continuous exploration and trial and error. Secondly, some of the public documents disclosed by the US military about “mosaic warfare” and fully

intelligent operations may have been deliberately released by the other side and cannot be fully believed; at the same time, the real core military technologies and achievements are often very confidential.

Table 1. Sorting through cases of technological fog

Serial number	Time	Events	Results
1	1984	Classified B-2 bomber programme	Added personnel and security facilities, paying an additional cost of 10-15% to delay an effective Soviet response.
2	January 1985	"Strategic Defence Plan for Anti-Ballistic Missile Defence Systems"	Accelerating the break-up of the Soviet Union and driving the development of various industries in the United States, including steel, machinery, electronics, new materials and electronic information.
3	1991	US secretly developing F-117 attack aircraft with stealth capabilities	The success of the secrecy-based technology fog strategy is a testament to the strategic advantage of concealing this technology and the loss of advantage when it is exposed.
4	2010	US announces 'successful test firing' of AIM-120D	A technological fog that would have consumed human, material and financial resources has led to the technological advances of other countries.
5	2011	Iranian forces claim capture of outpost RQ-170 drone	The loss of the RQ-170 has gone a long way towards closing the gap between the US and its rivals in stealth and drone technology.
6	2017	US DARPA proposes "mosaic warfare"	

3.2 Characterisation of the Technology Mist Case

Politics: The implementation of science and technology fog is usually carried out by a government agency or with a strong governmental influence, and the implementation of science and technology fog will indirectly or directly affect the government agency or behaviour of the party to which the science and technology fog is applied or disseminated. Whether during the Cold War or the globalisation period, the secret or open fog of science and technology has obvious political characteristics, and as a strategy, it serves politics to a certain extent. The US-Soviet space struggle, as one of the most important means of gaining military superiority over the Soviet Union, was a major strategic deployment by the US in order to strengthen its comprehensive national power and gain a greater voice in the political arena. The US is a major producer of technological fog and is under great threat from today's unpredictable international environment, hence the constant development of confusing strategies. Therefore the case of the technology fog is highly political in nature.

Game-playing: The subject of the technology fog and the responding party are usually two countries in competition, and the competition situation appears to be scorching. On the surface, it is a demonstration of technological strength, but in essence, it is a manifestation of will, a contest of the minds of the two competing parties. From the relationship between the disperser and the responder of the technological fog, we conclude that the technological fog is strongly confrontational or game-like, i.e. the two or more parties have conflicting interests or other aspects that are not easily mitigated and have to be resolved in the form of confrontation, which is generally a protracted and consuming game. Of course, the different engagement strategies of competing players can have a greater impact on the extent of confrontation. During the US-Soviet Cold War, different policy contests between the two sides enabled each other to change from a dominant position to a weak position, and from a weak position to a relatively dominant position.

Misleading: The disperser of the technological fog wants to disrupt the development rhythm of the opponent to whom the fog is addressed through the technological fog, so that it goes astray and wins without a fight. It may be possible to launch an onslaught on matters involving high-level decisions on the allocation of national resources and the focus of nation-building of the corresponding opponent. A fog, as the name implies, is something that causes one to lose one's way, and a technological fog refers to a technological fog caused to another country in terms of technological research and development, etc. Whether interpreted in terms of the direction of the definition law or in terms of the role it actually plays, certainly every technological fog event is

highly misleading. Deterred and frightened, they are not able to see through the technological fog and make objective judgements and appropriate response strategies calmly. As a result, they are misled by illusions and incur huge losses.

Duality: Artificially released technological fogs are clearly misleading, but their actual effectiveness depends on the strategy of the fog counterpart. Technology fog can give the implementer a competitive advantage and give the fogged party the key to victory. But it can also cost the implementer a great deal of time and effort while resulting in nothing, or it can leave the counterpart in a difficult position and overwhelmed. To a certain extent, it has two sides.

Mystery: The level of development of scientific and technological power is unknown, the signalling of scientific and technological power is indistinguishable from reality, and the content of the information used to convey scientific and technological fog is untrue, somewhere between true and false or completely wrong. From these typical cases of science and technology fog, it is easy to see the mysterious nature of science and technology fog, the main point being that the results produced by science and technology fog do not necessarily follow the expected effects. The disperser of the techno-fog may not necessarily be the beneficiary of the techno-fog event, or even the opposite. This is an understandable phenomenon, when a combination of uncertainties, especially the uncertainty of technological development, may make the dispersal and response to the technological fog a strategy of unknown direction, which implies that the outcome is unpredictable, mysterious and unknowable.

4. Tech Mist Case Insights

The dispersal of technological fog is closely linked to politics and can be extremely misleading. A small misjudgement may well have extremely costly and unpredictable consequences. In this paper, we conduct an immersive case study with the intention of finding the fundamental solution to the problem by defining clear concepts, analysing the causes and generalising common features and general patterns. As a result, we are inspired by the following points.

First, be familiar with the fog's features what we have known and be wary of technological fog. Each thing has unique characteristics that allow it to be distinguished from the others. In future practice, it will be important to delve into the characteristics of the technology fog and research trends so that we can quickly and easily identify the technology fog trap. It is important to drill down into existing features to understand how they are manifested and what level of sophistication is required to be identified as technology fog. In addition, we need to deepen and refine the case studies as much as possible to summarise or uncover the unknown common features they have. From a responder's perspective, we can reduce unnecessary, intrusive and misleading information dissemination and interpretation at source through a more scientific approach, ultimately achieving a victory for maximum effectiveness at minimum cost.

Secondly, to identify the fog of science and technology and to respond reasonably. Once an event is identified as a science and technology fog, it is necessary to correctly understand and effectively deal with the fog of science and technology on the basis of objective practice and in line with the attitude and principle of seeking truth from facts. At the same time, we must break the inherent thinking and proceed from the overall situation and long-term interests. For example, perhaps the best response is to "do nothing", as not to take any measures. The only way to respond accurately and effectively is to remain vigilant, treat intelligence information with caution, recognise technological fog, study the characteristics of technological fog and research trends, and form a systematic cognitive system. Objective reality is constantly changing, and this phenomenon also requires us to monitor and correct the strategies we deploy. We should be adaptable and resilient to changing conditions and the larger background environment.

Thirdly, learning about science and integrating multidisciplinary perspectives. With the growing age of big data, there is a move from zero information to complete information in many areas. While everything seems to be becoming increasingly transparent, in reality, what we hear and see may not be the truth. The point that has to be emphasised is that the formation and development of technological fog, to a certain extent,is also a manifestation of the development of scientific knowledge and science and technology. This also requires us to attach importance to the education of scientific knowledge, stimulate the spirit and enthusiasm of scientific researchers and even young people to explore the field of scientific research, and cultivate scientific character. The crossover, penetration, and integration of disciplines are also evident in the research process of the project. To make the study and response to scientific and technological mists much easier, we need knowledge from multiple disciplines and a team of talents from multiple disciplinary fields, as well as building in-depth horizontal and vertical links and carrying out multi-faceted and multi-faceted discussions and exchanges, so that sparks of thinking can constantly collide and scientific and technological mists can no longer remain a permanent mystery and be responded to with ease. We need to value the role that scientific knowledge can play, to be inclusive and open to multidisciplinary research, and to constantly widen the radius of our vision, so as to provide a pluralistic and scientific approach to the study of and response to scientific and technological fog.

Fourthly, we should attach importance to the training of talents and adhere to the people-oriented approach. Researchers are the only ones who can provide a constant source of motivation for the development of scientific research. China is already implementing the strategy of strengthening the country with talents, and we need to accelerate the training of high-quality scientific researchers and stimulate their enthusiasm and creativity. Highly sophisticated equipment and scientific research products are created by the hard work and superior wisdom of scientific researchers. Science and technology development is for the well-being of the people. We should always respect and value talents and provide them with good working conditions and development environment.

Fifth, insist on scientific and technological innovation and put it into practice in all aspects. Science and technology is an essential factor in the contemporary national security system and an important strategic force on guaranteeing national security, while innovation gives a country the potential to stand among the world's advanced nations without falling. Science and technology innovation is an eternal concept, and the innovation-driven strategy is gaining more and more attention in various fields. We need to focus on overcoming difficulties, breaking through technologies in core areas and creating clusters of scientific and technological innovation in various fields. We need to combine theory and practice closely to clarify our national development goals, improve science and technology innovation for the sake of national security, and promote national defence. Iron must be hardened by itself, we must adhere to independent research, improve our own scientific research, and build a strong scientific and technological nation so that technological fog cannot act as a deterrent.

Sixth, we should strengthen our national defence forces and improve our defence equipment. We must continue to improve our national defence system and strengthen our defence forces. National defence provides strong support for the economy, politics and culture, without national security it is impossible to have a stable environment to develop the country's livelihood. To comprehensively strengthen the national defence force, we must raise the level of defence equipment. To optimise, adjust and upgrade weapons and equipment on all fronts. On the basis of the existing research and development, we will continue to deepen the drilling and systematise the development. Adjust the direction, develop high-quality weapons and equipment, achieve the transformation from nothing to something, from something to something excellent, and accelerate the modernisation of national defence and the army.

Seventh, be realistic and learn from the best. The key to success is to be realistic, to learn from and strive to surpass the world's experience. Based on the national context, we should reasonably analyse whether the announcement of a research and development programme in another country can be recognised as a technological fog, the adverse effects of the announcement on the country, and the impact of various response strategies. On the other hand, it is important to take the best and remove the worst. We need to learn from the lessons of history and other countries in order to reduce the number of detours and mistakes; we need to learn from the good examples of how other countries have dealt with the technology fog, and by learning from them, make strategies that will benefit our own development. If we do not advance, we will fall back. We must always be aware of our worries. At the same time, we need to integrate ourselves further into the globalisation of science and technology innovation to meet more challenges and opportunities.

5. Conclusion

We need to recognise that no matter what kind of leap in technological development and what kind of distress the technological fog may cause, the key factor that can make scientific judgments and play a significant role in the technological fog is always human. We need to attach importance to the development and training of talents in relevant fields, and the makers of competitive strategies in science and technology can draw on a variety of external factors to formulate the right development strategies. We must firmly pursue technological innovation to achieve independence and self-reliance, so as to better safeguard national political, economic and defence security, support the achievement of our overall national development goals and steadily move towards the great rejuvenation of the Chinese nation.

Fund Project

This study was supported by the Undergraduate Innovation Fund Project of Southwest University of Science and Technology (Project No.: CX22-047).

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