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Evaluating the Economic Benefits of Foreign Military Sales on Japan's Defense Industry

September 2025

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Prepared for the Naval Postgraduate School, Monterey, CA 93943

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ABSTRACT

In response to intensifying security tensions in East Asia, Japan has significantly increased its defense budget. However, its defense industrial base remains economically fragile due to structural issues such as postwar pacifism, legal constraints, and a limited domestic market. This research evaluates the feasibility of adopting the U.S. Foreign Military Sales (FMS) to strengthen Japan's defense industry.

Through comparative qualitative analysis of Japan, the United States, France, and Germany, the analysis finds that FMS—by offering legal assurances, risk mitigation, and diplomatic support—is institutionally more appropriate for Japan than Direct Commercial Sales (DCS). A quantitative analysis based on the F-35's 23.8% markup model suggests that Japan could recover research and development (R&D) costs by exporting a limited number of Future Frigate Multi-mission (FFM) destroyers and Soryu-class submarines.

Policy recommendations include the establishment of an inter-ministerial FMS agency, leveraging overseas diplomatic missions, and fostering sustained public engagement across the short, medium, and long term. This research offers insights not only for Japan but also for policymakers in other countries seeking to promote strategic arms exports. Although the economic impact of FMS adoption warrants further empirical analysis, this study provides actionable guidance for strengthening Japan's defense industrial resilience through strategic international engagement.

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ABOUT THE AUTHOR

LCDR Kei Itazaki earned a Bachelor of Public Policy from the Japan National Defense Academy in 2012. He began his naval career as the Communications Officer aboard JS *Ashigara* (DDG-178). Following this assignment, he served as a contractor supporting ship maintenance operations at Yokosuka District Headquarters. In 2017, LCDR Itazaki was assigned as the Logistics Officer for aviation maintenance at Shimofusa Air Base. In 2019, he joined the Maritime Staff Office, where he contributed to the development of the JMSDF's annual budget plan. In 2021, he served as the Supply Officer aboard JS *Setoyuki* (TV-3518), deployed with the Japan Training Squadron. In 2023, he was selected as an instructor at the JMSDF Officer Candidate School. Upon completion of his graduate studies at the Naval Postgraduate School, LCDR Itazaki will report to the Maritime Staff Office to assume duties in budget planning and resource management.

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I am also profoundly thankful for the opportunity to study at the Naval Postgraduate School, which has been one of the most rewarding experiences of my life. The privilege of learning from outstanding professors and sharing this journey with dedicated students from both the United States and around the world has been inspiring. In addition, I would like to express my heartfelt appreciation to my family and friends for their unwavering support, patience, and understanding during the demanding periods of my research and writing. Their encouragement served as a constant source of motivation. I also want to express my appreciation to the Japan Maritime Self-Defense Force and its leadership for allowing me to attend one of the most prestigious schools in the world.

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LIST OF ACRONYMS AND ABBREVIATIONS

AAF	Adaptive Acquisition Framework
ATLA	Acquisition Technology and Logistics Agency
CBO	Congressional Budget Office
CLASSA	Cooperative Logistics Supply Arrangement
DBP	Defense Buildup Program
DCS	Direct Commercial Sales
DI	Direction Internationale
DIB	Defense Industrial Base
DoD	Department of Defense
DoS	Department of State
DMA	Delegation Ministerielle pour l'Armement
DSCA	Defense Security Cooperation Agency
EU	European Union
EUM	End Use of Monitoring
FFM	Future Frigate Multi-mission
FMS	Foreign Military Sales
GAO	The U.S. Government Accountability Office
GDP	Gross Domestic Product
GHQ	General Headquarters
GNP	Gross National Product
IA	Implementing Agencies
IMET	International Military Education and Training
ITAR	International Traffic in Arms Regulations
JSDF	Japan's Self-Defense Forces
JSF	The Joint Strike Fighter
LOR	Letter of Request
MDE	Major Defense Equipment
METI	Ministry of Economy, Trade and Industry
MOD	Ministry of Defense
MOF	Ministry of Finance

MOFA	Ministry of Foreign Affairs
NIPO	Navy International Program Office
NSC	National Security Council
PKO	Peace Keeping Operations
QCD	Quality, Cost, and Delivery
R&D	Research and Development
SAAM	Security Assistance Management Manual
SJC	Science Council of Japan
SME	Subject Matter Expert
SIPRI	Stockholm International Peace Research Institute
USFJ	United States Forces Japan

I. INTRODUCTION

This chapter outlines the necessity and background of this research, detailing how Japan can enhance the financial health of its defense industries by adopting foreign military sales (FMS). The research aims to provide an overview of the economic benefits of FMS and the barriers faced by defense industries.

In the past, the Japanese government avoided developing policies regarding its military, including defense research and development (R&D). Historically, the General Headquarters (GHQ) of the Allied Forces governed Japan after World War II (WWII). The GHQ banned research about dual-use technology, and the Science Council of Japan (SJC) took over GHQ policy (Kita, 2017). One notable result of this restructuring was that, in consideration of public opinion, the SJC never conducted war-related research (Kita, 2017). Furthermore, in 1967, the Japanese government established the Three Principles on Transfer of Defense Equipment and Technology, which regulated the limitations of exporting military equipment (Ministry of Defense in Japan, 2024a). Therefore, Japanese defense industries are subject to restrictions on the export of military equipment.

Despite growing international opportunities, Japan's defense industry saw little success in foreign markets due to the public's antiwar opinions and the limitations of Japanese law. As a result, major defense industries, such as Mitsubishi Heavy Industries, Kawasaki Heavy Industries, and NEC Corporation, made defense operations a smaller percentage of their net income (Uesala et al., 2021). The low dependency on defense operations led some defense industries to draw back from the defense market (Kubota, 2010). One way to improve the Japanese defense industry's size and health is for the Japanese government to consider increasing FMS.

Some countries, such as the United States, France, and Germany, are successful in worldwide arms exports (Hattori, 2023). This research examines the factors influencing Japan's defense equipment exports by comparing its defense exports with those of several other countries. The analysis is based on the findings of other researchers' studies. This is because many countries do not disclose precise defense information for reasons of

national security. According to the Ministry of Finance's directive, for instance, the Ministry of Defense (MOD) is exempt from disclosing the results of specific contracts due to national security concerns, such as those related to frigates (Tani, 2006). Additionally, in Jane's database, Jane assesses defense budget transparency based on the publication of documents and the level of data granularity. Table 1 presents the results of Janes's assessment of transparency among the top ten defense budget countries worldwide. Even if Japan does not disclose the results of all contracts, its transparency rank is second. Therefore, this research clarifies the characteristics of defense equipment exports from several countries, drawing on reports from other researchers to identify factors that influence military sales.

Table 1. The Defense Budget Transparency Rank in the top 10 defense budget countries. Source: Janes (2025a).

Rank	Country name	Defense Budget transparency score (Max 100)
1	United States	100
2	Japan	83.75
3	Germany	83
4	Korea, South	82.5
5	France	77
6	United Kingdom	74.25
7	India	70
8	Russian Federation	54.5
9	Saudi Arabia	15
10	China	10

A. BACKGROUND

1. The Incentive of Research

An improvement in the economic health of defense industries is linked to military operational effectiveness on the battlefield. The primary reason is that the military's capability is closely tied to the defense industry's capacity to develop and produce weapon systems. For instance, when the military requires improvement in the availability of defense equipment, logisticians consider decreasing maintenance requirements or

increasing the acquisition objective of defense equipment. However, these ways rely on defense companies. Therefore, the military requires improving defense industries to enhance capabilities.

Next, governments are required to sustain and improve military capabilities. Generally, the government expects the military to protect its country against external threats. Currently, severe external threats exist (MOD, 2024b). As the Ukraine war and conflicts in the Middle East demonstrate, unstable international environments are being created by countries seeking to alter the current international situation. This situation is the same in the seas around China, and countries are working to strengthen their defense capabilities to protect their sovereignty and independence. The MOD announced that national security was changing dramatically (MOD, 2024b). In light of East Asia's increasingly tense security environment, Japan needs to enhance its military capabilities.

The MOD outlined the scale of military capabilities it requires in its National Security Strategy. Japan's National Security Strategy 2022 aims to strengthen its overall national power, including the defense production and defense-related companies (Cabinet Secretariat in Japan, 2022). According to the Defense Buildup Program (DBP) between FY2023 to FY2027, the MOD decided on the seven key capabilities for improving defense capabilities with 43 trillion yen (MOD, 2024c). Table 2 shows the seven pillars of the DBP and the difference in scale of the former DBP (MOD, 2024c).

Table 2. The scale of difference in the Defense Buildup Program (trillion yen). Source: MOD (2024c).

Field	FY2023-2027	FY2019-2022
Stand-off Defense Capabilities	5	0.2
Integrated Air and Missile Defense Capabilities	3	1
Unmanned Defense Capabilities	1	0.1
Cross-Domain Operation Capabilities	8	3
Common and Control/ Intelligence-related Functions	1	0.3
Mobile Deployment Capabilities/ Civil Protection	2	0.3
Sustainability and Resiliency	15	6

Field	FY2023-2027	FY2019-2022
Reinforcing the Defense Production Base	0.4	1
Research and Defense Production	1	1
Other (education and training, fuel, etc.)	6.6	4.4
Total	**43**	**17.3**

The MOD could not achieve improvements in capabilities, even if it were successful in securing more budget. Table 3 presents the results of the acquisition from DBP FY2019 to FY2022. Table 3 is based on the audit report for FY2023 by the Board of Audit of Japan. The percentage of contracts indicates whether the MOD can procure programs, and the percentage of acquisitions refers to whether the MOD can acquire defense equipment within a five-year timeframe. According to Table 3, the MOD was unable to acquire four programs and failed to meet the complete requirements in 22 programs within a five-year period. The Board of Audit of Japan concluded that factors such as the weakening of the domestic defense industry infrastructure and the exchange rate for overseas imports influenced the MOD programs (Board of Audit of Japan, 2024). From this table, one can infer that the Japanese government should consider expanding the defense market to improve the economic health of the defense industries.

Table 3. The result of the Acquisition in DBP FY2019-FY2022. Source: Board of Audit of Japan (2024).

No	Programs	Scheduled	Contract	Acquired by FY2022	Percentage of Contract (Contract/ Scheduled)	Percentage of Acquiring (Acquired/ Contract)
1	**Combat vehicle**	**134**	**110**	**68**	**82.1%**	**61.8%**
2	**Armed vehicle**	**29**	**0**	**0**	**0.0%**	**0.0%**
3	**Multi-helicopter**	**34**	**26**	**6**	**76.5%**	**23.1%**
4	**CH-47**	**3**	**3**	**0**	**100.0%**	**0.0%**
5	**SSM**	**3**	**2**	**1**	**66.7%**	**50.0%**
6	**IRM**	**5**	**4**	**1**	**80.0%**	**25.0%**
7	**Aegis Ashore**	**2**	**2**	**0**	**100.0%**	**0.0%**
8	**Tank**	**30**	**24**	**13**	**80.0%**	**54.2%**
9	**Cannon**	**40**	**28**	**7**	**70.0%**	**25.0%**
10	**Frigate**	**10**	**8**	**2**	**80.0%**	**25.0%**
11	**Submarine**	**5**	**4**	**0**	**80.0%**	**0.0%**
12	**Escort-ship**	**4**	**0**	**0**	**0.0%**	**0.0%**

No	Programs	Scheduled	Contract	Acquired by FY2022	Percentage of Contract (Contract/ Scheduled)	Percentage of Acquiring (Acquired/ Contract)
13	Another- ship	4	4	0	100.0%	0.0%
14	P-1	12	9	0	75.0%	0.0%
15	SH-60K/L	13	7	0	53.8%	0.0%
16	Flagship drones	3	0	0	0.0%	0.0%
17	MCH-101	1	1	0	100.0%	0.0%
18	E-2D	9	9	0	100.0%	0.0%
19	F-35A	45	33	0	73.3%	0.0%
20	F-15	20	2	0	10.0%	0.0%
21	KC-46A	4	4	0	100.0%	0.0%
22	C-2	5	2	0	40.0%	0.0%
23	PAC-3MSE	16	16	16	100.0%	100.0%
24	Global Hawk	1	1	1	100.0%	100.0%

2. The Background of Research

The MOD stated that the reinforcement of the defense of production base in DBP aims to save defense industries (MOD, 2024b). Recently, some defense industries have withdrawn from the defense market. The decline of defense industries led Japan to limit its military options. The defense budget for the FY2023 to FY2027 defense capability development plan was approved at approximately 43 trillion yen, a significant increase from the 27.5 trillion yen allocated in the previous medium-term defense capability development plan (Watanabe, 2022). However, the MOD had to return 130 billion yen of the budget (The Nikkei, 2024). The reason for this is that the increase in imported equipment was affected by exchange rates (Board of Audit of Japan, 2024). In addition, there has been a withdrawal of defense-related companies, mainly small and medium-sized enterprises, and the defense industry, which is the foundation of defense capabilities, is weakening (MOD, 2024a). The current situation, which is biased towards imported equipment, is also undesirable from a supply chain management perspective, and it is essential to strengthen the production base of domestic defense-related companies in Japan.

The defense industry relies on government support. Unlike other industries, the domestic demand for the defense industry is mainly limited to the government or military, resulting in a relatively small market. Therefore, it is challenging to improve the

economic health of defense industries without government support. Japan's government should consider options to enhance the economic health of defense industries, thereby preventing them from withdrawing from the defense market.

One way to enhance the economic health of defense industries is by expanding the defense market. This research suggests that adapting the FMS system is a viable option for expanding the defense market. This is because the actions of other governments influence the defense market. In short, defense industries often require government assistance when seeking to export to other countries. Many countries export defense equipment and achieve benefits from the sale of that equipment (Stockholm International Peace Research Institute, n.d.). After the Cold War, for example, the Republic of Korea implemented a unified Korea system. An all-Korea system united the political, public, civilian, and military to strengthen the domestic economy by exporting defense equipment (Ito, 2022). Therefore, Japan can learn from other countries to strengthen the health of its defense industrial base.

The importance of defense production is increasing in every country, as evident in the National Defense Industrial Strategy presented by the United States in 2023 (DoD, 2022). The results of arms exports, as reported by the Stockholm International Peace Research Institute (SIPRI) in Table 4, show that many countries export defense equipment, while Japan does not. The defense budget for Japan over the next five years is $ 275 billion, but defense exports are only $ 13 million between 2020 and 2023 (SIPRI, n.d.). Japanese defense industries have few arms exports (see Appendix A; SIPRI, n.d.).

Japan's three principles and a strong aversion to the defense sector result in an imbalance between arms exports and its military spending (Muramatsu, 2017). Table 5 presents the top 10 countries by their defense budgets for the years 2020–2023. Japan's arms exports are relatively low compared to the defense budget. The background of Japan's arms exports is summarized in the next chapter. In this research, the definition of defense equipment includes "arms" and "arms technology," as stated by the Three Principles on Transfer of Defense Equipment and Technology from the Japanese Government (The Government of Japan, 2014).

Table 4. The average rank of military sales in the world ($ million). Source: SIPRI (n.d.). *(See Appendix A for details)*

Rank (2020-2023)	Country	Total (2020-2023)	2020	2021	2022	2023
1	United States	$47,485	$9,532	$11,074	$15,592	$11,287
2	France	$11,559	$2,387	$3,892	$3,268	$2,012
3	Russia	$9,710	$3,523	$2,315	$2,603	$1,269
4	Germany	$6,786	$1,161	$857	$1,481	$3,287
5	China	$6,525	$700	$1,310	$2,083	$2,432
6	Italy	$5,628	$825	$1,650	$1,716	$1,437
7	United Kingdom	$4,223	$637	$717	$1,665	$1,204
8	Spain	$3,510	$981	$619	$970	$940
9	Israel	$3,043	$395	$619	$870	$1,159
10	South Korea	$2,107	$772	$510	$204	$621
53	Japan	$13	0	0	0	$13

Table 5. The top 10 defense budgets in the world ($ million). Source: Janes (2025a).

Rank	Country	Defense Budget (2025)
1	United States	$909,206
2	China	$280,787
3	Russian Federation	$118,948
4	Germany	$79,261
5	United Kingdom	$76,559
6	India	$74,833
7	Saudi Arabia	$69,607
8	France	$64,893
9	Korea, South	$52,912
10	Japan	$52,335

Japan should consider allocating resources to enhance the economic health of its defense industries. Unless the market for the defense industry and the resulting demand signal for military arms/technology is expanded overseas, it will be hard to improve the capability and capacity of the defense industry. Consequently, it will be challenging to restore the financial health of defense industries. This research examines how the government can support arms exports to enhance the financial health of defense-related companies. The focus points are as follows. First, the Japanese government will apply the U.S. government's acquisition system to Japan and show its economic effects. Next, the factors of military sales success will be analyzed by researching other countries.

B. PROBLEM IDENTIFICATION

To strengthen Japan's defense capabilities, it is essential to enhance the country's defense production base. The Japanese government should consider stopping the current situation in which defense-related companies are withdrawing from the defense industrial base. Previous research on Japan's defense industry has been conducted in recent years by Sakurabayashi, Hattori, Okawa, Hasegawa, and others (Hasegawa, 2023). Generally, they recognized the need for arms exports for defense-related companies. However, they do not discuss the actual economic effects or the method of arms exports that is most suitable for Japan.

The challenge is that the defense industry is linked to defense capabilities, and it is necessary to secure a supply chain from domestic defense-related companies. The problem is not only for Japan but also for other countries. The same situation applies in the United States, for example, and the U.S. Congress has the following concerns: "Failing to seize the opportunity provided by our innovation ecosystem and U.S. and allied industrial bases creates risks for the United States and its ability to adapt to new and emerging threat environments. This includes strengthening and expanding the supplier base that largely consolidated after the Cold War." (Department of Defense, 2022).

Table 6 shows the results of the companies with the most significant arms revenues in 2023. According to Table 6, there are five U.S. companies in the top 10 arms-generating revenue companies. To sum up, the U.S. has the largest defense budget and is highly successful in military sales. Then, from Tables 4 and 5, it is evident that the seven countries with the top 10 defense budgets in the world are successful in military sales. Japan's defense budget was tenth in the world, but Japan's military sales were relatively low, ranking 53rd in the world (SIPRI, n.d.). The U.S. government created the FMS system and has been successful in sustaining the economic health of the defense industries. Therefore, this research refers to the system of the U.S. FMS.

Table 6. The top 10 arms revenues in the world ($ million). Source: SIPRI (n.d.).

Rank	Company	Country	Arms revenues (2023)
1	Lockheed Martin Corp.	United States	$60,810
2	RTX	United States	$40,660
3	Northrop Grumman Corp.	United States	$35,570
4	Boeing	United States	$31,100
5	General Dynamics Corp.	United States	$30,200
6	BAE Systems	United Kingdom	$29,810
7	Rostec	Russia	$21,730
8	AVIC	China	$20,850
9	NORINCO	China	$20,560
10	CETC	China	$16,050

The primary objective of this research is to study how to improve the Japanese defense industries' economic health by recommending how Japan could implement the U.S. FMS or DCS. A secondary objective is to analyze the system and status of arms exports in various countries to identify the factors that lead defense industries to export defense equipment easily. The Japanese government should focus on these factors. The research questions are the following:

1. Primary Question

- **How could Japan improve the financial health of defense industries through the adoption of FMS or DCS?**

2. Secondary Question

- **What factors influence the export of defense equipment?**

C. SCOPE AND LIMITATION

In terms of arms exports, Japan possesses soft power that not only has an economic impact but also enhances interoperability and cooperation with allied and like-minded countries in the realm of security (Machain, 2021). However, this research focuses on the economic impact of arms exports. In analyzing the economic effects, the F-35, which was jointly developed mainly by the United States, was used as an example for analysis. In addition, this research selects the United States, France, and Germany for comparison based on Japan's economic scale and the situation of defense-related

companies, analyzing characteristics in foreign military sales. Finally, this research uses only publicly available information.

D. SUMMARY

Increasing external threats compel countries to enhance their defense capabilities. Japan is no exception and needs to develop and improve its defense capability. Defense capabilities connect with the defense industries' capabilities (MOD, 2024b). Therefore, countries should sustain or improve the economic health of their defense industries. Furthermore, the Japanese domestic defense market is relatively small, so the government has expanded the defense market to enhance the benefits for defense industries.

This research utilizes the U.S. system for acquiring military capabilities and exporting military arms as a reference to study how to improve the financial health of Japan's defense-related companies. It analyzes the economic effects and the types of arms exports that are suited to Japan. This research aims to investigate how arms exports could help develop Japan's struggling defense sector, thereby contributing to the financial health of Japan's defense-related companies.

The following chapters explain why Japan was unsuccessful in sustaining the economic health of its defense industries, drawing on historical background and previous research. Chapter II summarizes an overview of Japan's defense military sales and the system of the U.S. FMS. The overview of Japan shows the history related to Japan's defense military sales. Section 1 presents the current situation regarding Japan's military sales, including organizations, laws, and defense industries, based on previous research about Japan's military sales and defense industries. Section 2 provides background knowledge on the U.S. FMS systems. Finally, Section 3 summarizes and introduces previous research on the U.S. FMS.

Chapter III introduces the methodology of analysis and the research approach. This research utilizes both qualitative and quantitative analysis. Furthermore, the quantitative analysis assesses the economic effectiveness of FMS in enhancing the financial health of the Japanese defense industry.

In Chapter IV, Sections 1 and 2 provide an overview of the institutional background and past defense policies related to Japan's defense equipment, summarizing

the constraints and preconditions for the introduction of FMS. Particular attention is paid to the methods Japan has used to acquire defense equipment, the characteristics of its legal and political foundations, and the factors influencing defense exports. Sections 3 and 4 conduct a comparative analysis using both quantitative and qualitative data to examine the economic impact of Japan's adoption of FMS. The qualitative analysis assesses the impact of variations in the defense market's structure, the nature of government support, and the level of dependence on defense exports by comparing Japan with other countries, including the United States, France, and Germany. The quantitative analysis evaluates cost reduction effects based on learning curve effects and economies of scale and estimates the feasibility of recovering R&D costs using the F-35 program as a case study. This quantitative analysis contributes to the evaluation of the economic effectiveness of defense exports in Japan.

Chapter V builds upon the analysis conducted in Chapter IV to first determine whether FMS or DCS is more suitable as an approach to arms exports for Japan. Based on the potential economic effects of implementing arms exports, the chapter then presents policy recommendations aimed at improving the financial soundness of Japan's defense industry.

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II. LITERATURE REVIEW

This chapter provides an overview of Japan's defense industry and FMS based on existing literature. In particular, it aims to clarify the institutional and policy environment surrounding Japan's defense industry and the characteristics of FMS.

A. OVERVIEW OF JAPAN'S DEFENSE MILITARY SALES

This section provides an overview of Japan's background in military sales and previous research. First, Japan's defense expenditure has accounted for approximately 1% of the country's gross domestic product/gross national product (GDP/GNP) for many years (MOD, 2024a). Since 2013, Japan's defense expenditure has been increasing due to external threats (MOD, 2024c). Second, the Japanese government has been revising the Three Principles on Arms Exports since WWII (Nishikawa, 2024). This indicates a shift in policy to utilize arms exports to maintain national security. Japan revised this principle in an attempt to sustain national security with arms exports (The Government of Japan, 2014). This section also provides an overview of Japan's acquisition systems. Finally, this section identifies the gaps that exist between previous studies and this research. The main objective of this section is to highlight the uniqueness and contribution of this study through a review of the literature on defense exports.

1. Background

This section provides an overview of the historical background of Japan's defense industry, including trends in defense expenditure and changes in arms export policy.

a. Defense Expenditure

In analyzing Japan's defense industry, this research focuses on national defense expenditures, including changes in the ratio of defense expenditures to GDP/GNP, since the military is the primary source of demand for defense equipment. Generally, the ratio of a country's GDP to its defense budget indicates how the country prioritizes defense expenditure. Figure 1 shows the result of Japan's defense expenditure and GDP/GNP since WWII (see Appendix B; 戦後における防衛関係費の推移 [Defense Expenditures

in the Postwar Period], 2017). Recently, Japan's defense expenditures have continued to increase due to severe external threats (MOD, 2024c). The only exception to this increase occurs between fiscal year FY2003 and FY2012. Then, Figure 2 shows the movement of the ratio of defense expenditures and GNP/GDP. As shown in Figure 2, Japan's government has maintained specific standards regarding the ratio of defense expenditures to its GNP/GDP. Figures 1 and 2 indicate that Japan's defense expenditures tend to increase, but the amount of defense expenditures remains stable at around a 1% ratio. Therefore, the characteristic of Japan's defense expenditures was sustained with the standard of the ratio of GDP/GNP (Nishikawa, 2024).

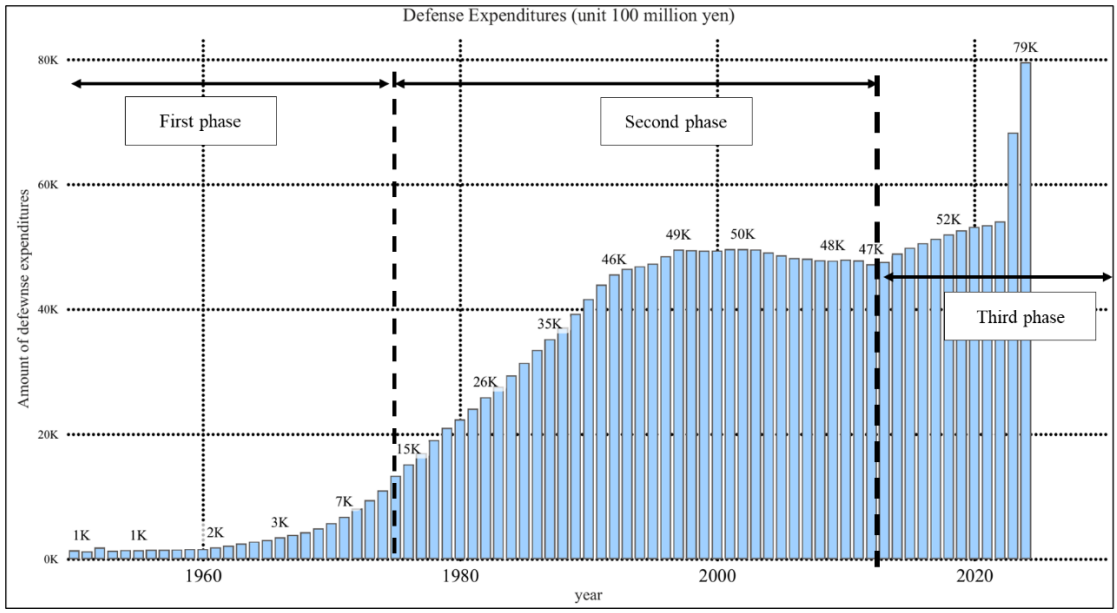


Figure 1. Trends in defense-related expenditures (100 million yen). Adapted from MOD (2024a).

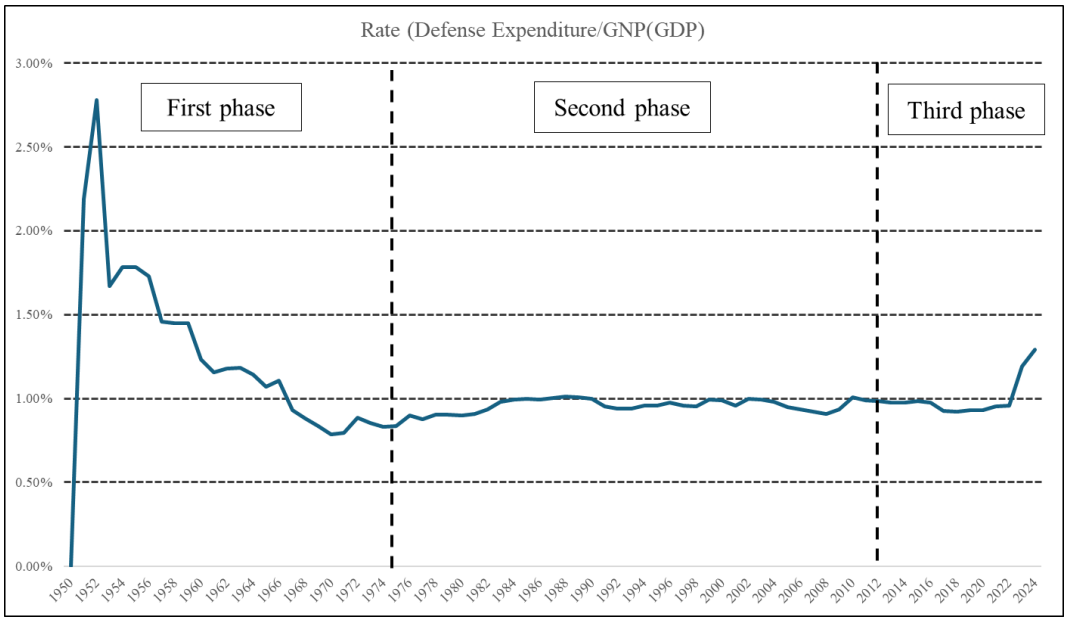


Figure 2. The rate of defense expenditures and GNP/GDP. Adapted from MOD (2024a).

The movement of Japan's defense expenditure has three phases in the tendency of defense expenditure amount. The turning points of changes in the ratio of GDP/GNP and defense expenditure are 1976 and 2012 (MOD, 2024a). The first phase spans from WWII to 1975, the second phase is from 1976 to 2012, and the third phase is from 2013 to the present. In the first phase, Japan needed to increase defense expenditures due to the U.S military's redeployment (戦後における防衛関係費の推移 *[Defense Expenditures in the Postwar Period]*, 2017). In those days, a strong anti-war sentiment characterized Japan's public opinion. The peace movement was popular in politics and academic fields (Fujisawa, 2014). During a peaceful movement, Japan's Self-Defense Forces (JSDF) were established in 1954 to protect against external threats such as communism (MOD, 2024a). In the first phase, the goal of JSDF was to improve defense capability under the shrinking United States Forces Japan (USFJ). In the first phase, Japan's government strengthened its defense capability despite the public opinion of antiwar and peace movements.

In the second phase, the key difference from the first phase is that Japan's government established a standard defense expenditure ratio of 1% of GNP (戦後における防衛関係費の推移 [Defense Expenditures in the Postwar Period], 2017). In 1976, the

Miki Takeo Cabinet implemented a cabinet decision to limit the defense expenditure to one percent of GNP (戦後における防衛関係費の推移 [Defense Expenditures in the Postwar Period], 2017). Later, in 1986, the Nakasone Cabinet reversed its decision to limit defense expenditure due to a change in national security (Watanabe, 2022). Japan's government terminated the limitation on defense expenditure, but defense expenditure generally remained at around one percent of GNP/GDP (Nishikawa, 2024). By the end of the Cold War, Japan's defense expenditures decreased for ten consecutive years from FY2003 to FY2012, with a long-term economic slump in Japan (Kim et al., 2010). The amount of defense expenditure decreased in the second phase, but the ratio of defense expenditure to GDP remained approximately constant at around 1%. This was because the budget was based on the idea of maintaining defense spending at one percent of the GDP, rather than considering the capabilities that require a defense budget (Nishikawa, 2024). The characteristics of the second phase include setting standards and allocating defense expenditures to meet these standards, without considering the required defense capabilities (MOD, 2024a).

The third phase is a different tendency from the second phase. In the third phase, Japan's cabinet changed to the Liberal Democratic Party, and the external threat from surrounding countries increased (MOD, 2024a). In December 2012, the cabinet changed with the adoption of the Abe Shinzo Cabinet. Japan's government stipulated the National Security Strategy in 2013 due to concerns about countries such as China and North Korea, which were attempting to alter the status quo (Cabinet Secretariat in Japan, 2013). Based on the National Defense Strategy, Japan's government increased the defense budget (MOD, 2024c). In December 2022, Japan's government decided to renew its National Security Strategy and create a National Defense Strategy. MOD presented a plan for the development of defense capabilities over a five-year period from 2023 to 2027. This plan for the development of defense capabilities has approved a budget of approximately 43 trillion yen for five years (MOD, 2024c). This amount is significantly larger than the budget of approximately 17.2 trillion yen for the previous plan for the period from 2019 to 2022 (MOD, 2024a).

The background of defense expenditures in Japan indicates that Japan's government has maintained the regulation of the ratio of defense expenditures to GNP/ GDP. The interpretation of regulations has undergone three phases of change. Currently, Japan has emphasized the need to enhance defense capabilities and operating defense expenditures without adhering to a specific ratio to GDP (MOD, 2024c).

b. The law of arms export

The law of arms export in Japan is similar to the movement of defense expenditures. First, the Japanese Constitution does not prohibit the export of weapons, and during the Korean War, the export of weapons increased (Nishikawa, 2024). However, due to criticism that Japan was exporting defense equipment to Indonesia and Yugoslavia, which were countries involved in the conflict at the time, the Sato Cabinet in 1967 announced the Three Principles on Arms Exports (The Government of Japan, 2014). The Three Principles on Arms Exports state that Japan will not permit the export of three types of weapons (The Government of Japan, 1967). In 1976, the Miki Cabinet clarified the definition of weapons and made it the government's position to effectively ban all weapons exports, including weapons technology (The Government of Japan, 2014).

The Three Principles on Arms Exports (The Government of Japan, 1967)

- In the case of exports to communist countries
- In the case of countries to which the export of weapons, etc., is prohibited by UN resolution.
- In the case of exports to countries that are parties to or may become parties to international disputes

The turning point of the law of arms sales was the Abe Cabinet. The Abe Cabinet announced its National Security Strategy in 2013, which included a policy on arms exports. According to the national security strategy guided by the principle of proactive pacifism, Japan's government would promote arms exports as a way to support international cooperation (Cabinet Secretariat in Japan, 2013). In 2014, the government announced the Implementation guidelines for the Three Principles on the Transfer of Defense Equipment and Technology, shifting its policy to one that allows arms exports,

subject to certain restrictions and following United Nations resolutions (The Government of Japan, 2014).

There has been a trend toward relaxing restrictions on Japanese arms exports since the Abe Cabinet was established. That is, Japan's government changed the law on arms sales to allow defense industries to export easily. Therefore, Japan's government believed that Japan's defense industries had recovered their economic health (Okawa, 2016). However, Japan's defense industries have not improved their economic outlook. Following the renewal of the Three Principles, the only recorded arms export was the sale of a warning and control radar to the Philippines in 2020 (MOD, 2023b). The domestic defense market is limited, and arms exports are needed to expand the defense market. If defense companies do not find economic advantages, they will not invest in the defense sector. As a result, researchers anticipate that the domestic defense industry will shrink, and the MOD will primarily rely on arms imports to meet Japan's defense needs (K. Ito & Kurumizawa, 2024). Thus, even though the Japanese government has increased its defense budget in recent years, the economic health of the domestic defense industry has not improved when defense spending is used for arms imports.

Figure 3 indicates that arms imports are significant in Japan. Figure 3 compares arms imports to defense expenditures from 2019 to 2022 in the top 10 in terms of defense expenditure. The data used in Figure 3 are taken from the SIPRI (SIPRI, n.d.). Except for Ukraine, which is currently at war, Japan has been in third place for five consecutive years, after India and Saudi Arabia. This graph also shows that Japan's arms imports comprise a larger portion of its defense expenditures than those of the other top 10 countries. Japan's government spent a relatively larger budget on arms imports than other countries, as shown in Figure 3.

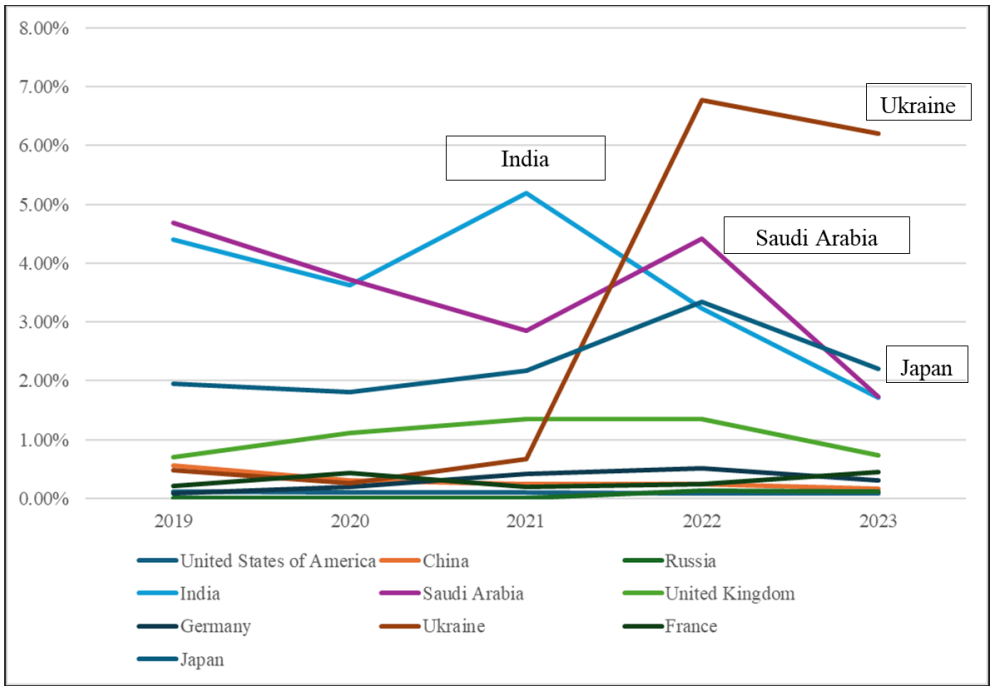


Figure 3. The ratio of imports and expenditures. Adapted from SIPRI (n.d.).

2. Implementation of Military Sales

This section outlines Japan's legal and institutional framework for arms exports, detailing the roles of key government agencies, relevant legislation, and the procedural flow of military sales. It also introduces the defense dependency ratio as a measure of the defense industry's reliance on military sales.

a. Institutions and Laws

Three departments oversee military sales: MOD, the Ministry of Foreign Affairs (MOFA), and the Ministry of Economy, Trade and Industry (METI) (The Government of Japan, 2014). MOD and MOFA oversee military sales in accordance with national security and international treaties. These two institutions judge the appropriateness of military sales. METI is responsible for the transportation process in military sales. These institutions operate under the authority of the National Security Council (NSC), which includes the Prime Minister and plays a central role in authorizing arms exports (The Government of Japan, 2023). Once the NSC approves a proposed arms sale, defense companies initiate the contract procedures. Figure 4 illustrates the process of arms

exports in Japan (Center for Information Security Trade Control Security Export Control Committee Secretariat, 2014).

Japan's government has operated military sales under the Three Principles and a few laws. The Three Principles on Transfer of Defense Equipment and Technology stipulate that military sales require deliberation at the National Security Council and approval of all permits (The Government of Japan, 2014). Japan has implemented legislation to prevent its advanced defense equipment from falling into the hands of countries of concern that are involved in the development and manufacture of weapons of mass destruction or terrorist organizations (MOD, 2024a). Regarding other legislation, Japan's government conducts military sales in accordance with the United Nations Arms Trade Treaty and the Foreign Exchange and Foreign Trade Act (The Government of Japan, 2023). METI oversees all exports with these two laws (METI, n.d.). Arms exports are subject to the same controls as other exports under these two laws. The Foreign Exchange and Foreign Trade Act regulates actions related to foreign exchange and foreign trade. The purpose of this law is to ensure economic stability while maintaining Japan's healthy international balance of payments (The Government of Japan, 1949). Under this law, Japan restricts imports, exports, and investments in foreign companies. Additionally, all exports are required to obtain permission from foreign traders through METI (METI, n.d.).

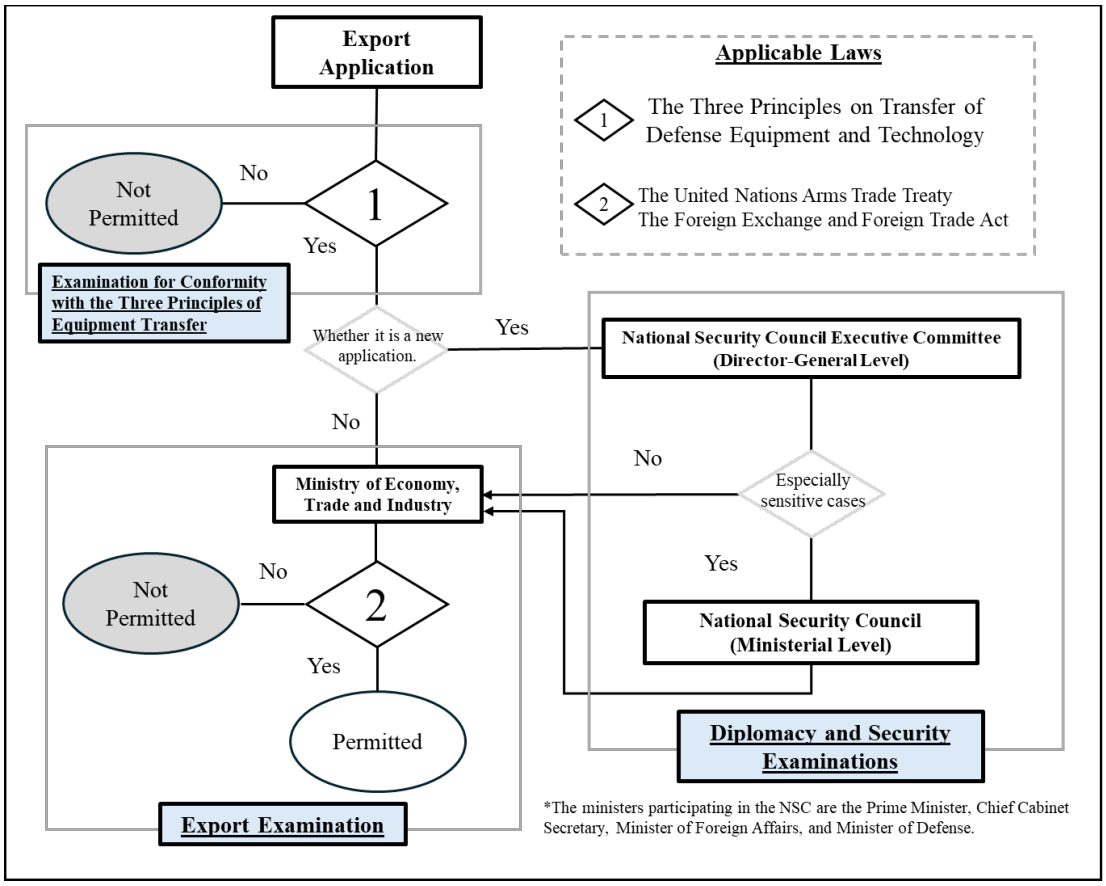


Figure 4. The process of arms export in Japan. Adapted from Center for Information Security Trade Control Security Export Control Committee Secretariat (2014); The Government of Japan (2023).

Japan's government has updated the Three Principles on the Transfer of Defense Equipment and Technology with the renewal of the National Security Strategy (Cabinet Secretariat in Japan, 2022). The reason for renewing the principle was to promote peace contributions and international cooperation from the standpoint of proactive pacifism based on international cooperation (MOD, 2024a). Specifically, the Three Principles stipulate clarification, screening, information disclosure, and proper management in cases where transfer is prohibited (The Government of Japan, 2023). Therefore, according to The Three Principles, Japan's government can deal with arms exports without political limitation. The following are cases where Japan's government prohibits a transfer under these regulations (The Government of Japan, 2023).

- Clarification of cases where transfers are prohibited.
- Limitations apply to cases where transfers may be permitted, as well as strict examination and information disclosure.

- Ensuring appropriate control regarding extra-purpose use or transfer to third parties. Source; The Government of Japan (2023).

b. Japan's acquisition systems and defense industries

This section discusses the methods used to acquire defense equipment and the current state of the defense industry in Japan, providing insight into the conditions related to arms sales. The MOD has regulations regarding the acquisition of defense equipment in its "Directive on the Implementation of Acquisition of Equipment and Services" (MOD, 2018). Additionally, the MOD classifies the methods of acquiring defense equipment as domestic acquisitions and import acquisitions. The MOD further classifies domestic acquisitions into domestic development, international joint production, and licensed domestic production. The MOD classifies import acquisitions into general import acquisitions and FMS. Table 7 shows these types of acquisitions. In general, import acquisitions have low unit costs and short lead times, but they rely heavily on the supply chain. On the other hand, domestic developments have high unit costs and long lead times but rely on an internal Japanese supply chain. Finally, licensed domestic productions have high unit costs but short lead times, particularly within the Japanese supply chain (K. Ito & Kurumizawa, 2024). From the above, the MOD chooses five acquisition ways to procure defense equipment.

Table 7. Type of acquisitions in MOD. Adapted from MOD (2018).

Types of Acquisitions in MOD				
Domestic Acquisitions			**Import Acquisitions**	
Domestic Development	**International Joint Production**	**Licensed Domestic Production**	**Import Acquisitions**	**FMS**

A characteristic of Japan's defense industries is the low dependency on defense-related sales in major defense companies (Center of Information on Security Trade Control, 2023). The main reason for the low dependency on defense-related sales is the low profit rate in the defense industry (Nishiguchi & Morimitsu, 2020). Generally, the customer in the domestic defense market is limited to MOD. Also, MOD regulates the profit rate in defense industries at about five percent (MOD, 2023a). From the private

sector's viewpoint, companies need to pursue their profits. Major defense companies must find other fields to develop economic health. The dependence rate on defense demand for large-scale defense-related companies, including prime contractors, is low at around 4% (Uesala et al., 2021). As shown in Figure 4 below, the dependency rate in the defense market is considerably lower than that of major defense-related companies in the United States. Therefore, the priority of major defense companies is not the defense market but other fields.

The low dependency on defense-related sales results in an asymmetric balance between major companies and subcontractors (Uesala et al., 2021). In Japan, a few major defense companies have contracts with a thousand companies to produce defense equipment. More specifically, over 2,000 companies are involved in the shipbuilding sector, and over 1,000 companies are involved in the aviation sector (MOD, 2024a). Because the Three Principles on Arms Exports meant that there was no real prospect of overseas markets, even for prime contractors, the defense-related industry was limited to a single division. As shown in Figure 5, the Japanese defense industry attributes the majority of its sales to the civilian demand sector. On the other hand, the dependence rate on defense demand for small-scale companies that are subcontractors is over 50% (K. Ito & Kurumizawa, 2024).

Finally, the low dependency and the asymmetrical balance result in defense companies' drawbacks in the defense market (Center of Information on Security Trade Control, 2023). The low dependency and small market potential resulted in minor defense divisions in the major defense companies. However, subcontractors have no choice but to deal with contracts from major companies, which often yield small profits. This is because small-scale companies often lack sufficient capital. Low profit structure due to low defense dependence has resulted in more than 100 defense-related companies exiting the defense industry market, including bankruptcy (K. Ito & Kurumizawa, 2024).

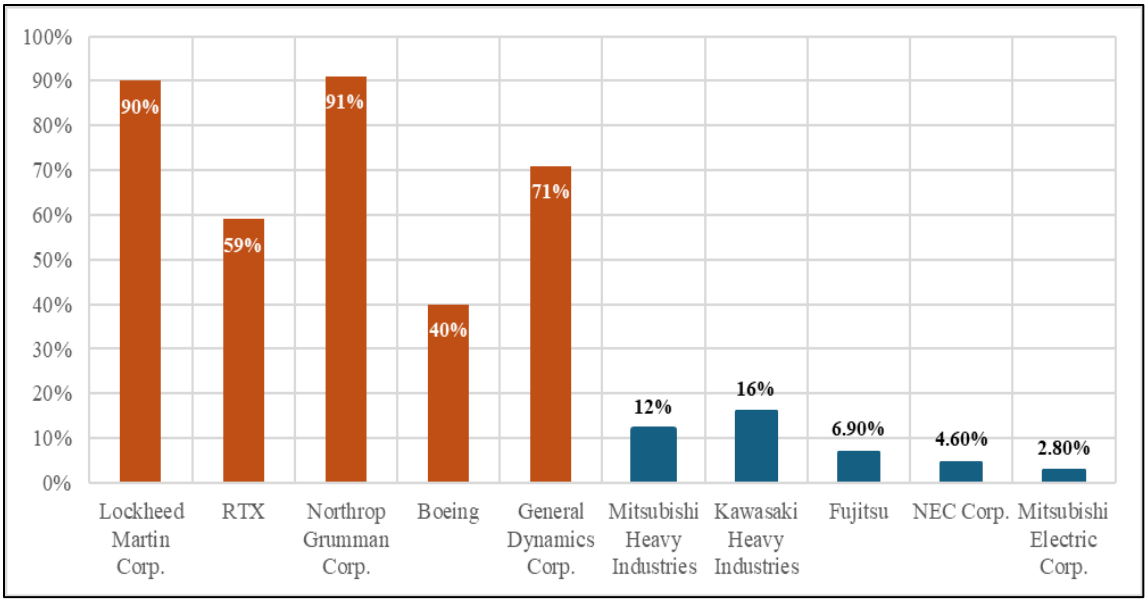


Figure 5. Arms revenues as a percentage of total revenues (FY2023). Adapted from SIPRI (n.d.).

3. Previous Research

Many researchers have examined Japan's arms exports in the form of comparative studies of the defense industry structures and systems of Japan and the United States, as well as research into the historical background of Japan's arms exports (Hasegawa, 2023; Hattori, 2023; Kubota, 2010; Muramatsu, 2017; Okawa, 2016). This section summarizes previous research to clarify the purpose of the current study. The research topic encompasses three fields: defense industries, Japan's laws regarding arms exports, and arms exports.

The research on Japan's defense industries has focused on the influence of national security. Mainly, researchers found similarities or differences in factors between comparative countries (Hattori, 2023). Following the end of the Cold War, the demand for defense equipment decreased as national security concerns were addressed, prompting the Department of Defense (DoD) to encourage defense industries to merge or consolidate (Luke, 2024). In the 1990s, there were fifty-one prime defense companies in the United States. Still, the trend of consolidation resulted in five prime defense companies (Office of the Under Secretary of Defense for Acquisition and Sustainment, 2022). The atmosphere of shrinking military production was the same in Japan, but Japan's defense industries did not proceed to merge (Kubota, 2010). Kubota insisted that

the low dependency of the defense field caused it not to merge but to draw back (Kubota, 2010). In short, Japan's defense companies decided that a better option was to withdraw from the defense market rather than merge with other defense companies. Finally, Kubota stated that the drawback of defense industries resulted in economic instability and the weakening of Japan's defense capability (Kubota, 2010).

Next, Japan's law system has evolved from restrictive laws governing arms exports to implementable laws that enhance Japan's defense industries (Okawa, 2016). The previous section described the transition in laws governing arms exports. Okawa researched the reason why Japan's defense industries do not export defense equipment, despite the Japan's government mitigating the regulation of arms exports. Okawa concluded that defense industries consider reputation risk in arms exports (Okawa, 2016). This is because Japan has maintained a policy of being a peaceful nation, and public opinion towards industries related to the military was severe (Muramatsu, 2017). Muramatsu conducted a survey of ordinary people and university students regarding arms exports in response to comments about Okawa's reputation risk. As a result, the percentage of people who did not care about the products of companies that export arms exceeded 80%. However, half of the respondents also indicated that they did not have a good impression of these companies, acknowledging to some extent that there was a reputation risk (Muramatsu, 2017). In addition, Hasegawa confirmed that reputation risk prevents the export of arms, as indicated by a questionnaire survey of defense industries (Hasegawa, 2023). Therefore, Okawa and Hasegawa argued that defense industries are reluctant to enlarge the defense field due to reputation risk. Both researchers acknowledged the effectiveness of changing the law on arms exports but enhancing the expansion abroad of defense industries requires more government support (Hasegawa, 2023; Okawa, 2016).

Finally, research on defense industries concluded the necessity of arms export (Hattori, 2023; Kodaira, 2022). Hattori analyzed the characteristics of arms exports in various countries and proposed that Japan should promote the U.S. FMS system by referring to other countries (Hattori, 2023). Furthermore, Kodaira emphasized the importance of joint development with the United States due to Japan's limited experience with its military equipment (Kodaira, 2022). Former research on arms exports shows that

arms exports are necessary for defense industries to maintain economic health. Moreover, Japan's government needs to prioritize cooperation in joint development efforts to compensate for the lack of domestic industrial base capability and capacity.

Based on previous research, the argument that the government should be actively involved in arms exports has been consistently recommended (Hasegawa, 2023; Hattori, 2023; Kodaira, 2022; Okawa, 2016). However, the economic effects of actively engaging in arms exports and the ideal arms export system for Japan, based on the arms export systems of other countries, have not been implemented for various reasons. This research selects the U.S. FMS system as a method to enhance the economic health of defense industries and assesses the specific economic effects of implementing FMS. This research then analyzes the factors influencing military sales from other countries and recommends improvements for Japan's defense industries' economic health.

B. FOREIGN MILITARY SALES

This section aims to explain FMS in the United States. The United States has two options for arms export: FMS and Direct Commercial Sales (DCS) (Gilman et al., 2014). Before adopting FMS in Japan, this section introduces the purpose and challenges of FMS, including processes and laws related to FMS.

1. The overview of FMS

This section provides an overview of the FMS, including its objectives, challenges, organization and legal framework.

a. The purpose and challenge

The U.S. government implements the FMS as part of its security assistance programs. The Defense Security Cooperation Agency (DSCA) then administers security assistance programs. According to the DSCA, there are twelve major types of security assistance programs, including FMS (DSCA, n.d.). The Department of State (DoS) and the DoD operate twelve security assistance programs. The DoS is responsible for leading this security cooperation. In addition, Title 22 of the U.S. Code allows the DoS to provide security assistance, such as military aid, economic aid, and humanitarian aid, to foreign

governments to promote the U.S. national security interests and foreign policy goals (DCSA, n.d.). Meanwhile, Title 10 of the U.S. Code authorizes the DoD to conduct activities such as joint military exercises, education, and the provision of services as part of its security cooperation efforts. FMS is a program that overlaps with two frameworks: the DoS's Security Assistance and the DoD's Security Cooperation (DSCA, 2012).

FMS has two main objectives: to exert influence over the region to which they are exported and to benefit the economy of the exporting country (Gilman et al., 2014). In the United States, as a superpower since the end of WWII, the emphasis is on exerting influence and stabilizing the region to which weapons are exported through strict export conditions and processes (Machain, 2021). Furthermore, FMS allows the U.S. defense companies to collect non-recurring costs and R&D costs. The purpose of FMS is to strengthen the defense capabilities and interoperability of purchasing countries, as well as to develop domestic economic health.

FMS causes some challenges between the United States and foreign countries. First, FMS may involve transferring technologies, depending on the contracts. In general, transferring technologies is called offset (Gilman et al., 2014). Offset provides purchase countries with the U.S. technologies, allowing U.S. defense companies to lose their technological superiority. Second, the DoD must oversee the export of equipment to prevent the transfer of the U.S. technology to adversaries. The Security Assistance Management Manual (SAMM) stipulates End Use Monitoring (EUM), which requires purchase countries to comply with not transferring equipment acquired through FMS. When terminating an FMS, the transition can be made after confirming any outstanding liabilities. However, the DoD must continue to confirm the management status of defense equipment, etc., as part of the EUM, even after the FMS case has been closed, in accordance with the Arms Export Control Law. This EUM will continue to monitor the final use of the equipment, including disposal and demilitarization. FMS has two challenges related to economic and national security for the United States and other countries.

b. The organization of FMS

The DoS and the DoD administer FMS by law. First, the DoS decides the policy of the Security Assistance Program (DSCA, n.d.). The responsibility of the DoS is budget allocation and specific details. Therefore, the DoS considers which countries and the scale or size to operate the Security Assistance program. The authority of the DoS is stipulated in the Foreign Assistance Act, the Arms Export Control Act, and the Presidential Decree (DSCA, n.d.). Additionally, the DoS also has the authority to grant export licenses based on the U.S. Munitions List. Next, the DoD is responsible for the direction and supervision of organizations involved in weapons exports. The specific organizations within the DoD involved in FMS are the DSCA, the Combatant Commands, the Security Cooperation Organization, and the Implementing Agencies (IA) of each military branch (DSCA, n.d.). The U.S. government and the DoD remain neutral about whether partner countries conduct transactions through FMS or DCS and avoid competing with defense-related companies (Lucas & Vassalotti, 2020).

c. The law system

FMS is a part of security assistance programs and operates arms exports through the U.S. government. Therefore, the law system of FMS is based on security assistance programs and exports. The Foreign Aid Act of 1961 laid the foundation for security assistance, including International Military Education and Training (IMET) and Peacekeeping Operations (PKO) (DSCA, n.d.). Then, the Arms Export Control Act was formulated in 1976, and this law established the FMS (Gilman et al., 2014). International Traffic in Arms Regulations (ITAR) manage the review, licensing, and regulatory requirements for defense equipment (DSCA, n.d.). In Appendix 1 of the SAMM, the DoD categorizes defense equipment requiring special export control as significant military equipment (SME) (DSCA, n.d.). Additionally, items with R&D costs exceeding $50 million or total production costs of over $200 million are classified as major defense equipment (MDE) (DSCA, n.d.). The SAMM also outlines the practical management guidelines related to the FMS (DSCA, n.d.).

The next section outlines the rules for governing the U.S. government's conduct of FMS. The President and DoD must obtain approval from the U.S. Congress before

implementing FMS (Lucas & Vassalotti, 2020). The number of days required for this notification to Congress varies depending on the country of origin of the defense equipment, etc. Specifically, the number of days required for notification to the U.S. Congress is shorter for countries that are members of NATO, as well as Japan, Australia, the Republic of Korea, Israel, and New Zealand (DSCA, n.d.). Although the disapproval of the U.S. Congress has never prevented the President and the U.S. government from exporting weapons, the U.S. Congress does have a particular influence on the decisions of the President and the U.S. government (Lucas & Vassalotti, 2020).

2. The process of FMS

The process of FMS is based on SAMM. The FMS implementation process begins with a letter of request (LOR) from a country that imports defense equipment from the United States. In preparing for the LOR, both the United States and the purchasing country admit the necessity of national security, external and internal threats, and capability gaps. The LOR is sent to the IA and DoS, with copies sent to the SCO, the U.S. Embassy, and the command (DSCA, n.d.). Once the IA has received the LOR, the FMS program will start. The U.S. government will then draw up an LOA in response to the LOR. The main point of contact with the foreign government is DSCA. The LOA is a legal document used by the U.S. government when selling defense equipment to foreign governments, as stipulated in the AECA. Once the LOA has been implemented, a formal tender will be made by the U.S. government.

There are three types of FMS programs, as shown in Figure 6 (DSCA, n.d.). The first type is a defined order case. This case is a specified defense article and services identified. Mainly, IA develops LOA data and prepares requests. The second type is a blanket order. This case is a general category of material and services. The partner countries determine the case value. The third type is a cooperative logistics supply arrangement (CLSSA). In this case, the DoD can procure stock in anticipation of demand, and partner countries can acquire defense equipment in the DoD's logistics system.

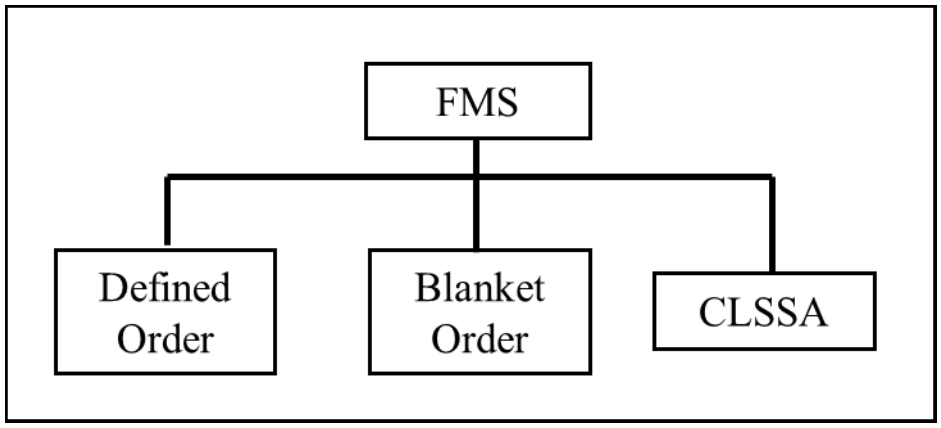


Figure 6. Three types of FMS programs. Adapted from DSCA (n.d.).

The advantage of FMS is that the U.S. government conducts bidding with U.S. defense-related companies based on funds that have been transferred in advance from the purchasing country (Gilman et al., 2014). And, regarding coordination between governments, the government agency represented by the IA conducts the coordination (Gilman et al., 2014). Therefore, defense-related companies do not need to incur coordination costs with the purchasing country. Additionally, in some cases, FMS is approved for defense equipment that has not been approved for sale under DCS, which is also a significant advantage (DSCA, n.d.).

3. Direct Commercial Sales

DCA is based on the same law as FMS, but the difference between DCS and FMS is government support. DCS is carried out under AECA and ITAR in the same way as FMS (Kerr, 2023). To carry out DCS, defense-related companies must obtain a license from the Office of Defense Trade Controls of the U.S. Department of State for the export of defense equipment (Gilman et al., 2014). The main difference between DCS and FMS is that DCS does not involve the U.S. government in the export of weapons. Therefore, defense-related companies can achieve more flexible and speedy transactions in weapons export contracts. However, because it is not a government-to-government transaction, there are also the following disadvantages. Foreign transactions for defense equipment are complex, and each coordination may be difficult. There is also uncertainty such as a lack of funds in the purchasing country or readjustment of quantities. In FMS, which is a

government-to-government transaction, defense-related companies do not bear these risks (Kodaira, 2022).

The U.S. government and DoD take a neutral stance when it comes to whether partner countries should use FMS or DCS when purchasing defense equipment. Also, certain defense equipment items are restricted to FMS only for security reasons, so there are also defense equipment items that cannot be purchased through DCS (Kerr, 2023). In addition, the U.S. Congress does not allocate a budget to FMS, so the U.S. government just supports the process of FMS for national security. Therefore, whether FMS or DCS is better is not something the U.S. government recommends to buying countries.

4. Previous Research about FMS

This section introduces previous research about FMS. Former researchers analyzed FMS as economic and national security viewpoints (Arepally, 2016; Evans, Frederick, & Scott, 2014; Gilman et al., 2014; Kodaira, 2022; Vannoy, 2013). From the standpoint of national security, FMS contributes not only to the U.S. security but also to other countries' national security by enhancing defense capabilities (Vannoy, 2013). Then, in the economic aspect, the U.S. defense companies enlarge the external market through FMS, so FMS develops the U.S. defense industries' economic health (Arepally, 2016). The U.S. Government Accountability Office (GAO), however, observed that FMS was not enough to make a benefit for the United States due to both economic and national security (Bair, 2019; United States General Accounting Office, 1999; U.S. General Accounting Office, 1998). The focus points of FMS are economic benefits and contribution to national security.

a. The economic advantage of FMS

Previous researchers have analyzed the economic impact of FMS, its effectiveness, and strategies to increase FMS efficiency. The GAO recommends rectifying the FMS process, but the economic impact of FMS is positive due to cost avoidance and cost reduction (Allen et al., 2015; Arepally, 2016; United States General Accounting Office, 1999; U.S. General Accounting Office, 1998). In general, cost avoidance refers to actions aimed at minimizing anticipated future expenses, while cost

reduction involves measures taken to lower the actual costs associated with achieving a specific goal (Allen et al., 2015). Through case studies, some researchers showed that cost avoidance and cost reduction are increased or decreased by four factors: economies of scale, sustainability, production line gaps, and international cooperation partners. They also pointed out that government procurement strategies lack specificity in the process of considering overseas sales (Allen et al., 2015; Arepally, 2016).

FMS has not only good points for the U.S. economy. In the past, recommendations by GAO, for example, FMS has had problems with administrative costs, underestimation of cost, and inadequacy of EUM (United States General Accounting Office, 1999; U.S. General Accounting Office, 1998). However, FMS contributes to the health of the U.S. economy due to economic scale, learning curve in manufacturing, and increasing distribution channels, although FMS has different problems. Furthermore, FMS allocates all management costs paid by partner countries to the United States, thereby eliminating any burden on U.S. taxpayers.

FMS leads to a decrease in the risk of defense industries to modernize. This is because the U.S. government could offer contracts to defense industries when defense companies operate modernization (Vannoy, 2013). In particular, FMS is beneficial for the cost of research and development (R&D) (Arepally, 2016). Some researchers state that it is important to utilize FMS capital to contribute to military modernization effectively (Vannoy, 2013). Therefore, in the preliminary stages of the LOR with partner countries, the U.S. government should match exported defense equipment with the defense equipment that the U.S. military is planning to modernize (Vannoy, 2013). The agreement will contribute to the concentration of capital investment and labor in defense-related companies and will ultimately lead to a reduction in the unit price of defense equipment procured by the U.S. military and a reduction in the risk of modernization (Vannoy, 2013).

The DoD should consider FMS at an early stage in the defense equipment acquisition program to improve the effectiveness of FMS (Evans, Frederick, & Scott, 2014). According to DoD 5000.02, in the Adaptive Acquisition Framework (AAF), some checklists adapt to FMS or not (DoD, 2020). However, the AAF check may not be

sufficient to consider FMS. This is because program managers tend to avoid the risk of export to improve the probability of the program's success in the stage of AAF (Evans, Frederick, & Scott, 2014). Even if the DoD plans to operate joint development, the DoD should consider whether the program could adapt to FMS or not, in order to acquire the utilization of a common production base (Evans, Frederick, & Scott, 2014). There are some concerns about exporting technology, but program managers could mitigate risk by separating different modules (Evans, Frederick, & Scott, 2014).

b. The national security advantage of FMS

The FMS's advantage of national security is based on the Security Assistance program. Through operating FMS, the U.S. government can create relationships with foreign countries, enhance the credibility of the U.S. government, and improve interoperability (Arepally, 2016). According to the National Defense Industry Strategy, the U.S. defense industries lack the ability to produce the required defense equipment and stockpiles (DoD, 2022). Therefore, even if FMS creates offsets, foreign production bases would work effectively for U.S. defense resilience. In addition, the U.S. military is deployed all over the world, so existing available foreign production bases are beneficial for the United States in terms of national security (DoD, 2022). For example, U.S. warships and some aircraft can be repaired in Japan, but the U.S. military needs repair parts from defense industries. If there were defense companies acquiring technology or licenses from U.S. defense companies, the U.S. military could save on maintenance downtime. As a result, FMS contributes to national security by improving resilience.

C. SUMMARY

This chapter explained Japan's history and the U.S. FMS system for research. Based on Japan's defense expenditures, economic trends, and changes in arms export legislation, the feasibility of arms sales is more relevant than ever. However, Japan's defense industries have been hesitant to increase arms exports due to the low dependency on defense expenditures. In addition, domestic defense capabilities require the success of the defense industry to maintain and improve Japan's military resilience (MOD, 2024b).

With these points in mind, previous researchers have recommended the necessity of arms exports for Japan (Hattori, 2023; Kodaira, 2022).

Next, this chapter reviewed the U.S. FMS system to identify the system required if Japan were to adapt. The FMS is based on the Security Assistance Program, and multiple organizations are related to FMS. The law of FMS is not different between the United States and Japan (DSCA, n.d.; The Government of Japan, 1949). Therefore, Japan's government needs to build up support organizations in the MOD for adapting FMS. Previous research clarified the positive economic impact of FMS and provided recommendations.

Chapter III introduces the methodology of analysis and the research approach, such as comparative analysis. The purpose of this study is to determine the effectiveness of adapting the U.S. FMS system within Japan to improve the economic health of the defense industry. Chapter III presents quantitative research by adapting the U.S. FMS to Japanese defense equipment. This research selects the F-35 program and Japan's Future Frigate Multi-mission (FFM) effort to analyze the economic benefits of FMS.

III. METHODOLOGY

This chapter outlines the research approach and case selection. This research aims to evaluate the effectiveness of FMS and identify its features and concerns. To achieve this, the research approach is a comparison of the various aspects of FMS. The first section explains the research methodology, including the process and types of data used for comparison. The second section justifies the case selection, focusing on defense equipment and country-specific characteristics. Finally, the third section introduces the process of analysis used in this research.

A. RESEARCH APPROACH

This research uses comparative analysis to support findings logically with both quantitative and qualitative data. In general, a comparative analysis is used to strengthen theories (Eisenhardt & Graebner, 2007). Furthermore, a comparative analysis allows researchers to identify the correlations and differences in case studies (Hayford, 2021). This research uses the characteristics of countries and the difference types of arms exports as qualitative data. For quantitative data, this research examines the results of the U.S. FMS case and Japan's defense expenditures.

1. Quantitative Data

This research uses quantitative data to confirm the economic health of U.S. FMS in Japan. The U.S. Congressional Budget Office (CBO, 1976) has stated that the benefit of FMS is cost savings. In addition, previous researchers have shown the effectiveness of FMS's cost savings and cost avoidance (Allen et al., 2015; Evans et al., 2014; Arepally, 2016). Although the CBO report is from 1976, its conclusions remain relevant today. This research analyzes "R&D recoupment, learning curve effects, and economies of scale" as quantitative data (DoD, 2024; Jaber, 2011; GAO, 2023). Specifically, this research assesses the benefits of Japan adopting a U.S. FMS-like system by estimating R&D recoupment.

a. Learning Curve Effects

The learning curve effect suggests that costs or production time decrease at a predictable rate as production volume increases (Yelle, 1979). According to Wright, who first introduced the learning curve effect in 1936, doubling production volume reduced time per unit by 20% (Cunningham, 1980). The cost reduction rates range from 60%–90%, and human-based manufacturers have higher cost-reduction rates than machine-based manufacturers do (Cunningham, 1980). Previous research concluded that some arms exports enhanced learning curve effects, but not in all cases (Allen et al., 2015; Evans, Frederick, & McConnell, 2014). Chapter IV examines the application of the learning curve effect on Japan's defense equipment to assess the economic advantages of FMS.

The DoD recognizes the learning curve effect as a key benefit of FMS because of cost reductions in large-scale defense programs to increase production efficiency (Arepally, 2016). For example, the learning curve effect was used to explain the cost savings of the F-35 program. The F-35 development program involves the participation of many countries (Department of the Navy, 2023). Lockheed Martin projected that F-35 programs would achieve production cost savings through increased efficiency by higher production volumes, including those from FMS (GAO, 2019). The next chapter evaluates the economic benefit of FMS using J.R. Crawford's model of the learning curve effect as one indicator (Jaber, 2011; Liao, 1988). While Crawford's model is based on incremental unit cost, Wright's model is based on a cumulative average (Liao, 1988). Since this research uses incremental unit cost for its analysis of the DoD, the next chapter adopts Crawford's model (Liao, 1988).

b. Economies of Scale

Economies of scale occur when production increases to a level that enables companies to reduce their costs. The difference between the learning curve and economics of scale is what variables lead to increased production (Allen et al., 2015). This research provides cost savings on fixed costs and R&D costs due to economies of scale. This analysis clarifies the effectiveness of FMS in Japan.

In Chapter IV, economic sizes are estimated based on past arms exports of countries that were likely to participate in FMS. This research assumes that Japan is successful in military sales to Australia. This is because Australia stated its intentions to import from Japan in the past (MOD, 2024a).

2. Qualitative Data

This research uses qualitative data to enhance the logic of analysis, focusing on laws, organizations, and characteristics. This research conducts a comparative analysis of national defense acquisition strategies, comparing factors such as defense policy and the domestic defense market. Chapter IV presents findings on whether Japan should prioritize FMS or DCS. Additionally, the next chapter analyzes the factors influencing FMS, including four countries in defense acquisition strategies. In general, researchers analyze qualitative data with their interpretations (Hayford, 2021). This research analyzes the viewpoints of the domestic market, defense dependency, and government support for arms exports. The next paragraphs explain these viewpoints.

Chapter II provided a background on Japanese defense spending and related arms export laws. Although the Japanese government has maintained stable defense spending since the 1950s, it has decided to increase defense capabilities in response to external threats (MOD, 2024c). To accomplish this, the MOD spent Japan's defense budget on imported defense equipment because of shortcomings in the country's defense industry capabilities (Ito & Kurumizawa, 2024). However, over-reliance on imported defense equipment weakens Japan's domestic defense industries and reduces its bargaining power in the international defense market (DoD, 2022; MOD, 2024a). Additionally, dependency on imported equipment exposes Japan to supply chain vulnerabilities, as Japan would hold more bottlenecks. According to Porter's Five Forces, Japan's domestic defense market has low competitiveness due to a limited number of suppliers and buyers (Timlon, 2023). However, domestic defense industries did not increase their defense departments even after Japan's government increased defense expenditures due to limited defense production(Ito & Kurumizawa, 2024). To strengthen the domestic defense industry and enhance economic resilience, Japan's government implemented policies to expand the defense market and provide increased support for defense industries (MOD, 2024a).

To conduct a qualitative analysis, this research uses three key indicators: domestic market, defense dependency, and government support for arms exports, including the national security framework. These factors were selected because Japan's defense industries have historically faced growth constraints due to regulatory restrictions and limited defense market demands (Nishikawa, 2024). In addition, this research assumes that defense dependence and government support influence military sales and arms exports based on Japan's recent results of arms exports.

B. DATA SELECTION

This section explains the choice of data and the focus of the research. This research examines country-specific data, the U.S. FMS system, and Japan's defense equipment to evaluate the feasibility of adapting the U.S. FMS system to Japan. Additionally, this research explores the factors of arms exports by analyzing how the unique characteristics of each country influence arms exports.

1. Case Study

This research examines the economic benefits of Japan's arms exports through a case study. The case study examines the F-35 program in the United States and Japan's future frigate multi-mission (FFM) and submarine programs. The analysis clarifies how much R&D costs the U.S. FMS imposes on partner countries in the F-35 program. The F-35 program analysis is based on GAO data and DoD public reports. FFM and submarine data based on MOD and Acquisition Technology and Logistics Agency (ATLA) public reports are also examined. Next, the case study estimates the cost to Japan if the country adopts the U.S. FMS system. Furthermore, the case study assesses the economic impact of FFM and submarine exports, assuming sales to Australia. The reason for selecting Australia for the case study is the strong security relationship the two countries share and the high likelihood of Japan therefore securing military sales to Australia (Bergmann, 2024).

2. Comparative Countries

This research chooses the United States, France, and Germany as comparative countries. Among the top 10 defense equipment exporters, these countries are selected for

their relevance because the United States and France have government support for military sales, and Germany and Japan have the same historical background. (SIPRI, n.d.). Specifically, this research evaluates these countries' domestic markets based on defense expenditures and the scale of the countries' defense industries. Additionally, defense dependency and government support are assessed using data on defense companies involved in arms exports and national policies.

Japan's defense expenditures are comparable to those of the selected countries, except for the United States (SIPRI, n.d.). However, Japan lags significantly behind these countries in arms exports. To address this problem, Chapter IV analyzes the similarities and differences between the countries to identify the factors related to Japan's limited arms exports. Furthermore, this analysis provides recommendations based on successful arms export policies from each country.

C. ANALYSIS APPROACH

Chapter IV details the economic impact of adopting the U.S. FMS in Japan. The analysis approach of this research examines economic effectiveness in a step-by-step manner. The two primary ways to export defense equipment are FMS and DCS, excluding grants. The first step of the analysis examines whether Japan prefers FMS or DCS, based on its history and legal framework, after identifying constraints on its defense capability. The second step identifies key factors influencing arms exports by analyzing international characteristics. The third step analyzes the economic benefits of Japan adopting the U.S. FMS through a case study.

D. SUMMARY

This chapter explained the research approach and case selection. This research primarily employs two types of analyses: quantitative and qualitative. For quantitative analysis, this research utilizes data from public and government reports from the DoD, GAO, MOD, ATLA, and others. The quantitative analysis also examines case studies to assess the economic effectiveness of adapting the U.S. FMS for Japan. Furthermore, the next chapter analyzes qualitative data on the F-35, FFM, and submarines, focusing on the

learning curve and economies of scale. In this qualitative analysis, this research relies on military sales information from open data sources, including SIPRI and Janes.

The first step analyzes the constraints on Japan's defense capability based on a literature review. The second step provides the qualitative analysis and identifies the factors to affect military sales by comparing Japan's situation with other countries. Furthermore, the qualitative analysis determines whether it is better for Japan to choose FMS or DCS. Finally, the economic effectiveness of military sales for Japan is analyzed. Although previous research insisted on the necessity of military sales, it has not confirmed the economic benefits of those sales. Therefore, this research examines the effectiveness of military sales in strengthening the economic health of Japan's defense industry.

IV. ANALYSIS AND FINDINGS

This chapter first examines the constraints and structural factors affecting the economic health of Japan's defense industrial base. It then presents a qualitative analysis comparing Japan with other countries to evaluate whether FMS or DCS would be more appropriate. Finally, this chapter provides a quantitative analysis based on the F-35 program in the United States to estimate the potential economic benefits of adopting an FMS model.

A. THE CONSTRAINTS OF DEFENSE CAPABILITY IN JAPAN

This section presents defense capability constraints in Japan and the necessity of arms exports for the country. Utilizing Japanese history, government reports, and previous research, this research identifies the three main factors of defense capability in Japan: budget, legal system, and defense industry (Nishikawa, 2024). After WWII, Japan faced the historical barrier of government involvement with the military (Kita, 2017). The historical barrier stems from strong anti-war public opinion, which was based on experiences of wartime tragedy and a deep-seated distrust of the military. These historical factors led to the development of the three specific factors impacting Japan's defense capability, as shown in Figure 7. Although these three factors still exist in Japan, the Japanese government has made efforts to address them in response to the necessity of improving the country's defense capability in a strict national security environment (House of Councilors in Japan, 2017; MOD, 2024a, 2024b).

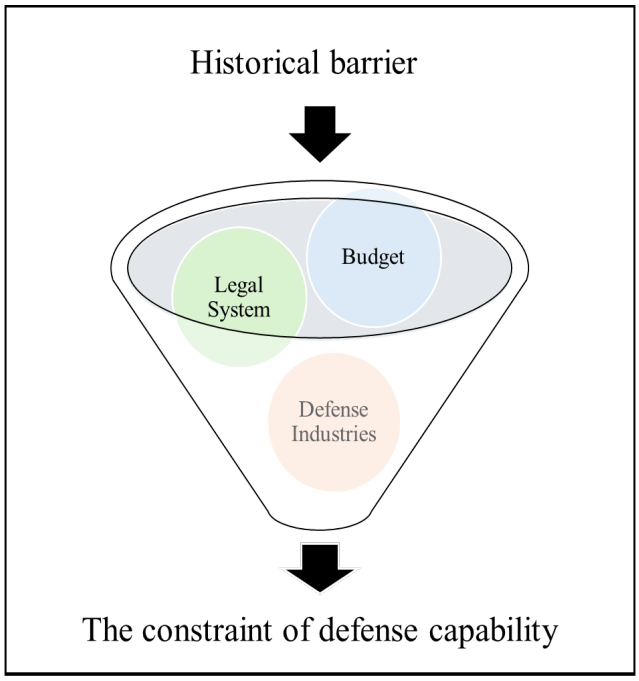


Figure 7. The constraint of defense capability in Japan

To strengthen Japan's defense policy, the Japanese government has overcome factors related to the budget and the legal system. Specifically, to enable an increase in the defense budget, the Japanese government removed the restriction that limited defense expenditures to 1% of GDP. Moreover, the Japanese government revised the legal framework for arms export to enhance sales feasibility and efficiency (Nishikawa, 2024; The Government of Japan, 2023; Watanabe, 2022). As a result of these measures, the MOD expects to improve its defense capability. However, Japan's defense industries continued to struggle with competitiveness and production capacity, forcing the MOD to remain dependent on imported defense equipment (Ito & Kurumizawa, 2024). Consequently, the increase in the defense budget did not contribute to the economic health of the domestic defense industries, as import spending continued to be a financial burden. The economic health of defense industries is linked to key defense capabilities, including the supply chain, readiness, and bargaining power (Cabinet Secretariat in Japan, 2022; DoD, 2022). Therefore, while the Japanese government successfully addressed budgetary and legal factors, challenges in strengthening the defense industries' competitiveness persist (MOD, 2024a).

Next, this section analyzes Japan's defense industries from the MOD and MOFA public information and previous research shown in Chapter II. Japan's defense industries hold characteristics that hinder the country's defense capability. Figure 8 represents the cause and effect of the characteristics of Japan's defense industries. This research finds mainly four factors impacting Japan's defense capability: the low scale of production, the low economic benefit, the reputation risk, and the barrier to entering defense markets. At present, Japan's government has addressed the low economic benefit and the barrier to entering defense markets. For example, the MOD provides grants to defense industries to offset investment costs and adopted a new evaluation system for calculating profit that includes the quality, cost, and delivery evaluation system (ATLA, 2023b; MOD, 2024a). In addition, previous research examined the influence of reputation risk on defense industries and found that it had no significant impact (Muramatsu, 2017; Okawa, 2016). Therefore, three out of the four main reasons for the cause and effect of the characteristics were resolved. This research, therefore, focuses on the low scale of production as the primary characteristic that restricts Japan's defense capabilities. Moreover, low dependency in defense industries is derived from the small domestic market. The root cause of the constraint on defense capability from Japan's defense industries is the small domestic market, and Japan's government requires enlarging the domestic defense market as the next step to strengthen the country's defense capability.

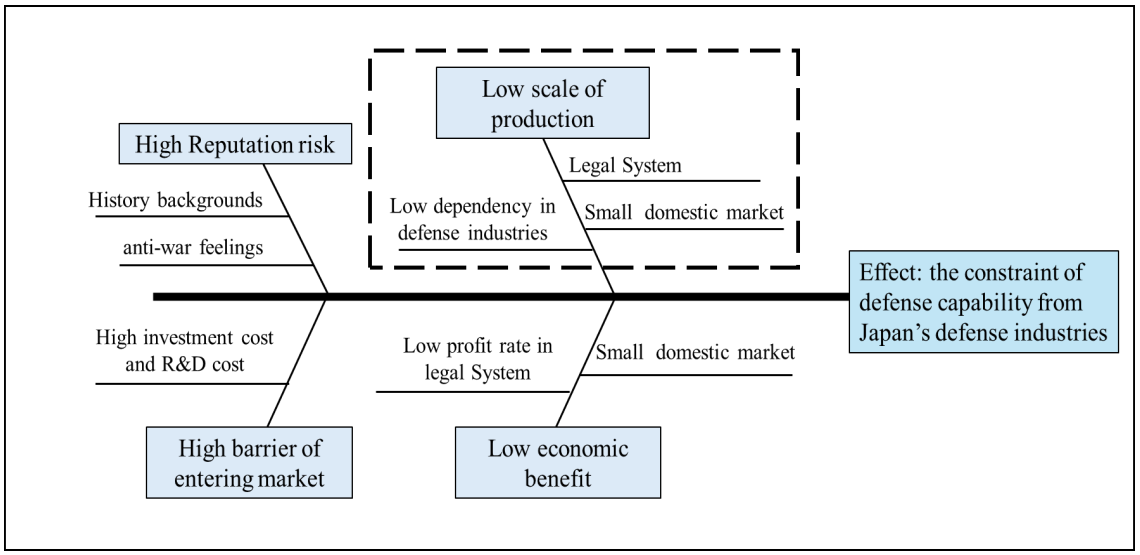


Figure 8. The cause and effect of Japanese defense capabilities from the defense industries. Adapted from ATLA (2023a), Kubota (2010), Muramatsu (2017), Nishiguchi & Morimitsu (2020), Nishikawa (2024), and Okawa (2016).

B. FMS VS. DCS

The next step in the analysis examines whether FMS or DCS is best for Japan to expand its domestic defense market. The U.S. government uses both FMS and DCS for arms exports. This section compares the factors between FMS and DCS to determine the best practice for Japan. The main difference between FMS and DCS is government involvement. In addition, the delivery of DCS is generally faster than that of FMS (Kerr, 2023). For instance, Japan acquired amphibious combat vehicles from the United States with DCS in 2024 (MOD, 2024a). This is because the MOD emphasized schedule over other priorities and wanted to quickly strengthen the defense capability of isolated islands (MOD, 2024b). Therefore, the advantage of DCS is delivery speed and flexible contracts without government support, while the advantage of FMS is the credibility of government support and the same packages of the DoD.

Although DCS offers significant advantages, Japanese defense industries may be exposed to major risks by engaging with foreign governments without government support. For example, Lockheed Martin Corporation (2023) recognizes that contracts with other governments, including the U.S. government, are a risk factor. As Chapter II has shown, Lockheed Martin has a high dependency on defense contracts. In addition, the British company BAE Systems (2023) states in its annual report that the main risk of

relying on defense contracts is that dealing with government customers is unstable for the economic health of the company. BAE Systems' dependency on defense contracts is 98%, and this dependency is the highest among the top 10 defense companies in 2023 (SIPRI, n.d.). Therefore, negotiating with foreign governments without government support is the main risk even for defense companies with high defense dependency. Specifically, the risk of contracting with government customers without government support can be categorized into three points: change in government policy, contract modifications and fluctuations, and investment risks in production lines (Arepally, 2016). Major Japanese defense industries have a low defense dependency, so these companies must consider whether they can assume these risks.

In the United States, the amount of DCS is greater than that of FMS (Badhwar, 2025). As indicated in Chapter II, the defense companies in the United States are highly dependent on defense contracts, considering revenues from defense contracts (SIPRI, n.d.). On the other hand, Chinese companies are completely controlled by the government when conducting business with foreign countries. According to SIPRI (2025) data, China is the world's fifth-largest exporter of defense equipment. However, the Chinese defense companies, which were among the top 20 defense industries in 2023, are an average of 28% (SIPRI, n.d.). The comparison between the United States and China suggests that defense enterprises with a high defense dependency may be willing to accept the risk of contracting with foreign governments, while companies with low defense dependency may not accept such risk without government support. In short, the risk of engaging in contracts with foreign governments without government support is higher for companies with low defense dependency than it is for companies with high defense dependency. For private companies with low reliance on defense-related benefits, accepting such risk without government support is not feasible. Therefore, this analysis suggests the assumption that countries having defense industries with low defense dependency should weigh in support of defense industries to increase their defense markets. This analysis finds that defense dependency can influence whether to choose FMS or DCS, as shown in Figure 9. Japanese defense industries are low dependency, so FMS is more optimal for Japanese defense industries than DCS is. This finding is examined by comparing qualitative data from other countries in the next section.

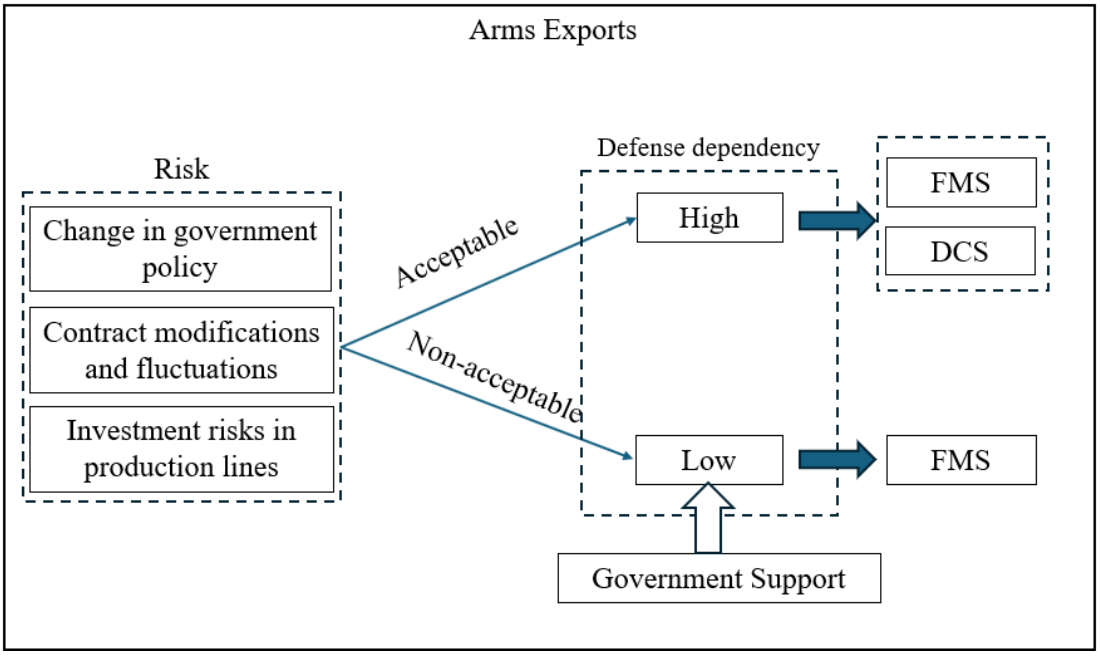


Figure 9. The effect of defense dependency on the choice of FMS or DCS.

C. COMPARATIVE ANALYSIS

This section provides a comparative analysis of key arms-exporting countries—namely the United States, France, and Germany—using three analytical dimensions: historical background, legal framework, and the scale of the defense market. Japan's defense capability is shaped by these three factors, as shown in Figure 7. In Chapter II, this research examined how Japan's history and legal system have influenced its defense policy, including reforms in legal systems for arms exports and defense expenditures. To clarify the barriers to Japan's arms exports, this analysis focused on the top countries that sold military equipment, comparing the United States, France, and Germany. To systematically compare these countries, the next section analyzes them in the following order: history, legal system, and scale of the defense market. The first case study focuses on the United States, the world's largest defense market and a key player in the global arms trade.

1. The United States

This section analyzes the history, legal framework, and defense industry market to compare U.S. arms exports.

a. History

In the United States, the trend of defense expenditures followed a similar movement to other countries from WWII to the end of the Cold War (Luke, 2024). By the 1940s, the United States had not yet developed a large defense industrial base (DIB), as the government was prioritizing commercial markets (Luke, 2024). However, the necessity of a strong DIB became evident when the United States entered WWII, leading to a significant expansion in defense spending, which surpassed $1.4 trillion in constant FY2025 estimates (Luke, 2024). During the Cold War, sustained defense expenditures supported the growth of the defense industry. However, after the Cold War, as defense spending became a lower priority, the U.S. government encouraged consolidation within the defense sector (Kubota, 2010). By 2015, five companies—Boeing, Lockheed Martin, Northrop Grumman, Raytheon, and General Dynamics—dominated the industry (refer to Appendix C; Office of the Under Secretary of Defense for Acquisition and Sustainment, 2022; Sankar, 2024). A similar trend of declining defense expenditures and industry consolidation was observed in France, Germany, and the United Kingdom (Hattori, 2023).

The United States differed somewhat from these other countries, however, in that it continued to prioritize defense capabilities as part of its national security strategy in an effort to maintain global security(Janes, 2025b). Therefore, the United States has maintained its position as the country with the biggest defense capability (SIPRI, n.d.). In short, operation-related defense industries have historically been supported in the United States, but antiwar sentiment has occasionally appeared, such as during the Vietnam War (Hall, 2004). Based on this information, in the United States, there are no historical factors against arms exports and public opinion toward military industries is generally positive. These historical factors indicate that the United States has consistently prioritized maintaining a strong defense industrial base, which has facilitated its arms export policy. Unlike Japan, where legal and political restrictions have limited arms exports, the U.S. government has actively promoted defense sales through both government and commercial channels.

b. Legal System

This research presented the U.S. legal system and organization related to arms exports in Chapter II. The U.S. legal process is similar to that of other countries in two different ways. First, the government complies with ITAR, which regulates arms exports from a national security viewpoint. Unlike countries where arms exports are restricted by public sentiment or parliamentary constraints, the U.S. system allows for proactive promotion through its inter-agency collaboration, such as between the DoD, DoS, and DSCA. Second, there is a domestic debate about the impact of arms exports on national security. After these two steps, the government or military companies begin to negotiate contracts. Other countries follow a similar process.

This analysis focuses on the legal system related to arms exports. Although the U.S. government does not involve itself in the choices of partner countries regarding either FMS or DCS, the U.S. Congress has the power of decisions on arms exports, and the DoD supports negotiations with partner countries (Gilman et al., 2014). This positive attitude toward military sales is evident in the inclusion of the arms export review process in the U.S. AAF (Office of the Under Secretary of Defense for Acquisition and Sustainment, 2020). Additionally, the U.S. government oversees the organizations related to military sales. Specifically, the DoD provides comprehensive support to partner countries in FMS cases, and each branch has its own FMS organizations, such as the Navy International Program Office (NIPO) (Allen et al., 2015; DSCA, 2012; Lucas & Vassalotti, 2020). For instance, NIPO supports the government's contracts to smooth the FMS process. Therefore, the United States has the legal system, organizations, and acquisition systems in place to support arms exports.

c. The Scale of the U.S. Defense Market

In this research, the defense market scale is defined as the total economic size of the defense sector, which includes defense industry revenues, defense expenditures, and the number of military personnel. This definition assumes that these three factors collectively represent the scale of the defense market and influence a country's ability to export arms. Based on this definition, this research conducts a comparative analysis to

examine how the defense market scale differs among France, Germany, and the United States.

The U.S. defense industry has demonstrated a high level of dependency on revenue from defense markets, largely due to consolidation following the post–Cold War era (refer to Appendix C). Past research has sought to determine whether this consolidation is an advantage or a disadvantage. Some researchers have found that consolidation contributes to improving efficiency in defense industries, while others argue that this consolidation degrades competition in the defense industries (Kubota, 2010; Sankar, 2024). For example, by consolidating the domestic defense industry, defense companies can eliminate the need for the same factories and infrastructure. Additionally, government contractors may benefit from reduced administrative burdens due to integrating with private companies. However, from the perspective of arms exports and the defense industry, an elevated level of defense dependency limits the options for companies to utilize their resources and encourages them to maintain a strong presence in the defense industry. Figure 10 illustrates the top 10 defense revenues in the United States in 2023. The blue bar represents defense revenues in 2023, and the red line indicates the level of defense dependency. These companies' average defense dependency is 70%, while the top 100 global defense companies' defense dependency is 52.8% (refer to Appendix D) (SIPRI, n.d.). Therefore, the top 10 U.S. defense companies have a relatively high defense dependency, which enables the U.S. defense industry to accept the risk associated with foreign government contracts.

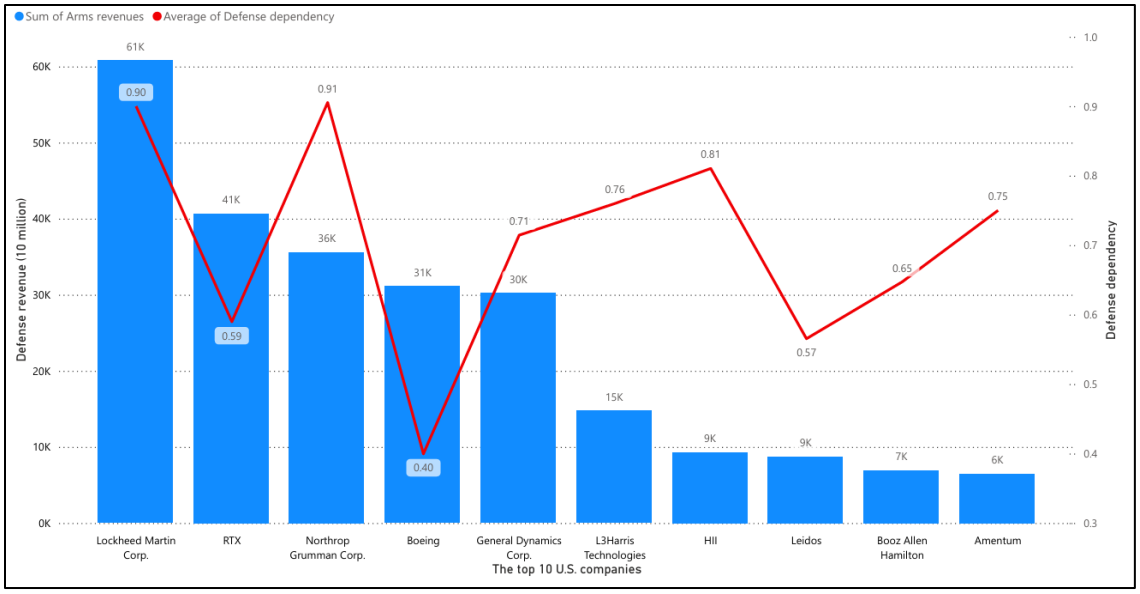


Figure 10. Top 10 U.S. defense companies in 2023 (defense revenue & defense dependency). Adapted from SIPRI (n.d.).

The following section analyzes the relationship between the number of military personnel and defense expenditures to confirm the scale of the defense market. The scale of the U.S. defense market is the largest in the world. Figure 11 shows the U.S. ratio of defense expenditure per GDP based on the SIPRI (n.d.) database. The ratio of U.S. defense expenditure per GDP remained over 3% after the post–Cold War period (SIPRI, n.d.). Furthermore, defense expenditure has continued to increase. Therefore, the scale of the U.S. defense market is sufficient in terms of expenditure and its ratio to GDP. Figure 12 provides the trend for U.S. military personnel, which shows that the number of U.S. military personnel decreased steeply after the Cold War and has continued to remain stable since then. Figures 11 and 12 indicate that the need for defense equipment declined after the Cold War, and as budgets decreased, the size of the military also decreased. While the size of the military itself has remained unchanged, the budget amount has been on the rise. Although the U.S. military is the third largest military in the world, to evaluate the size of the defense market, it is appropriate to consider that the size of the budget of the country in question has a more direct impact on the size of the defense market (refer to Appendix E; World Population Review, 2025). The high dependency on revenue from defense markets means that U.S. defense firms primarily cater to domestic

military demand. In addition, the size and stability of the defense budget enable companies to sustain large-scale production, which in turn supports arms exports.

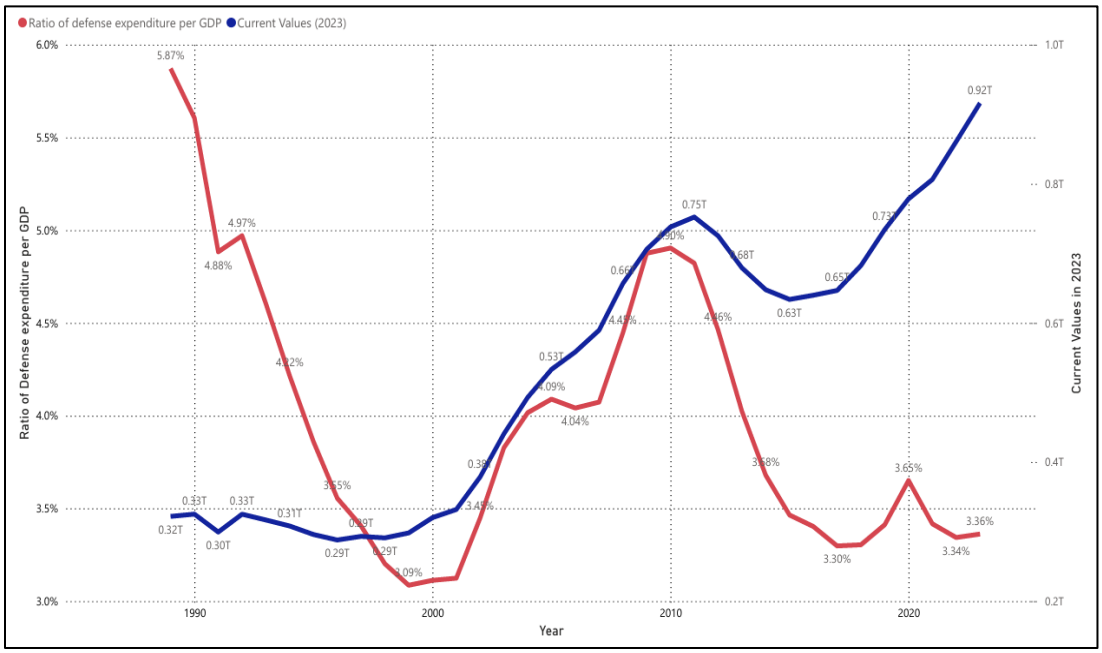


Figure 11. Ratio of defense expenditure per GDP and current value in the United States (2023). Adapted from SIPRI (n.d.).

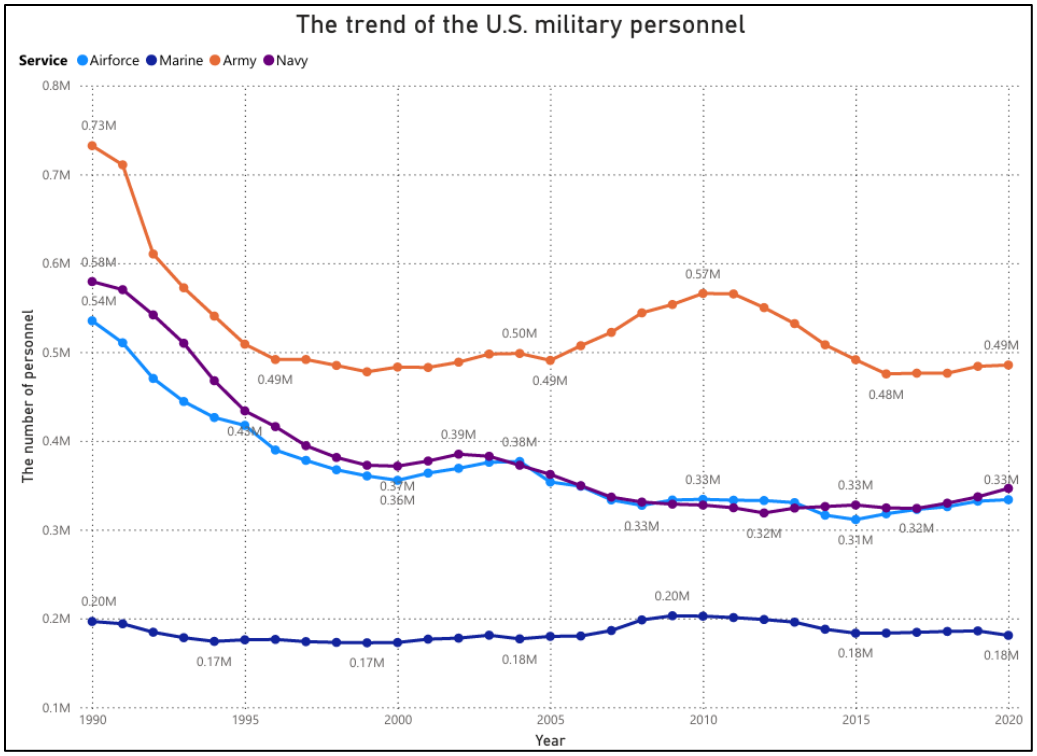


Figure 12. U.S. military personnel trends. Adapted from Defense Manpower Data Center (2025).

d. Evaluation

The United States has several positive factors for arms exports, including its history, legal system, and the scale of its defense market. Historically, the United States was one of the victorious nations in WW II. Additionally, the United States has created international value by deploying its military. These historical factors lead to the American public's positive evaluation of defense industries. In the U.S. legal system, the government has established systematic organizations based on detailed laws. Specifically, the U.S. government holds organizations in various roles: DoS, DoD, DSCA, and IA. Additionally, the U.S. government has enough organizations and personnel. For example, the DSCA has approximately 1,000 personnel (DSCA, 2025). Therefore, the U.S. legal system is a cross-functional organization with detailed support systems for arms exports. Examining the scale of the defense market, the United States has a high level of defense dependency and a large scale of arms exports relative to other countries. According to a Defense Archives analysis of the State Department, the amount of FMS is $200.8 billion and the amount of DCS is $318.7 billion (Badhwar, 2025). These three positive factors

allow the United States to encourage arms exports. In addition, the United States has supportive government organizations and high defense dependency. These factors contribute to high defense revenue from FMS and DCS in the United States. Particularly, this analysis predicts that the high defense dependency of the defense industry contributes to a large amount of DCS.

These three factors support the development of economic health in the U.S. defense industry. In the qualitative analysis, this research evaluates factors based on the results of the U.S. analysis. The three main factors are history, the legal system, and the scale of the defense market. The detailed factors are as follows: historical factors include whether the country was victorious in WWII, whether the country's citizens have anti-war sentiments and whether the country has experienced military coups. Next, the legal system depends on whether the government has a legal system and supportive organizations related to arms exports. Finally, the factor of the scale of the defense market is whether the country's major defense companies have a high level of defense dependency and defense expenditure as a percentage of GDP to evaluate the scale of the defense market. The United States' strong historical, legal, and economic foundations have made it one of the world's most influential arms exporters. These factors contribute to its ability to maintain a competitive and sustainable defense industry. The following section examines France and Germany, which have also played significant roles in the global arms market but operate under different historical and legal constraints.

2. Europe (France and Germany)

The primary difference between France, Germany, Japan, and the United States lies in the membership of France and Germany in the European Union (EU). EU membership subjects France and Germany to unique regulations and protection systems. Specifically, the EU has product safety regulations, and there are protection systems covering the EU member countries in the Common Agricultural Policy and the Geographical Indications Protection System (Tanaka, 2020). In addition, this research selects France and Germany due to their distinct historical and political backgrounds and the magnitude of their defense expenditures. This analysis focuses on three factors previously applied to the United States.

The EU is primarily based on a group of six countries that participated in the European Coal and Steel Community in 1951, including France, Germany, Italy, Belgium, and Luxembourg (Wada, 2011). The Treaty of Rome in 1957 established the European Economic Community and the European Atomic Energy Community, promoting economic integration in Europe. With the Maastricht Treaty in 1993, the group officially became the EU. By building up the EU, European countries enhanced their economic, political, and security cooperation. Despite its responsibility for European security, the EU was unable to prevent the Yugoslav conflict successfully (Shepherd et al., 2015). The EU's inability to deter the Yugoslav conflict indicated its security policy limitations, leading to the establishment of the Common Security Defense Policy in 1999 (Shepherd, 2015; High Representative of the Union for Foreign Affairs and Security Policy to the Council, 2024; Tanaka, 2020). This policy led to defining specific goals, such as the Helsinki Headline Goals, and creating institutions like the European Defense Agency in 2004 (High Representative of the Union for Foreign Affairs and Security Policy to the Council, 2024). Additionally, the EU has not only institutions and rules related to arms exports but also transparency and human rights regulations that may affect France and Germany. The following section applies the three factors analyzed in the United States to France and Germany. The differences between these two countries are examined, with a focus on their impact on arms export policies.

a. France

This section analyzes France's arms exports in terms of historical factors, the legal system, and the scale of the country's defense market. Specifically, France's arms export policy is relatively generous, while Germany's arms export policy is more restrictive. This difference stems from historical and political factors. The following section examines the three factors in detail.

(1) History

One of the most significant historical influences on France's arms exports is Charles de Gaulle's foreign policy after WWII (Béraud-Sudreau, 2020; Wada, 2011). In 1940, France was invaded and occupied by Germany. However, after the war, in 1958,

General de Gaulle became president, with the goal of restoring France's independence and dignity. Here, *independence* refers to the ability to act autonomously without external constraints, while *dignity* means engaging in international affairs without being influenced by other nations (Béraud-Sudreau, 2020). After WWII, France relied on the United States' support for rebuilding its defense capabilities. However, under de Gaulle's leadership, France pursued greater autonomy in defense and economic dimensions. One clear example of this policy was France's decision to develop its nuclear weapons. Instead of relying on the North Atlantic Treaty Organization's nuclear deterrent, France aimed to acquire its nuclear capabilities as a means of securing true independence (Béraud-Sudreau, 2020). As an extension of the country's foreign policy approach, the French government supported the improvement of the defense industry (Hattori, 2023). Moreover, unlike Japan, which has restricted arms exports due to anti-war sentiments, France's historical experiences of invasion reinforced its commitment to a strong national defense industry. This perspective might contribute to a generally favorable attitude toward arms exports within the country.

France also experienced military coup attempts in 1958 and 1961, known as the Algerian Crisis and the Generals' Putsch, respectively (Béraud-Sudreau, 2020). These events were acts of defiance against the French government's colonial policies. However, de Gaulle overcame these military coups by establishing the Fifth Republic and introducing a semi-presidential system in which power was divided between the president and the prime minister. This reform stabilized the political system, curbed military intervention in politics, and reinforced France's democratic foundation (Béraud-Sudreau, 2020). As a result, despite the attempted military coups, public trust in the government remained strong. There was no significant opposition to the government-led policies of autonomy and independence, and the impact of these events on arms exports was minimal.

(2) Legal System

The French government supports arms exports via its legal system. One of the key organizations influencing France's defense industry is the Delegation Ministerielle pour l' l'Armement (DMA), established in 1961 as part of the Ministry of Defense (Béraud-

Sudreau, 2020). The DMA later became what is now known as the Direction Générale de l'Armement (Béraud-Sudreau, 2020). This organization was responsible for procurement and policy coordination within the defense industry, playing a crucial role in shaping France's arms export policies. After its establishment, the DMA led a series of mergers within the French defense industry, successfully consolidating several defense companies in the 1980s. This process was similar to the consolidation efforts seen in the United States during the same period. However, there was a key difference between the two approaches: In the U.S. approach, the defense industry maintained competition among private defense companies, while in the French approach, the defense industry remained under government control, significantly limiting market competition (Wada, 2011). In other words, while the United States sought to preserve market competitiveness, France prioritized economic and industrial protection in pursuit of national autonomy. The DMA's policy encouraged and supported arms exports as a key economic strategy. The success of this approach is visible in the country's defense industry revenues. After establishing the DMA, French arms exports have continued to increase (SIPRI, n.d.).

Additionally, in 1965, France established the Direction des Affaires Internationales under the DMA to actively promote arms exports (Béraud-Sudreau, 2020). This organization, now known as the Direction Internationale (DI), collaborates with embassies and military attachés to negotiate with foreign governments and promote French defense equipment (Béraud-Sudreau, 2020). Notably, the DI is responsible for both approving and promoting arms exports. This system, which involves government organizations involved in military companies' contracts with foreign countries, differs significantly from those in Japan and the United States. In France, the Ministry of Defense oversees arms exports, with the Ministry of Foreign Affairs and the Ministry of Economy also participating in the approval process, but export promotion and regulation occur in multiple offices outside the Ministry of Defense. However, the Ministry of Defense remains the central authority in arms export decision-making, which contrasts with Japan's legal system. Moreover, under the Fifth Republic's semi-presidential system, the president holds primary authority over foreign policy and national security, meaning that the parliament has very limited influence over arms exports (Béraud-Sudreau, 2020). This French legal system is another key distinction from the United

States and Japan, where legislative bodies play a more active role in arms export policies. Furthermore, since the de Gaulle era, France's major political parties have generally supported arms exports, reinforcing the effectiveness of the government's export policies. The legal and institutional framework, involving multiple governmental bodies but limited parliamentary oversight, makes France's arms export policy highly effective.

It is clear from the French government's policies that it provides aggressive support for the country's defense industry. In particular, the French government has stock in defense companies and is able to exert influence on these companies; the French government holds 100% of Nexter stock, about 25% of Thales stock, and about 60% of Naval Group stock (Janes, 2025a). Finally, the French government operates a military sales system similar to the U.S. FMS. The difference between the French system and the U.S. FMS is that the French government does not have any obligations or guarantees for defense companies and partner countries (Hattori, 2023). To conclude, the French government clearly intends to support arms exports through government policy and investment in military companies.

(3) The Scale of the Defense Market

France's defense industry has been consolidated under government leadership to maintain national independence and dignity. The primary defense companies in France include Dassault Aviation, Thales, Nexter, Safran, and Naval Group (SIPRI, n.d.). The highest defense dependency is 98% of the Naval Group, and the average defense dependency is 55%. This average is comparable to that of the top 100 defense companies in 2023, indicating the success of the French government's support for the defense industry (SIPRI, n.d.). Figures 13 and 14 provide defense revenues and defense dependency in French primary defense companies. France's primary defense companies continue to maintain stable economic health, and the defense dependency is high in all companies except for Safran, which primarily builds aircraft engines for private aircraft.

Next, the French domestic defense market is stable according to the amount of defense expenditures and the rate of defense expenditures in GDP. The French defense expenditure is €47.2 billion, and the rate of defense expenditures in GDP is about 2% (Janes, 2025a). These standards are high for Europe (refer to Appendix F; Defense

Information and Communication Delegation, 2024). Most post–Cold War European countries shrank their defense spending, but France kept spending about 2% of its defense expenditures on the GDP. Therefore, the French government sustained the French domestic defense market.

The scale of the French military is about 200,000 active personnel and about 60,000 civilian personnel (Defense Information and Communication Delegation, 2024). In addition, the French government assigns 6,000–10,000 active personnel for homeland security, so the French government deploys almost all active personnel to international missions (Defense Information and Communication Delegation, 2024). Thus, the French government upheld Charles de Gaulle's foreign policy of maintaining military influence in international regions. Considering defense expenditures and the scale of its military, France has a large domestic defense market that is the second largest in the world thanks to the government's support (refer to Table 4).

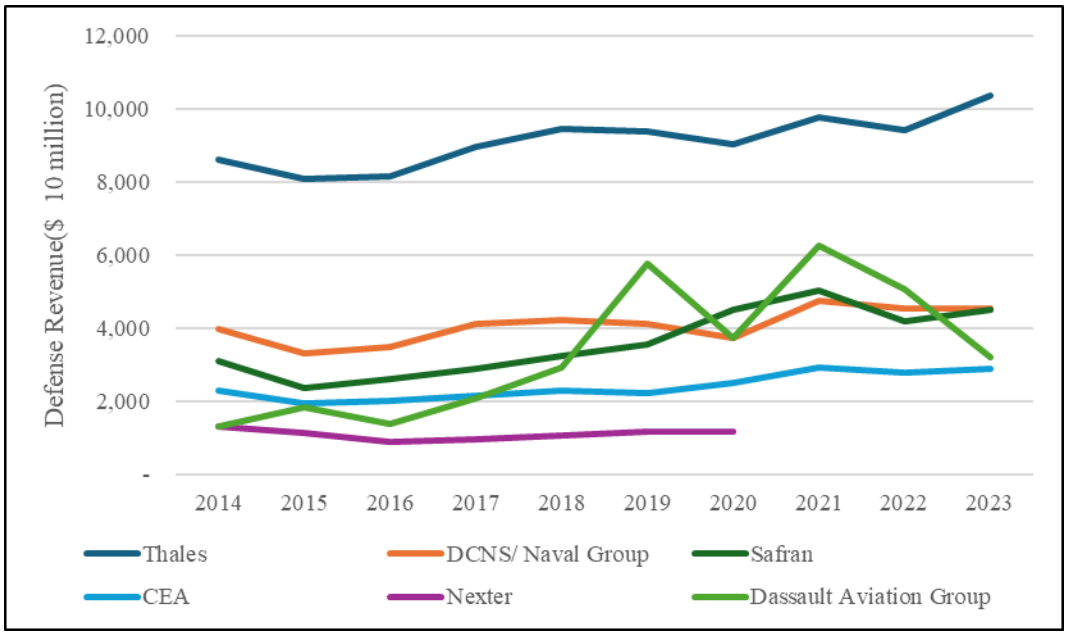


Figure 13. French defense revenue tendency. Adapted from SIPRI (n.d.).

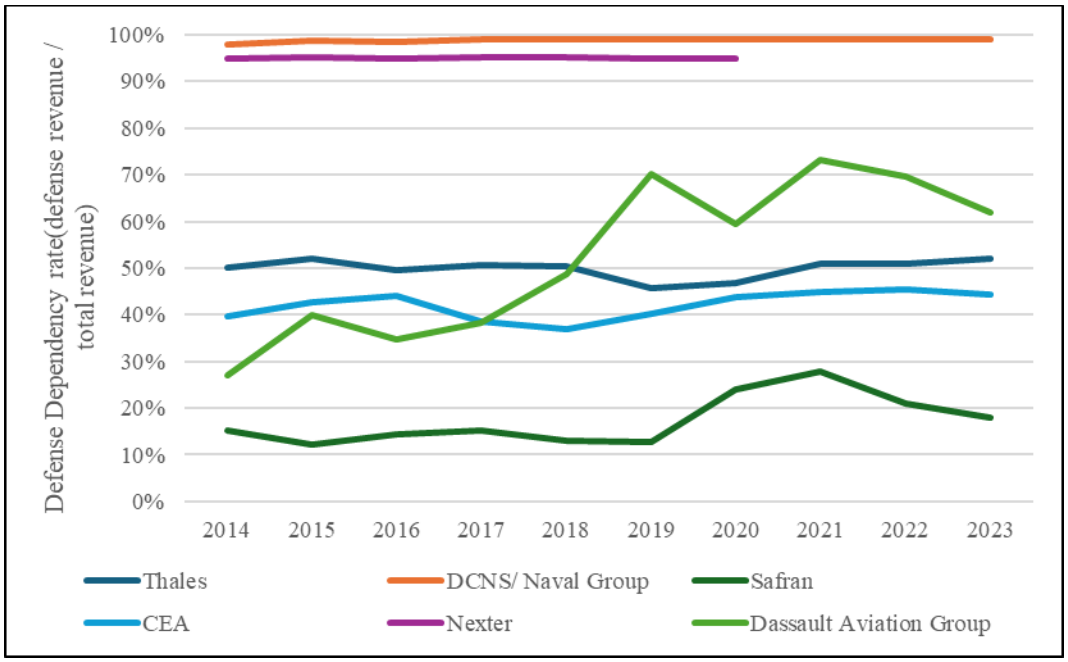


Figure 14. French defense dependency tendency. Adapted from SIPRI (n.d.).

b. Germany

Next, this section conducts a comparative analysis of Germany on arms exports as well as the United States and France.

(1) History

Similar to Japan, Germany has maintained an anti-militarist stance toward arms exports due to its historical experiences. Following the Cold War, Germany unified East and West under the Basic Law, originally enacted in 1949 (Hattori, 2023; Janes, 2025a). The traumatic legacy of WWII continues to influence Germany's passive approach to national security and arms exports.

According to Article 26 of the German Constitution, military actions, including arms exports, require parliamentary approval (Ito, 2019). Public sentiment also reflects this passive security stance. For example, when NATO proposed a defense spending target of 2% of GDP, some German political parties argued for a 1.5% cap, suggesting that anything higher could be seen as a return to militarism, given Germany's economic scale (Takashima, 2022). Furthermore, before Russia invaded Ukraine, 71% of the German public reportedly opposed supporting Ukraine militarily (Takashima, 2022).

These examples indicate that Germany's anti-militarism and cautious defense policies are deeply rooted in its historical experience of WWII.

(2) Legal System

The German government is adherent to EU law related to arms exports and is more restrained in arms exports than France is (Hattori, 2023). The German foreign policy has three principles. The first principle is pacifism, which means that Germany never launches a war. The second principle is multilateralism, and the third principle is humanism (Takashima, 2022). The German government executes arms exports based on these foreign policies. Additionally, the German rules about arms exports are the Arms Trade Treaty, War Weapons Control Law, and guidelines for arms exports (Ito, 2019). These rules stipulate the necessity of parliamentary examination in cases of the production and export of weapons. The German parliament examines arms exports strictly, so the German government does not support arms exports of defense companies aggressively. For instance, the Schmidt administration decided to export tanks to Saudi Arabia, but the German parliament denied Schmidt's decision. Therefore, the German legal system is well organized in its examination of arms exports, but it does not support arms exports.

(3) The Scale of the German Defense Market

Germany's defense market is considered relatively large in terms of both defense expenditures and the number of defense-related companies. The country is home to five of the world's top 100 defense companies by revenue and ranks as the fourth-largest arms exporter globally (SIPRI, n.d.). These indicators reflect the considerable scale of Germany's defense market.

Between 2014 and 2023, German defense companies maintained an average defense dependence of over 50%, a figure aligned with the global average for the defense sector. Major exports include weapons such as the Leopard 2 tank and Thyssen Krupp submarines, which are primarily supplied to NATO allies and Middle Eastern nations (Janes, 2025b). Figures 15 and 16 illustrate the trends in defense revenue and defense dependence among German defense firms. As shown, most companies have enjoyed

stable revenues over the past decade, except for ThyssenKrupp, which demonstrates a higher reliance on defense contracts. Germany's defense spending as a share of GDP had been in decline since the end of the Cold War. Viewing Russia as a potential threat, Germany adopted a strategy of addressing security concerns through NATO and EU cooperation (Janes, 2025b). However, since the outbreak of the war in Ukraine, the German government has significantly increased investments in military modernization. As a result, the defense budget is now on an upward trajectory, with Germany aiming to reach the NATO target of 2% of GDP (Janes, 2025b).

Although Germany has faced a persistent shortage of military personnel since the suspension of conscription in 2011, the size of its armed forces—the 28th largest globally and the third largest in Europe—remains sufficient for sustaining a robust defense market in terms of manpower (Kido, 2011). Furthermore, like France, Germany benefits from advantageous access to EU and NATO markets due to institutional ties and geographic proximity, offering a competitive edge over the United States and many Asian countries.

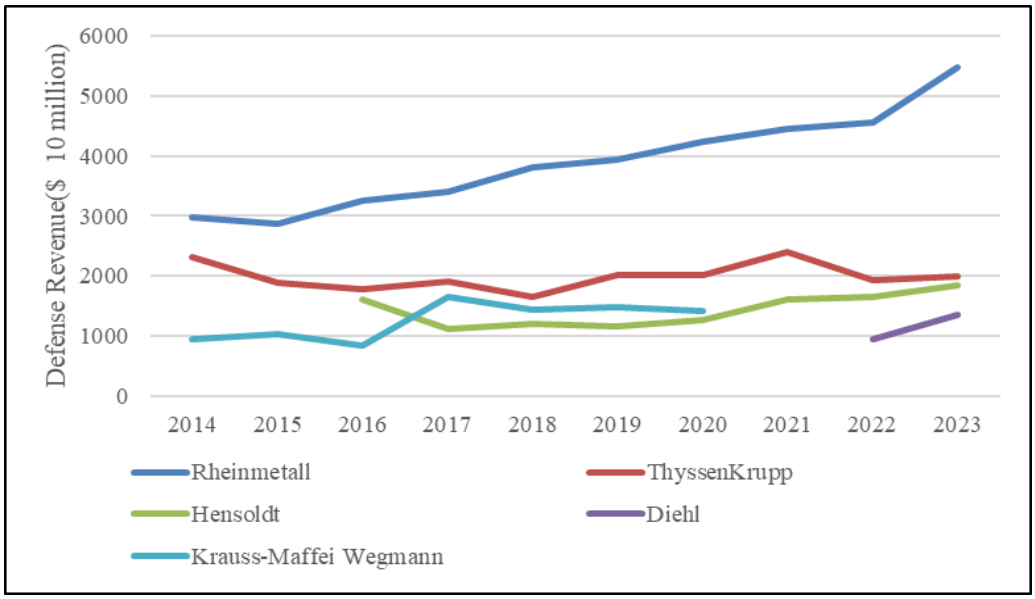


Figure 15. German defense revenue tendency. Adapted from SIPRI (n.d.).

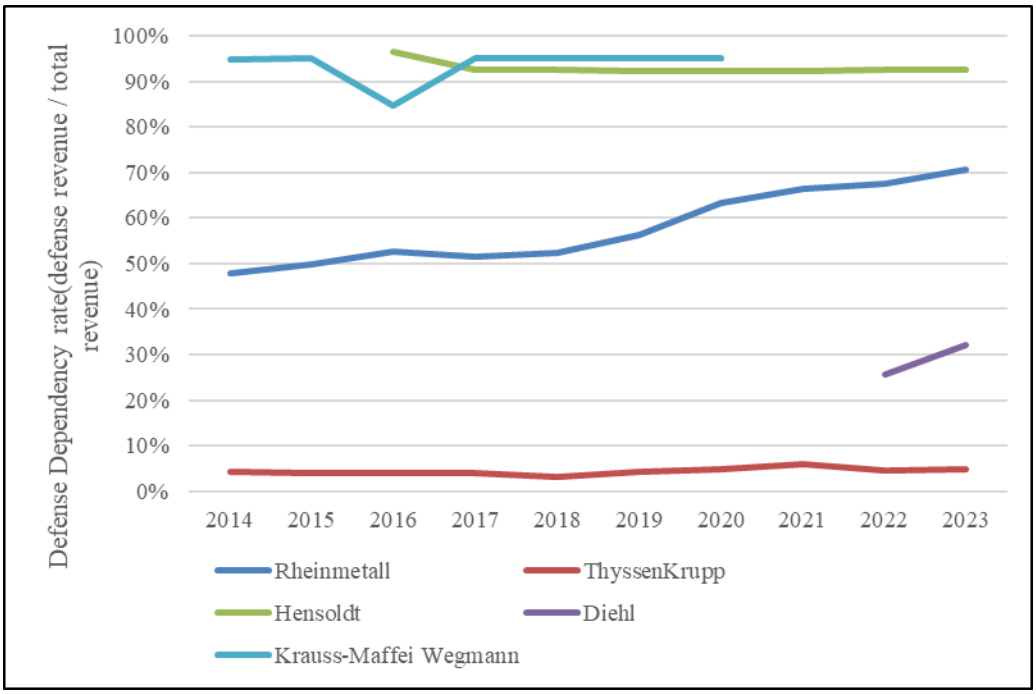


Figure 16. German defense dependency tendency. Adapted from SIPRI (n.d.).

3. Summary

This comparative analysis has examined the factors influencing the arms export policies of the United States, France, and Germany from three main perspectives: historical background, legal framework, and the size of the defense market. These perspectives were selected to gain a deeper understanding of the structural challenges that Japan faces in developing its own defense export capabilities.

From the viewpoint of historical and political contexts, both the United States and France have built strong and active defense industries supported by favorable public opinion and national strategies that emphasize autonomy and international involvement. In contrast, Germany, like Japan, has taken a more cautious approach due to its post-WWII anti-militarist stance. From a legal perspective, the United States and France have established institutional frameworks that not only regulate arms exports but also actively promote them. These systems include interagency cooperation, specialized organizations, and streamlined procedures. On the other hand, Germany's legal system is more restrictive, as arms exports are subject to parliamentary approval and are closely related to human rights policies. In terms of defense market size, the United States maintains the

world's largest defense industry in terms of both defense spending and industrial capacity. France also has a stable defense industry with strong government support. While Germany possesses a significant defense market, it is less aggressive in promoting exports due to its historical and legal limitations.

These findings suggest that historical experience, political systems, and legal and institutional capacity are critical in shaping national arms export policies. For Japan, which shares similarities with Germany in terms of constitutional restrictions and public sentiment toward militarization, the experiences of the United States and France offer important insights. In particular, the French model—balancing historical challenges with a state-led industrial strategy—may be especially informative for Japan as it considers expanding its role in the global defense market. In addition, when comparing defense industries, the ratio of defense-related revenue to total revenue, also known as defense dependence, is significantly higher in the United States and France, with both countries exceeding 50% (SIPRI, n.d.). Even Germany, despite its cautious stance on arms exports and a similar historical background to Japan, has achieved economic success, ranking fourth in the world in arms exports.

One of the key differences between Japan and Germany lies in each country's level of defense dependence among defense-related companies as well as access to regional defense markets such as the EU and NATO. As discussed in Chapter II, companies with high defense dependency require an environment that allows them to focus their resources on defense production. In such an environment, the government either provides well-developed legal systems for arms exports or it has a strong influence over defense companies, as is the case in France. Figure 17 illustrates the relationship between arms revenue and defense dependency in the top 100 defense revenue companies. Figure 17 indicates that high defense dependency is required to maintain or develop economic health. Based on Figure 17, at least two-thirds of defense-related companies are dependent on defense-related sales for more than 20% of their revenue.

To improve the economic health of Japan's defense-related companies, it is necessary to raise the level of defense dependence and create an environment that enables firms to concentrate on defense business. However, as Japan shares certain historical

constraints with Germany, implementing French-style government intervention may be difficult. Therefore, to facilitate access to global arms markets, Japan needs to strengthen its institutional framework, enabling the government to support arms exports actively. By studying the approaches of other countries, Japan can develop a more effective and sustainable strategy for supporting its defense industry.

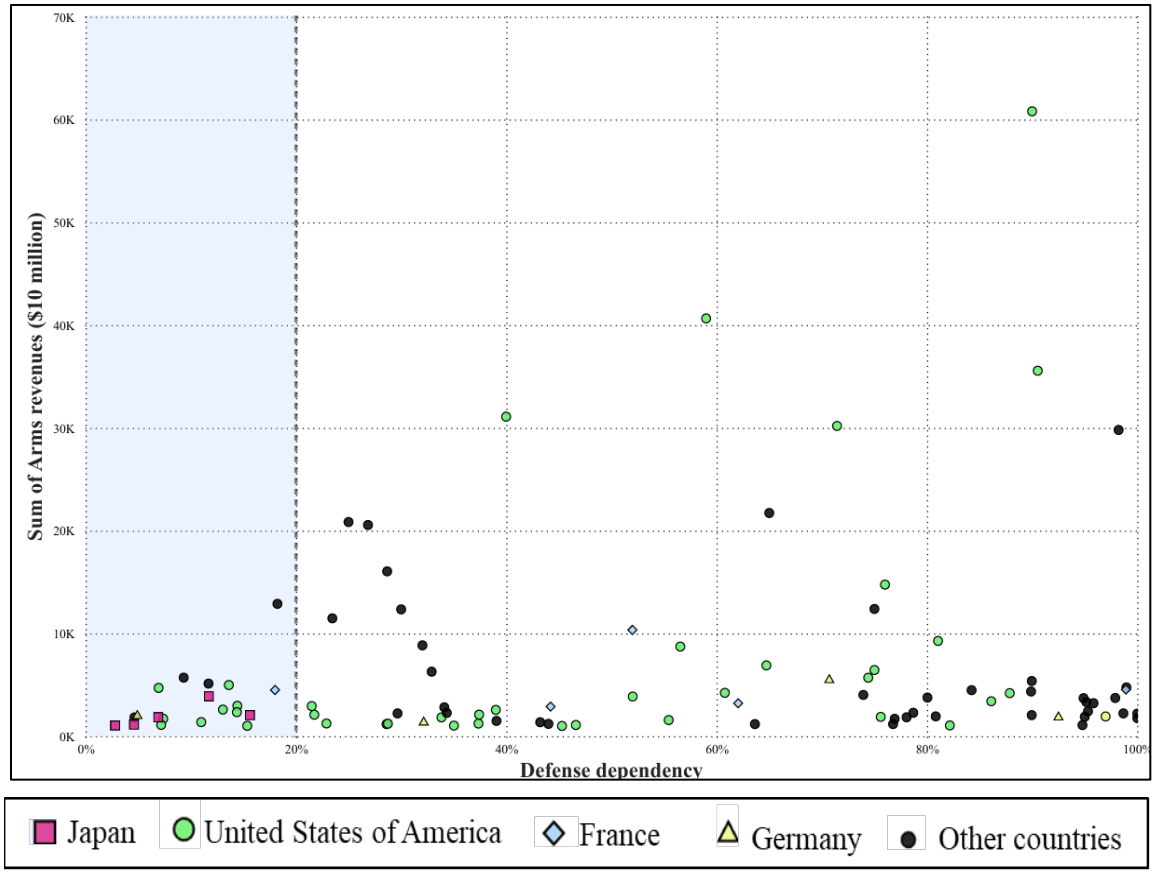


Figure 17. Relationship between total arms revenue and average defense dependency (2023). Adapted from SIPRI (n.d.). *(See Appendix G for details)*

D. CASE DESCRIPTION AND ANALYSIS

This research analyzes R&D recoupment and learning curve effects using quantitative data. The F-35 program, part of the U.S. FMS, was selected as a case study. Due to limitations in clearly identifying the total R&D recoupment amount, the analysis uses the F-35 purchase prices of various countries. Based on the U.S. classification of partner countries, R&D cost recovery is estimated by comparing the purchase price paid by the United Kingdom (the largest contributor to F-35 R&D) with that of other

purchasing countries. The estimated R&D cost recovery rate is calculated as the ratio of recouped R&D cost to the total sales price. Additionally, this analysis applies the same estimation method to a hypothetical FMS case involving the sale of Japanese FFM and submarines to Australia. The learning curve effects are also evaluated in relation to past academic studies on FMS.

1. F-35 Program

This section provides an overview of the F-35 program as the central case study for this research, detailing its multinational development framework, variant-specific capabilities, and persistent programmatic challenges (GAO, 2024). It further analyzes procurement price disparities between the United States and partner nations to evaluate the extent of recovery of R&D costs through international sales.

a. Overview of the F-35 Program

The F-35, also known as the Joint Strike Fighter (JSF), is a multinational development project initiated in the 1990s by the United States and seven partner countries (GAO, 2024). As of 2023, 918 F-35s have been procured, including those sold under FMS (DiMascio, 2024). The F-35 is a fifth-generation fighter jet with three different variants tailored to the operational needs of different military branches. According to manufacturer Lockheed Martin, the F-35 possesses more than four times the air-to-air combat capability of fourth-generation fighters (Zaffran & Erwes, 2015).

Despite its advanced performance, the F-35 program has faced significant challenges in terms of cost, schedule, and execution. It is considered the most expensive acquisition project in U.S. military history and has been reported to be at least 7 years behind schedule (Parsons, 2014). Some studies also suggest that its technological edge may be temporary due to rapid advancements in radar systems that could challenge its stealth features (Zaffran & Erwes, 2015). However, Lockheed Martin claims that increasing production volume could reduce the unit cost by approximately 4% (Zaffran & Erwes, 2015). The program is also projected to create more than 120,000 direct and indirect jobs in the United States, contributing to domestic economic benefits (DiMascio, 2024).

This research analyzes the potential profit gained from F-35 sales to foreign countries by evaluating the difference in unit prices paid by different partner nations. The JSF program categorizes partner countries based on their levels of involvement in R&D and spending on the amount of money: Level 1 (United Kingdom), Level 2 (Italy and the Netherlands), and Level 3 (Australia, Denmark, Norway, and Canada) (Department of the Navy, 2023; Hoehn, 2022). To assess the financial viability of the F-35 program, it is essential to examine how R&D costs are distributed between domestic and international procurement. The following section evaluates the extent to which these costs are recovered through unit pricing strategies.

b. Recovery of R&D Costs

The DoD estimates that the total life-cycle cost of the F-35 program—including acquisition, operations, and support—exceeds $2 trillion (GAO, 2024). According to the Modernized Selected Acquisition Report (MSAR) for FY2025, the average unit cost per aircraft for each F-35 variant, based on a total of 3,388 aircraft to be procured by the U.S. and its international partners, is estimated at $72.7 million for the F-35A, $99.78 million for the F-35B, and $87.65 million for the F-35C (DoD, 2024; DiMascio, 2024). However, these figures reflect only recurring flyaway costs and do not include R&D expenses or other non-recurring costs. To more accurately assess the full unit cost, including the recovery of R&D expenses, the unit price must be recalculated using the total program cost and distributed across either the U.S. procurement quantity alone or the combined U.S. and international procurement quantities. Table 8 provides this analysis by presenting the average unit cost based on DoD budget estimates for both the F-35 airframe and engine subprograms.

As shown in Table 8, if R&D costs were recovered solely from the 2,470 aircraft procured by the U.S. military, the R&D cost per unit would range from $33.57 million to $35.39 million, depending on whether the objective or threshold cost estimates are used. When international purchases are included, bringing the total number of aircraft to 3,888, the R&D cost falls to $21.33 million to $22.48 million. The corresponding total unit cost, combining procurement and R&D expenses, ranges from $89.82 million to $123.77 million, depending on the cost estimate and procurement base considered.

Table 8. The total budget estimate present value in 2025. Adapted from DoD (2024).

Field ($ Million) (Base Year: 2012)	Range	Procurement	Average Unit Cost (U.S.: 2,470)	Average Unit Cost (Total: 3,888)
Procurement	Objective	$266,285.3	$107.81	$68.49
	Threshold	$393,818.6	$159.44	$101.29
RDT&E	Objective	$82,919.1	$33.57	$21.33
	Threshold	$87,411.8	$35.39	$22.48
Procurement + RDT&E	Objective	$349,204.4	$141.38	$89.82
	Threshold	$481,230.4	$194.83	$123.77
Total Expense (Including MILCON)	Objective	$352,727.4	$142.80	$90.72
	Threshold	$485,253.2	$196.46	$124.81

Next, the amount per unit is determined based on the number of units sold through the FMS and the purchase price. Table 9 presents the purchase price, the number of F-35s purchased, and the average amount per aircraft by country. Note that some countries have already introduced additional F-35s, but clearly, the figures were obtained based on the amounts and quantities published by the DoD. Table 9 shows that, except for the Netherlands, there are no differences between partner country categories. The partner countries that have implemented development cooperation have purchased the aircraft at a cost of $24.8 million per aircraft.

The countries that purchased the aircraft through the FMS saw significant increases in the purchase price, but this is presumably due to the differences in the value of security those countries provide to the United States, since the FMS itself is implemented to contribute to the security of the United States. Table 9 shows that countries purchase the aircraft as FMS do so for $176.8 million per aircraft. However, based on the Pentagon's target budget estimate, the United States adds an average of $34 million to the F-35 price when it sells the aircraft in FMS. This additional amount is roughly equivalent to the U.S. military's target R&D cost per aircraft. This additional amount is equivalent to 23.8% of the U.S. military's procurement cost of $142.8 million per aircraft. With regard to the F-35 FMS case, when selling defense equipment to countries that are not participating in joint development, it is assumed that the R&D cost per unit will be doubled, or 23.8% will be added to the procurement cost per unit. For the

purposes of this study, the amount Japan adds to sales of its defense equipment is also heavily influenced by its security relationship with Australia. However, in this research, the 23.8% price increase is used to estimate the effect of defense equipment sales through FMS on the economic health of Japanese defense-related companies.

Table 9. The unit cost of F-35s in foreign countries. Adapted from DoD (2024).

Country	Partner Status	Quantity	Fundings (Million)	Average Unit Cost
United Kingdom	Level 1	138	$3,425.3	$24.8
Italy	Level 2	90	$2,233.7	$24.8
Netherlands	Level 2	52	$1,141.8	$22.0
Australia	Level 3	100	$2,482.1	$24.8
Canada	Level 3	88	$2,183.9	$24.8
Denmark	Level 3	27	$670.2	$24.8
Norway	Level 3	52	$1,290.5	$24.8
Belgium	FMS	34	$5,100.0	$150.0
Czech Republic	FMS	24	$4,580.0	$190.8
Finland	FMS	64	$10,790.0	$168.6
Germany	FMS	35	$6,476.0	$185.0
Greece	FMS	40	$8,600.0	$215.0
Israel	FMS	75	$8,966.0	$119.5
Japan	FMS	67	$11,270.0	$168.2
Poland	FMS	32	$4,590.0	$143.4
Romania	FMS	32	$7,200.0	$225.0
Singapore	FMS	12	$2,750.0	$229.2
South Korea	FMS	60	$10,340.0	$172.3
Switzerland	FMS	36	$5,569.0	$154.7

2. FFM

The FFM is a naval vessel that combines the equipment of a conventional destroyer with the capabilities of a minesweeper (Asagumo Newspapers, 2024). Characteristically, the FFM can respond to anti-submarine warfare, anti-air warfare, anti-surface warfare, and anti-mine warfare by changing equipment according to the mission. In addition, the ship's damage control against fire and flooding is being automated to save manpower. The Japan Maritime Self-Defense Force has built 10 FFMs since 2018 (MOD, 2024a). Additionally, an improved FFM started being built in FY2024, with plans for 12 of these ships to be built by FY2028 in addition to the 12 older generation FFMs.

This section examines the R&D cost recovery effect of applying the FMS to the improved FFM, known as the Mogami type.

In Project Sea 3000, the Royal Australian Navy is selecting a replacement for its 11 aging Anzac-class frigates (Bergmann, 2024). The Japanese FFM Mogami class and the German MEKO 200 have been selected as candidates, with a decision to be made in FY2025 (Bergmann, 2024). The Australian government plans to spend between $5.5 billion and $8.5 billion on these 11 vessels. The first three vessels will be built overseas, and the remaining eight will be built in Australia.

Figure 18 shows the change in the value of the FFM, including the actual construction value of the FFM adjusted using the consumer price index for FY2024. The average price per FFM is about ¥49.6 billion (refer to Appendix H). The research and development cost of the FFM was ¥19.7 billion in FY2020, according to data from the Acquisition Technology and Logistics Agency (2020). The export price can be estimated at approximately ¥61.4 billion by adding 23.8% of the average price per ship, or ¥11.8 billion, to the procurement price. Applying the Bank of Japan's exchange rate of ¥149 to the U.S. dollar and the 1 Australian dollar to 0.63 U.S. dollar as of May 2025, the export price of ¥61.4 billion per vessel, including the FFM's R&D cost recovery, would be approximately 654 million Australian dollars (Bank of Japan, 2025). Therefore, the cost of 11 FFMs is 7.194 billion Australian dollars. This is below the lower budget limit of $8.5 billion for the Royal Australian Navy's Project Sea3000 and is estimated to be a feasible option in terms of price.

Even if Japan exports only the first three vessels under the project, the total export amount would be approximately ¥184.2 billion, which is more than 1.8 times the R&D cost of the FFM. Furthermore, Japan can expect future FFM-related business opportunities such as maintenance contracts, parts supply, and upgrade support. This increase in the number of FMS vessels will bring about economies of scale in the defense industry, which may contribute to improved financial health.

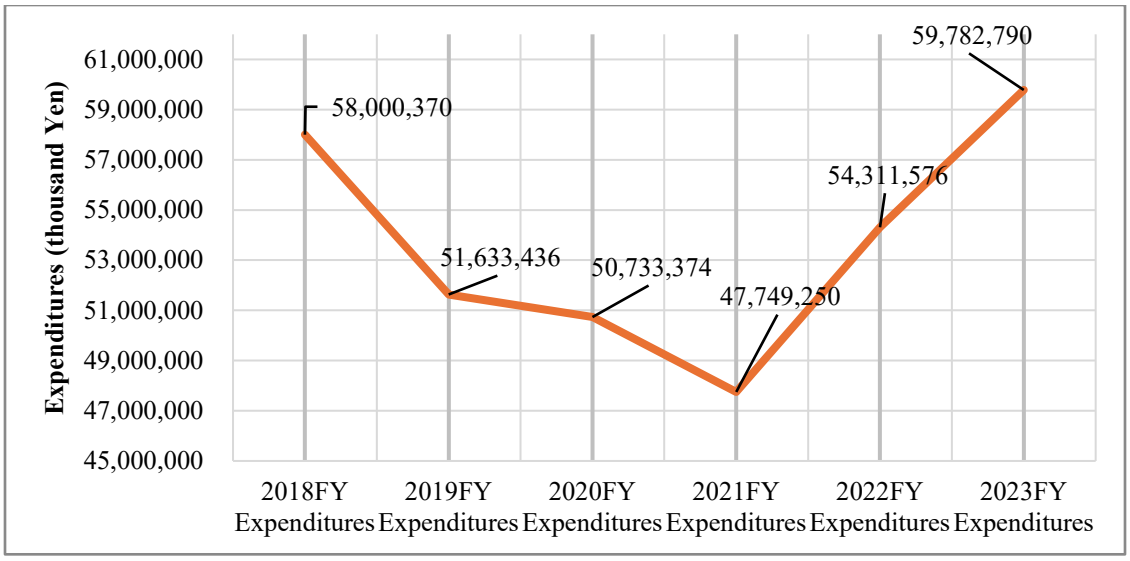


Figure 18. The acquisition cost of FFM. Adapted from Ministry of Finance (2025).

3. Submarines

The second example of Japanese defense equipment is the Soryu-class submarine. The Soryu-class submarine has been under construction since 2005 and is Japan's first conventional-powered submarine equipped with a non-atmosphere-dependent propulsion system. In addition, vessels built since 2015 have used lithium-ion batteries, contributing to improved submarine time and quietness (Asagumo Newspapers, 2024). Australia was considering the purchase of 12 vessels to replace its Collins-class submarines, following proposals from Japan, Germany, and France. The French Attack-class submarines were ultimately selected, but in 2020, Australia changed its policy to introduce nuclear-powered submarines from the United States (Janes, 2025b).

The actual construction cost of Soryu-type vessels is based on the construction cost of 12 vessels from built from 2007–2024, which was confirmed from publicly available information from the Ministry of Finance (refer to Appendix H). As in the case of the FFM, the adjusted amount using the CPI for 2024 is shown in Figure 19. The R&D cost for submarines in FY2020 was about ¥39.6 billion according to data from the Acquisition Technology and Logistics Agency (2020). The 23.8% R&D recovery cost identified in the FMS case of the F-35 would be about ¥15.9 billion for the Soryu submarine, and more than the R&D cost can be recovered by exporting three or more weapon ships.

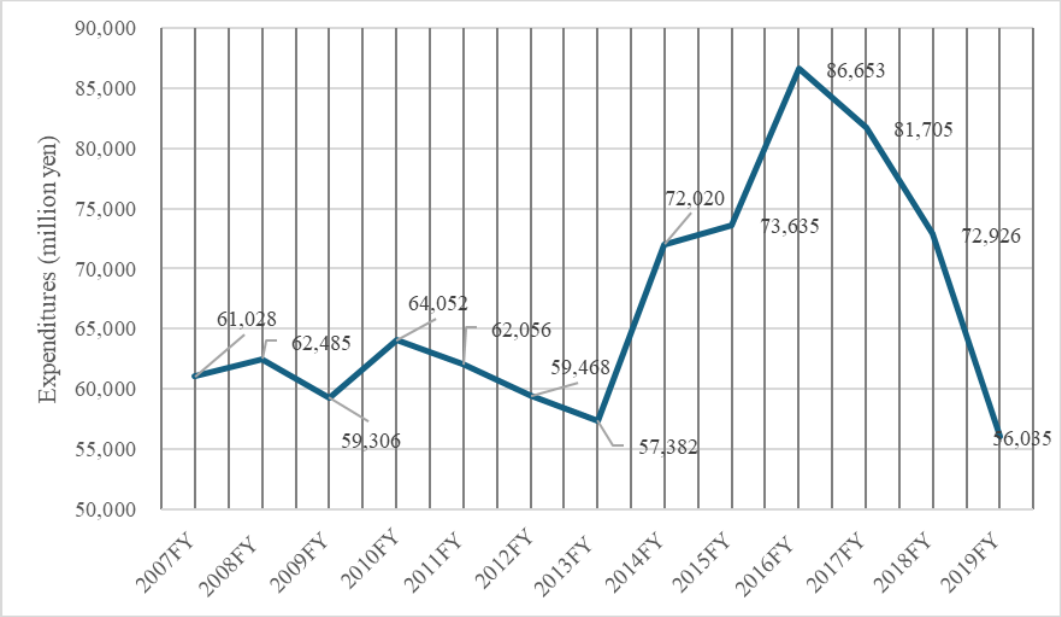


Figure 19. The acquisition cost of submarines. Adapted from Ministry of Finance (2025).

4. Learning Curve

Finally, this research examines the learning curve effect, which has been mentioned in previous studies as an economic benefit of FMS. The results of the analysis shown previously in Figures 18 and 19 did not confirm the learning curve effect. Therefore, the assertion in previous studies that cost reductions due to FMS are attributable to learning curves is not necessarily valid for Japanese defense equipment. In addition, although a certain amount of data is necessary to verify the learning curve effect, the current limited number of equipment items that can realistically be exported in enormous quantities in Japan makes it difficult to demonstrate the effect. In particular, no other countries are currently considering the export of small arms and other equipment from Japan. Furthermore, for complex equipment such as naval vessels and submarines, it is necessary to measure the effect of the learning curve on each component. From this perspective, verification of the learning curve should remain limited.

However, it is still possible to validate the learning curve effect if it is narrowed down to specific components, such as the antenna components of the FFM that India is considering importing (MOD, 2024d). If exports of such equipment are realized in the

future, verifying the learning curve effect at the component level will be an important research issue.

E. SUMMARY

The qualitative and quantitative analyses revealed that, due to structural factors, the FMS is well-suited for Japan to enhance the fiscal health of the defense industry, and the economic benefits of the FMS are evident. This section provides the results of both analyses.

1. Findings from the Qualitative Analysis

This research highlights three key constraints affecting Japan's defense industrial base: its historical background, the legal system, and the scale of the domestic market. After WWII, the Japanese government established the defense budget, legal system, and defense industrial structure with national policies influenced by anti-war sentiment and public distrust of the military.

According to the analyses of other researchers, the main factors limiting the capacity of the Japanese defense industry were reputational risk, low economic returns, a limited market size, and high barriers to entry. Among these factors, the most critical issue is the small domestic market, which constrains the scale and competitiveness of Japan's defense companies. As a result, enhancing relationships with foreign partners is essential for maintaining the economic health of Japan's defense industry. The Japanese government has been working to eliminate the 1% of GDP defense budget limitation and relax arms export restrictions to expand such international relationships. Moreover, the Japanese government illustrates a shift toward a more proactive defense policy. However, despite these reforms, domestic defense firms continue to face structural challenges that make independent growth difficult.

This research considers two U.S. arms export mechanisms, FMS and DCS, to address the limitations of the domestic market. FMS, which is a government-to-government contract system, offers high reliability and comprehensive support. In contrast, DCS offers more flexibility and faster delivery, but it carries a greater contractual risk due to the lack of government support. Even companies with high

defense dependency, such as Lockheed Martin and BAE Systems, recognize the risks associated with DCS. For Japanese companies, which rely heavily on the civilian market and have low defense dependency, such risks are even clearer. Therefore, FMS is more appropriate for Japan's defense industry due to the need for government involvement and reduced exposure to foreign contract risks.

A comparative qualitative analysis involving countries such as the United States, France, and Germany further supports this conclusion. In the United States, DCS is viable due to a defense dependency of around 70%, whereas in France and Germany, defense dependency averages 50% and is bolstered by government-led initiatives and access to regional markets, such as the EU. In contrast, Japanese companies are significantly less dependent on defense revenues, which limits their capacity to endure the risks associated with DCS. Based on this comparative analysis, this research concludes that expanding Japan's defense market requires strong government involvement. The Japanese government should establish and enhance the adaptation of the FMS system rather than relying on DCS to strengthen competitiveness and ensure the economic health of Japan's defense industry. The growth and resilience of Japan's defense industry must be sustained through a framework of government support, actively utilizing FMS.

2. Economic Benefits of FMS

This research analyzes R&D recoupment and the learning curve effect with particular focus on the F-35 program under the U.S. FMS. The analysis begins with a detailed overview of the F-35 program, highlighting its multinational development and substantial life-cycle costs, as well as its categorization of partner countries based on levels of participation in R&D investment. By examining the unit prices paid by various countries, this research estimates the extent to which the United States recovers R&D costs through FMS. Countries not involved in the development pay significantly higher prices, suggesting that part of the R&D cost is incorporated into these export prices. In the F-35 program, approximately 23.8% is added to account for R&D recoupment.

The same methodology is applied to Japan's defense exports, using the Mogami-class FFM and Soryu-class submarines as case studies. For the FFM, the estimated export price, including R&D recovery, is competitive and remains within Australia's projected

budget for its Project Sea 3000, which seeks to replace aging frigates. Exporting just three vessels could more than recover the initial R&D investment, and further economic benefits are expected from post-sale support such as maintenance and spare parts supply. Similarly, the case of the Soryu-class submarine demonstrates that the R&D costs could be recovered by exporting three or more units, assuming the same 23.8% markup. Although Australia ultimately selected French nuclear-powered submarines, the analysis remains relevant for evaluating the feasibility of future export opportunities.

Lastly, this research considers the learning curve effect. Previous research on FMS in the U.S. has associated cost savings with increased production. However, evidence to this effect in the Japanese case proved to be limited, given the small number of units available for export and the complexity of the defense equipment being considered for arms export. Future research also suggests the possibility of testing such effects at the component level, for example, in antenna systems that might be exported to India. Overall, this research contributes to understanding the economic rationale for defense exports and emphasizes the importance of strategic pricing that reflects both R&D costs and security relationships.

V. CONCLUSIONS

This research examined how Japan can enhance the economic health of its defense industry by adapting to the structure and economic effects of the U.S. FMS system. Through both qualitative and quantitative analyses, the research identified the structural challenges facing Japan's defense-related companies. It offered targeted policy proposals informed by international best practices and comparative case studies.

A. SUMMARY OF FINDINGS

The qualitative analysis revealed three core constraints undermining Japan's defense industrial competitiveness: (1) historical restrictions shaped by postwar pacifism, (2) legal and policy limitations, particularly the Three Principles on the Transfer of Defense Equipment and Technology, and (3) the structural fragility of domestic defense companies due to a small domestic market and persistently low-profit margins. Although the Japanese government has increased its defense budgets, these challenges remain unresolved, hindering the sustainable development of the defense industry's economic health.

In contrast, countries like the United States, France, and Germany have sustained strong defense industries through extensive government support, established arms export systems, and high levels of defense dependency among companies. This comparison highlights Japan's limited institutional situation for promoting arms exports and supporting long-term R&D investments.

Through an assessment of the U.S. FMS and DCS systems, the research determined that FMS—offering legal assurance, risk mitigation, and diplomatic leverage—is better suited to Japan's defense industry than DCS, which imposes higher burdens on private firms. Given the low defense dependency and high corporate risk aversion in Japan, a government-to-government sales model would enhance credibility, reduce operational hurdles, and develop long-term stability.

Quantitatively, this research demonstrated the potential economic benefits of introducing an FMS-style markup model. Using the F-35 program as a benchmark, the

analysis showed that a 23.8% export markup applied to non-partner countries could lead to significant R&D cost recovery. Simulation scenarios involving Japan's FFM and Soryu-class submarines confirmed that exporting even a limited number of platforms could offset R&D costs. Additionally, the potential for component-level exports—such as radar and antenna systems—suggests that, over time, Japan could realize economies of scale and learning curve efficiencies if the Japanese government implements policy support.

B. POLICY RECOMMENDATIONS

Based on this study, the Japanese government should implement the following key policy measures to strengthen the economic health of Japan's defense industry and support sustainable growth. The policy recommendations categorize three terms as short-term, medium-term, and long-term perspectives necessary for the successful implementation of FMS adoption. Finally, this section proposes key indicators to evaluate the security implications of introducing FMS systems. Table 10 summarizes the policy recommendations.

1. Short-Term Initiatives

As a short-term measure, Japan should establish a government-led military sales program modeled after the U.S. FMS system but tailored to Japan's legal and defense industry. Japan's government should implement this process by establishing an inter-ministerial organization encompassing the MOD, MOFA, and METI under a unified arms export system managed by the NSC to ensure a swift response.

Additionally, Japan should incorporate a transparent R&D cost recovery into export pricing, applying markups similar to the F-35's 23.8%, particularly for sales to non-partner countries. This R&D cost recoupment would ensure economic stability while enabling reinvestment in Japan's defense industry.

Japan should begin by targeting countries such as India, which has low regulatory and political barriers, as its strategic entry point, starting with the export of defense components, including radar and antenna systems. Finally, Japan's arms exports should be consistent with comprehensive security cooperation initiatives, similar to the U.S.

FMS program, and prioritize sales to strategic partners. Arms exports promote interoperability, strengthen mutual trust, and contribute to the development of a robust and globally competitive defense industry.

2. Medium-Term Initiatives

In the medium term, Japan should focus on establishing legal and institutional frameworks to support FMS systems while also promoting its defense equipment and identifying the defense needs of allied and friendly nations. Although Japanese companies have participated in international defense exhibitions hosted by countries such as the United States and France, opportunities for showcasing defense equipment at domestically hosted events remain limited (MOD, 2024a). To pursue increasing opportunities to represent Japanese defense equipment, this research recommends that Japan utilize its overseas diplomatic missions, under the MOFA's jurisdiction, to promote Japanese defense equipment and gather information on local defense requirements.

This promotional and intelligence-gathering role aligns with the objective stipulated in Articles 3 and 4 of the Act for the Establishment of the Ministry of Foreign Affairs, which includes safeguarding national interests and enhancing national security (The Government of Japan, 2016). Therefore, institutionalizing such efforts within diplomatic positions constitutes a realistic and impactful medium-term initiative for advancing FMS systems.

3. Long-Term Initiatives

In implementing the FMS, a long-term effort is necessary to mitigate the reputational risk that private companies perceive as a drawback when exporting defense equipment, given Japan's historical background. To eliminate this aversion to the military, continued careful explanation and dissemination of information over the long term are necessary. The government must repeatedly inform the public that strengthening the defense industrial base is directly linked to enhancing defense capabilities to protect the lives and safety of the Japanese people. It must also ensure that the public correctly understands the threats posed by Japan's neighboring countries.

Through the above short-term, medium-term, and long-term efforts, Japan can effectively establish the FMS and achieve financial health in the Japanese defense industry.

Table 10. Policy Recommendations

Term	Policy Recommendation
Short-Term	- Establish a government-supported arms export system modeled on the U.S. FMS, adapted to Japan's legal and defense system. - Establish an inter-ministerial organization (MOD, MOFA, METI) under the NSC to ensure swift coordination. - Implement a transparent R&D cost recoupment. - Initiate exports with strategic partners focusing on components. - Integrate arms exports with international security cooperation.
Medium-Term	- Develop legal and institutional frameworks to support Japan's FMS. - Actively promote defense equipment through overseas diplomatic missions. - Institutionalize intelligence-gathering and promotional roles in diplomatic posts, aligned with MOFA's legal mandate (Articles 3 and 4).
Long-Term	- Mitigate reputational risks through long-term public engagement. - Communicate that the defense industry growth supports national defense.

4. Security Evaluation Indicators for FMS

The economic benefits of the FMS, as described in this research, included economies of scale effects, increased efficiency due to the learning curve, and recovery of R&D costs. This section of the policy recommendations discusses how the security benefits can be evaluated to help inform the post-implementation evaluation of the FMS.

Unlike the DCS, FMS provides an advantage to the purchasing country, as the government is involved in the arms export process and receives education and training on defense equipment (Gilman et al., 2014). This advantage of education and training is also beneficial for the providing country, as it enhances interoperability. Interoperability can

be quantitatively evaluated as a security benefit of FMS by recording the number of countries or units that have sold the same defense equipment as Japan.

The second advantage is enhanced resilience (Machain, 2021). The sale of Japanese defense equipment to other countries would lead to the export of production and maintenance infrastructure. These production and maintenance infrastructures will diversify the supply chain that can be utilized in the event of a contingency and enable the use of repair facility bases outside of Japan, thereby contributing to resilience enhancement. Resilience enhancement can also be quantitatively assessed in terms of FMS security by accounting for production and repair bases outside of the country.

Based on the above, the improvement of interoperability and the enhancement of resilience can be quantitatively evaluated by recording the number of countries and units purchased and the number of production and repair bases through FMS as indicators for evaluating FMS in terms of security.

C. RECOMMENDED AREAS FOR FUTURE RESEARCH

This research suggests that adapting the U.S. FMS system to Japan has the potential to improve the economic health of the defense industry. However, several issues remain to be addressed to realize the recommendations and further research is needed.

First, regarding concerns associated with arms exports, such as technology leaks and the management of EUM, this research introduces existing measures implemented by the United States. However, it lacks a specific analysis of how to institutionalize and operate these measures in Japan.

Second, this research utilized the F-35 program as a case study and calculated an estimated 23.8% of R&D recoupment. However, equipment exports by the FMS include a wide variety of products, and there are likely to be significant differences in their respective R&D recoupment. Therefore, in future research, it will be necessary to conduct a comparative analysis of multiple cases of FMS programs to identify reference values and trends for each piece of equipment.

Third, although the analysis in this research focuses on the economic aspect, the FMS program is a system that should emphasize security benefits, such as improved

interoperability with allied countries and the dispersion of supply chains. The FMS should also be able to demonstrate its contribution to the security environment.

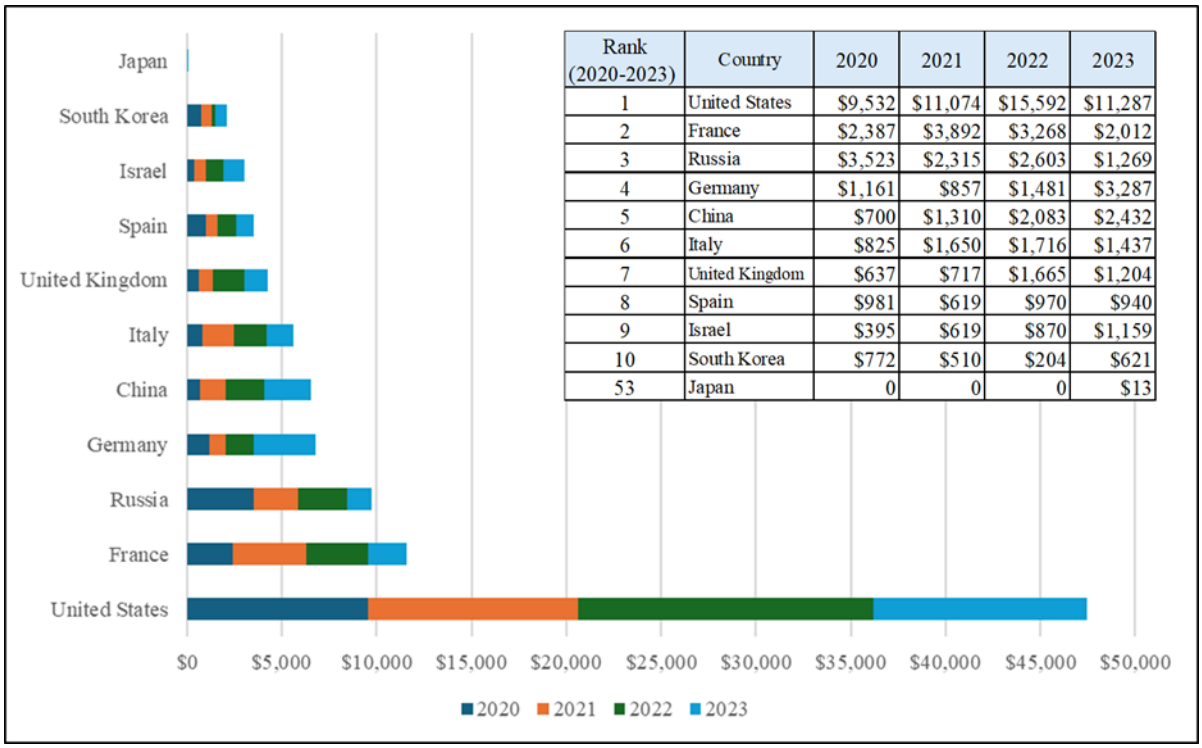
By comprehensively addressing these perspectives, future research can develop more effective policy recommendations and simultaneously contribute to shaping public opinion on defense industry policy in Japan.

D. CONCLUSION

The findings of this research strongly support the adoption of government-supported arms exports in Japan, such as the U.S. FMS system. In the face of retreating defense companies, shrinking domestic demand, and growing geopolitical uncertainty, Japan must take aggressive steps to strengthen its defense industry. Implementing a robust FMS system would not only facilitate R&D cost recovery and economic health but also position Japan as a more capable and credible actor in international security. This research makes an original contribution by integrating comparative institutional analysis and R&D cost recoupment perspectives still underexplored in previous research. However, the research is limited by its reliance on assumptions regarding export conditions and political decisions due to the use of open-source data.

Future research should examine the political, legal, and industrial feasibility of implementing the FMS system in Japan and assess how international cooperation frameworks could further support the economic health of the defense industry.

APPENDIX A. THE AVERAGE RANK OF MILITARY SALES IN THE WORLD ($ MILLION).



Rank (2020-2023)	Country	2020	2021	2022	2023
1	United States	$9,532	$11,074	$15,592	$11,287
2	France	$2,387	$3,892	$3,268	$2,012
3	Russia	$3,523	$2,315	$2,603	$1,269
4	Germany	$1,161	$857	$1,481	$3,287
5	China	$700	$1,310	$2,083	$2,432
6	Italy	$825	$1,650	$1,716	$1,437
7	United Kingdom	$637	$717	$1,665	$1,204
8	Spain	$981	$619	$970	$940
9	Israel	$395	$619	$870	$1,159
10	South Korea	$772	$510	$204	$621
53	Japan	0	0	0	$13

Source: SIPRI (n.d.).

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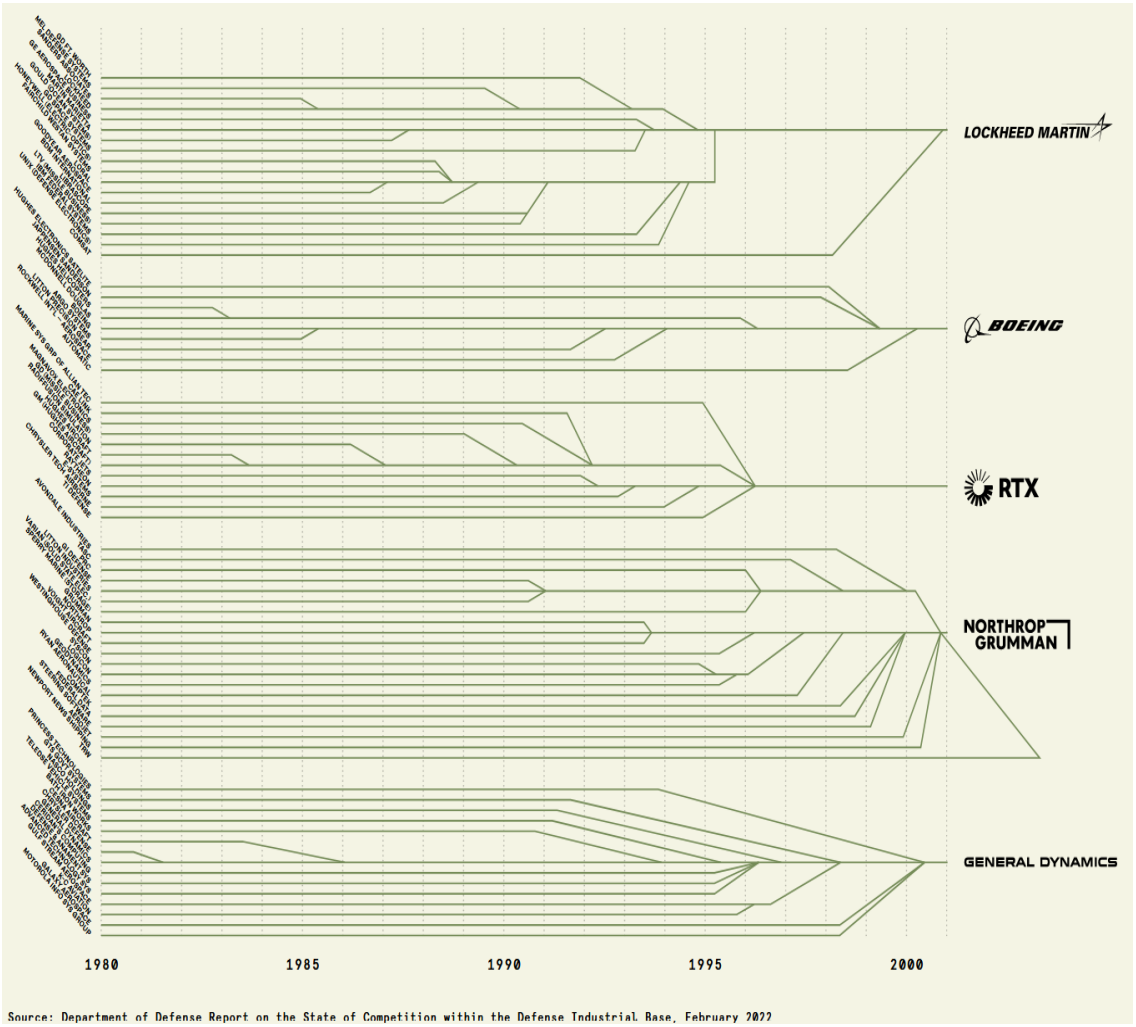
APPENDIX B. DEFENSE EXPENDITURES AND GNP/GDP (100MILLION YEN).

year	GNP(GDP)	Defense Expenditures	Rate (Defense Expenditure/GNP(GDP)
1950	-	1310	-
1951	54815	1199	2.19%
1952	63730	1771	2.78%
1953	75264	1257	1.67%
1954	78246	1396	1.78%
1955	75590	1349	1.78%
1956	82600	1429	1.73%
1957	98500	1435	1.46%
1958	102470	1485	1.45%
1959	107620	1560	1.45%
1960	127480	1569	1.23%
1961	156200	1803	1.15%
1962	176700	2085	1.18%
1963	203900	2412	1.18%
1964	240700	2751	1.14%
1965	281600	3014	1.07%
1966	308500	3407	1.10%
1967	409500	3809	0.93%
1968	478400	4221	0.88%
1969	578600	4838	0.84%
1970	724400	5695	0.79%
1971	843200	6709	0.80%
1972	905500	8002	0.88%
1973	1098000	9355	0.85%
1974	1315000	10930	0.83%
1975	1585000	13273	0.84%
1976	1681000	15124	0.90%
1977	1928500	16906	0.88%
1978	2106000	19010	0.90%
1979	2320000	20945	0.90%
1980	2478000	22302	0.90%
1981	2648000	24000	0.91%
1982	2772000	25861	0.93%
1983	2817000	27542	0.98%
1984	2960000	29346	0.99%
1985	3146000	31371	1.00%
1986	3367000	33435	0.99%
1987	3504000	35174	1.00%
1988	3652000	37003	1.01%
1989	3897000	39198	1.01%
1990	4172000	41593	1.00%

1991	4596000	43860	0.95%
1992	4837000	45518	0.94%
1993	4953000	46406	0.94%
1994	4885000	46835	0.96%
1995	4928000	47236	0.96%
1996	4960000	48455	0.98%
1997	5158000	49475	0.96%
1998	5197000	49397	0.95%
1999	4963000	49322	0.99%
2000	4989000	49358	0.99%
2001	5186000	49553	0.96%
2002	4962000	49560	1.00%
2003	4986000	49530	0.99%
2004	5006000	49030	0.98%
2005	5115000	48564	0.95%
2006	5139000	48139	0.94%
2007	5219000	48016	0.92%
2008	5269000	47796	0.91%
2009	5102000	47741	0.94%
2010	4752000	47903	1.01%
2011	4838000	47752	0.99%
2012	4796000	47138	0.98%
2013	4877000	47538	0.97%
2014	5004000	48848	0.98%
2015	5049000	49801	0.99%
2016	5188000	50541	0.97%
2017	5535000	51251	0.93%
2018	5643000	51911	0.92%
2019	5661000	52574	0.93%
2020	5702000	53133	0.93%
2021	5595000	53422	0.95%
2022	5646000	54005	0.96%
2023	5719000	68219	1.19%
2024	6153000	79496	1.29%

Adapted from MOD (2024a); 戦後における防衛関係費の推移 [Defense Expenditures in the Postwar Period] (2017).

APPENDIX C. CONSOLIDATION OF THE U.S. DEFENSE INDUSTRY



Source: Sankar (2024).

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APPENDIX D. TOP 100 DEFENSE REVENUE COMPANIES IN 2023 ($ 10 MILLION).

Rank	Company	Country	Arms revenues	Total revenues	Defense dependency
1	Lockheed Martin Corp.	United States	60810	67570	90.0%
2	RTX	United States	40660	68920	59.0%
3	Northrop Grumman Corp.	United States	35570	39290	90.5%
4	Boeing	United States	31100	77790	40.0%
5	General Dynamics Corp.	United States	30200	42270	71.4%
6	BAE Systems	United Kingdom	29810	30350	98.2%
7	Rostec	Russia	21730	33430	65.0%
8	AVIC	China	20850	83430	25.0%
9	NORINCO	China	20560	76600	26.8%
10	CETC	China	16050	55990	28.7%
11	L3Harris Technologies	United States	14760	19420	76.0%
12	Airbus	Trans-European	12890	70710	18.2%
13	Leonardo	Italy	12390	16520	75.0%
14	CASC	China	12350	41170	30.0%
15	CSSC	China	11480	48950	23.5%
16	Thales	France	10350	19910	52.0%
17	HII	United States	9280	11450	81.0%
18	CASIC	China	8850	27640	32.0%
19	Leidos	United States	8730	15440	56.5%
20	Booz Allen Hamilton	United States	6900	10660	64.7%
21	Amentum	United States	6450	8600	75.0%
22	Rolls-Royce	United Kingdom	6290	19120	32.9%
23	AECC	China	5780	. .	. .
24	Hanwha Group	South Korea	5710	61300	9.3%
25	CACI International	United States	5700	7660	74.4%
26	Rheinmetall	Germany	5480	7750	70.7%
27	Elbit Systems	Israel	5380	5980	90.0%
28	CSGC	China	5130	43930	11.7%
29	Honeywell International	United States	4990	36660	13.6%
30	MBDA	Trans-European	4760	4810	99.0%
31	General Electric	United States	4710	67950	6.9%
32	Naval Group	France	4550	4600	98.9%
33	Safran	France	4510	25060	18.0%
34	Israel Aerospace Industries	Israel	4490	5330	84.2%

Rank	Company	Country	Arms revenues	Total revenues	Defense dependency
35	Saab	Sweden	4360	4850	89.9%
36	KBR	United States	4230	6960	60.8%
37	Sandia National Laboratories	United States	4200	4780	87.9%
38	Babcock International Group	United Kingdom	4030	5450	73.9%
39	Mitsubishi Heavy Industries	Japan	3890	33210	11.7%
40	Science Applications International Corp.	United States	3870	7440	52.0%
41	United Shipbuilding Corp.	Russia	3770	4710	80.0%
42	Rafael	Israel	3730	3810	97.9%
43	Hindustan Aeronautics	India	3710	3910	94.9%
44	V2X	United States	3410	3960	86.1%
45	KNDS	Trans-European	3340	3510	95.2%
46	Dassault Aviation Group	France	3220	5190	62.0%
47	NCSIST	Taiwan	3220	3360	95.8%
48	Bechtel Corp.	United States	2970	20600	14.4%
49	Textron	United States	2940	13680	21.5%
50	CEA	France	2900	6560	44.2%
51	Fincantieri	Italy	2820	8270	34.1%
52	Parker-Hannifin Corp.	United States	2600	19930	13.0%
53	TransDigm Group	United States	2570	6590	39.0%
54	ASELSAN	Türkiye	2440	2560	95.3%
55	Jacobs Engineering Group	United States	2350	16350	14.4%
56	Korea Aerospace Industries	South Korea	2290	2910	78.7%
57	Serco Group	United Kingdom	2280	6640	34.3%
58	ST Engineering	Singapore	2230	7520	29.7%
59	Atomic Weapons Establishment	United Kingdom	2230	2260	98.7%
60	JSC Ukrainian Defense Industry	Ukraine	2210	2210	100.0%
61	General Atomics	United States	2120	. .	. .
62	Teledyne Technologies	United States	2110	5640	37.4%
63	Oshkosh Corp.	United States	2100	9660	21.7%
64	PGZ	Poland	2060	2290	90.0%
65	Kawasaki Heavy Industries	Japan	2060	13190	15.6%
66	ThyssenKrupp	Germany	1990	40550	4.9%
67	Bharat Electronics	India	1940	2400	80.8%
68	Sierra Nevada Corp.	United States	1930	1990	97.0%

Rank	Company	Country	Arms revenues	Total revenues	Defense dependency
69	Baykar	Türkiye	1900	2000	95.0%
70	BWX Technologies	United States	1890	2500	75.6%
71	Fujitsu	Japan	1850	26790	6.9%
72	QinetiQ	United Kingdom	1850	2370	78.1%
73	Hensoldt	Germany	1850	2000	92.5%
74	CNNC	China	1840	39680	4.6%
75	Parsons Corp.	United States	1840	5440	33.8%
76	LIG Nex1	South Korea	1770	1770	100.0%
77	Eaton	United States	1710	23200	7.4%
78	Turkish Aerospace Industries	Türkiye	1700	2210	76.9%
79	Curtiss-Wright Corp.	United States	1580	2850	55.4%
80	Kongsberg Gruppen	Norway	1500	3840	39.1%
81	Amphenol Corp.	United States	1380	12560	11.0%
82	CAE	Canada	1370	3170	43.2%
83	Diehl	Germany	1350	4200	32.1%
84	Keysight Technologies	United States	1250	5460	22.9%
85	Moog	United States	1240	3320	37.3%
86	ViaSat	United States	1230	4280	28.7%
87	Hyundai Rotem	South Korea	1210	2750	44.0%
88	Navantia	Spain	1190	1550	76.8%
89	Czechoslovak Group	Czechia	1190	1870	63.6%
90	Melrose Industries	United Kingdom	1190	4160	28.6%
91	NEC Corp.	Japan	1140	24800	4.6%
92	Fluor Corp.	United States	1110	15470	7.2%
93	Mitre Corp.	United States	1100	2360	46.6%
94	Mazagon Dock Shipbuilders	India	1090	1150	94.8%
95	The Aerospace Corp.	United States	1060	1290	82.2%
96	Mitsubishi Electric Corp.	Japan	1050	37500	2.8%
97	HEICO Corp.	United States	1040	2970	35.0%
98	United Launch Alliance	United States	1030	. .	. .
99	Howmet Aerospace	United States	1020	6640	15.4%
100	TTM Technologies	United States	1010	2230	45.3%

Source: SIPRI (n.d.).

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APPENDIX E. ACTIVE MILITARY PERSONNEL RANK

Rank (Active military Personnel)	Country	Active military Personnel	Military Reserve Personnel	Paramilitary Personnel	Total Personnel
1	China	2,035,000	510,000	500,000	3,045,000
2	India	1,475,750	1,155,000	1,616,050	4,246,800
3	**United States**	**1,326,050**	**806,700**	**-**	**2,132,750**
4	North Korea	1,280,000	600,000	5,700,000	7,580,000
5	Russia	1,100,000	1,500,000	559,000	3,159,000
6	Ukraine	800,000	400,000	250,000	1,450,000
7	Pakistan	660,000	550,000	291,000	1,501,000
8	Iran	610,000	350,000	40,000	1,000,000
9	Ethiopia	503,000	-	-	503,000
10	South Korea	500,000	3,100,000	3,013,500	6,613,500
11	Vietnam	450,000	5,000,000	40,000	5,490,000
12	Egypt	438,500	479,000	379,000	1,296,500
13	Indonesia	404,500	400,000	290,200	1,094,700
14	Brazil	366,500	1,340,000	395,000	2,101,500
15	Thailand	360,850	200,000	138,700	699,550
16	Turkey	355,200	378,700	156,800	890,700
17	Eritrea	301,750	-	-	301,750
18	**France**	**270,000**	**63,700**	**141,050**	**474,750**
19	Sri Lanka	265,900	5,500	30,400	301,800
20	Colombia	257,450	34,950	165,050	457,450
21	Saudi Arabia	257,000		24,500	281,500
22	**Japan**	**247,000**	**55,900**	**14,700**	**317,600**
23	Mexico	216,000	81,500	111,900	409,400
24	Myanmar	210,000	-	107,000	317,000
25	Morocco	195,800	150,000	50,000	395,800
26	Iraq	193,000	-	148,000	341,000
27	South Sudan	185,000	-	-	185,000
28	**Germany**	**183,500**	**50,050**	**-**	**233,550**
29	Afghanistan	170,000	-	-	170,000
30	Israel	169,500	465,000	8,000	642,500

Adapted from World Population Review (2025).

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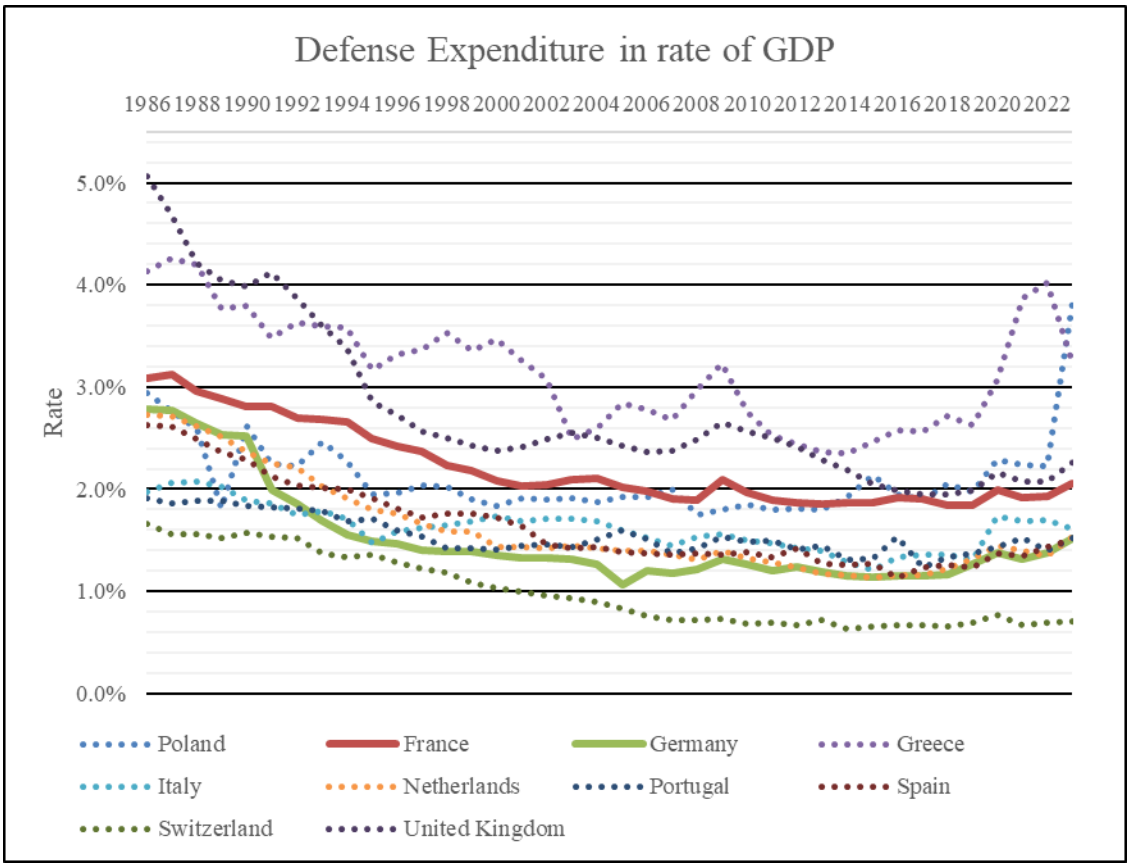
APPENDIX F. DEFENSE EXPENDITURE AS A RATE OF GDP IN EUROPE



Adapted from SIPRI (n.d.)

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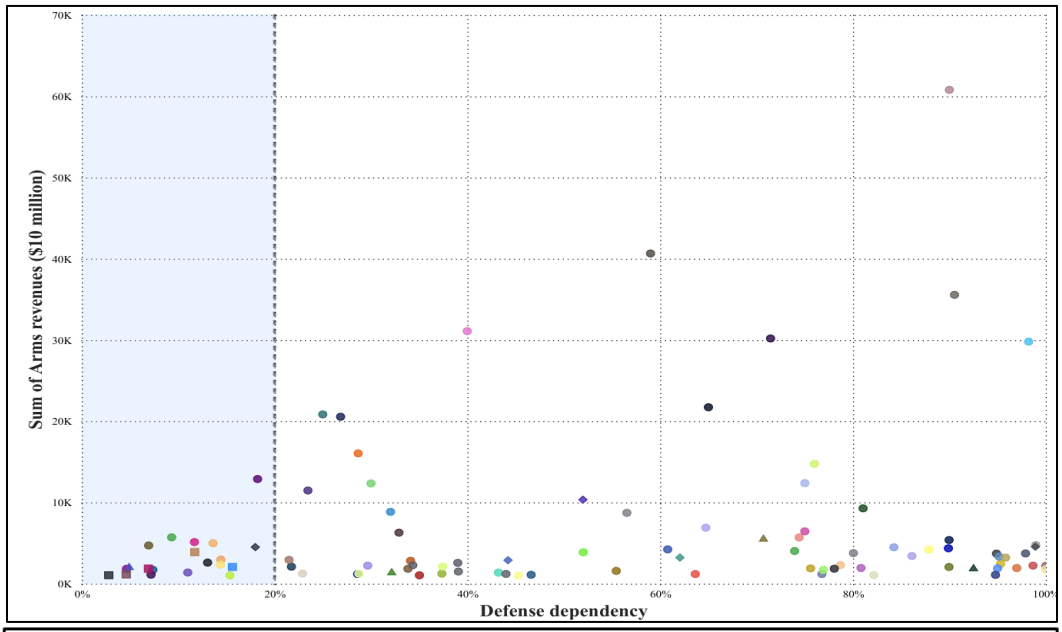
APPENDIX G. RELATIONSHIP DEFENSE DEPENDENCY



Adapted from SIPRI (n.d.).

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APPENDIX H. CASE STUDY EXPENDITURES (FFM AND SS)

Defense Expenditures on FFM (thousand yen)

Program/Year	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Total (per two FFM)	FFM expense
2018FY	343,706	7,549,369	64,969,235	24,691,220	8,523,647							106,077,177	53,038,589
2019FY		1,617,398	13,094,721	52,966,199	27,133,217							94,811,535	47,405,768
2020FY			5,852,200	13,526,622	35,389,323	40,674,631						95,442,776	47,721,388
2021FY				1,711,240	7,175,964	62,268,557	21,126,166					92,281,927	46,140,964
2022FY					2,209,486	16,550,869	54,399,529	18,175,688	16,455,565			107,791,137	53,895,569
2023FY						3,021,908	28,357,091	46,006,348	42,056,713			119,442,060	59,721,030
CPI	99.5	100	100	99.8	102.3	105.2	109.5	109.5	109.5	109.5	109.5		

Defense Expenditures on FFM (Price Index Adjustments)

Program/Year	2,018	2,019	2,020	2,021	2,022	2,023	2,024	2,025	2,026	2,027	2,028	Total (per two FFM)	FFM expens
2018FY	378,249	8,266,559	71,141,312	27,091,068	9,123,552							116,000,741	58,000,370
2019FY		1,771,051	14,338,719	58,114,216	29,042,886							103,266,873	51,633,436
2020FY			6,408,159	14,841,334	37,880,067	42,337,187						101,466,747	50,733,374
2021FY				1,877,563	7,681,017	64,813,755	21,126,166					95,498,501	47,749,250
2022FY					2,364,992	17,227,378	54,399,529	18,175,688	16,455,565			108,623,152	54,311,576
2023FY						3,145,427	28,357,091	46,006,348	42,056,713			119,565,579	59,782,790

Defense Expenditures on Submarines (yen)

Program/Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
2007FY	95,708,000	3,886,190,000	20,375,057,000	13,836,999,000	14,825,121,663						
2008FY		81,519,000	3,450,606,000	24,644,718,000	11,548,353,000	14,316,493,316					
2009FY				66,161,000	2,575,235,000	23,271,581,000	13,069,301,800	12,644,232,895			
2010FY					83,147,000	5,211,858,000	29,421,278,250	8,119,774,200	13,318,170,835		
2011FY						67,297,000	8,248,048,000	22,137,293,350	10,799,243,650	13,938,089,204	
2012FY							93,839,000	8,618,223,000	22,250,715,000	9,655,515,000	12,689,720,871
2013FY								101,492,000	9,746,572,000	19,687,450,000	9,591,638,000
2014FY									125,700,000	11,880,634,000	21,659,921,840
2015FY										1,169,501,000	9,862,817,000
2016FY											252,287,000
2017FY											
2018FY											
2019FY											
CPI	96	97	96	95	95	95	95	98	98	98	99

2018	2019	2020	2021	2022	2023	2024	Total
							53,019,075,663
							54,041,689,316
							51,626,511,695
							56,154,228,285
							55,189,971,204
							53,308,012,871
12,515,499,013							51,642,651,013
16,168,923,000	15,315,704,321						65,150,883,161
18,909,464,000	23,490,357,000	13,557,104,671					66,989,243,671
1,362,017,000	33,494,909,016	31,952,444,984	12,039,329,078				79,100,987,078
106,699,000	7,549,369,000	27,498,988,000	22,428,388,280	17,379,094,906			74,962,539,186
	74,772,000	3,276,949,500	28,106,554,626	14,197,400,074	22,309,461,020		67,965,137,220
		912,687,685	7,539,888,315	15,203,180,130	29,277,545,010	16,372,472	52,949,673,612
100	100	100	100	102	105	110	

Defense Expenditures on Submarines (Price Index Adjustments)

Program/Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
2007FY	109,738,492	4,396,051,705	23,361,976,351	15,982,609,604	17,178,315,578						
2008FY		92,214,158	3,956,454,000	28,466,209,082	13,381,424,905	16,588,952,573					
2009FY				76,420,142	2,984,002,460	26,965,482,746	15,079,963,615	14,200,446,174			
2010FY					96,344,937	6,039,137,048	33,947,628,750	9,119,131,025	14,850,709,841		
2011FY						77,979,063	9,516,978,462	24,861,883,301	12,041,926,473	15,557,805,992	
2012FY							108,275,769	9,678,927,369	24,811,133,325	10,777,562,615	14,092,539,913
2013FY								113,983,323	10,868,122,546	21,975,288,226	10,651,971,207
2014FY									140,164,460	13,261,258,135	24,054,375,674
2015FY										1,305,406,315	10,953,128,413
2016FY											280,176,739
2017FY											
2018FY											
2019FY											

2018	2019	2020	2021	2022	2023	2024	Total
							61,028,691,730
							62,485,254,718
							59,306,315,139
							64,052,951,600
							62,056,573,291
							59,468,438,991
13,773,338,110							57,382,703,412
17,793,940,387	16,770,696,231						72,020,434,888
20,809,912,643	25,721,940,915	14,845,029,615					73,635,417,901
1,498,903,131	36,676,925,373	34,987,927,257	13,209,484,309				86,653,416,809
117,422,518	8,266,559,055	30,111,391,860	24,608,301,770	18,602,257,011			81,705,932,214
	81,875,340	3,588,259,703	30,838,354,024	15,196,630,578	23,221,349,636		72,926,469,280
		999,393,015	8,272,723,151	16,273,198,673	30,474,250,747	16,372,472	56,035,938,058

Adapted from Bank of Japan (2025); Ministry of Finance in Japan (2025).

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