Potential and Prospects of Defence Production in the Context of Industrial Development in Pakistan

Muhammad Abdullah[1], Tahira Yasub [2], Sadiq Ullah Jan[3], Said Nawab[4], Rizwan Ullah[5]

Syed Khizar Ali Shah[6], Dr. Muqeem ul Islam [7]

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Abstract:

Pakistan's defense industry, established in 1951 under the Ministry of Defence Production (MoDP), plays a significant role in meeting domestic arms and ammunition needs. Despite its long history, the sector has not achieved substantial commercial growth. The defense production industry consists of 20 state-owned enterprises (SOEs) and 145 private sector organizations, producing a range of defense products, from small arms to UAVs. However, limited research and development (R&D) and continued reliance on foreign technology hinder its growth. The sector mainly depends on surplus production for export, but the current capacity is inadequate to meet global demand. Moreover, R&D efforts have not kept pace with technological advancements, resulting in outdated defense products. While Pakistan's defense sector contributes to the national economy, the lack of innovation, along with international financial restrictions (e.g., FATF), impedes its potential. This study assesses the challenges facing the sector and proposes strategies to enhance its capabilities and global competitiveness.

Key words:

Defense Industry, Pakistan, R&D, Technology Transfer, Commercial Growth

[1] *Military Land & Cantonment Group, Email: mohammadabdullah@gmail.com*
[2] *Police Department- Govt. of Gilgit-Baltistan, Email; tahira@gmail.com*
[3] *National Accountability Bureau Email: jan.sadiqullah@gmail.com*
[4] *Provincial Management Service-Khyber Pakhtunkhwa, Email: saidnawabsdm@gmail.com*
[5] *Provincial Management Service-Khyber Pakhtunkhwa Email:rizwanullahk746@gmial.com*
[6] *Information Group, Government of Pakistan, Email: khizarshah78@gmail.com*
[7] *Chief Instructor, National Institute of Management Peshawar, Peshawar, Email: muqeemci@nipapeshawar.gov.pk*

Introduction

Pakistan inherited no ordnance factories after the partition; there were sixteen ordnance factories pre-partition, all located in present-day India. In 1951, Pakistan Ordnance Factories were established to meet domestic arms and ammunition requirements. To make domestic production more self-reliant, the Defence Production Division was created in 1972 to formulate procedures for production, procurement, technological development, growth of the public defense sector, and indigenous production by promoting R&D. The Defence Production Division was granted the status of a ministry, the Ministry of Defence Production (MoDP), in 2004. Under MoDP, there are 20 SOEs and 145 private sector organizations where defense-related equipment ranging from small arms and ammunition to UAVs, tanks, and aircraft are locally manufactured. These products are primarily used domestically, and the surplus is utilized for commercial purposes, contributing to the overall industrial sector of Pakistan. Although the defense production industry has been operational for the last seven decades, no visible commercial growth has been achieved. Reliance is still placed on the transfer of technology from foreign countries due to weak R&D. Furthermore, the involvement of the private sector in the defense industry remains a gray area, which is a huge setback.

Statement of Problem

The Defense Industry of Pakistan was established in 1951 under MoDP, and for the last seven decades, it has been producing a wide variety of defense-related equipment, which also contributes to the overall industrial sector of Pakistan. However, this part of the industrial sector contributes only a fraction to total industrial development, even though it has been in existence for decades. This situation warrants an analysis of the potential and prospects of the defense industry, diagnosing the fault lines, and proposing means for improvement.

Scope Of Research

This simulation exercise focuses on the production potential of the defense industry for domestic consumption and exports, the factors that are hampering its growth, an analysis from various perspectives, and providing viable solutions to enhance the contributions of this industry to the overall industrial development of Pakistan.

Research Methodology

A qualitative method of research was conducted after obtaining data from both primary and secondary sources. Relevant books, research papers, journals, and websites were consulted for data collection, and situational, stakeholder, comparative, critical, SWOT, and GAP analyses were conducted.

Literature Review

As this research is specific to armaments, secondary data availability is limited. Considering the research scope, secondary data was collected and analyzed through the study of limited available articles, reports published by SIPRI (Stockholm International Peace Research Institute), World Bank, IMF, and a variety of relevant material available on the World Wide Web, the official website of the Ministry of Defence Production (MoDP), and the Defence Exports Promotion Organization (DEPO). Due to the uniqueness of the study scope, specific articles, reports, and studies on the subject are not available for review. Efforts have been made to analyze the Defense Production Units of Pakistan, opportunities in the international market, challenges, and workable recommendations to enhance the substantial level of sales that ultimately contribute to the national economy. Political changes in the world, the core order of economic shaping, regionalism, the desire for control of energy and natural resources, nuclear proliferation, and the world order are continuing trends that have an influence on Pakistan's economy in a global context (Jochen Hippler et al., 2022). The double face of globalization presents both opportunities and threats for Pakistan. Pakistan has a location advantage and can link with South Asia, Central Asia, West Asia, or the Middle East through Gwadar Port. However, Pakistan remains exposed to the effects of globalization and has less influence on it compared to global economic giants like the USA, EU, and China. The Soviet Union substituted the changing world order with uncertainty, increasing pressure on governments to make adaptive national security decisions in light of changing social, political, and economic pressures. They focused on maintaining an appropriate national defense capability and emphasized the reduction of costs to maintain domestic industry through privatization, actively engaging private investors in international defense product trade. They formed alliances and pooled resources as vital components of national security.

The Defense Industry of Pakistan is a state-owned industry that deals with arms/ammunition, the purchasing and retailing of weapons, ammunition, and other military/defense products. Contrary to adaptive decisions in the changing environment of globalization, the development of the defense sector is dictated by the requirements of the armed forces.

The Defense Industry of Pakistan relies on technology transfer (ToT), even for a single product. Decisions on inducting any product are usually taken with strategic requirements in mind rather than market needs. Limited budget investment in R&D activities for product innovations has hindered the diversification of products. However, Pakistan's defense production units have potential for conventional arms and ammunition for the region. The geopolitical situation surrounding Pakistan has changed rapidly in the past few years, and this changing situation may continue at an even faster pace in the coming years. Many changes in the South Asian region, the interests of India and Europe in Afghanistan, and the collapse of several Middle Eastern states, as well as rampant sectarian and proxy civil wars, have altered the scenario and choices for countries. Pakistan is also facing the effects of conflicts and aggression from neighboring countries. The security situation, both internally and externally, is more complex compared to previous decades (Dr. Rasul Bakhsh Rais, 2022). The crisis between Russia and Ukraine has created both opportunities and threats for the countries in the region. Currently, the crisis is limited to Ukraine, but there are fears it may spill over and last longer than anticipated. If this happens, many countries, including Pakistan, will face grave challenges. This crisis has opened opportunities for the global market, including Pakistan, to trade and invest with neighboring and regional economies (Dawn, 2022). Pakistan cannot remain aloof from the changing world order, as it directly impacts its economic and security policies. Presently, Pakistan faces a major threat: the balance of payments crisis. Pakistan has not succeeded in securing oil from Russia at low prices, while India, China, and Bangladesh have successfully shielded their populations from rising prices. However, economic opportunities for Pakistan abound in the multipolar world order. In just a few months after the start of the crisis, both Russia and Ukraine exhausted their stocks of conventional weapons and are now looking for new supply sources. In this context, Pakistan has the opportunity to supply conventional weapons to Ukraine and escape the threat of defaulting on external debt payments. Pakistan is supplying weapons to Ukraine with the help of British Airways, according to a new report by Ashish Dangwal (October 7, 2022). Pakistan is capitalizing on the export opportunity for conventional defense products. However, diplomatically, Pakistan faces the challenge of maintaining ties with both Russia and the West, including the US and EU.

Legal and Institutional Framework

Legal Framework

The defense industry operates under the ambit of several legislations, which are essential for understanding this sector.

Rules of Business 1973

Rules 7 and 8 of the Rules of Business 1973 lay down policies or guidelines on all matters related to defense production, such as procurement of defense products, R&D of defense equipment and stores, indigenous production and manufacturing of defense equipment, MOUs for the purchase of military stores, transfer of technology, and so on.

POF Board Ordinance 1961

This ordinance governs the functioning of POF Wah, which operates in the form of a board consisting of three members: a chairman, a financial adviser, and a director of industrial and commercial relations. The main functions of this board are to run the factories, produce to meet domestic requirements, and export the surplus for commercial benefits, while also focusing on capacity building for R&D in production.

Heavy Industries Board Act 1997

HIT also functions as a board headed by a chairman (appointed by the Federal Government on the recommendation of the Chief of Army Staff) and five members. HIT has the mandate to manufacture products for national consumption and to utilize the surplus capacity to meet the requirements of the civilian population and friendly or brotherly countries.

Pakistan Aeronautical Complex Board Ordinance 2000

This is a five-member board with a chairman (appointed on the recommendation of the Chief of Air Staff). The main function of the board is to manage the affairs of the factories and operate them on sound commercial lines to meet domestic consumption needs and utilize surplus capacity for commercial gains. It also works to enhance the R&D capabilities of the factories in production.

Institutional Framework

The Ministry of Defence Production (MoDP) and Defence Exports Promotion Organization (DEPO) are two government-owned entities that play a key role in Pakistan's defense industry.

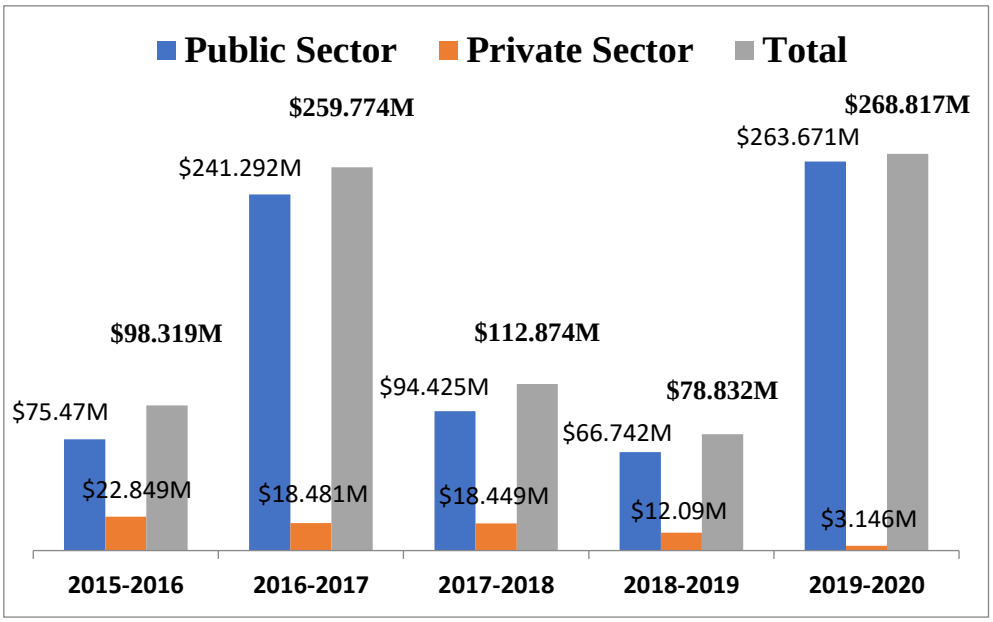
Role of MoDP

The defense production sector is regulated by the Ministry of Defence Production (MoDP), which was created in 1972 and is responsible for ensuring the manufacturing or procurement of arms, weapons, and ammunition for the three services. The main objectives and functions of the Ministry of Defence Production Division are:

- Import replacements through indigenization
- Achieving self-reliance
- Maintaining the current system with minimal imports
- Involving the local industry in defense production
- Producing cost-effective and competitive equipment
- Generating funds by exporting defense products
- Research and development of defense equipment
- Procuring equipment for defense purposes and securing foreign loans or assistance
- Achieving balance in the economy via optimal production and procurement

Role of Defence Exports Promotion Organization

The Defence Exports Promotion Organization (DEPO) is a government-owned organization. Its mandate is to ensure coordination with international customers' requirements for exporting high-quality products. Furthermore, it helps promote Pakistan's defense products globally in coordination with MoDP and ensures the presence of defense products at various national and international events. The Pakistan Naval Show was inaugurated by DEPO in 1999. The International Defence Exhibition and Seminars (IDEAS), which started in 2000, created an opportunity for the public and private sectors involved in the defense industry to access the international market and gain exposure to international trends and modern technology. DEPO is also tasked with organizing seminars and conferences where the defense sectors of participating embassies take part. The core objectives of these exercises are to introduce Pakistan's defense products and facilitate defense exports. The table below provides details of defense exports from Pakistan:



Source: (MODP & DEPO)

Heavy Industries Taxila (HIT)

HIT was established in 1971 and manufactures main battle tanks (MBT), armored recovery vehicles (ARV), and armored personnel carriers (APC). It also rebuilds and modernizes armored vehicles. HIT develops, markets, and undertakes heavy engineering works for Pakistan's military as well as for civilian law enforcement agencies. Surplus capacity is utilized to meet the demand of friendly countries. Prominent defense and commercial products of HIT are:

Defense Products:

- Tank Al-Khalid
- Tank Al-Zarrar
- APC Saad
- APC Talah
- Command Post Carrier (SKAB)

Commercial Products:

- Armored Land Rover Defender 110
- Armored Toyota Altis 1.8 VVTI
- Armored Toyota Land Cruiser
- Armored Toyota Hilux VIGO
- Mohafiz Hybrid

- Mohafiz-II
- Mohafiz-III
- Armored Guard Post 1 Man
- Armored Guard Post 2 Man
- Bomb Blanket
- Hifazat
- North Benz 6x4 Prime Mover

Institute of Optronics (IOP), Rawalpindi

IOP manufactures night vision devices and scopes essential for the night operations of the armed forces and law enforcement agencies of Pakistan.

Karachi Shipyard and Engineering Works (KS&EW), Karachi

KS&EW is the only shipyard in Pakistan, catering to shipbuilding, ship repair, and general heavy engineering works. It has played an important role in transferring technology and broadening the industrial base of the country. KS&EW develops a variety of ships that meet the quality and reliability requirements of national and international clients. KS&EW performs complete construction, erection, painting and blasting, outfitting equipment tests, and trials, adhering to major classification societies such as Lloyd's Register for Shipping, Bureau Veritas, and China. The following are some of the services and projects of KS&EW:

Services:

- Shipbuilding
- Ship repair
- Material testing laboratory
- Shipyard Institute of Technology

Projects:

- F22P Frigate
- Small Tanker Cum Utility Ships (STUS)
- GOSTA 90B Submarine
- Jalalat Class Missile Boat
- Fleet Tankers
- Coastal Oil Tanker Floating Dock

National Radio Telecommunication Corporation (NRTC), Haripur

NRTC produces stable and reliable high-tech communication equipment and solutions. NRTC develops and manufactures military and commercial telecommunication equipment, electronic systems, and IT solutions through indigenous R&D.

Global Industrial & Defence Solution (GIDS)

GIDS is a state-owned corporation and an emerging industry with vast potential in developing high-tech export-quality products for air, land, naval, and security sectors. GIDS is involved in the export and marketing of military, industrial, and technological products and services. A list of products manufactured by GIDS includes:

Air Systems:

- Shahpar UAV
- Uqab UAV
- Huma Tactical UAV
- Scout Mini-UAV

Land Systems:

- PAKFIRE - Artillery Fire Control System
- PAKSIM - Artillery Forward Observer Simulator
- Negahbaan Day/Night Surveillance System
- NOD Night Observation Device
- Baktar Shikan - Anti-tank Guided Missile Weapon System

Naval Systems:

- Slim Line Towed Array-Sonar for Naval Application
- Bridge Pilotage Simulator (BPS)
- Action Speed Tactical Trainer (ASTT)
- Naval Police Boat

Nuclear Biological and Chemical (NBC) Systems:

- NBC Defense Suit
- Individual Protective Equipment
- HEADS: High Efficiency Advanced Decontamination System

Security Systems:

- Ballistic Helmets
- Metallic Mine Detector
- Non-metallic Mine Detector
- Explosive Detector
- Stun Grenade
- Tear Gas Shell
- Walk-through Scanning Gate

Pakistan Aeronautical Complex (PAC), Kamra

PAC manufactures, repairs, and maintains radar and avionics systems. The premier product manufactured by PAC is the JF-17 Thunder, along with Mushshak and Super Mushshak. PAC also manufactures the Karakorum-8 (K-8), a joint venture aircraft with the Nanchang Aircraft Manufacturing Company (CNMC) of China, used for basic operational jet training for newly inducted pilots.

Pakistan Machine Tool Factory (PMTF), Karachi

PMTF is engaged in the manufacturing of precision and high-tech engineering goods. The product range includes conventional and CNC machines, various automotive products, and defense products such as launchers for light, medium, and heavy mortars.

Pakistan Ordnance Factories (POF)

POF consists of 14 ordnance factories and three commercial subsidiaries. POF manufactures various types of explosives and ammunition and also has facilities for the manufacture of brass, copper, and aluminum ingots and extrusions. The list of products manufactured at POF Wah includes:

- Infantry Weapons
- Small Arms Ammunition
- Artillery Ammunition
- Mortar Bombs
- Aircraft & Anti-aircraft Ammunition
- Tank and Anti-tank Ammunition
- Military Explosives & Propellants
- Rockets
- Grenades
- Commercial Explosives

People Steel Mills Ltd, Karachi

People Steel Mills Ltd in Karachi, Pakistan, is a world-class alloy and special steel manufacturing plant. This plant has the capability to produce steel that meets international military standards. A diverse base of customers includes high-profile end users in automotive, defense, machinery, construction, special/high-rise buildings, transportation, and engineering sectors. Components manufactured at this plant are supplied to renowned European and Japanese automobile manufacturers.

Precision Engineering Complex (PEC), Karachi

PEC manufactures high-precision parts for the aerospace industry, which are used for the cohesion of various engine parts and in other industries. PEC works with world-renowned companies such as General Electric, Airbus Industries, and Boeing.

The services of PEC also include cutting a wide range of basic and exotic materials, including hard steels and aluminum alloys, as well as machining a variety of castings, forgings, and extrusions.

Private Sector Defense Production Companies in Pakistan

There are 145 private sector defense production companies in Pakistan. Some of the notable ones include:

Integrated Dynamics

ID is a privately owned company that develops high-tech unmanned aerial vehicles (UAVs) and has greater potential than state-owned enterprises to broaden Pakistan's industrial base in defense production. A list of UAVs developed by ID is given below:

- Military UAVs
- Civilian UAVs
- Aerial target UAVs
- Multicopters
- Unmanned marine vehicles
- Unmanned ground vehicles
- Flight control
- Telecommand
- Ground control stations
- Antenna tracking systems
- Video and data downlinks

Daud Sons Armory (Pvt) Ltd

A private defense production company specializing in small firearms, mortars, parts, and ammunition for tanks and aircraft.

Sysverve Aerospace

Sysverve Aerospace is a leading provider of unmanned air target systems for live-fire training and weapon system tests and evaluations in Pakistan. Sysverve designs and develops surveillance and combat UAVs. The total annual capacity is 500 drones.

BSF Associates

BSF Associates is a private defense production company producing ballistic protection products and providing ballistic body armor tailored to customers' needs and comfort. It also produces bomb suppression blankets and letter bomb containment bags.

Role of Universities and Research Institutions

To provide a research base for the defense industry of Pakistan, several universities and research organizations are working as discussed below:

National Defence University

This university has several defense research centers, such as the Center for Aerospace and Security Studies (CASS), which focuses on topics like aerospace technology, defense production, and economic diplomacy. The Center for International Maritime Affairs (CIMA) is involved in research on maritime security and the blue economy.

Pakistan Defence Engineering Council (PDEC)

PDEC focuses on the design and development of defense systems and equipment.

Pakistan Council of Scientific and Industrial Research (PCSIR)

This center conducts research in various fields related to the defense industry. The Materials Research Division conducts material research on composites, ceramics, and polymers that can be used in defense systems. Similarly, the Applied Chemistry Research Center (ACRC) focuses on research in explosives, propellants, and chemical warfare. In addition, the Precision Systems Training Center (PSTC) is involved in the development of precision systems for defense applications and provides training in areas such as electronics, optics, and mechanical engineering relevant to the development of precision systems. Another unit, the Technology Development Fund (TDF), provides financial support for research and development in projects that have the potential to be incorporated into defense production. Finally, the Center for Applied Molecular Biology (CAMB) conducts research in molecular biology and biotechnology, which helps in the defense-related field of biodefense.

Potential Defense Products for Industrial Growth

The products of the defense industry include a wide range of small arms, artillery, ammunition, missiles, military vehicles, night-vision devices, ships, and more. The defense industry also provides other operational and logistical support. Pakistan's exportable defense products can be categorized as follows:

- Small Arms and Ammunition
- Artillery Ammunition
- Tank and Anti-Tank Ammunition
- Mortars and Launchers
- Aircraft and Anti-Aircraft Ammunition
- Military Telecommunication
- Naval Ships
- Fighter Jets
- Unmanned Vehicles/Drones
- Missile Technology
- Military-Grade Raw Materials and SKDs of Ammunition
- Military Uniforms and Personnel Load Carrying Equipment

Situational Analysis of the Legal & Institutional Framework

Almost 95% of defense production is manufactured by state-owned enterprises (SOEs), with only 5% contributed by private organizations. All the legal frameworks are designed to facilitate SOEs, which has led to a monopoly in the defense industry that hampers the growth of the private sector. Moreover, the cumbersome legal procedures pose a significant threat to the private sector's growth, as it is nearly impossible for private organizations to obtain a license from MoDP to independently manufacture tanks, aircraft, UAVs, etc., due to the prevailing security situation in the country.

As outlined in the legal frameworks of POF, PAC, HIT, etc., it is the mandate and responsibility of these bodies to carry out research and development to broaden the capabilities of defense production in Pakistan, but little to no efforts have been witnessed in this regard in the last seven decades. Furthermore, Pakistan's defense industry relies heavily on technology transferred by friendly countries like China and Turkey. The end products of these technologies cannot be used unilaterally by Pakistan for commercial purposes, which hampers the industrial prospects of the country. Institutes working in defense production have exclusive rights for the production of heavy machinery like aircraft, tanks, and heavy ammunition. Except for Integrated Dynamics (a private organization producing various AI systems), there is little visibility of the private sector in Pakistan's defense industry. Additionally, these institutions are reluctant to involve private entities and are not expanding their operations to other parts of the country.

Stakeholder Analysis of Organizations in Defense Production in Pakistan

The main stakeholders in Pakistan's defense industry include the federal government, armed forces, SOEs, private organizations, universities, and research institutes.

Federal Government

The federal government is the primary stakeholder in the defense industry, working to promote overall industrial growth in the country. All legislation related to the growth of the defense industry originates from it. However, the legal framework provided by the federal government favors SOEs, with no supportive legislation allowing private sector involvement in the defense industry.

Armed Forces of Pakistan

The majority of defense production is consumed locally by the armed forces of Pakistan, and the surplus is utilized for commercial growth. The heads of SOEs are appointed from the armed forces to manage the defense requirements of the armed forces.

State-Owned Enterprises

SOEs account for 95% of the total defense-related production. These organizations are primarily focused on meeting the defense needs of Pakistan's armed services, with some efforts directed toward reaching international markets for industrial growth. This suggests that SOEs lack the potential to significantly contribute to the broader industrial sector in Pakistan. The involvement of private organizations in the defense industry is minimal.

Private Sector

The private sector has significant potential to contribute to Pakistan's industrial growth. However, it faces numerous barriers, including the lack of a specific legal framework for private sector involvement, the monopoly of SOEs, a lack of technology transfer from the state, limited government incentives, and the security situation over the past five decades.

Universities and Research Institutions

Research plays a vital role in the development of any industry, including the defense industry of Pakistan. Several research and development centers are operating at various institutes to support the growth of the defense industry. However, this side of the industry has failed to integrate innovative technology for commercial viability and domestic excellence. Consequently, Pakistan's defense production remains heavily reliant on the transfer of technology from foreign countries.

Comparative Analysis Of The Defense Industry Of Pakistan, Turkey, And Israel

Defense Industry of Pakistan

Pakistan is a major player in the defense industry, with a well-established defense production base. The country has various facilities that produce advanced defense equipment, including aircraft, naval vessels, and missiles. Pakistan has a strong aerospace industry, with several companies specializing in aircraft production, such as the Pakistan Aeronautical Complex (PAC). Additionally, Pakistan has a robust nuclear program that contributes to its overall defense production capacity.

Defense Industry of Turkey

Turkey is another significant player in the defense industry, with a rapidly growing defense production base. The country has made substantial investments in the defense sector in recent years, leading to the establishment of several defense companies. The Turkish arms industry grew from $1 billion in 2002 to $11 billion in 2020, with more than $3 billion in exports, making Turkey the 14th largest global defense exporter. These companies produce a wide range of defense equipment, including aircraft, naval vessels, and missiles. Turkey focuses strongly on developing its own defense technologies, with several initiatives aimed at fostering indigenous defense capabilities.

Defense Industry of Israel

Israel is considered to have one of the most advanced defense industries in the world, with a well-established defense production base. The country has several companies specializing in advanced defense equipment, including aircraft, naval vessels, and missiles. Israel is also a world leader in the development of unmanned aerial vehicles (UAVs) and has developed several advanced systems in this field. Additionally, Israel has a robust nuclear program, which contributes to its overall defense production capacity.

Comparison Of Incentives and Financial Support To Defense Production Industry

S.No	Support	Pakistan	Turkey	Israel
1	Research and development support:	✓	✓	✓
2	Financial support:	✓	✓	✓
3	Export support:	✓	✓	✓
4	Collaboration support:	✓	✓	✓
5	Tax incentives:	✓	✓	✓

These measures are intended to stimulate investment, innovation, and growth in the defense industry, while also enhancing the country's overall defense capabilities.

Comparison of the Regulatory Framework for Defense Production

The following is a comparison of the regulatory framework for the defense production industry in these three countries:

S.#	Pakistan	Turkey	Israel
	The Ministry of Defense Production (MoDP) is responsible for regulating the defense production industry in Pakistan. The MoDP regulates the import, export, and production of defense products and services. The Pakistan Defense Export Promotion Organization (DEPO) is responsible for promoting and facilitating defense exports. The MoDP also provides licenses for the manufacturing of defense products.	The Under secretariat for Defense Industries (SSM) is responsible for regulating the defense production industry in Turkey. The SSM regulates the procurement, production, and export of defense products and services. The SSM also provides licenses for the manufacturing of defense products.	The Israeli defense industry is regulated by several government bodies, including the Ministry of Defense, the Ministry of Economy, and the Israel Defense Export Control Agency (DECA). The Ministry of Defense regulates the import and export of defense products, while DECA regulates the export of defense-related products and technologies. The Ministry of Economy is responsible for promoting and supporting the Israeli defense industry.

Overall comparative Analysis of Defence Industry of Pakistan, Turkiye and Israel

s.#	Pakistan	Tukey	Israel
CONTRIBUTION IN DEFENCE PRODUCTION			
1	90% state owned 10 % private sector	30 % state owned 70 %private sector	20% state owned 80% private sector
PRODUCTION CAPACITY OF TANKS, UAVs and Aircrafts			
2	50 (max) Tanks per year	250 (max) Tanks per year	Israel manufactures one of the top tanks of the world, i.e. Merkava-V. However, no record of annual production capacity is available publically.
	Pakistan has a relatively young UAV program. The country has developed and produced several UAVs for military and civilian applications, but its capabilities are generally considered to be less advanced. Some of the most well-known Pakistani UAVs include the Burraq, the Shahpar, and the Uqab	TAI Aksungur: The TAI Aksungur is a MALE UAV developed by Turkey. It has a maximum speed of 230 km/h and a range of up to 6,000 km. The TAI Aksungur is primarily used for surveillance and reconnaissance, but can also carry payloads such as communications and electronic warfare equipment.	Israel has been at the forefront of UAV development for many years, and its defense companies have produced some of the most advanced UAVs in the world. Israeli UAVs are known for their high quality, reliability, and advanced capabilities. Some of the most well-known Israeli UAVs include the Heron, the Hermes, and the Skylark.
	Pakistan Aeronautical Complex has annual Aircraft production capacity of 25 number JF-17 Thunder. Additionally, it also manufactures Mushak/Super Mushak trainer Aircrafts	Turkish Aerospace Industry manufactures 48 number of (F-16 Fighting Falcon) and 50 – 60 number of TF-X Aircrafts annually.	Israel manufactures 20-24 F-16 Fighting Falcon aircrafts annually. While it also manufactures 5th generation F-35 Lightening II (stealth technology) Aircrafts
RESEARCH & DEVELOPMENT			
3	2.6 % of total Defence Budget	5% of Total Defence Budget	4.5 % of Total defence budget
EXPORTS OF DEFENCE PRODUCTIONS			
4	268 Million US $ in 2020	2.7 Billion US $ in 2020`	8.3 Billion US $ in 2020`

CONTRIBUTION IN GLOBAL MARKET (1.9 TRILLION US$)			
5	0.051%	0.9 %	2.4 %
COST EFFECTIVE (LABOR CHARGE PER DAY)			
6.	2.94 US$	15 US$	50 US$

Analysis of the Growth of the Turkish Defence Industry

Turkey has implemented various policies to promote public-private partnerships (PPPs) in the defense industry, aimed at increasing domestic production and reducing dependency on foreign suppliers. Some of these policies include:

1. **Legislative Framework**: Turkey has enacted laws and regulations to establish a legal framework for PPPs in the defense industry. The Public Procurement Law and the Law on the Promotion of Private Sector Investment are examples of laws that support PPPs in the defense industry.

2. **Technology Transfer**: Turkey has encouraged technology transfer from foreign defense companies to local partners. This is aimed at building local capacity and promoting knowledge transfer to Turkish companies.

3. **Local Content Requirements**: Turkey has implemented local content requirements in defense procurement contracts. This means that a certain percentage of the value of the contract must be produced locally, which encourages the involvement of Turkish companies in the defense industry.

4. **Incentives**: Turkey has introduced various incentives to encourage private sector participation in the defense industry. These include tax incentives, financial support, and preferential treatment in government procurement.

5. **R&D Support**: Turkey has provided support for research and development (R&D) activities in the defense industry. This includes funding for R&D projects and the establishment of research centers to support innovation and technology development.

Overall, these policies have helped to promote PPPs in the defense industry in Turkey, which has led to increased domestic production and a reduction in dependency on foreign suppliers.

Comparative Analysis of Pakistan Ordnance Factories (POF) Working with the Private Sector

Pakistan Ordnance Factory

Pakistan Ordnance Factories (POF) is a government-owned defense production organization in Pakistan. POF was established in 1951 and currently comprises 14 defense production units. POF manufactures conventional arms and ammunition primarily for the Armed Forces of Pakistan, law enforcement agencies, and additionally for commercial use and export.

Comparative Analysis with the Private Sector

Private sector companies in Pakistan also engage in defense production. There are 145 private sector defense production companies in Pakistan. Some of the notable ones include:

a. **Daud Sons Armory (Pvt) Ltd.**: A private defense production company specializing in small firearms, mortars, parts, and ammunition for tanks and aircraft.

b. **Integrated Dynamics**: A defense production company that develops and manufactures unmanned aerial vehicles (UAVs) for surveillance, reconnaissance, and intelligence gathering.

c. **Sysverve Aerospace**: Sysverve Aerospace is a leading provider of unmanned air target systems for live-fire training and weapon system test and evaluation in Pakistan. Sysverve designs and develops surveillance and combat UAVs. The total annual capacity is 500 drones.

d. **BSF Associates**: BSF Associates is a private defense production company producing ballistic protection products and providing ballistic body armor as per customer needs and comfort. It also manufactures bomb suppression blankets and letter bomb containment bags.

Following is a comparative analysis of POF's best practices with the private sector (Daud Sons Armory) in Pakistan:

S.No	Category	POF (SOE)	Private sector
1	Quality control compliance	✓	✓
2	Collaboration with international companies and organizations	✓	X
3	Investment in capacity building of employees	✓	✓
4	Production capacity	Large scale	Small scale
5	Export	Globally (Large scale)	Globally(Small scale)
6	Relaxations/Benefits	access to certain	private sector

		resources and benefits	companies do not have access to benefits.
7	Innovation	Innovative defense products	private sector companies have more flexibility in experimenting with new ideas and technologies.
8	Multiple productions	112 products	DSA has now expanded its line of production from Sporting Arms, Rifles, and Pistols to the International Standard Pump Action shotguns **"SHOOTER"** and also to sophisticated **Airborne Armaments**

Critical Analysis of The Defence Industry of Pakistan

Product Quality

Pakistan's defence industry faces various challenges and limitations, along with opportunities. The primary factors responsible for these difficulties are the lack of institutional interest in defence exports, inadequate focus on marketing quality, absence of coherent product development and prioritization, insufficient private sector efforts for defence production modernization, and a narrow concentration on manufacturing small arms for the armed forces without considering the needs of the international market. Furthermore, Pakistan's Defence Production Units manufacture arms and ammunition that are unable to compete with more responsive international market competitors. Additionally, the armed forces generally lack interest in research and development, and joint ventures with other countries may potentially hinder Pakistan's domestic industry. The solution to these issues is closely related to the leadership and management of these organizations and can be addressed by prioritizing product quality development, innovation, and effective marketing strategies to cater to the international defence market. Pakistan's defence industry is not yet self-sufficient in developing new or innovative products that meet international standards, due to weak research and development, reliance on foreign countries for technology transfer, and the need for sophisticated plant and machinery to meet military standards.

Non-Involvement of the Private Sector

Globally, the defence industries of countries are typically operated through a public-private partnership, with most defence industries being private or independent entities regulated by the government. These entities operate on purely commercial lines and are driven by market needs. In contrast, the majority of Pakistan's defence industry is owned by the government and lacks the necessary funding for investing in research and development for introducing new products. While the public sector receives budgets to meet the requirements of the armed forces, it must divert resources for the export of defence products. In Pakistan, the defence industry does not have the required level of independence due to the fact that most defence production is governed by state-owned entities (SOEs), which are directly controlled by the armed forces. These SOEs function like armories that only produce new weapons or products as per the requirements of the armed forces. The Defence Production Units in Pakistan, such as Heavy Industries Taxila (HIT), Pakistan Ordnance Factories (POF), Pakistan Aeronautical Complex (PAC), and Karachi Shipyards & Engineering Works (KSEW), are directed by the armed forces on processes and product innovation at all times. However, Pakistan's defence industry is making efforts to expand the exports of defence-related products despite financial constraints and by reviewing other export-related policies.

International Restrictions

Pakistan has faced significant bans and restrictions on international trade and imports of various plants and machines since 9/11, and especially after becoming a nuclear power. The United States and the European Union have been strict about the non-proliferation treaty and have consequently imposed bans on defence-related Pakistani trade, imports of specialized plants and machinery, and transfers of technology. International treaties on arms trade, as well as India's dominance in falsely convincing the world that Pakistan is a source of terrorist activities, have not only damaged Pakistan's image internationally but also resulted in a decline in defence-related exports and under-utilization of its potential. From June 2018 to October 2022, Pakistan was placed on the FATF grey list, which is a jurisdiction under increased control. Pakistan was forced to resolve the identified strategic deficiencies within FATF's timeframes. Research has shown that FATF restrictions have resulted in losses of over $38 billion to Pakistan's GDP (Aziz, 2022). The adverse economic effects of being on the grey list are increasingly evident, and they have an impact on foreign direct investment (FDI) and the ease of doing business. Hostile states have also used Pakistan's status to damage its reputation as a responsible member of the international community.

Raw Material

To maintain the quality of conventional arms and ammunition in defence products during manufacturing, it is crucial to have a reliable supply of specified standard raw materials. Unfortunately, the defence industry of Pakistan faces challenges in this area, as it relies on foreign countries for the supply of necessary raw materials. Since the 9/11 terror attacks, due to the threat of terrorism, there have been shortages of specified raw materials in the international market, especially for a Muslim third-world country, which is a growing concern for Pakistan and its defence industry's quality standards. While China has become one of the major suppliers of raw materials to Pakistan's defence industry in recent years, the quality of its materials has been compromised, affecting the country's defence output. As a result, Pakistan's defence industry has limited regional options for potential exports, primarily in the Middle East and African countries. The use of low-grade steels has led to compromised quality of defence products, making it difficult for the country to compete with the quality of competitors' products in the international market.

Since steel makes up nearly 90% of the raw materials required in the defence industry, the underdeveloped steel industry in Pakistan has forced its defence industry to rely on private steel suppliers or China as an alternative. This reliance on these sources has raised serious concerns about the quality of the materials used in Pakistan's defence industry. In the past decade, People Steel Mills in Karachi was one of the main beneficiaries of steel requirements for the defence industry in Pakistan.

Internal Security Challenges

In the past two decades, internal security challenges in Pakistan have been a significant concern, reducing international interest in the country's defence industry. The primary focus of the defence industry has been to serve the armed forces, resulting in a decrease in surplus production capacities and a reduction in defence exports. Despite minor fluctuations, defence exports have increased in recent years, mainly due to improved internal security and events like the IDEAS trade expo, which have attracted more international companies to approach Pakistan for defence exports. The improved internal security situation in the country is expected to have a positive impact on Pakistan's defence exports in the future.

Monopoly in the International Defence Market

The major players in the global defence export industry are the USA, Russia, the EU, France, and China. In recent years, the trend in the industry has been towards public-private partnership models.

The USA has been leading the way in this regard by encouraging private manufacturing units to produce conventional arms for the military while also contributing to the country's defence exports. Private companies now handle most of the conventional arms production within the USA. However, the production of strategic-level industries with non-conventional arms remains under public control. These global giants enjoy a dominant position in the market due to their high-tech defence products, which have created a monopolistic situation.

Swot Analysis of the Defence Industry of Pakistan and International Best Practices

Swot Analysis of the Legal Framework

Strengths	Weaknesses
• Adequate legal framework for SOEs • Laws encourage growth of defence industry • R&D made integral part of legal system	• Designed specifically for SOEs only • No room for growth of private sector or PPP as laws are silent • Cumbersome process for obtaining NOC for private sector • little to no efforts to enhance indigenous R&D by research institutes • adhocism is promoted
Opportunities	**Threats**
• Incorporation of laws for private sector for growth of defence industry (like Turkey) • PPP and joint venture of private sector and foreign defence industry (like Israel-USA for F-35) • Laws needed to transfer technology to private sector for growth in defence industry (like JV of Turkey and Singapore)	• Vested interests of "stake holders" to amend laws • Ever prevailing security situation in Pakistan

Swot Analysis Of Institutional Framework

Strengths	Weaknesses
• Well-structured SOEs boards constituted like HIT, POF, PAC etc • POF capacity to build wide range arms and ammunitions adding to GDP • Foreign technology of JF-17	• Limited foreign technology available for hi-tech production, foreign countries reluctant to share technology • SOEs leading the way, private sector and PPP are not institutionalized

Thunder with PAC having commercial value • HIT manufacturing export quality MBTs and armoured vehicles • GIDS showing progress in making UAVs, land and naval systems • ID(Private) achieving excellence in making UAVs for military, civilian and naval utilities • Daudsons producing high quality arms and ammunitions • Export quality conventional produced by SOEs at lower cost due to low-cost labour	• SOEs only headed by military personnel instead of business savvy heads • Growth of SOEs only in few cities like Wah, Taxila, Kamra etc, institutes are not extended to other cities for commercial growth • SOEs primarily concerned for domestic consumption • No private sector is allowed to collaborate or work with institutes of SOEs • Public sector apprehensions that private sector might take over this industry • Defence industry not considered as an industry in Pakistan
Opportunities	**Threats**
• Low-cost labour for increased production in SOEs and Private sector (like investing of POF in Egypt) • Every war (Russia Ukraine war) is an opportunity for defence sector growth • ID, Daudsons etc showed that private sector can grow and has great potential despite unconducive environment • Technology transfer from China and Turkey for increased production of commercial value	• Pakistan under security threat since forever • Restrictions like FATF • Dollar rate fluctuation • Unavailability of raw material • Reliance on imports • Changing world order, friendly countries to share technology, Pakistan has to align with one

International Best Practices

There are several best practices in the defense industry that are recognized worldwide. Here are some of them:

1. **Research and Development**: The defense industry requires a constant focus on research and development to create new technologies and improve existing ones. The best defense companies invest significant resources in R&D to maintain their competitive advantage.

2. **Public-Private Partnership**: Collaboration between the government and private companies can help promote innovation, reduce costs, and increase the effectiveness of the defense industry. Public-private partnerships have been successful in many countries worldwide.
3. **International Collaboration**: Collaboration between defense companies from different countries can help promote the sharing of technology, expertise, and resources, leading to cost savings and improved capabilities.
4. **Flexibility and Adaptability**: The best defense companies are flexible and adaptable to changes in the market and to the evolving needs of their customers. This enables them to quickly adjust to new situations and continue to provide high-quality products and services.
5. **Quality Control**: Quality control is critical in the defense industry, where products and services need to meet high standards to ensure they are reliable and effective. Best practices include rigorous testing, compliance with international standards, and certification.
6. **Ethics and Compliance**: The defense industry must adhere to ethical and legal standards. Best practices include transparency, accountability, and compliance with international laws and regulations.
7. **Sustainability**: The defense industry has an impact on the environment and communities where it operates. Best practices include sustainable manufacturing processes, resource conservation, and responsible waste management.

Overall, the best practices in the defense industry focus on innovation, collaboration, quality, ethics, and sustainability. These practices can help promote the growth and success of the industry while ensuring that the products and services produced meet the needs of customers.

Best Practices **of Israel**

There are several best practices that have contributed to Israel's success. Here are some of them:

1. **Government Support**: The Israeli government has been a major supporter of the defense industry, providing funding and incentives for research and development. The government has also created a favorable regulatory environment, allowing defense companies to operate more efficiently.

2. **Collaboration**: Israeli defense companies have a strong tradition of collaboration, working closely with each other and with the military to develop innovative technologies. This collaboration has enabled the industry to develop cutting-edge solutions quickly and efficiently.

3. **Innovation**: The Israeli defense industry is known for its innovative spirit. Companies are encouraged to think outside the box and develop novel solutions to complex problems. This focus on innovation has helped the industry to stay ahead of the curve and maintain its competitive edge.

4. **Skilled Workforce**: Israel has a highly educated and skilled workforce, with many engineers and scientists working in the defense industry. This talent pool has enabled the industry to develop and produce sophisticated technologies.

5. **Export Orientation**: The Israeli defense industry is highly export-oriented, with a focus on developing products that can be sold to other countries. This has helped to generate revenue for the industry and boost the Israeli economy.

6. **Public-Private Partnerships (PPPs)**: PPPs have played a significant role in the Israeli defense industry. The Israeli government and private companies have been collaborating to develop and produce cutting-edge defense technology for many years.

   One notable example is the Iron Dome missile defense system, which is a joint project of the Israeli government and the defense company Rafael Advanced Defense Systems. The Iron Dome has proven to be highly effective in intercepting incoming rockets and missiles, saving countless lives in Israel.
   Another example is the development of the F-35 fighter jet, which involved a partnership between the Israeli government and the US defense contractor Lockheed Martin. Israel is the only country outside of the US to have the F-35, and its involvement in the project has helped to strengthen the relationship between the two countries.

7. In addition to these examples, there are many other instances where the Israeli government and private companies have collaborated on defense projects. These partnerships have helped to ensure that Israel remains at the forefront of defense technology and can maintain its security in a volatile region.

Overall, the Israeli defense industry's success can be attributed to a combination of government support, collaboration, innovation, a skilled workforce, and an export-oriented focus.

Best Practices of Turkey

1. **Domestic Production**: Turkey has focused on developing its own defense industry and reducing dependence on foreign suppliers. The country has been investing heavily in research and development, which has enabled it to produce a wide range of defense equipment, including tanks, missiles, and aircraft.

2. **Collaboration with International Partners**: While Turkey is working towards self-reliance, it recognizes the value of partnerships. The country has established collaborations with several international partners, including the United States, Europe, and Asia, to develop advanced defense technologies.

3. **Investment in Human Capital**: The Turkish government has invested in education and training to develop a highly skilled workforce. The country has also established several research and development centers, universities, and technology parks to support the growth of the defense industry.

4. **Innovation and Technology Transfer**: Turkey has focused on innovation and technology transfer to develop its defense industry. The country has established partnerships with leading defense companies worldwide to transfer knowledge and technologies.

5. **Export-Oriented Strategy**: Turkey's defense industry is export-oriented, and the country is one of the world's top defense exporters. Turkish defense companies have been successful in exporting their products to several countries, including the Middle East, North Africa, and Asia. It is also exporting to Pakistan, Indonesia, and Azerbaijan.

In conclusion, the Turkish defense industry has been successful in developing its capabilities through domestic production, collaborations with international partners, investment in human capital, innovation, and technology transfer, as well as an export-oriented strategy.

Gap Analysis

S.No	Current State	Desired State	Remedies
1	Weak legal framework that supports SOEs only	Favorable regulatory environment, allowing defense companies to operate more efficiently	Legal framework that supports growth of private sector, PPP and Joint ventures of private firms with foreign industries (short to midterm solution)
2	Defence industry is	Profitable	Considerable contribution is

	not a profit earning industry and contributes only in fractions in the overall industrial sector	Defence Industry which contributes to the economy	expected from this sector in the industrial sector if private sector is involved (mid to long term solution)
3	Prevailing ad-hocism is hampering growth of defence industry as heads of SOEs	Technically and operationally sound and experienced individuals at the top.	Business savvy Chairman needed to head SOEs (needs policy and paradigm shift from the stakeholders)
4	Although decision of boards of SOEs are taken by a majority vote, at times it is dictated by sitting chairmen, consequently unilateral decisions imposed (primary source)	Think outside the box and develop novel solutions to complex problems	Boards must be constituted of technocrat members having functional specialization that can lead this industry towards progression (needs policy change from stakeholders)
5	Limited capacity of R&D in all SOEs and government research centers	Research and development centers, universities, and technology parks to support the growth of the defense industry	Enhancement of capacity of R&D and that can be done by sending research scientists in bulk to leading and renowned institutes/universities. Budget allocation shall be made so that the research scientist when return to Pakistan must be capable of reverse engineering (Long term measure)
6	SOEs are not giving any room to private sector to collaborate in their existing setups. And SOEs are not growing to other parts of Pakistan	Collaboration between the government and private companies promote innovation, reduce costs, and increase the effectiveness of the defense industry	There is dire need that SOEs involve private sector for production growth that needs amendment in the legal framework and policy (midterm to long term). Furthermore, SOEs need to make their branches in other cities in collaboration with private sector for production growth (needs policy change and is a long-term measure)

ISSUES AND CHALLENGES

The above-mentioned analysis reveals that there are certain challenges involved in the optimum utilization of Pakistan's Defense Industry in overall industrial development. These can be summarized as follows:

i) **State-Owned Enterprise**: Due to a strict legal and regulatory framework, private investors have not been encouraged in defense production. Defense production has not been given the status of an industry, where the private sector could contribute and invest freely.

ii) **No Public-Private Partnership**: Defense production in Pakistan is mainly state-owned and is primarily managed by the Armed Forces of Pakistan. The management of these organizations does not encourage entering into public-private partnerships, which could not only enhance the capacity of private partners but also help introduce new ideas in defense production.

iii) **Limited Focus on Research & Development**: The defense production sector of Pakistan has never focused on research and development. Pakistan has mostly relied on foreign technology.

iv) **International Sanctions on Pakistan**: Restrictions on Pakistan due to its nuclear tests and FATF restrictions limit its capacity to collaborate with international partners and enhance its defense production.

v) **Products Not as per International Standards**: Due to numerous reasons, including the non-availability of raw materials, lack of technology, and technical expertise, the defense equipment produced by Pakistan does not meet the standards of those available in the international market.

vi) **Total Reliance on Foreign Technology for Production**: Pakistan lacks indigenous technology for defense production and relies on foreign technology from China, the USA, the UK, and Europe. Due to non-indigenous technology, the products cannot be exported until a certain time.

vii) **Raw Material Import**: Ninety percent of the raw material for defense production consists of steel. Although Pakistan's defense production industry obtains steel from People's Steel Mill, its limited capacity cannot meet the overall requirements of the industry. Therefore, most of the raw materials for defense production are imported.

Conclusion

Following a thorough review of literature and qualitative analysis of the data, the following conclusions can be drawn:

i. Throughout the world, defense sectors are mostly private and run purely on commercial lines, based on market needs, but regulated by the government. However, Pakistan's defense sector is based on state-owned defense production units, which are dictated by the Armed Forces of Pakistan.

ii. Pakistan's defense production units contribute to the national economy through the export of conventional ammunition, based on surplus capacities. However, the existing capacity is not sufficient to meet the demand for conventional weapons in the changing global scenario.

iii. R&D activities in Pakistan's defense production units are not sufficient to introduce innovative and advanced products that meet the demand of the international market. Pakistan is producing defense products relying on technologies from the late seventies and early eighties, which do not meet the standards of the international defense market. Pakistan relies on technology transfer from foreign developed countries to meet required military standards.

iv. Due to restrictions on Pakistan from FATF between June 2018 and October 2022, as well as the impact of nuclear tests, international money transactions and the import of raw materials and technology have been restricted, which has resulted in Pakistan lagging behind in defense production.

Recommendations

i. **Legislation**: Legislation is urgently needed that allows private sector and PPP involvement in the defense industry (an Act of Parliament is required as a mid-term measure).

ii. **Recognition of Defense Industry**: The defense industry should be recognized as a proper industry. The heads of state-owned enterprises (SOEs) must be business-savvy individuals based on functional specialization, and the board members must be technocrats from the same field (an Act of Parliament is required as a short- to mid-term measure).

iii. **Technology Transfer**: Transfer of technology from friendly countries directly to the private sector is essential for the survival of Pakistan's defense industry (consensus of stakeholders is required as a short-term measure).

iv. **Strengthening R&D**: The R&D base needs to be strengthened. This can be achieved by selecting and sending research scientists to developed countries with advanced defense production for research purposes.

v. These scientists, upon return, can strengthen the R&D capacity of Pakistan's defense sector (Finance Division, HEC consent, and budgetary allocations are required as a mid- to long-term measure).

vi. **Investments in Steel Industry**: Investments in the steel industry should be encouraged, as steel constitutes 90% of the raw material in defense production. This will help ensure the availability of raw material for defense production and will also assist in the development of an allied industry (consensus of the Ministry of Industries and Production and BOI is required as a mid- to long-term measure).

vii. **Expansion of SOEs**: SOEs must extend their workstations to other areas in collaboration with PPPs to increase the production capacity of SOEs and enhance commercial gains (consensus of stakeholders with relevant amendments in the legal framework is required as a mid- to long-term measure).

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