Defence Procurement and Industry Policy

A small country perspective

Edited by
Stefan Markowski, Peter Hall and Robert Wylie

Routledge Studies in Defence and Peace Economics
Defence Procurement and Industry Policy

Arms purchases are among the most expensive, technologically challenging and politically controversial decisions made by modern-day governments. Superpower spending on weapons systems is widely analysed and discussed but defence procurement in smaller industrial countries involves different issues which receive less attention. This volume presents a general framework for understanding smaller country defence procurement supported by country, industry and project studies.

Part I provides a general framework for analysing smaller country defence procurement, focusing on the formation of national defence capabilities. The framework is then used to analyse issues around the development of procurement demand, the characteristics of defence industry supply, contracts and relationships between buyers and sellers, and government policy for defence procurement and industry development. Part II focuses on defence procurement in seven smaller industrial nations with widely varying historical and political settings (Australia, Canada, Israel, Singapore, Spain, Sweden and The Netherlands). Part III consists of two Australian case studies of the procurement issues raised in, respectively, the naval shipbuilding industry and a major, complex defence project.

The book addresses the needs of public and private sector managers, military planners, procurement specialists, industry policy-makers, and defence procurement and industry educators. It presents general principles in an accessible manner and points to real-world experience to illustrate the principles at work. Therefore, it will be of interest to scholars and practitioners in defence economics, strategic procurement, public sector procurement, and defence industry policy.

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Preface

The concept of this book has evolved with our interest in defence procurement and industry policy going back to the mid-1990s. What has emerged is a volume that aims to introduce defence practitioners to concepts and tools used by defence economists and expose academic economists to the challenges faced by contemporary defence procurement and industry practitioners. Although the book focuses specifically on defence issues, much of it has a broader applicability and should be of interest to anyone involved in procurement in large organisations, particularly in government departments. While most of the countries in the world can be regarded as small or at most mid-sized in terms of defence procurement, there is a paucity of literature in this area that adopts the small country perspective. Being based in Australia, we have come to believe that decision-makers in small countries face more acute economic choices than those in the larger powers and have less room for mistakes. The issues in such countries deserve, we feel, special treatment.

The book is divided into three parts. Part I provides a general overview of issues involved in defence procurement and industry policy making by smaller military powers. Part II contains a selection of national case studies mostly written by external contributors. Part III comprises two industry studies to highlight particular aspects of the procurement of complex military systems by small countries.

External contributions to this book comprise invited chapters on the experience of small, advanced industrial economies. Nearly all were written especially for this volume. Seven countries were selected for inclusion using a three-step procedure described in the Introduction. We are most grateful to the expert country specialists who accepted our invitation to write relevant chapters. Their contributions were peer-reviewed and revised before final submission to the publisher and highlight particular aspects of defence procurement or industry that their authors regarded as important. They were not structured around an editor’s template. This approach, we hope, will give the contributions relevance well into the future while, at the same time, all the latest data can best be obtained from reliable internet sources and annual publications such as the SIPRI Yearbook.
Acknowledgements

The book took longer to produce than originally anticipated. We are most grateful to our external contributors and our publishers at Routledge for putting up with this protracted gestation period. We also wish to express our gratitude to Routledge (Taylor & Francis Group) for allowing us to include a refined version of a paper by Ron Matthews and Nellie Zhang, ‘Small Country “Total Defence”: A Case Study of Singapore’, which was previously published in Defence and Peace Economics, 7(3) (2007): 376–95, and to use parts of a chapter by Markowski and Hall, ‘Mandatory defence offsets – conceptual foundations’, which was first published in Jürgen Brauer and J. Paul Dunne (eds) (2004) Arms Trade and Economic Development, Theory, Policy and Cases in Arms Trade Offsets, London: Routledge, pp. 44–53. We are grateful to the Editors of Defence and Peace Economics and Professors Brauer and Dunne for their kind permission to use the aforementioned work.

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Abbreviations

ACOA Atlantic Canada Opportunities Agency
ADAS amphibious deployment and sustainment
ADF Australian Defence Force
ADI Australian Defence Industries
ADM (Mat) Assistant Deputy Minister (Materiel) (Canada)
AECMA European Association of Aerospace Industries
AFP Australian frigate project
AGP agreements on government procurement
AII Australian Industry Involvement
AIP Australian Industry Participation
AIT Agreement on Internal Trade
AMC Australian Marine Complex
AMEC Australian Marine Engineering Corporation
ANAO Australian National Audit Office
ANZAC Australian and New Zealand Army Corps in World War I
ANZUS the Australia, New Zealand and the United States security alliance
ASC Australian Submarine Corporation
ASD AeroSpace and Defence Industries Association of Europe
ASPI Australian Strategic Policy Institute
ASW anti-submarine warfare
AWA Amalgamated Wireless Australasia Ltd
AWACS airborne warning and control system
AWD air warfare destroyers
BHP Broken Hill Propriety Ltd
CBRN chemical, biological, radiological, and nuclear
CBW chemical and biological weapon systems
CDC Computing Devices Canada
CDF Chief of the Defence Force (Australia)
CDIB Canadian defence industry base
CEDQRP Canada Economic Development for Quebec Regions
CEO DMO Chief Executive Officer Defence Materiel Organisation (Australia)
Abbreviations

CF Canadian Forces
CoA Commonwealth of Australia
CoBPSC Code of Best Practice in the Supply Chain
CoPS complex product systems
COTS commercial-off-the-shelf
CPFs Canadian patrol frigates
CRS Congressional Research Service (USA)
CSIC Spanish Council for Scientific Research
CSP Commercial Support Program (Australia)
CTC competitive tendering and contracting
CTOL conventional-take-off-and-landing
CUF common user facility
CV carrier version
DAO Defence Acquisition Organisation (Australia)
DCP Defence Capability Plan (Australia)
DDR&D Directorate of Defence R&D in the MoD (Israel)
DER Defence Efficiency Review (Australia)
DFAIT Department of Foreign Affairs and International Trade (Canada)
DFO Department of Fisheries and Oceans (Canada)
DIB Defence industry base
DMO Defence Materiel Organisation (Australia)
DMP Defence materiel process
DMS Defence Maritime Services Pty
DND Department of National Defence (Canada)
DoD Department of Defence (Australia)
DOD Department of Defense (USA)
DPA Defence Procurement Agency
DPDSA Defence Production and Development Sharing Arrangements (Singapore)
D&S defence and (national) security
DSO Defence Science Organisation (Singapore)
DSTA Defence Science and Technology Agency (Singapore)
DSTO Defence Science and Technology Organisation (Australia)
EADS European aerospace conglomerate
EC Environment Canada
EDA European Defence Agency
EDIG European Defence Industry Group
EFA European fighter aircraft
EREA European Research Establishments Association
ESF Economic Support Fund
ESDP Europe’s security and defence policy
EU BAM EU Border Assistance Mission
EUFOR European Military Force
EUMM EU Monitoring Mission
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<td>EUPOL</td>
<td>EU Police Mission</td>
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<td>EUROPA</td>
<td>European Understandings for Research Organisation, Programmes and Activities</td>
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<td>EUSEC</td>
<td>EU Security Sector Reform Mission</td>
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<td>FC</td>
<td>Finance Canada</td>
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<td>FDA</td>
<td>Force Development and Analysis Division (Australia)</td>
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<td>FDI</td>
<td>foreign direct investment</td>
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<td>FFA</td>
<td>Aeronautical Research Institute (Sweden)</td>
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<td>FFG</td>
<td>guided missile frigate</td>
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<td>FMF</td>
<td>US Foreign Military Funded Program</td>
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<td>US Foreign Military Sales program</td>
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<td>Defence Procurement Agency (Sweden)</td>
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<td>FOI</td>
<td>Defence Research Establishment (Sweden)</td>
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<td>FTA</td>
<td>free trade agreement</td>
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<td>GD</td>
<td>General Dynamics</td>
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<td>General Motors Diesel Division</td>
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<td>gross national income</td>
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<td>GPA</td>
<td>Agreement on Government Procurement</td>
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<td>GPFs</td>
<td>general purpose frigates</td>
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<td>HRC</td>
<td>Human Resources Canada</td>
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<td>HRSDC</td>
<td>Human Resources and Social Development (Canada)</td>
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<td>IAI</td>
<td>Israeli Aircraft Industries</td>
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<td>IC</td>
<td>Industry Canada</td>
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<td>ICPs</td>
<td>industrial cooperation programs</td>
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<td>ICT</td>
<td>information communications technology</td>
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<td>IDF</td>
<td>Israeli Defence Force</td>
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<td>IDSS</td>
<td>Institute of Defence and Strategic Studies</td>
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<td>IED</td>
<td>improvised explosive device</td>
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<td>IFOR</td>
<td>Peace Implementation Force</td>
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<td>IMAT</td>
<td>International Military Advisory Team</td>
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<td>IMI</td>
<td>Israeli Military Industries</td>
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<td>IMOD</td>
<td>Israeli Ministry of Defence</td>
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<td>INAC</td>
<td>Indian and Northern Affairs Canada</td>
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<td>IP</td>
<td>intellectual property</td>
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<td>IRB</td>
<td>Industrial and Regional Benefits (Canada)</td>
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<td>International Traffic in Arms Regulations</td>
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<td>JORN</td>
<td>Jindalee Operational Radar Network</td>
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<td>JSF</td>
<td>Joint Strike Fighter</td>
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<td>KFOR</td>
<td>Serbia-Kosovo-Albania and Kosovo Force</td>
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<td>LAV</td>
<td>Light Armoured Vehicle</td>
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<td>LBD</td>
<td>learning-by-doing</td>
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Abbreviations

LCH heavy landing craft
LCS littoral combat ships
LEO low earth orbiting
LHD landing helicopter dock
LoI Letter of Intent
M&A merger and acquisitions
MCP major crown project
MDD McDonnell Douglas
MEA Ministry of Economic Affairs (The Netherlands)
MHP maritime helicopter project
MINDEF Ministry of Defence (Singapore)
MLRS multiple launch rocket systems
MoD Ministry of Defence (UK, The Netherlands)
MOTS military-off-the-shelf
NAFTA North American Free Trade Agreement
NDC National Defence College
NDHQ National Defence Headquarters (Canada)
NDIB national defence industry base
NDO National Defence Organisation
NFFP National Aeronautical Research Programme
NRCan Natural Resources Canada
NS national security
NSA new shipboard aircraft
OCCAR Organisation Conjoint pour la Coopération en matière d’Armement
OEF Operation Enduring Freedom
OEM original equipment manufacturer
OTHR over-the-horizon radar
PBS portfolio budget statements
PCO Privy Council Office (UK)
PFI private finance initiative
PfP Partnership for Peace
PLO Palestinian Liberation Organization
PMC private military company/contractor
PMO project management office
PP partnership
PSOs peace support operations
PWGSC Public Works and Government Services Canada
RAN Royal Australian Navy
R&D research and development
RFI request for information
RFP request for proposal
RFT request for tender
RIR Riksrevisionen, Sweden’s Audit Organisation
RLM Lockheed Martin–Tenix joint venture
Abbreviations

RMA Revolution in Military Affairs
RSN Republic of Singapore Navy
R&T research and technology
SAF Singapore Armed Forces
SAR search and rescue
SCP security cooperation participant
SEMA Swedish Emergency Management Agency
SFOR Peace Stabilisation Force
SIPRI Stockholm International Peace Research Institute
SME small and medium-sized enterprise
SPAC Senior Project Advisory Committee (Canada)
SSMs surface-to-surface missiles
ST Singapore Technologies
S&T science and technology
STOVL short-takeoff/vertical landing
TB Treasury Board (Canada)
TBS Treasury Board Secretariat (Canada)
TNO Dutch National Defence Group
TPC Technology Partnerships Canada
TTCP Technical Cooperation Program
TWP terror weapons
UAV unmanned airborne/aerial vehicle
UN United Nations
UNMEE UN Mission in Ethiopia and Eritrea
UNMIS United Nations Mission in Sudan
UNPROFOR United Nations Protection Force Bosnia
UNTAC United Nations Transitional Authority – Cambodia
UNTSO United Nations Truce Supervision Organisation
US DIB US defence industry base
USN US Navy
VTOL vertical take-off and landing
WEAG Western European Armaments Group
WED Western Economic Diversification (Canada)
WEP weapons effect and protection
WMDs weapons of mass destruction
WTO World Trade Organisation
WTO-AGP WTO Agreement on Government Procurement
Introduction

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This book is about defence procurement and industry policy in small, advanced industrial economies. It is largely an exercise in applied economics but the contributions of legal and management scholars and defence procurement and industry policy practitioners will also be apparent throughout. The book inevitably draws on themes and analysis treated in the defence economics literature and reviewed, for example, in publications such as Hartley and Sandler (1995) and Sandler and Hartley (2007). Our aim, however, is not to focus exclusively on issues in economic theory but rather to introduce a wider range of questions faced by defence procurement practitioners and policy-makers. We also aim to introduce practitioners to concepts and tools used in economics to show how the approach of the discipline might support policy making and the development of practical procurement guidelines.

Defence procurement

Procurement is simply another word for the process by which an economic entity, such as a business enterprise or a government agency, acquires the goods, services or assets which it needs to carry out its economic activities. The procurement process involves several dimensions of choice: the nature of what is to be acquired; the identity of suppliers; the legal mechanism to be used to effect the acquisition; and side-deals and wider economic and social effects that might accompany the purchase (Arrowsmith and Hartley, 2002: ix). Economics recognises the significance of these issues in analysis of product quality and characteristics, inter-firm performance differences, deficiencies and asymmetries in information in relationships between the buyer and the seller, transaction costs, and externalities and spillovers. This book illustrates the importance attributed by economics to how purchases and acquisitions are arranged and take place, even though the word ‘procurement’ itself rarely appears in the economic literature. For legal scholars and practitioners, the interest of the procurement process lies particularly in contracting relationships between parties and enforcement aspects. In management research, the focus is on the organisation and its relationship to suppliers in
the supply chain or network. And for defence policy practitioners, the interest lies in how the procurement of goods and services by the National Defence Organisation (NDO) contributes to the formation and sustaining of national military capabilities and in how it could be conducted in the most efficient and timely manner.

For economic units producing any output at all, inputs must be acquired to enable production to take place; procurement is the process of implementing their demand for factors of production. In the case of defence procurement, inputs are acquired to enable the NDO, a publicly owned and government-controlled economic entity, to produce the output defence. By ‘defence’ we mean protecting, if need be by application of lethal force, the nation (its people and physical assets) from military threats posed by other nations, groups or individuals. Increasingly, these threats are posed by ‘quasi-military’ organisations and groups that aim to perpetuate armed violence and acts of terrorism and which may or may not be controlled by other governments. However, in the sort of mature democracies of primary interest to us in this volume, only governments organise the supply of national security, including ‘defence’, because in democracies only the state is empowered to use lethal force.

**Value chain perspective**

We shall focus below on the process of national security provision in its entirety – which occurs through what we refer to as the defence value-adding or supply chain. We need to consider this value-adding context since the nature of the end product determines the specific production capabilities that the NDO must possess and, thus, the inputs required to create them (e.g., military skills, equipment, and technical know-how). If essential inputs are unavailable domestically or if it is strategically or economically efficient to do so, the government may decide to substitute security ‘imported’ from allies for that produced at home. By determining the required volume and content of national security to be produced in-country, the government determines the volume of resources required by the NDO from domestic suppliers of inputs. Many inputs, however, are imported. Governments must therefore decide which source for the required inputs offers the best value for money, regardless of where suppliers are located, and whether value for money or other factors should determine the location of supply.

In principle, the NDO’s demand for goods and services, such as military equipment, consumables, through-life support services and training, is a derived or dependent demand determined by the nature of military capabilities to be formed and sustained in-country. In practice, though, military products are sometimes sourced from legacy industries that governments wish to protect. To this end, governments may direct the NDO to buy goods and services from suppliers the government wishes to keep in business rather than those who offer the best value for money.
Defence procurement policy

Defence procurement policy is a key aspect of this book. As we argue in Chapter 5 of this volume, such policy has two general objectives: (1) to access and/or form dependable supply chains to form and maintain defence capabilities in the required state of operational readiness; and (2) to buy what is needed cost effectively and in accordance with Defence’s quality and schedule requirements. These two objectives are not necessarily compatible and policy trade-offs are inevitable. For example, increased supply dependability may come at a price as more reliable sources of supply may also be more costly.

In functional terms, defence procurement policy should guide the NDO in determining:

- which of the required capability inputs should be made in-country and which is best sourced from either local or overseas suppliers on a best-value-for-money basis (local content requirements);
- which of the materiel required to be made in-country would best be made in-house, in government-owned and government-operated factories and shipyards, and which would best be sourced from external suppliers (make-or-buy considerations);
- how to go about selecting sources of supply, e.g., whether to rely on market competition or designate preferred suppliers (source selection requirements);
- which type of contract to use to engage the chosen supplier (contracting arrangements); and
- how to manage the delivery process and associated relationships with suppliers (supplier relations management).

We shall discuss challenges facing defence procurement policy-makers in Chapter 5.

Defence industry policy

Defence industry policy is another key aspect of this book. The most general definition of industry policy encompasses all the actions taken by governments to influence directly the production decisions of commercial and public production entities operating within national boundaries. The operation of industry policy reflects government perceptions that these entities could serve the national interest better by making different decisions than they would make in the absence of policy. Such policy might set out to influence industry structure directly (e.g., by restrictions and controls on mergers and takeovers) or the conduct of firms (e.g., by outlawing predatory pricing or encouraging business R&D). Or it might seek to influence conduct by exposing firms to more intense competition (e.g., by reducing levels of tariff protection). Ultimately, the objective of industry policy is to influence the performance of
production entities by changing the settings within which these producers make their output, pricing, investment, operational and marketing decisions.

In Chapter 5, we argue that defence industry policy may be viewed as a sub-set of defence procurement policy. Defence industry policies become relevant if the government decides to rely to a greater or lesser extent on domestic suppliers to form and sustain the required military capabilities and assuming policy-makers believe domestic supply would be unavailable or impeded in the absence of active intervention. The policy takes the form of local content requirements in that either all or some of the capability inputs must be sourced from domestic suppliers in designated industry sectors. Defence industry policy complements defence procurement in the sense that it is designed to encourage or bring about the investments in domestic industry capabilities necessary if procurement is to be able to draw on local supply. That is, if the government deems it necessary for industry capability to be located in-country, defence industry policy is primarily concerned with establishing and maintaining indigenous supply and support options. We shall return to the concept of defence industry policy in Chapter 5.

Small country perspective

Much of the theoretical and empirical analysis of defence procurement has tended to focus, implicitly or explicitly, on the way the process has evolved and operated in the defence industry of a superpower, the USA, and to a lesser extent, the larger European countries, such as the United Kingdom. Rather less has been said about the experience of NDOs and their entanglements with defence industry policy in ‘small’ countries. Of particular interest to us in this volume are those ‘small’, advanced industrial economies that are significant spenders on defence for their size. To differentiate ‘small, advanced, industrial’ economies from large and other small but less-advanced countries we use a three-step procedure. First, we use gross national income (GNI), to distinguish between large and small countries. Second, we use GNI per person to distinguish between advanced and less advanced economies. Third, we use a measure of military expenditure to draw up a list of small, advanced countries which spend enough on defence to face interesting make-or-buy choices and trade-offs in their procurement practices.1 The final list of countries discussed in Part II of this volume includes: Australia, Canada, Israel, Singapore, Spain, Sweden, and The Netherlands. These national studies provide more detailed and country-specific perspective on defence procurement and industry policy challenges faced by small, highly industrialised countries.

From an analytical perspective, ‘smallness’ implies expected differences in the way defence procurement takes place relative to other countries. Small countries are hypothesised to procure defence-related goods and services (military materiel) differently from larger countries and we will be seeking evidence in support of this position. Economic theory might lead us to expect
that small buyers have little market (bargaining) power and, thus, relatively little influence on the price and specifications of volume-produced products. In the case of defence procurement, we would expect small countries to have, individually, less, if any, influence on prices and the specifications of weapons systems and military consumables developed by large arms producers. That is, relative to large countries we would anticipate they are more likely to be price (and specification) takers in markets for volume-produced military materiel. We would also expect small countries to be restricted in their access to large weapons systems embodying the latest military technology. This is because they lack the resources or are reluctant to invest in the development of such systems while large countries that have the capacity to develop state of the art technologies will tend not to release them to other countries, even their closest allies. We would also expect small countries to face scale-related production diseconomies because their own armed forces can only buy limited quantities of military equipment and consumables and, in the absence of export opportunities, their home production facilities are either small (below a minimum efficient scale of production) or, if large, underutilised. In either case we expect them to incur cost penalties associated with small-batch production.

Small countries may also find it difficult to attract and/or retain internationally competitive producers of defence materiel. As we see later, national security provision tends to be exempt from the competition-related provisions of international free trade agreements (see Chapters 4 and 5) thereby allowing governments extra freedom to pursue local content objectives that impede direct imports of military materiel and favour local production. In this environment, producers in small countries face relatively small domestic markets and barriers to entering foreign markets. As a result, there is a tendency to fragment and duplicate production capabilities (see Chapter 3).

But, even in the absence of such barriers to specialisation and trade, to be able to sell weapons systems and consumables to a third party, the prospective exporter may need to demonstrate the product’s attractiveness by selling it to the exporter’s home armed forces. It is also normal for buyers of expensive and durable products to seek assurances that supplies will continue and after-sale product support will be forthcoming. Thus, we expect it to be more difficult, although not impossible, for firms in small countries to be internationally competitive. Other things being equal, the combination of larger domestic sales and better export prospects built upon them should make a larger economy more attractive as a location for an internationally mobile defence supplier. By the same token, defence suppliers based in large industrial countries (e.g., US, UK or French firms) find it relatively easy to establish a successful ‘footprint’ (e.g., subsidiaries, joint ventures) in small countries that procure reasonable quantities of military materiel (see, for example, the two industry case studies in Part III – Chapters 13 and 14).

Smallness also has significant strategic implications. Under various international conventions and understandings, such as the United Nations Charter, all national entities recognised as sovereign countries are deemed to be
equally sovereign. But the formal acknowledgement of sovereignty is often at variance with the real ability of small nations to enforce their sovereign rights, i.e., to protect their interests, if need be by the use of force. History tends to show that large countries are often more ‘sovereign’ than the small, whose strategic options include:

- accepting the vulnerability of smallness, spend little or nothing on defence and take all risks that go with that decision; or
- declaring active neutrality, spending as much as is perceived necessary for unilateral self-defence (e.g., Sweden during the Cold War – Chapter 11); or
- seeking large and powerful protectors (e.g., Australia – Chapter 6, Canada – Chapter 7); or
- forming alliances of like-minded nations (e.g., The Netherlands – Chapter 12, Spain – Chapter 10).

(These strategies are not necessarily mutually exclusive.) However, countries such as Israel (Chapter 8) and Singapore (Chapter 9), are highly security-conscious and insist on a high degree of self-reliance to maintain the operational sovereignty of their armed forces and to use their dependence on allied support as a measure of last resort.

The neutrals are entirely self-reliant and must fend for themselves in the event of military threats materialising. Nevertheless, for a small country, neutrality may be an effective strategic posture if military threats are highly unlikely, or country geography provides an element of natural protection. Those entering international alliances can share the burden of defence by becoming direct importers and exporters of national security within the alliance, given the expectation that allies assist each other in military contingencies. (The credibility of such promises needs to be examined, however – see below.) What is important here is that small countries are obliged by their smallness to choose among strategic options and their choice shapes subsequent defence procurement decisions.

We expect small, advanced economies not only to face different choices and constraints in their defence procurement than large countries but also we expect different small countries to respond differently to challenges posed by the smallness of their demands for military equipment, services and consumables. In this volume we are interested in the different ways in which the defence procurement process is organised: the structure and conduct of defence procurement entities, their procedures for choosing suppliers and the nature of the relationships they form with suppliers. A mark of being small is that, on average, those involved in defence procurement have to be ‘smarter’ to achieve the same results as their counterparts in larger countries where order size and scale economies are more relevant. But because they are advanced economies, we expect them to be well positioned to generate imaginative policy experiments that enable them to be ‘smart’. Thus, we have been particularly interested in exploring differences in the way small countries
respond to the challenges of ‘smart’ defence procurement. Contributors were invited to focus on issues of particular significance to a country under consideration and, as a result, Part II of this volume covers a wide range of issues that complements the general conceptual framework in Part I.

Industry studies

In addition to case studies of defence procurement in a number of small, advanced industrialised countries, we also include in this volume a defence industry case study, naval shipbuilding in Australia (Chapter 13) and a case study of indigenous development of a leading-edge solution to a military capability requirement (Chapter 14 – the procurement of over-the-horizon radar by the Australia NDO). Australia is a particularly interesting case of a country that has been trying to strike a balance between membership of a military alliance and self-reliance – in the sense of having some independent capabilities to defend itself and committing to in-country industry capabilities to sustain these military capabilities in wartime. Thus, policy-makers in Australia have experimented with various instruments of defence procurement and industry policies to develop in-country, defence-related industry capabilities. Governments have also used defence procurement dollars to achieve broader economic and political objectives. In some areas, these attempts to set up viable industrial capabilities have backfired and presented policy-makers with industrial legacy issues that one normally expects to find in ‘older’ economies forced to adapt to new forms of international division of labour (see the case study of naval shipbuilding in Chapter 13). In other areas, policy-makers have been more successful in ‘picking winners’ but have been rather inefficient in their choice of policy instruments. Thus, there are both positive and negative lessons from Australian attempts to develop defence-related industry capabilities and implications for small-country defence procurement and industry policies are discussed in Part III.

As we prepared this volume, we tried to focus on issues we believed had enduring significance. We hope that the resulting discussion will thus remain relevant even as statistical details and institutional arrangements change. Current data are readily available from websites and annual publications such as the Yearbook published by the Stockholm International Peace Research Institute (SIPRI).

Notes

1 In identifying ‘smallness’, we began by excluding economies that were unambiguously large. Thus, we excluded countries whose gross national incomes (GNIs, in current prices) were larger than a certain threshold which we set at US$1000 billion in 2003 (World Bank, 2004, Table 1: 256–7). At the first step, we therefore eliminated from further consideration the then seven largest economies: the USA, Japan, Germany, the UK, France, China and Italy. To narrow down the choice of small countries to those which we, also arbitrarily define as ‘advanced’, we used the
same data source to select all those small countries that had GNI per capita of more than US$15,000 in 2003 (also in current prices). This income threshold was nearly three times larger than the then world average ‘upper middle income’ level of US$5,340 per head (ibid.). This second step elimination reduced the pool of ‘advanced’ small countries to 17. These countries were considered to be advanced in that they had small but relatively sophisticated economies capable of considerable import substitution. Finally, as we were interested in countries that were involved in defence procurement of some significance, we had to eliminate small-scale defence spenders such as Ireland or Austria. At the third step, we set the minimum 2004 defence expenditure level of US$5 billion in current prices (IISS, 2006, Table 44: 398–401) for our final list of small, advanced defence spenders. Since the largest defence spenders are also the largest economies that were excluded at step one and a number of other countries were excluded at step two as falling below the GDP per person threshold, we are left with a shortlist of Australia, Canada, Israel, Singapore, Spain, Sweden and The Netherlands, which are used in this volume to provide country-specific perspectives on defence procurement. In 2004, 26 countries spent more than US$5 billion on defence (ibid.). The USA was in a league of its own with an expenditure of US$455.6 billion. The ‘second division’ of military spenders comprised nine countries including China (the largest spender: US$84.3 billion) and India (the smallest: US$19.8 billion). The ‘third division’ comprised 16 countries and was led by South Korea (US$16.4 billion). The smallest spender in this group was Singapore (US$5.1 billion). All seven countries in our sample belong to the third division and a highly representative of the entire group. Australia (US$14.3 billion), Spain (US$12.6 billion) and Canada (US$11.5 billion) represented the top end of the ‘third division’, Israel (US$9.7 billion) and The Netherlands (US$9.6 billion) the middle, and Sweden (US$5.4 billion) and Singapore the bottom end of the ‘division’.

For example, the USA, the leading developer and user of advanced military systems, prohibits exports of its most advanced technologies (e.g., at the time of writing, the F22 aircraft) even to its closest allies. (For further details, see Chapter 4.)

References


Part I

Conceptual foundations
1 Procurement and the chain of supply
A general framework

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As noted in the Introduction, procurement is another word for describing the activity of purchasing or acquisition, and defence procurement refers to these activities in relation to providing a country's national security. Defence procurement and the defence industry policy associated with it thus operate in the broad context of defence production and this chapter offers a framework for considering the relationships involved. In the next section, 'Defence products and capabilities', we present a bedrock model of the production of national security (defence) that focuses on the process that progressively converts intermediate inputs into final products. This section is primarily concerned with what is produced as a basis for understanding what is procured and with what implications for industry suppliers. The production of national security occurs within what we call the defence production chain which describes the physical process of national security production. To stylise the production process, we assume ‘Defence’ (the National Defence Organisation, NDO) to be the ‘producer’ of national security. In most countries, the NDO combines military and civilian elements as administrative and logistic capability involves the employment of civilian public servants as opposed to the military (in-uniform) public servants who are either drafted as conscripts or employed under military-specific contractual arrangements.

The NDO is a component of Government; the latter is ultimately responsible for the provision of national security and the allocation of resources to the NDO to carry out its tasks. However, the NDO may not produce all national security, some of which may be ‘imported’ from allies (see below) or produced by other government agencies (e.g., homeland security) and, increasingly, by private security firms. The distinctions between the publicly and privately produced activities and combat-related and other support operations have, however, become increasingly blurred. Such complications are initially ignored in our stylised representation, or model, of the defence production chain but will be considered later in the book.

In the stylised model, the capital inputs and consumables needed to produce national security are sourced from Industry, which in some cases may be located partly or wholly within the organisational boundaries of Defence itself (see below). Similarly, some (or all) capital inputs and consumables may
be imported from other nations. Human resources are obtained from domestic Households (either by conscription or through labour markets). They can also be imported in the sense that members of the defence force may be hired through international labour markets (e.g., the French Foreign Legion). This admittedly stylised setting is useful for considering a number of concepts fundamental for the discussion of defence procurement.

To respond to military contingencies, Defence must develop and draw on its military capabilities, that is, acquire the assets and know-how needed to undertake the activities required by Government under various military and civilian contingencies. Military capability calls for human and non-human (materiel) inputs, technical war-fighting knowledge and organisational structures. Defence procurement is about acquiring the non-human, physical elements of capability, the inputs needed to form new or to modify/sustain existing elements of military capability. These products may include simple civilian consumables and durable goods (e.g., photocopier paper and office furniture) and complex civilian capital goods (such as airliners and super-fast computers); simple military equipment (such as handguns) and complex military systems (e.g., fighter planes and command and control networks); and civil and military equipment services (for example, services provided by leased military aircraft or equipment maintenance provided by contractors).

The following section, ‘Value creation’, introduces the notion of value into the analysis and discusses how the defence production chain may also be interpreted as a chain of value creation and value adding.

Next, in ‘Actors and decision-makers’, we revisit the defence value-adding chain to examine the organisational decision-takers driving the production process. Given our focus on defence procurement and industry, we are mostly interested in the upstream suppliers of military materiel and those elements of Defence involved in forming military capabilities. In this context, the defence value-adding chain can be represented as the defence supply chain – the emphasis shifts from what is produced to who is doing it.

The NDO may take different organisational forms depending, for example, on whether its combat arm is structured as a single organisational entity or fragmented into Services and on how military and civil elements work together. The relationship with Government is particularly important as the NDO is a government agency dedicated to the production of national security. In this book, we are primarily concerned with the procurement-related tasks of the organisation. There may be a single, specialised unit within Defence responsible for all defence procurement – the Defence Procurement Agency (DPA). Or, procurement activities may be dispersed between operational elements such as the Services, or centralised within a specialised but organisationally detached agency. In the latter case, the detached agency may be Defence-specific (as in Australia) or it may act as a procurement agent for a number of government departments, including Defence as, for example, in Canada.

The procurement agency places orders with industry suppliers at home and abroad. The success (or otherwise) of the DPA in meeting the requirements of
the Services depends on the efficiency and effectiveness of Industry and the relationships between industry suppliers and procurement personnel. Capital equipment and consumables may be produced in-house (e.g., in shipyards and arsenals owned and operated by Defence) or sourced from outside Defence. Thus, Industry, an upstream producer of intermediate inputs into the formation of military capabilities, may take many organisational forms: from complete integration of upstream industrial support into the NDO’s organisational structure, to defence-focused private contractors (domestic and foreign), to private and public firms for whom Defence is one of many customers.

In the final section, ‘Supply chain links and relationships’, we focus on how entities involved in the production of defence are linked and interact with each other. We note first that when the interface between the DPA and Industry is market-mediated, the relationship between buyer and supplier is influenced by industry structure. A supplier of a product for which no close substitutes are available, and facing no threat from potential industry rivals, is potentially in a strong position to use its market (monopoly) power to demand higher prices, determine quality standards, or allow delivery schedules to slip. However, when the DPA deals with many sellers of close substitutes, it may rely on competition between sellers to ensure that prices charged are reasonable and product quality and the timeliness of deliveries are not compromised. Also, when the DPA is a very large or the only (monopsony) buyer of a product, it is potentially in a strong position to impose its terms on the supplier(s).

In this section we also outline the nature of transactions associated with the acquisition of goods and services by the NDO from Industry, that is, how procurements are arranged and executed:

- the nature of the business deal involved in the transaction, its scope, scale and timeframe, the nature of exchange involved (e.g., goods-for-money or barter), and the associated consideration (price);
- the contract determining rights and obligations of the parties in the context of the transaction;
- the relationship between the parties following the signing of the contract.

These issues are examined in greater depth in later chapters.

The present chapter is only intended to provide a framework for the subsequent discussion of defence procurement and the relationship between Defence and Industry, and many specific aspects of the defence production chain will be examined in greater detail in other parts of this volume.

**Defence products and capabilities**

Figure 1.1 is a stylised representation of the defence production chain. In Figure 1.1, domestic production runs from left to right, from upstream industry capabilities and the production of outputs that serve as intermediate
inputs into downstream military capabilities and the production of the final output, national security. Arrows indicate flows of goods and services. Production capabilities, inputs and outputs are represented as boxes. The logic implicit here is that the requirement for the end product (i.e., military responses to threats to national security) determines inputs required by downstream defence activities and, thus, the outputs, activities and capabilities of upstream producers. If the final product was well defined and had a clear and observable market value, it would be relatively straightforward, in principle, to work out the derived demand for defence intermediate inputs and their associated industry capabilities. But the contingent nature of national security and its ‘public good’ characteristics complicate matters considerably.

**National security as a contingent good**

The end product, national security, may be viewed as a set or vector of final outputs (military responses) produced to counter threats to or violations of national sovereignty. Broadly, this set of final outputs comprises two sub-sets, one related to deterrence and the other to wartime deployment of military capabilities. Deterrence-related outputs comprise the (usually unobservable) instances of prevention of hostile acts against the country and its interests, which would have occurred if relevant military capabilities had not been in place. Deployment-related outputs comprise the actions Defence takes to counter threats to, or violations of national sovereignty, and provide other forms of service at the direction of Government (e.g., peacekeeping). The specific services comprising the deployment-related end products are

![Figure 1.1 A stylised defence production/value chain](image-url)
contingent on the state of the world – military contingencies. These end products are only produced if particular military contingencies actually materialise.

Ex ante, it is impossible to specify every relevant military contingency or, as we shall also call it, scenario. The latter may include global nuclear war, ‘conventional’ local wars, terrorist activities, and minor military emergencies during peacetime (e.g., intrusions into national waters or airspace, military espionage). In practice, only a limited number of scenarios can be envisaged in detail and some are better understood and thus easier to describe than others. Similarly, perceptions of the likelihood of different military contingencies can usually only be described in terms such as ‘very likely’, ‘rather unlikely’, or ‘credible’ rather than in precise, probabilistic terms. The development of ‘credible’ military scenarios is an art rather than a science, highly subjective and usually involves small groups of experts with access to classified data. Judgements about the likelihood of alternative states of the world also tend to be rather short-lived, and new scenarios and strategic outlooks are often required to reflect the impact of recent events.

However, to determine what military capabilities are required, strategic planners seeking to act rationally have little choice but to develop a set of military scenarios to shape and frame their recommendations to Government. For each identified contingency they must also consider a range of military response options. For example, to deal with a scenario of peace enforcement in a neighbouring state, a broad response may involve the dispatch of a small expeditionary force. However, there are specific options within this broad response that may differ considerably in their particulars. For example, a peacekeeping operation may either be highly labour-intensive, with a relatively large number of peace-keepers on the ground to win the hearts and minds of the locals, or highly capital-intensive (aircraft, armour, etc.) to show the force needed to intimidate troublemakers.

To make decisions about acquiring various elements of military capability, such as weapons systems and consumables, personnel and operating skills, Defence and its political masters must determine which military contingencies are most likely to occur; what they involve; what needs to be done to handle them; and, given the budget constraint set by Government, what investments in new capabilities have to be made to produce the required military responses. Thus, most end products of Defence are contingent outputs in the sense that they are only produced if certain military contingencies occur. To the extent that the production of defence end products is conditional on the occurrence of certain military contingencies, their value can be judged and assessed only ex post, once the outputs are actually produced.

In the case of deterrence, success results in an absence of conflict and although peace may be taken as an outcome of deterrence-related national security production, it is not possible to determine the extent to which the absence of hostilities results from defence spending on particular capabilities or other factors. In peacetime, the capabilities of the NDO are not fully deployed or operational. At
such times, the NDO concentrates on producing intermediate services such as training personnel, maintaining equipment, developing military response options, and so on.

**National security as a public good**

Many final outputs produced by Defence (e.g., deterrence, combat activities) are what economists call public goods. Such goods are characterised by non-excludability (of non-payers from consumption/use) and non-rivalry (among users – so that one user’s consumption does not reduce the availability of the good for other users). These conditions discourage the commercial, private market provision of such goods, so that government may have to arrange to supply them if they are to be provided at all (Spulber, 2002).

Publicness poses the challenge of finding a workable and reliable way of placing a value – a social value – on such goods. There are no market-generated price signals to indicate preferences for one type of public good rather than another or one type of defence output rather than another. Such choices are usually made by Government as part of a broad ‘package’ of goods and services (some highly ‘public’ in content and some not) that it promises to deliver or have delivered. When political parties contesting an election promise alternative packages of public goods, the electorate influences the mix of what is to be provided, including defence. However, the electorate is not normally involved in deciding the specific composition of defence expenditure, which it leaves to ‘experts’ in Defence and other government agencies to determine.

Despite that, governments sometimes frame their relationship with Defence as a transaction-like exchange between a buyer and a seller. In Australia, for example, the government has described itself as buying ‘outputs’ from the Australian Defence Force (ADF) to achieve desired ‘outcomes’. The purpose of applying this quasi-transactional framework is to provide a basis for setting targets and measuring the performance of the ADF to make it more efficient and accountable to the government (ASPI, 2006b). But this quasi-market exchange should not obscure the fundamental nature of national security as a public good and the attendant valuation problems.

**Contingent outputs and military capabilities**

There is also an intermediate step between a NDO acquiring resources such as personnel, physical weapons and defence-related knowledge, on the one hand, and producing national security outputs, on the other. For the NDO to respond to military contingencies, it must acquire the capability or capabilities to produce military end products. The notion of capability generally refers to an organisation’s ability to undertake an activity it wishes or may be called upon to perform. Thus, to respond to military contingencies, Defence must generate appropriate military capabilities – it must be able to acquire and
combine factors of production to form production units capable of delivering specific military effects or responses that may be required under various threat scenarios. Each of these capabilities can be viewed as a component of the nation’s overall military capability and may take the form of production (operational) units (e.g., a tank regiment or an intelligence network). National military capabilities are shown in Figure 1.1 as (domestic) capabilities that could be deployed to produce the effects needed to address particular military contingencies. At the aggregate level, the key or ‘core’ capability to produce national security is the potential to deter hostile acts and/or engage effectively in military operations. In this volume, we are primarily concerned with capability increments in the sense that we focus on goods and services acquired to extend or enhance existing capability or procured to maintain elements of capability.

To know what specific military capabilities are required calls for knowledge of a wide range of different threat scenarios and how they might be dealt with. Since few, and possibly none of these threat scenarios will ever actually materialise, what the Government most of the time provides through its investment in military assets constitutes a contingent capability – a capability that has the potential to be used if certain contingencies occur but which will otherwise only ever be visible under the inevitably artificial circumstances of exercises or simulations. To have this potential, Defence must acquire inputs, assets or resources such as weapons systems, facilities and other supportive physical assets, consumables and skills (for example, in Australia these inputs are referred to as ‘fundamental inputs to capability’ while in the United Kingdom they are described as ‘defence lines of development’). It might also have to arrange for the production of new military knowledge (e.g., military intelligence, doctrine, operating instructions). The Defence resources of physical, human and knowledge inputs must be organised into operating systems capable of responding to challenges posed by different military contingencies. These operating systems may span the entire NDO (as with secure communications) but often appear in the form of organisational elements of capability such as combat units. Defence may also have to ensure that certain upstream civil capabilities are available in-country (e.g., industry capabilities; see below).

For a capability to have the potential to be used if certain contingencies occur, it is likely to be hypothecated, that is, designated to be deployed under particular military response options. For example, a ‘killer submarine’ is needed to hunt other submarines. However, once these capabilities are formed, they may also be deployed ‘flexibly’ in circumstances that have not been anticipated. There is always an element of surprise, innovation and learning-by-doing when military capabilities are deployed. That is, new capacities, or capability boundaries, are discovered as capabilities are tested and their limits explored. The same discovery process may also reveal unanticipated limitations of various capability elements. In the above example, the capacity to track and kill other submarines may turn out to be limited or
obsolete but the submarine may be usefully adapted to transport and land special force units and/or perform a wide range of intelligence-gathering tasks.

This process of discovery is common to production of many civilian and military goods and services. What distinguishes military from civilian activities, however, is the contingent nature of military deployments and the way the operational experience is acquired. Most civil, and in particular commercial, producers of goods and services tend to produce their end products on a day-to-day basis. There is opportunity to validate and fine-tune product specifications and refine production processes to accommodate changes demanded by customers. In contrast, there are limited opportunities to obtain real combat and operational experience in peacetime. Simulations and exercises may enhance learning about how military assets perform in controlled experiments but they lack the true dynamics of the real battlefield with their informational asymmetries and rapid product and process innovation by the combatants. Thus, like defence outputs, contingent military capabilities cannot be directly observed or measured in peacetime. It is only when particular contingencies materialise that their true performance characteristics and boundaries are discovered.

**Products procured**

Once desired capability is determined, NDOs must acquire the inputs with which to build their capability elements. Such inputs may be human (the business of recruiting), or non-human (the business of procurement). Knowledge inputs may be acquired through training and education (for which procurement agencies may acquire physical infrastructure), or through dedicated R&D (the business of procurement, if contracted out), or through intellectual property (IP) agreements with suppliers forming part of larger procurement contracts.

The non-human inputs can, in principle, be classified in terms of their technical complexity, the volumes in which they are procured, durability, and their value per unit. Technical complexity in our usage here refers to the number of separate components that are combined in generating a working system. Complexity in acquisition, however, may also reflect policy requirements to combine purchases of a physical system (be it simple or complex) with additional demands for related or unrelated products or activities – such as technological know-how or local production. Volume refers to the number of units of a product purchased with the scale of a transaction relating either to the volume or, in some cases, the value of the purchase. Durability concerns the life-span of a military system. Given the pace of innovation in much military technology, technological obsolescence can often precede the physical ageing of the equipment. Platforms such as ships or aircraft will often have long life-cycles punctuated by periodic modifications and upgrades while knowledge-intensive systems (like most software) will reach the end of their lives relatively quickly.
Consumables, like photocopying paper and catering supplies, are typically at the ‘simple’ end of the scale of technical complexity, perishable or readily disposed of, procured in consignments of many units and at unit prices that are relatively low across the spectrum of goods. Such products are not of great interest to us in this book. They are usually bought through straightforward, arm’s length, off-the-shelf transactions in markets where suppliers are numerous and where the main issues surround timely delivery of products of known quality at a settled price.

Our focus, rather, is on technically complex products, or products procured in the context of complex acquisitions; products with long lives, sometimes comprising systems that are, per unit, among the most expensive traded in modern economies. Batch sizes in production may be as small as one; in many cases (especially in small countries) orders call for the supply of a dozen units or less; but in some cases involve purchases made by the fleet (e.g., of vehicles), or large consignments (e.g., of small arms). A further dimension relates to the regularity and potential repeatability of such purchases.

Knowledge inputs may be relatively simple if they require nothing beyond the recovery of existing information from public sources; they become complex once research, by definition with uncertain outcomes, is required. Knowledge once acquired through research or learning by doing can be stored, retrieved and transmitted relatively easily. However, knowledge transfers may be deliberately impeded and elements of knowledge may rapidly become obsolete when new knowledge is produced. Also, if its tacit components are known only by certain people, this tacit knowledge may disappear with the individuals involved. Thus, the price for acquiring new knowledge may be anything from trivial to stupendous; the quantity acquired to some extent non-measurable. How knowledge inputs are handled in procurement has an important bearing on organisational design, how contracts are written with suppliers, relations with foreign military organisations and governments, and the structure of incentives.

**Industry production capabilities**

To supply Defence with equipment and consumables and provide logistic support services, upstream Industry, whether located in-country or overseas, must have the appropriate production capabilities. These production capabilities upstream in the defence production chain are shown in Figure 1.1 as ‘Domestic Industry Capabilities’ and ‘Overseas Industry Capabilities’. The military equipment used by Defence is analogous to the intermediate inputs into civil industry production and military consumables equivalent to civil industry materials inputs. In Figure 1.1, the defence intermediate inputs are shown to include goods such as equipment and consumables, and services such as research and development and through-life logistic support.

Most economies, and particularly smaller economies, can only produce domestically a few of the weapons systems and military consumables their
defence forces require. The propensity to import intermediate products is partly explained by comparative advantage in international trade. However, since some industry production capabilities may be regarded as strictly complementary to domestic military capabilities, Defence or Government may require their location in country for strictly national security reasons. Government may also insist on additional local capability content for broad economic or political reasons. Thus, international specialisation is likely to be limited, with governments insisting on what economists describe as trade diversion to form and sustain local, defence-oriented industry capabilities. As many governments apply local content (trade diversion) policies, export opportunities for the producers of defence materiel in all countries – and especially small ones – are also likely to be impeded.

**Derived demands and direction of causality**

In describing the production chain in this section, our working assumption is that causality runs from the final demand for national security to demands for the intermediate products needed to form military capabilities. In that sense input demands are derived or dependent demands. This applies to all elements of the production chain. Demands for components and ‘original equipment’ (sub-systems) produced by upstream elements of Industry depend on the production activities of mid-stream system integrators and other assemblers of (intermediate) products required by Defence. The fundamental logic behind this production chain is that the end product, including deterrence, should drive the requirements for inputs into final activities and, thus, determine the outputs, activities and capabilities of upstream Industry. Benefit to the nation is only created downstream when the NDO’s capabilities have been formed and sustained. In this context, a further distinction can be made between the ex ante valuation of defence capabilities, based on their expected performance under various military response scenarios, and the ex post valuation of these capabilities when they are actually deployed ‘in anger’. The ex post and ex ante valuations are likely to diverge as unexpected surprises always arise when military capabilities are deployed in combat conditions, however intensive prior preparations may have been. (See discussion below in section ‘Value creation’.) Costs to the national defence budget are incurred, however, before it is possible to fully judge operational performance.

**Defence imports and exports**

As Figure 1.1 shows, Defence produces some but not all national security: some of it is imported directly through international alliances such as the North Atlantic Treaty Organisation or the 1952 ANZUS Alliance between Australia, New Zealand and the USA. Similarly, some of the services produced by Defence may be exported in the form of a country’s contribution to alliance-based military operations (e.g., allied contributions to the US-led
coalition forces in the two Gulf Wars) or to other international military operations (e.g., Australia’s contribution to the UN-led peace-keeping and-enforcement operations in East Timor in 1999–2000). In some cases, there are ‘export markets’ for defence services, for example, for contributing to peace-keeping operations or for commercial mercenary services. But most military alliances involve non-market exchange arrangements, where promises of mutual assistance are bartered between alliance members on the basis of ‘equitable sacrifice’.

A key aspect of national sovereignty relates to the extent to which national security is produced in country rather than imported from allies. Alliance members determine how much in-country capability they require and decide the extent to which their requirements must reflect the demands of interoperability between allied forces. The ratio of imported security relative to domestic security production derives from high-level strategic decisions. That is, which military response options are available to governments depends critically on prior choices concerning the balance between domestic defence capabilities and outputs supplied by allies. In practice, how much national security is actually imported varies widely – for reasons that are political and technological as well as economic. The more a government decides to depend on imports from allies, the smaller will be its NDO and, thus, the smaller the requirement for upstream inputs necessary to form domestic defence capabilities.10

Most nations import at least some national security and ‘self-reliance’ is a phrase often used to describe a degree of self-sufficiency in national security provision. In Australia, for example, ‘self-reliance’ is about ‘the defence of Australia without relying on the combat forces of other countries’ (DoD, 2000). In practice, however, desired and actual levels of self-reliance may diverge widely. For example, when key enabling aspects of military capability (e.g., military intelligence, communications, and consumables) are not produced or available domestically and, like it or not, must be imported from allies, the real degree of self-reliance may be quite low even though a large proportion of inputs required for capability formation and to sustain it is locally sourced. That is, the criticality of various inputs to capability formation determines the real, as opposed to the apparent, degree of military self-sufficiency (for a more detailed discussion, see Chapter 8, which focuses on Israel, and Chapter 14, which is a case study of Australia’s acquisition of the over-the-horizon radar network, JORN). Insofar as the formation of upstream defence capabilities is deemed necessary for national security provision, ‘self-reliance’ may also involve a degree of domestic self-sufficiency in the supply of capital goods and consumables for the armed forces.

**Value creation**

In a market economy, value is created when something is produced for which someone is prepared to pay. The ‘someone’ may be a group of people, or an