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Risks in defence procurement: India in the 21st century

Although there exist several remarkable theories that facilitate the understanding of procurement risks in imperfect market conditions, methods to quantify the impact and identify the most severe risks are less well-known. This paper uses the method of risk analysis to discuss defence procurement challenges in India. An original dataset of 88 contracts has been created to identify the most probable and the most severe causes for poor procurement performance. A schedule performance parameter has been constructed to quantify the impact of different adverse events. The findings display a high probability of technological risks followed by contractual risks as the cause for delays in Indian defence procurement. Technological risks are concentrated in cases of indigenous procurement due to a lack of infrastructure and resources while contractual risks mostly occur in contracts where the Ministry of Defence deals with external agents like foreign suppliers. This indicates frictions and transaction costs. These and other findings from the quantitative data on procurement performance are supplemented by insights from an extensive fieldwork in India which included 53 interviews.

Keywords: defence procurement; risk analysis; India; defence-industrial complex; transaction cost economics

JEL: H57; N45; O14; D23

Introduction

In 1952, the economist John Perry Miller at Yale predicted the need for economic analysis in military procurement, because unlike the two world wars where economic mobilization for war had been a temporary event, the Cold War created a situation where there was ‘a possibility of a large procurement program lasting possibly for decades’ (Miller 1952, 453). The identification of risks in defence procurement has assumed greater importance since the end of Cold War because of globalisation of defence production. Globalisation in the 21st century exposes the costs of internal arming- the diversion of resources from activities which voters may have greater preference for (health, education, infrastructure), the inefficiencies of

industrial protectionism, and the comparative advantage of importing weapons when they are of superior quality (Kapstein 2002, 146).

There exist several remarkable theories that help us to understand the challenges of defence procurement. For example, the agency theory posits the challenge of public procurement (and defence procurement is a form of public procurement) as one where the incentives for the agent are not sufficient to make them act in the interests of the principal (Rogerson 1991; Reichelstein 1992; McCue and Prier 2008). Transaction cost economics assumes that there are non-pecuniary costs to contracts and some of the parties in a contract behave opportunistically, selfishly and with guile, which is the reason for problems in contract negotiation and execution (Williamson 1979; Oudot 2010). In a more general sense, defence procurement occurs in imperfect market conditions, if one considers the procurement of non-standardized, technologically complex items, sometimes unique to military use. Since the market cannot provide full information, generate competition, and mediate on the price, the government has to regulate and create a market, sometimes choosing to even take control of production, besides being a buyer (Keisler and Buehring 2005). The research on information asymmetry is also relevant for studying the challenges of defence procurement (Tirole 1986; Laffont and Martimort 2009). Research on organisational behaviour (Manohara 1998; Franck and Udis 2017), public choice theory (Cowen and Lee 1992), and industrial policy research (Pugh 1993; Hall, Markowski, and Thomson 1998) have been used to identify the challenges of defence procurement.

A variety of challenges have been identified over time and these can be broadly categorised into three types of risks- technological, contractual, and organisational. Technological risks refer to the rapid rate of innovation and technological change in the face of relatively low technical capabilities and inability to precisely anticipate or comprehend futuristic requirements, engineering, and design issues (Kirkpatrick 1995; Frankenstein and

Gill 1996; Markowski and Hall 1998; Flyvbjerg, Bruzelius, and Rothengatter 2003; Department of Defence 2013; Oxenstierna and Westerlund 2013). Contractual risks involve awarding a contract in a situation of incomplete information (Bower and Osband 1991; Crocker and Reynolds 1993; Hong and Shum 2002; Bulow and Klemperer 2002; Kwak and Smith 2009), opportunism in the formulation and enforcement of contracts (Williamson 1985; Klein 1996; Mayer and Argyres 2004; Carson, Madhok, and Wu 2006; Oudot 2010), and inefficiencies resulting from renegotiation of contracts (Tirole 1986; Baron 1988). Organisational risks refer to organisational structure and management that affect procurement performance (Rogerson 1990; Cornish and Dorman 2009; Gray 2009; Franck and Udis 2017).

A method to identify the most critical challenge in procurement to inform policymaking and procurement reform is risk analysis, and it is relatively new and less well-known. Risk analysis involves identifying objectives pursued in the procurement process, determining performance indicators corresponding to the objectives (i.e. the performance parameter), obtaining statistics on the indicators specified and finally explaining the variation in the statistics. Since a performance parameter is associated with the risks, it is possible to identify the probability of occurrence and impact of risks on the procurement performance parameter. Demonstration of the method can be found in government publications of the USA. and the UK. Since 2013, the Department of Defence in USA has been publishing an annual report titled *Performance of the Defence Acquisition System* which calculates cost overruns, delays, and the fulfilment of technical objectives and makes it possible to analyze the severity of different challenges in procurement. In the UK, the National Audit Office publishes an annual *Major Projects Report* that provides information on equipment acquisition. The report discusses cost and time schedules, the difference between projected and actual values in these categories and provides explanations for the performance. Oudot

(2010) uses risk analysis to identify procurement challenges for the French defence sector.

This paper will use the method of risk analysis to identify the challenges of defence procurement in India in the 21st century, demonstrating the advantages of risk assessment and providing an authoritative account of the challenges in Indian defence sectorⁱ.

India provides a fascinating background for studying defence procurement challenges. With the fifth largest military expenditure in the world, India needs little justification in terms of significance for defence economists. India is engaged in military conflicts with Pakistan and China to protect its territory and therefore wishes to achieve self-sufficiency in arms procurement, but at the same time it must contend with an unfulfilled developmental agenda that makes it very hard to invest in military research and specialised productionⁱⁱ. Thus, this study is valuable as an investigation of defence procurement challenges in a resource-constrained economy in the 21st century. Currently, Indian defence procurement is in the midst of policy revisions and increasing its interactions with the rest of the world in the global arms market. In March 2016 the government updated the Defence Procurement Procedure (DPP), a document that provides guidelines for procurement. DPP-2016 describes defence procurement as an industrial policy by favouring indigenous manufacturing and this study is a timely intervention to identify the challenges that may be encounteredⁱⁱⁱ.

The next section describes the defence procurement system in India and the literature on defence procurement challenges. The section on research methods describes risk analysis and gives details about the creation of the dataset used in this study, highlighting its advantages and limitations. The findings and the analysis of the results form separate sections, and the conclusion summarizes the paper.

Defence procurement in India

From an operational perspective, India has been engaged in territorial conflicts since its

independence in 1947. The Indian Army and Indian Air Force were called to intervene in securing India's northern frontier in Jammu and Kashmir in 1947-1948. The Indian Army was engaged again in 1962 with China in the northern and eastern border. India and Pakistan fought wars in 1965 and 1971. Indian Peace Keeping Forces were engaged in operations in Sri Lanka from 1987 to 1990. In 1999, India and Pakistan fought over the control of Kargil in the Jammu and Kashmir region for nearly 3 months. India and Pakistan continue to engage in cross-border firings even today. Thus, for India, arms procurement has been large in magnitude and composition, and conflicts have lasted for decades with no plausible end in sight. This makes it important to analyse defence procurement and identify risks in the Indian context.

Despite frequent and continuous military engagements, the Indian military has never harboured political ambitions and is subservient to civilian control. The Ministry of Defence (MoD) is headed by a Member of Parliament nominated by the Prime Minister and most of the executives in the ministry are civilians, members of the Indian Administrative Service (IAS) deputed to serve in the MoD for variable lengths of time. The military's involvement with the MoD occurs through the Service Headquarters located in the national capital. The Ministry has four sub-departments- the Department of Defence, the Department of Ex-Servicemen Welfare, the Department of Defence Production and the Department of Defence Research and Development. Procurement is handled by the Department of Defence in coordination with the Department of Defence Production and the Department of Defence Research and Development.

Planning and procurement

Unlike some countries, the Indian government does not publish any white paper on defence. Defence plans are classified documents and there is no public version, even for the

Parliament's review. There is an expectation that defence plans should be approved by a cabinet committee and be prepared in consultation with the Ministry of Finance, but this is not a procedural or statutory requirement and has been rarely attempted. MoD therefore exercises considerable autonomy in defining the defence strategy, operational requirements, and choice of equipment, although the lack of coordinated planning and absence of cabinet approval might reduce the level of government commitment that can be projected for the plans (Amit Cowshish 2017).

The user service (Indian Air Force/ Indian Army/ Indian Navy) has a dominant role in the formulation of Service Qualitative Requirements (SQRs) and the issuing of tender documents like Request for Information (RFI) and Request for Proposal (RFP). The RFP document invites vendors to supply an item based on the specifications in the SQR. The SQRs are approved at three stages- the Services Capital Acquisition Plan Categorisation Committee, the Services Capital Acquisition Higher Categorisation Committee and the Defence Acquisition Council (DAC). The Categorisation Committees and DAC accord 'Acceptance of Necessity' for procurement. These bodies include representatives from the concerned service, the finance division of the MoD (MoD Finance), the integrated defence service headquarter, the Defence Research and Development Organisation (DRDO), the Department of Defence Production and the Acquisition Wing of MoD. The actual procurement is processed by the Acquisition Wing. Essentially, the responsibility of requirement formulation and contract management lies on the service headquarter (SHQ) and post-contract management and monitoring is conducted by the Acquisition Wing jointly with the concerned SHQ.

The responses received to an RFP from vendors are then subjected to technical evaluation, followed by commercial evaluation. Technical evaluation is conducted in two

stages, the first based on the documents provided by the vendor, and the second at the field, with the equipment offered by the vendor. The SHQ is involved in the technical evaluation and the field trial team is composed of members from the SHQ, the Directorate General-Quality Assurance of the respective service, the DRDO and MoD Acquisition Wing. The commercial evaluation and subsequent selection of vendor and finalisation of contract is done in a collegiate manner by the Contract Negotiation Committee (CNC) which involves the MoD, its finance and acquisition wings, and the SHQ. The involvement of MoD Finance is integral in decision making at every stage of the procurement process to accommodate financial concerns (Ghose 2013). While different offices of the MoD are involved in the procurement (MoD Finance, Director General of Acquisitions), the major functions are performed by the SHQ.

The guidelines for procurement are provided in a document called the Defence Procurement Procedure (DPP), first compiled in 1992. It has undergone a number of revisions and the latest version was released in March 2016. The document defines the procedures to be followed for different kinds of capital procurement, the roles and responsibilities of different stakeholders and the policies regarding domestic industry promotion through procurement. Defence procurement in India happens in a preferential manner under the following categories: Buy (Indian), Buy and Make (Indian), Make (Indian), Buy and Make, and Buy (Global). The preference order requires that the Services provide a reason for not using a higher category that involves a greater degree of indigenisation during procurement. DPP-2016 introduced a new category for procurement called 'Buy (Indian- Indigenously Designed, Developed and Manufactured)' which has been placed as the most preferred category, placing emphasis on defence industries in India.

Defence industries

The first defence industries to be set up in India were the Ordnance Factories which supplied simple arms and ammunition for the British Army's operations in the region when India was still a British colony. After independence, these factories formed the core of the state-controlled defence industry. The 1962 military defeat in the hands of China urged India to build its defence industry in order to achieve self-reliance, either through licence production or co-production arrangements with foreign suppliers. But receiving low-interest rate credits and deferred foreign currency payments for arms imports during the Cold War weakened the pressure on industrialisation (Hébert 1996).

In 2001, India liberalised the defence sector and private Indian companies began to compete for defence contracts. However, private sector participation in defence procurement is still quite limited. The Ordnance Factories and state-owned Defence Public Sector Undertakings (DPSU) continue to enjoy a privileged position in the defence industrial base, partly because defence production has a steep learning curve and prohibitive costs because of its specificity. Companies that have been in the industry longer have advantages over new entrants, especially for major projects. Private industries in India hoping to enter the defence sector face conflicting incentives- while the government is vocal about enhancing indigenous capacity, the Buy/ Make hierarchy is more of a curse than a boon since it imposes indigenous requirements that are costlier to meet for private enterprises (Behera 2011). Liberalisation has not led to desired results.

Neither has defence industrialisation benefitted from technology transfers from abroad. This is attributed to the structural weaknesses in Indian defence industries- a risk-averse, state-centric, bureaucratic attitude that resists efforts at revitalization (Bitzinger 2015, 537). An offset policy was formally announced in 2005. Before this, India's offsets policy had been an undefined territory that witnessed licensed production, deferred payment for

imports, and countertrade, but these failed to develop India's defence industries because suppliers always withheld core technologies and countertrade mainly involved non-military goods (Baskaran 2004). In the 2005 offset policy, it was stipulated that for contracts with a value of more than 300 crore INR (approximately 42 million USD), a 30% offset would be mandatory. The policy was supplemented with information on the methods of executing offsets- direct purchase of Indian defence products and investments in India's defence industry or R&D capacity. The 2008 revision of the policy included a 'banking provision' that allowed the transfer of excess value of offset from one contract to future contracts. The 2013 revision included a multiplier to create incentives for purchase from small industries located in India. In 2016, MoD changed the threshold at which offsets become mandatory from 300 crore INR to 2000 crore INR (approximately 282 million USD). All these changes are yet to yield substantial results. Absence of an explicit intellectual property rights policy hampers technology transfers from abroad (Gupta 2008). Indian industries also lack the capacity to absorb technology (Behera and Balachandran 2018, 340).

It is possible to execute offsets by transferring technology to the Defence Research and Development Organisation (DRDO) as well. DRDO was formed in 1958 to function as India's military innovation lab, but DRDO only got a major boost in resources during the 1980s when it was asked to undertake ambitious projects like development of a fighter aircraft, main battle tank, torpedoes and missile systems. Currently the DRDO is involved in all procurement projects to identify opportunities for indigenous technological development. DRDO has its headquarters in New Delhi, at close proximity with the Ministry of Defence. The Scientific Advisor to the Defence Minister is usually a senior DRDO scientist and has a say in the formulation of the Request for Proposal document and choice of categorisation for procurement (Buy/ Buy and Make/ Make).

Defence procurement challenges in India

India's defence procurement performance is far from perfect. The book *Arming without Aiming* describes India's struggle with military modernisation and is replete with examples of delayed acquisition (Cohen and Dasgupta 2013). The sources of risk are to be found in a variety of places: lack of review in the acquisition process to enforce time and cost discipline (Raghunath 2013), a distortionary budgeting process that is not outcome-oriented (Sisodia and Cowshish 2015), the lack of organisational capacity to cope with the volume of work associated with procurement (Khan and Jhajj 2013), continually changing priorities of the military services (Rai 2000), low levels of resources and scientific expertise (Behera and Misra 2012), ambiguous Service Qualitative Requirement documents (Suman 2006), infrastructural limitations of defence industries (Arora 2013), and poor enforcement of contracts with foreign suppliers (Bakshi 2006). Much of this work comes from the Institute of Defence Studies and Analyses, an Indian MoD thinktank where researchers from different backgrounds provide expertise and advice to the government on reforming its procurement system.

It is important to note that there is an unfortunate lack of academic attention to the study of defence procurement challenges in India. A search query^{iv} on Scopus and Web of Science finds not more than 20 relevant articles, commentaries, and book chapters, few of which discuss the risks associated with defence procurement. The three research articles that do also varied in their attention. Pant (2010, 138) discusses defence policy and India's relationship with different countries in the military domain and explains the need to simplify procedures and organisational structures to make procurement a smoother experience for all concerned parties. Cowshish's (2017) primary concern is India-Israel defence trade and his argument for improving the ease of doing business includes a description of the procurement challenges that emerge from withholding information and the Ministry's intentional

ambiguity about defence requirements. It is only Behera (2012) who explicitly and exclusively focussed on the procurement system and procurement reforms in India, explaining the reasons for poor procurement performance, one of which is the lack of knowledge and experience about contract negotiation in the MoD.

Behera's 2012 article is also exceptional for stating the research methods that have led to the findings and conclusion. Much of the existing knowledge on defence procurement challenges in India seems to be based on observations and experiences of the authors and this has resulted in a large number of conjectures and impassioned policy guidance. Navigating through this literature establishes the methodological gap that this paper seeks to address by using risk analysis.

Method and data

Risk analysis is the method of assessing differences between objectives pursued and results achieved and attributing the difference to events or risks. The method is implemented in four steps- (1) identification of objectives pursued in the procurement process, (2) determination of performance indicators corresponding to the objectives, (3) curation of statistics on performance indicators, and (4) explanation for the variation in statistics. There are several advantages in using risk analysis as a method to identify challenges. Performance parameters can be calculated for a wide variety of projects and contracts and without relying on comparable case studies or benchmarks to define poor performance and determine its causes. Additionally, the use of statistics allows quantification of the impact of adverse events in the procurement process.

Risk analysis has been used to discuss procurement challenges in the French defence sector by Oudot (2010) but it is difficult to find references of this technique in academic writings elsewhere. In the last few years, governments have started presenting their data in

formats that facilitate the use of risk analysis to identify procurement challenges. For example, since 2013, the Department of Defence in USA has been publishing an annual report titled *Performance of the Defence Acquisition System* which calculates cost overruns, delays, and the fulfilment of technical objectives and makes it possible to analyze critical challenges to performance. In the UK, the National Audit Office publishes an annual *Major Projects Report* that provides information on equipment acquisition, compares the actual progress with the initial plans and provides explanations for differences in the two, if any. In India, the Comptroller and Auditor General (CAG) performs this function and its annual reports provide data that can be used to measure the performance of procurement projects and identify risks.

An overall procurement performance measure would refer to cost performance, schedule performance, and technical performance of the final product. This study is based on the analysis of schedule performance^v. Schedule performance can be considered as a transversal variable for operational, strategic (autonomy, security of supply), and economic objectives of defence procurement. Delays have an adverse impact of operational readiness^{vi}, they can jeopardise long term strategic plans^{vii}, and from an economic perspective, non-adherence to planned deadlines increases the risk of cost escalation through inflation, exchange rate variation, deterioration of bargaining position, and the cost of maintaining facilities and teams dedicated to the projects. Therefore, the research question is:

What are the challenges to timely defence procurement in India?

Data

Data for this research was obtained by mining and coding information on defence procurement contracts from 28 defence audit reports, published between 2005 and 2016 and available on the website of the Comptroller and Auditor General of India (CAG). CAG is an

autonomous institution mandated by the Constitution of India to audit all receipts and expenditure of the Indian government and its audit reports provide reliable and impartial information of public expenditure activities of the government. Surveying defence audit reports is possibly the best method to collect data on procurement contracts since the CAG can access project files, contract agreements, and request responses from the Ministry of Defence (MoD) in a way few researchers can.

Information on schedule performance could be obtained for 88 contracts signed by the MoD in India, initiated mostly in the 21st century^{viii}. This original dataset forms the basis of the study and includes information on the cause of delay, the procurement phase in which delay occurred, the nature of the project, the contractor or partner agency, and the military service for whom the contract was being pursued. While the dataset is neither an exhaustive list of all MoD contracts, nor a random sample of Indian defence contracts (CAG only publishes information of contracts that display deviation), it covers a wide range of procurement activities (like development, production, off-the-shelf procurement, maintenance and upgrade^{ix}) and actors (defence laboratories, defence public sector undertakings, foreign companies, and Indian private companies). Table 1 provides the composition of the dataset in terms of type of activity and actors.

[Table 1 here]

In addition, 53 semi-structured interviews were conducted in India between August and October 2016 to appreciate the complexity and nuances, cross-check points of view, ideas and conclusions, and gain additional stakeholder perspective. The interviewees were identified on the basis of their involvement in an executive capacity in defence procurement in recent years, either in the government or industry, and through snowball sampling. Interviews were conducted with 4 civilian bureaucrats from the Ministry of Defence, 14

officers from the Indian Air Force, 13 officers from the Indian Army, 10 officers from the Indian Navy, 7 executives from Indian defence public sector undertakings, and 5 from private-sector defence companies. The interviews were conducted with the aid of a questionnaire that contained both open-ended and closed questions. The questionnaire was shared with participants prior to the interview. The responses were transcribed and contributed in the analysis of the information obtained from the CAG defence audit reports.

A mixed method approach has been used in this study by combining quantitative data on contract performance and qualitative data from interviews. The motive behind using mixed methods in this study is to enhance the level of comprehension and analysis than what would have been possible only with a single source of data (Jick 1979). It is not an attempt at triangulation- both sources of data (audit reports and interviews) may not be representative samples of the population. The CAG defence audits do not offer information on every contract undertaken by the MoD but only those that display deviation from initial plans. Snowball sampling, while suitable for recruiting respondents from populations that are secretive and hard to access (like people working for the military), can rarely claim to be representative (Atkinson and Flint 2011).

Calculating schedule performance

Delay is the percentage of excess time taken with respect to the planned duration of the activity. The planned duration is pre-determined by guidelines and approved by the Ministry before undertaking any activity. Thus, if an activity was supposed to take 12 months to complete and instead took 24 months, the schedule performance parameter will show a delay of 100%. The distribution of delays is presented in Table 2.

[Table 2 here]

The average delay is 180.05%, with a minimum of 4.17% and a maximum of 1660%. The wide range is ideal for exploring the types of risks and their frequency distribution. The descriptive statistics of the dataset are provided in Table 3.

[Table 3 here]

Categorizing contracts according to sources of risk

CAG defence audit reports provided the reason for delay in 76 of the 88 contracts. In cases where there were multiple reasons for delay, each reason was considered for coding purposes^x. For methodological and analytical ease, the reasons for delay were categorized into three sources of risk- technological, contractual, and organizational.

A contract is said to have faced ‘technological challenges’ when the delay was due to the lack of technological skills, resources, and infrastructure relative to the technological complexity of the project, or because of changes in design. A contract is said to have faced ‘contractual challenges’ if the schedule performance was affected by delays in negotiation and writing of contracts, compliance to design requirements, lack of response from the supplier, non-adherence to contract by supplier, or non-enforcement of contracts. A contract is said to have faced ‘organizational challenges’ when there were delays in authorization, delegation of tasks, coordination, or because of ambiguity of regulations and procedures, conflicting reports from different executive branches involved in the project, or even organizational capacity (overworked and understaffed organizations).

Findings

Risks according to probability

Technological challenges are the most probable of defence procurement challenges in India when discussing delays in procurement. These affected 39 contracts in the dataset. This is followed by contractual challenges, which affected 30 contracts and finally organizational challenges (20 contracts). No cause for delay could be established for 12 contracts in the dataset.

Risks according to impact

Figure 1 shows the distribution of the sources of risk in 6 broad intervals of the performance indicator. It is interesting to note that although technological risks are the most probable cause for delays, the observations displaying worse schedule performance (delays greater than 300%) were affected by contractual and organizational risks. Contractual risks emerge as the source of risk having greatest impact on performance, affecting 9 of the 15 contracts facing delays greater than 300%. Contractual risks also become more probable than technological risks when delays are greater than 100%: in the 46 contracts where delays are greater than 100%, 19 are affected by contractual risks in comparison to 16 affected by technological risks. The average delay caused by contractual risks is much higher than any other source of risk, although organizational risks follow closely behind (Table 4).

[Figure 1 here]

[Table 4 here]

Risks according to phases of procurement

Rogerson (1994) divides the life cycle of a defence procurement program into 3 phases- design, which is associated with specification of requirements and multiple firms pursuing competing designs; sole-source selection, where firms submit their plans, bid for the contract, and the negotiation of the contract with the vendor takes place; and production, the phase in which production, supply and sometimes renegotiation of the contract takes place.

In the dataset, delays occurred mostly in the production phase (48 contracts), followed by the design phase (24 contracts), and finally the selection phase (16 contracts)^{xi}. Figure 2 shows the sources of risk in the three phases of procurement. Technological risks are prevalent in the design phase (19 of 24 contracts) and organizational risks in the selection phase (11 of 16 contracts). In the production and supply phase, technological and contractual risks help to explain a high share of delays^{xii}.

[Figure 2 here]

Risks according to partner agency

Partner agency here refers to the supply-side organization with whom the Ministry of Defence signed the contract. The various supply-side organizations are the Defence Research and Development Organisation (DRDO), the government-owned defence companies (defence public sector undertakings or PSUs), privately-owned Indian defence companies (Indian private company), and foreign firms. Of the 76 contracts where a reason for delay was mentioned, 10 involved DRDO on the supply-side, 35 involved DPSUs, 23 involved foreign firms, and 4 involved Indian private companies^{xiii}.

[Figure 3 here]

Figure 3 associates procurement challenges with different suppliers. Technological risks prominently feature in contracts with the DRDO, India's research and development organization (all 10 DRDO contracts). Technological challenges are also prominent in the contracts with defence public sector companies (26 of 35 contracts involving DPSUs). On the other hand, contractual challenges are prominent when an Indian private company or a foreign firm is on the supply side (19 of 27 contracts). This is possibly an illustration of transaction cost economics where the Ministry of Defence incurs high transaction costs when dealing with external agents.

Risks according to military service

On the demand-side, it is possible to note the occurrence of adverse events for the different military services that are involved in the contract. The user-service (Indian Air Force/ Indian Army/ Indian Navy) in India, through the service headquarter (SHQ), have a dominant role in the formulation of Service Qualitative Requirements and the issuing of Request for Information and Request for Proposal that invites vendors. The concerned service headquarter is also involved in the technical and commercial evaluation of the bids. Of the 76 contracts where procurement challenges could be identified, 21 involved the Indian Air Force, 20 involved the Indian Army, and 34 involved the Indian Navy. Figure 4 leads to two interesting observations- the prevalence of technological risks in Indian Navy contracts (23 of 34 contracts) and contractual risks in the contracts of the Indian Army (11 of 20 contracts).

[Figure 4 here]

Analysis

Technological risks in indigenous procurement

Technological risks emerged as the most probable source of risk that caused delays in this dataset. Further analysis of the 39 contracts which faced technological risks shows 19 cases of delay due to lack of infrastructure or raw materials, 14 cases of delay due to changes in design and re-development, and 8 cases of delay due to initial teething problems of an indigenization effort^{xiv}. While revisions of technological requirements and delays in indigenously developing a new technology can be imagined easily, illustrative examples of the lack of raw materials and infrastructure can be truly astounding. The production of the Indian Aircraft Carrier was delayed because the necessary steel could not be procured (CAG 2016b, 40). The Parachutes (PARA) Special Forces battalions of the Indian Army did not have parachutes for over a decade because MoD had ordained that parachutes must be procured indigenously but Ordnance Parachutes Factory in Kanpur could not supply the required quantity due to lack of fabric (CAG 2015b, 44–45).

The lack of infrastructure and raw materials was described by some of the interviewees in detail. For example, Rear Admiral H^{xv} remarked:

As far as the Navy is concerned, the conceptualization phase is not a problem since the requirements are frozen prior to accord of AoN [Acceptance of Necessity]. The time allocated for the issue of RFP [Request for Proposal] is also defined in the Defence Procurement Procedure and the vendors are also well known. Only the actual production phase faces delays, and this is due to delays in availability of docks, nominated systems, spares, etc. (author interviews, 13 September 2016)

A senior executive in Hindustan Aeronautics Limited (HAL), India's biggest state-owned aerospace and defence company, expressed that fragmented budgets led to a lack of infrastructure and associated delays- 'most often the funds are released at a bare minimum

level, without rational comparison with similar projects elsewhere. This leads to fragmented development work and inadequate infrastructure' (author interviews, 30 August 2016). This also explains why technological risks are prominent in the production phase (Figure 2), besides being common in the design phase where delays due to technological risks are found because of difficulties in designing and specifying requirements.

What is perhaps more interesting and relevant is the concentration of technological risks in contracts where the DRDO or DPSUs are on the supply-side (Figure 3). This could be due to lack of technological skills and resources in the Indian defence sector. Technological risks prominently feature in contracts with the DRDO, India's government-run research and development organization. Behera (2016, 95–97) explains that the shortage of scientists coupled with high attrition rates is the source of technological challenges in the DRDO. A Parliamentary Committee report revealed that only 10% of DRDO's scientists have a PhD degree (Ministry of Defence 2008). Technological challenges are also very prominent in the contracts with defence public sector companies.

The association of technological challenges in cases of indigenous procurement is an important finding with respect to India's interest in using defence procurement as an industrial policy. The 39 Ordnance Factories and 9 Defence Public Sector undertakings under the administrative control of the Ministry of Defence form the backbone of India's defence industrial base and is claimed to be one of the largest defence industrial complexes in the developing world. However, this large system has not allowed India to reduce its import dependence, even for low technology items.

Technological risks are to be found in all the three services but affects the procurement of the Indian Navy the most. This may be because the Indian Navy has a more indigenous procurement portfolio than the other services. This was suggested by some of the

interviewees and has also been articulated in a commentary by Srivastava (1999, 205), attributing the higher level of indigenization to the Indian Navy's ability to invest in the same since the 1970s because the service was not expected to play a critical role in any armed conflict.

Frictions and opportunism in international procurement

Contractual risks are second in order of probability but have the highest impact on schedule performance (Table 3). Risk analysis would therefore identify contractual risks as the most critical risk for India's defence procurement. Further analysis of the 30 contracts facing contractual challenges reveals non-compliance to contractual terms and difficulty in contract enforcement as the most commonly cited cause of delay (17 cases). Challenges in negotiation is found in 9 cases and delays due to subcontractor management in 5 cases. Enforcing contracts in a non-competitive market is not straightforward and the findings suggests paying greater attention to this aspect for improving schedule performance of defence procurement in India. In some of the contracts, like the production of Kolkata-class destroyer and Shivalik-class frigate for the Indian Navy, the audit report notes that the absence of contractually agreed timelines made it difficult to monitor and arrest delays (CAG 2010, 46). This may be the reason why delays in the production and supply phase seem to have a high share of contracts affected by contractual risks (Figure 2). Contractual risks emerge after the signing of the contract, i.e. ex post, which implies opportunistic behavior on the part of the suppliers.

At the heart of the issue lies the lack of skills in the Indian procurement system to negotiate and enforce contracts. According to Air Marshal A:

Most people involved in defence procurement have no formal training, and feel their way around the policy and processes, [thereby] causing delays. With limited tenures, both in the MoD and

in SHQs, a lot of time is wasted in learning the process while there is little handing over of the skills and knowledge acquired by predecessors. (author interviews, 24 August 2016)

That India lacks a trained cadre of defence contract specialists has been noted in the literature (Suman 2006) and was highlighted by the interviewees. Brigadier M expanded upon tenure problems in the Ministry of Defence to show the lack of informed decision-making:

In the Army, officers need to go to different places to get their next rank. But we need experts. We need to identify specialists and keep them there. We need to give them an environment to remain and not get sentimental about them staying in one place. For the Army in MoD, the hierarchy is affected because the real expert is the Colonel who has been in the Headquarters for 3 years, rather than the Lieutenant General who is here for 6 months. This affects the quality of discussion and decision-making. (author interviews, 19 October 2016)

This lack of skills is put to special test when interacting with foreign firms. Some interviewees called this 'colonial hangover' - contract enforcement is relaxed for foreign entities because of India's long history of colonial subjugation. However, another line of thinking stresses on the strategic nature of defence purchases and that the buyer's (here India's) attitude has little say in the outcome. In certain cases, reputation and performance may be of little consequence when the supplier is able to get a captive buyer. This is often the case in international arms market where competition is limited for complex and advanced weapons system and the choice of supplier is guided by strategic considerations. Air Marshal B gives an example of the nature of this problem:

We are grossly dependent on the suppliers, you know. Take the cases where we bought from Russia. We have always approached them with a begging bowl full of money. And they never stuck to contracts, but they were dependable friends, dependable suppliers. At least compared to the others.

Not that Russians are saints. There is no kind of incentive that makes them deliver as per schedule. And then of course, there is the language barrier and translation issues, and they have always taken benefit of the confusion. (author interviews, 23 August 2016)

Contractual risks are most prominent in international procurement and in the small number of contracts that the MoD signs with privately-owned (non-government) Indian defence companies (Figure 3). This is possibly an illustration of transaction cost economics where the Ministry of Defence is unable to control the transaction costs associated with dealing with external agents. Contractual risks were a source of delay in 26% of contracts with a public-sector firm but 58% of contracts with foreign firms and all the contracts with Indian private enterprises. Of the 19 cases of procurement from international and private Indian companies which experienced poor schedule performance due to contractual risks, 11 occurred in the production and supply phase, i.e. *ex post*. One of the behavioural assumptions of transaction cost economics is that parties behave opportunistically (Williamson 1993). Transaction cost economics, which emphasizes on both pre-contract and post-contract periods, is therefore a useful perspective to adopt while analyzing procurement challenges in such cases.

India continues to be one of the largest arms importer in the world and in recent years, the government has been encouraging private defence companies in India (rather than the DPSUs) to compete for defence contracts through its 'Make in India' initiative. Therefore, contractual challenges, which occur particularly with these agencies, should be given greater attention. Finding contractual risks in a high share of contracts of the Indian Army (Figure 4) is another reason to emphasize on contractual challenges in Indian defence procurement because the Indian Army is the largest and most pro-active of the three services. Through the Indian Army, contractual risks have a serious impact on operational readiness.

Organisational challenges in the procurement system

Organisational risks, although relatively low in probability have a high impact on schedule performance (Table 3). Organisational risks found in the dataset include delays due to lack of organisational capacity to process procurement (8 cases), delay due to conflict in procedures (8 cases), and delays due to problems in coordination with different agencies (4 cases). Some of the contracts reported clearly display the procurement system's lack of capacity to process and complete tasks within stipulated timelines and one of the interviewees commented that 'the procurement branch in Ministry of Defence is overworked' (author interviews, 26 September 2016). It is difficult to find evidence to support this statement, but it may be noted that based on the Kargil Review Committee Report (Subrahmanyam et al. 2000), the Group of Ministers recommended the creation of the Defence Procurement Organisation, a separate and dedicated institutional structure to facilitate faster procurement. Procedures are solely responsible for leading to adverse schedule performance in 4 cases. An illustrative example of this is the production order for low level light weight radar 'Aslesha' for the Indian Air Force (IAF). During user acceptance trials, IAF suggested improvements that led to increase in the weight of the radar from 190 kg to 205 kg. Although the increase in weight was acceptable to the IAF, the delivery was withheld pending amendment to contractual specifications, which delayed the programme by 23 months (CAG 2015a, 117–18).

Another important finding is the occurrence of organisational risks in the selection phase (Figure 2). Many of the interviewees claimed that schedule performance in the selection phase was affected because of isolation between different organisations of the MoD during planning and decision making, rigidities in cooperation, procedures that are inefficient to follow, and the lack of incentives to perform. Besides these, relations between organisations are sometimes so poor that they cannot work in harmony. Brigadier R describes

the ‘blame game’ that occurs between DRDO, the manufacturer and the user whenever an enquiry takes place, to the extent that it makes identification of the actual cause impossible:

We once had a problem where the ammunition would explode in its casing. The manufacturer blamed the design, claiming the barrel was too thin. DRDO blamed the user [Indian Army], that you did not clean the barrel. At the end of the day, the cause is never identified. (author interviews, 24 September 2016)

According to some of the interviewees, DRDO faces a conflict of interest- it is the supplier of technology as well as the evaluator for import decisions and therefore has an incentive to promote its growth and interest. DRDO ‘has power to kill any procurement proposal from the armed forces without being accountable for performance of the project’ (Cohen and Dasgupta 2010, 32). If this is true, then in the words of some of the interviewees DRDO engages in a ‘foot-in-the-door policy’ to maintain their participation^{xvi}. Air Marshal AL described a meeting where the DRDO representative was enthusiastic to be the partner:

My response was, “I cannot take you for your word, sir!” DRDO has to substantiate its claims to produce! (author interviews, 26 September 2016)

One possible solution could be a collegiate system of decision-making. A review of Defence Procurement Procedure 2013 identified the lack of trust in the basic architecture for defence procurement and noted that ‘entities work in their own silos, leading to conflicts and delays’ (Singh 2015, para. 4.2.04). The new Defence Procurement Procedure 2016 has attempted to address the lack of coordination by stipulating that the Request for Information (RFI) document needs to be formulated by the concerned Service Headquarter in consultation with other stakeholders like DRDO and the Department of Defence Production so that varied concerns can be dealt with at the very beginning of procurement.

Conclusion

Military engagements are nowhere near abatement, especially in the Indian sub-continent, and identifying defence procurement challenges continues to be of interest to defence economists. Indian defence procurement, despite its size and participation in the international arms market, has not received the attention it is due, and this paper contributes by shedding some light on the topic. India's defence procurement policy has been revised and updated in recent years to respond to changes in operational, strategic, and economic circumstances and it is important to identify the challenges that can occur in Indian defence procurement to help inform such policy revisions. In this paper, the identification of challenges is based on evidence of defence procurement activities in India in the 21st century that can be found in defence audit reports. The risk assessment method used in this paper has two key advantages- it is testable (falsifiable) and can be applied to an updated dataset if more data becomes available (for example, with every subsequent CAG audit report). The findings from the numerical data have been supplemented by several interviews with executives in government and industry in India to add context.

In this study it was found that delays in procurement occur for many reasons in India, but the most probable cause for delays are technological challenges. These can be attributed to the technical complexity of the systems being procured, but often in the case of a resource-constrained economy like India, technological challenges include a lack of infrastructure and raw materials. The Indian government is interested in promoting manufacturing in India under its 'Make in India' initiative and has instituted steps that will favour defence production undertaken within the country as opposed to production and assembly overseas. However, if the issue of industrial capacity and resources is not addressed, such policies would fail to yield positive results and possibly aggravate the Indian military by causing delays that harm strategic objectives and operational readiness. Contractual challenges are

most critical when the average delay caused by the risk is combined with its probability of occurrence. They are prominent in the production and delivery stages of procurement, i.e. after the signing of the contract, and happen to be the most common cause for delay in procurement contracts with foreign firms and Indian private companies, i.e. organisations external to the Ministry of Defence. These empirical observations confirm the existence of transaction costs in Indian defence procurement and the behavioural assumptions of opportunism in transaction costs economics.

Although several steps are being taken to improve defence procurement performance in India, especially directed at the organisational level, there is little evidence to show that the government is aware of technological challenges in indigenous procurement and the transaction costs it incurs whenever the MoD interacts with international or private Indian suppliers. It is therefore hoped that this research with its use of risk analysis will help in generating attention towards the other, and based on existing data more critical, risks in Indian defence procurement.

At least three directions for further research can be identified^{xvii}. The first can be a more in-depth quantitative analysis, possibly using techniques like probit modelling to identify the probability of a technological, contractual, and/or organisational risk occurring because of the presence of certain actors and types of activities. The second is a more in-depth qualitative analysis based on a detailed case study of ongoing defence procurement programmes in India, applying the knowledge gained from this study to identify likely challenges for a particular case. Finally, it would be interesting to replicate the risk assessment method in other countries and note commonalities and differences in defence procurement challenges in different institutional contexts.

References

- Arora, R. K. 2013. 'Indian Experience in Contracting/Post Contract Implementation and Project Management Challenges'. In *Defence Acquisition: International Best Practices*, edited by Laxman Kumar Behera and Vinay Kaushal.
- Atkinson, Rowland, and John Flint. 2011. 'Snowball Sampling'. In *The SAGE Encyclopedia of Social Science Research Methods*, edited by Michael Lewis-Beck, Alan Bryman, and Tim Futing Liao, 1044. SAGE.
- Bakshi, J. 2006. 'India-Russia Defence Co-Operation'. *Strategic Analysis* 30 (2): 449–66.
- Baron, David P. 1988. 'Procurement Contracting: Efficiency, Renegotiation and Performance Evaluation'. *Information Economics and Policy* 3 (2): 109–42. [https://doi.org/10.1016/0167-6245\(88\)90022-4](https://doi.org/10.1016/0167-6245(88)90022-4).
- Baskaran, A. 2004. 'The Role of Offsets in Indian Defense Procurement Policy'. In *Arms Trade and Economic Development: Theory, Policy and Cases in Arms Trade Offsets*, edited by Jurgen Brauer and John Paul Dunne, 212–22. Routledge Taylor & Francis Group. <https://doi.org/10.4324/9780203392300>.
- Behera, Laxman K. 2016. *Indian Defence Industry: An Agenda for Making in India*. Pentagon Press.
- Behera, Laxman K., and S. N. Misra. 2012. 'India's Naval Shipbuilding Industry: Key Gaps and Policy Options'. *Defence Studies* 12 (3): 434–51.
- Behera, Laxman K. 2011. 'Enhancing Private Sector Participation in India's Defense Production'. *Defense and Security Analysis* 27 (3): 251–65. <https://doi.org/10.1080/14751798.2011.604485>.
- Behera, Laxman K. 2012. 'India's Defense Acquisition System: Need for Further Reforms'. *Korean Journal of Defense Analysis* 24 (1): 89–105.
- Behera, Laxman K., and G. Balachandran. 2018. 'Indo-US Defence Industry Cooperation: A Prognosis'. *India Quarterly* 74 (3): 337–42. <https://doi.org/10.1177/0974928418785455>.
- Bitzinger, Richard A. 2015. 'Comparing Defense Industry Reforms in China and India'. *Asian Politics and Policy* 7 (4): 531–53. <https://doi.org/10.1111/aspp.12221>.
- Bower, Anthony G., and Kent Osband. 1991. 'When More Is Less: Defense Profit Policy in a Competitive Environment'. *The RAND Journal of Economics* 22 (1): 107–19. <https://doi.org/10.2307/2601010>.
- Bulow, Jeremy, and Paul Klemperer. 2002. 'Prices and the Winner's Curse'. *The RAND Journal of Economics* 33 (1): 1–21. <https://doi.org/10.2307/2696372>.
- CAG. 2010. 'Performance Audit of the Indigenous Construction of Indian Naval Warships'. Audit report 32. Comptroller and Auditor General of India.

- CAG. 2015a. 'Union Government (Defence Services) Air Force'. Audit report 44. Comptroller and Auditor General of India.
- CAG. 2015b. 'Union Government (Defence Services) Army, Ordnance Factories and Defence Public Sector Undertakings'. Audit report 44. Comptroller and Auditor General of India.
- CAG. 2016a. 'Union Government (Defence Services) Army, Ordnance Factories and Defence Public Sector Undertakings'. Audit report 19. Comptroller and Auditor General of India.
- CAG. 2016b. 'Union Government (Defence Services) Navy and Coast Guard'. Audit report 17. Comptroller and Auditor General of India.
- Carson, Stephen J., Anoop Madhok, and Tao Wu. 2006. 'Uncertainty, Opportunism, and Governance: The Effects of Volatility and Ambiguity on Formal and Relational Contracting'. *Academy of Management Journal* 49 (5): 1058–77. <https://doi.org/10.5465/amj.2006.22798187>.
- Cohen, Stephen P., and Sunil Dasgupta. 2013. *Arming without Aiming: India's Military Modernization*. Brookings Institution Press.
- Cornish, Paul, and Andrew Dorman. 2009. 'National Defence in the Age of Austerity'. *International Affairs* 85 (4): 733–53. <https://doi.org/10.1111/j.1468-2346.2009.00825.x>.
- Cowen, Tyler, and Dwight Lee. 1992. 'The Usefulness of Inefficient Procurement'. *Defence Economics* 3 (3): 219–27. <https://doi.org/10.1080/10430719208404730>.
- Cowshish, Amit. 2017. 'India–Israel Defence Trade: Issues and Challenges'. *Strategic Analysis* 41 (4): 401–12. <https://doi.org/10.1080/09700161.2017.1330445>.
- Cowshish, Amit. 2017. '13th Five-Year Defence Plan (2017-22) – A Re-Run of the Past'. *Indian Defence Review* (blog). 31 July 2017. <http://www.indiandefencereview.com/13th-five-year-defence-plan-2017-22-a-re-run-of-the-past/>.
- Crocker, Keith J., and Kenneth J. Reynolds. 1993. 'The Efficiency of Incomplete Contracts: An Empirical Analysis of Air Force Engine Procurement'. *The RAND Journal of Economics* 24 (1): 126–46. <https://doi.org/10.2307/2555956>.
- Department of Defence. 2013. 'Performance of Defense Acquisition System Annual Report'. Office of the Under Secretary of Defense Under Secretary of Defense, Acquisition, Technology, and Logistics.
- Flyvbjerg, Bent, Nils Bruzelius, and Werner Rothengatter. 2003. *Megaprojects and Risk: An Anatomy of Ambition*. Cambridge University Press.
- Franck, Raymond, and Bernard Udis. 2017. 'Quarrelsome Committees in US Defense Acquisition: The KC-X Case'. *Defence and Peace Economics* 28 (3): 344–66. <https://doi.org/10.1080/10242694.2015.1073488>.

- Frankenstein, John, and Bates Gill. 1996. 'Current and Future Challenges Facing Chinese Defence Industries'. *The China Quarterly*, no. 146: 394–427.
- Ghose, R.K. 2013. 'Towards an Optimal Procedural Framework: The Indian Experience'. In *Defence Acquisition: International Best Practices*, edited by Laxman Kumar Behera and Vinay Kaushal, 41–54. New Delhi: Pentagon Press.
- Gray, Bernard. 2009. 'Review of Acquisition for the Secretary of State for Defence: An Independent Report'. Ministry of Defence.
- Gupta, V.K. 2008. 'India: IPr and the National Security'. *Journal of Intellectual Property Rights* 13 (4): 318–25.
- Hall, Peter, Stefan Markowski, and Douglas Thomson. 1998. 'Defence Procurement and Domestic Industry: The Australian Experience'. *Defence and Peace Economics* 9 (1–2): 137–65. <https://doi.org/10.1080/10430719808404898>.
- Hébert, J.P. 1996. 'Offsets and French Arms Exports'. In *Defence Procurement and Countertrade*, edited by S. Martin, 139–62. Routledge.
- Hong, Han, and Matthew Shum. 2002. 'Increasing Competition and the Winner's Curse: Evidence from Procurement'. *The Review of Economic Studies* 69 (4): 871–98. <https://doi.org/10.1111/1467-937X.00229>.
- Jick, Todd D. 1979. 'Mixing Qualitative and Quantitative Methods: Triangulation in Action'. *Administrative Science Quarterly* 24 (4): 602–11. <https://doi.org/10.2307/2392366>.
- Kapstein, Ethan B. 2002. 'Allies and Armaments'. *Survival* 44 (2): 141–55. <https://doi.org/10.1093/survival/44.2.141>.
- Keisler, Jeffrey M., and William A. Buehring. 2005. 'How Many Vendors Does It Take to Screw down a Price? A Primer on Competition'. *Journal of Public Procurement* 5 (3): 291–317. <https://doi.org/10.1108/JOPP-05-03-2005-B001>.
- Khan, A., and H.S. Jhajj. 2013. 'Challenges of Defence Procurement: A User Perspective'. In *Defence Acquisition: International Best Practices*, edited by Laxman Kumar Behera and Vinay Kaushal, 88–98. Pentagon Press.
- Kirkpatrick, David L. I. 1995. 'The Rising Unit Cost of Defence Equipment — The Reasons and the Results'. *Defence and Peace Economics* 6 (4): 263–88. <https://doi.org/10.1080/10430719508404831>.
- Klein, Benjamin. 1996. 'Why Hold-ups Occur: The Self-enforcing Range of Contractual Relationships'. *Economic Inquiry* 34 (3): 444–63. <https://doi.org/10.1111/j.1465-7295.1996.tb01388.x>.
- Kwak, Young H., and Brian M. Smith. 2009. 'Managing Risks in Mega Defense Acquisition Projects: Performance, Policy, and Opportunities'. *International Journal of Project Management* 27 (8): 812–20. <https://doi.org/10.1016/j.ijproman.2009.02.002>.
- Laffont, Jean-Jacques, and David Martimort. 2009. *The Theory of Incentives: The Principal-Agent Model*. Princeton University Press.

- Manohara, Chinniah. 1998. 'Defence Procurement and Industry Policy - A Singapore Perspective'. *Defence and Peace Economics* 9 (1-2): 119-36.
<https://doi.org/10.1080/10430719808404897>.
- Markowski, Stefan, and Peter Hall. 1998. 'Challenges of Defence Procurement'. *Defence and Peace Economics* 9 (1-2): 3-37. <https://doi.org/10.1080/10430719808404892>.
- Mayer, Kyle J., and Nicholas S. Argyres. 2004. 'Learning to Contract: Evidence from the Personal Computer Industry'. *Organization Science* 15 (4): 394-410.
<https://doi.org/10.1287/orsc.1040.0074>.
- McCue, Cliff, and Eric Prier. 2008. 'Using Agency Theory to Model Cooperative Public Purchasing'. *Journal of Public Procurement* 8 (1): 1-35.
<https://doi.org/10.1108/JOPP-08-01-2008-B001>.
- Miller, John P. 1952. 'Military Procurement Policies: World War II and Today'. *The American Economic Review* 42 (2): 453-75.
- Ministry of Defence. 2008. 'Recommendations of Rama Rao Committee on DRDO'. Technical report. Government of India.
- Oudot, Jean-Michel. 2010. 'Performance and Risks in the Defense Procurement Sector'. *Journal of Public Policy* 30 (2): 201-18.
<https://doi.org/10.1017/S0143814X10000073>.
- Oxenstierna, S., and F. Westerlund. 2013. 'Arms Procurement and the Russian Defense Industry: Challenges up to 2020'. *Journal of Slavic Military Studies* 26 (1): 1-24.
<https://doi.org/10.1080/13518046.2013.757135>.
- Pant, H.V. 2010. 'Indian Defense Policy at a Crossroads'. *Asia-Pacific Review* 17 (1): 124-44. <https://doi.org/10.1080/13439006.2010.482759>.
- Pugh, P. G. 1993. 'The Procurement Nexus'. *Defence Economics* 4 (2): 179-94.
<https://doi.org/10.1080/10430719308404758>.
- Raghunath, P. R. 2013. 'Defence Acquisition: A Shipyard Perspective'. In *Defence Acquisition: International Best Practices*, edited by Laxman Kumar Behera and Vinay Kaushal, 289-300. Pentagon Press.
- Rai, A. K. 2000. 'Defence Budget 2000-01: Some Observations'. *Strategic Analysis* 24 (4): 841-45.
- Reichelstein, Stefan. 1992. 'Constructing Incentive Schemes for Government Contracts: An Application of Agency Theory'. *The Accounting Review* 67 (4): 712-31.
- Rogerson, William P. 1990. 'Quality vs. Quantity in Military Procurement'. *The American Economic Review* 80 (1): 83-92.
- Rogerson, William P. 1991. 'Incentives, the Budgetary Process, and Inefficiently Low Production Rates in Defence Procurement'. *Defence Economics* 3 (1): 1-18.
<https://doi.org/10.1080/10430719108404711>.

- Rogerson, William P. 1994. 'Economic Incentives and the Defense Procurement Process'. *Journal of Economic Perspectives* 8 (4): 65–90. <https://doi.org/10.1257/jep.8.4.65>.
- Singh, Dharendra. 2015. 'Report of Expert Committee for Amendment to DPP-2013'. Technical report. Government of India.
- Sisodia, N. S., and Amit Cowshish. 2015. 'Defence Planning, Programming, and Budgeting: An Agenda for Reform'. In *Core Concerns in Indian Defence and the Imperatives for Reform*, edited by V. Misra, 101–20. Pentagon Press.
- Srivastava, A. 1999. 'Indo-Russian Military Technical Cooperation: Implications for Southern Asia'. *World Affairs* 161 (4): 200–210.
- Subrahmanyam, K., K. Hazari, B. Verghese, and S. Chandra. 2000. 'Kargil Review Committee Report'. Technical report. Government of India.
- Suman, M. 2006. 'Weapons Procurement: Qualitative Requirements and Transparency in Evaluation'. *Strategic Analysis* 30 (4): 724–44.
- Tirole, Jean. 1986. 'Procurement and Renegotiation'. *Journal of Political Economy* 94 (2): 235–59. <https://doi.org/10.1086/261372>.
- Williamson, Oliver E. 1979. 'Transaction-Cost Economics: The Governance of Contractual Relations'. *The Journal of Law and Economics* 22 (2): 233–61. <https://doi.org/10.1086/466942>.
- Williamson, Oliver E. 1985. *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*. Free Press.
- Williamson, Oliver E. 1993. 'Opportunism and Its Critics'. *Managerial and Decision Economics* 14 (2): 97–107. <https://doi.org/10.1002/mde.4090140203>.

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Table 1: Composition of the dataset by types of contracts and partner agency

	DPSU	DRDO	Foreign	Indian private company	Internal*	Total
Development	3	11	1			15
Off-the-shelf procurement	1		11			12
Production	16		7	1		24
Repair	6		5	1	1	13
Upgrade	13		2			15
Infrastructure	3			2	4	9
Total	42	11	26	4	5	88

*Internal agent refers to different branches of the Ministry of Defence. These are observations where two or more branches within the MoD failed to prevent delay.

Table 2: Distribution of schedule performance parameter

Delay	Number of observations
Less than or equal to 50%	21
50% - 100%	21
100% - 200%	22
200% - 300%	09
300% - 500%	11
Greater than 500%	04
Total	88

Table 3: Descriptive statistics of the dataset

	Number of observations	Mean	Median	Mode	Standard deviation	Min	Max
Start year	72	2004.6	2005	2002	4.25	1987	2012
End year	72	2010.4	2010	2010	3.80	2002	2016
Planned duration (in months)	88	30.21	24	24	24.55	2.5	114
Actual duration (in months)	88	65.62	49	46	47.12	11.25	291
Delay (in %age)	88	180.05	117.69	500	217.61	4.17	1660

Table 4: Risk probability and impact

Risk	Probability	Average delay in %age
Technological	0.4432	125.828
Contractual	0.3409	260.294
Organizational	0.2273	239.174

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Figure 1: Distribution of sources of risk according to delays

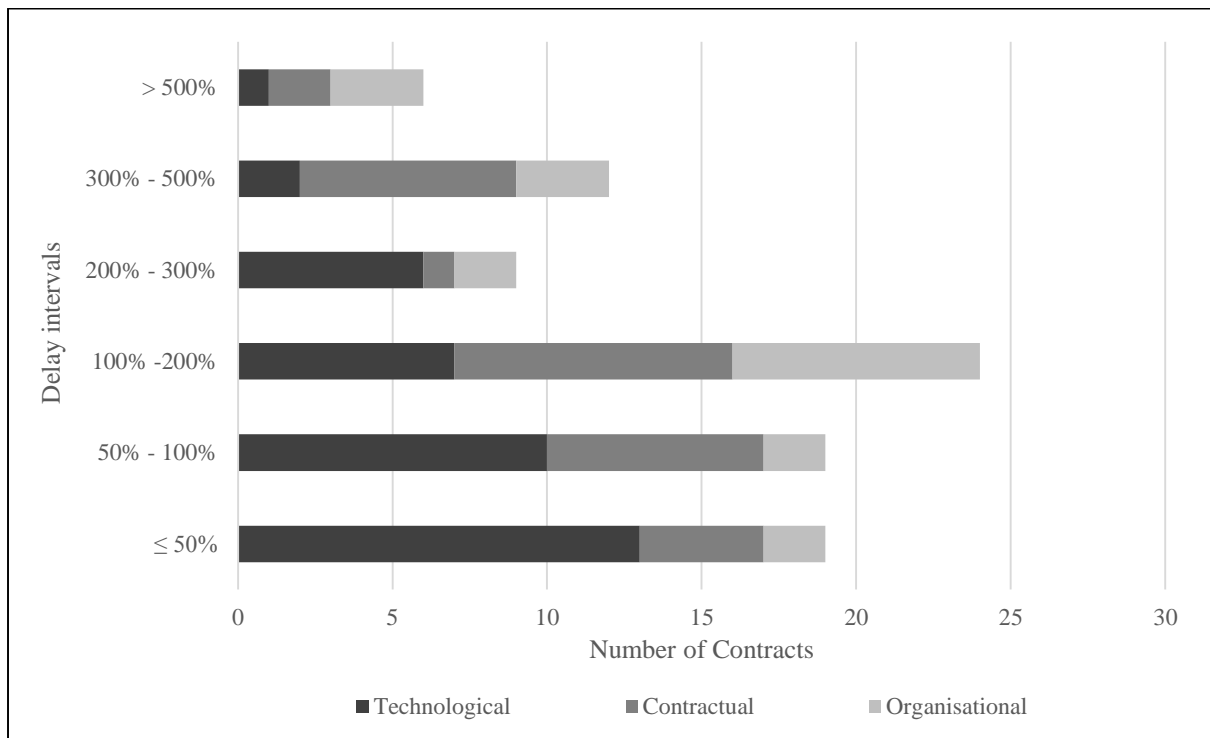


Figure 2: Sources of risk associated with phases of procurement

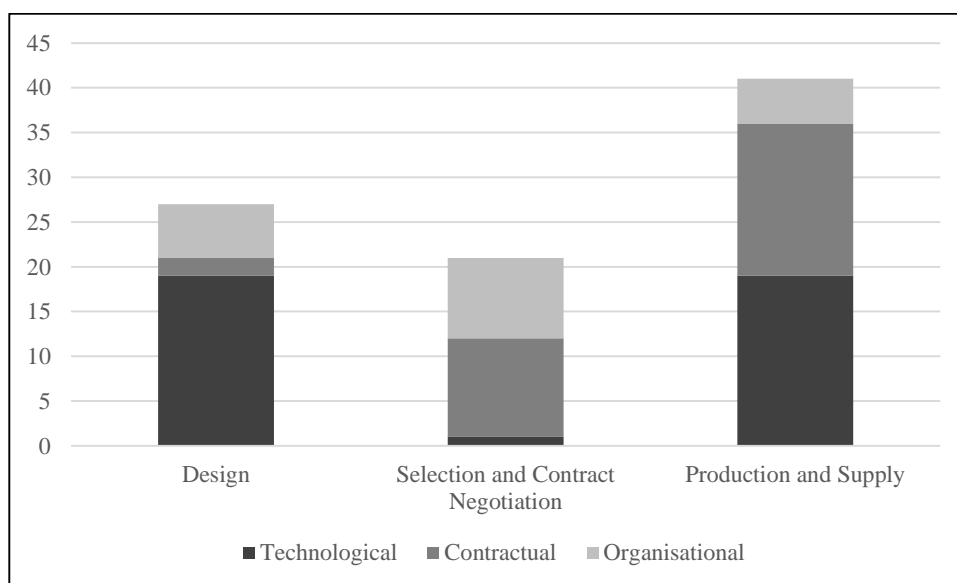


Figure 3: Sources of risk associated with suppliers

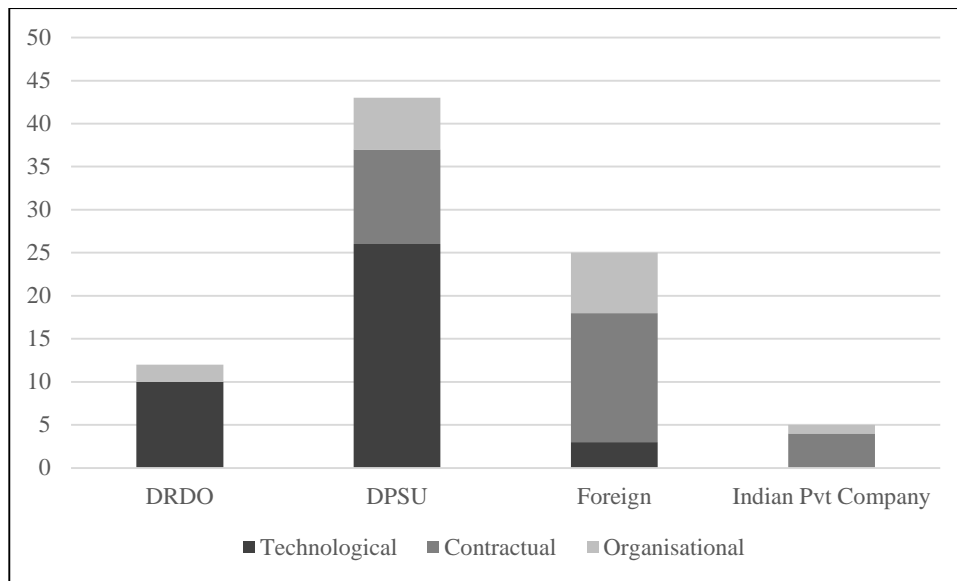
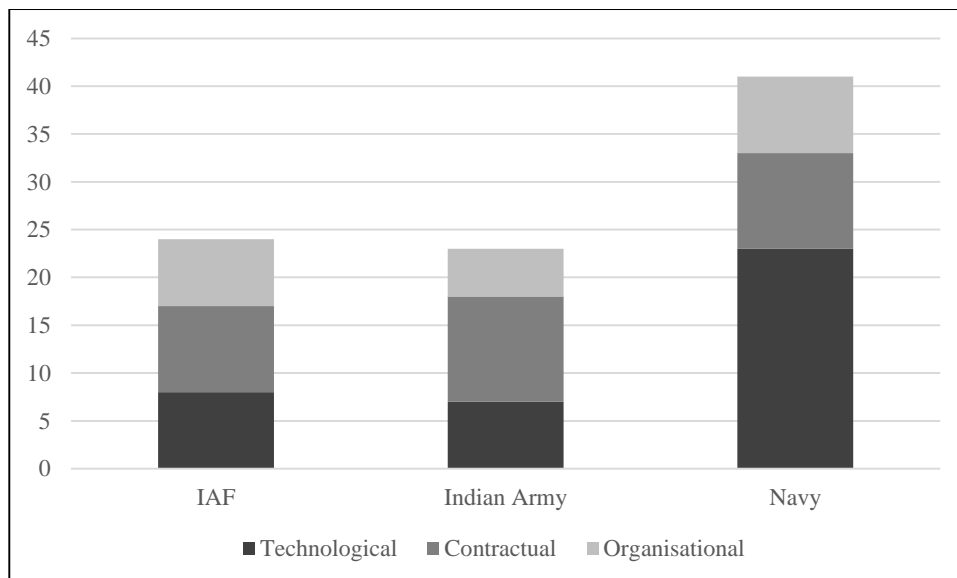


Figure 4: Sources of risk associated with military service



ⁱ While the method can be extended to achieve a complete construct which would include not just calculating the likelihood and impact of risks, but also devising risk mitigation, risk reduction, and risk monitoring measures, the current paper focusses only on the risk analysis component as a first step in a larger research project.

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- ii India ranks 130 in the UN Human Development Index 2018. Development statistics for the country are appalling. High levels of inequality lead to a confusing picture. Drèze and Sen (2013) can be consulted to make some sense of the confusion and to get a comparative picture of India's development with respect to the rest of the world.
- iii Molas- Gallart (1998) has a similar motivation for discussing the Spanish attempt to use defence procurement as an industrial policy.
- iv Search query: (defence OR military) AND (procurement OR acquisition) AND (India) in Title, Abstract, or Keywords.
- v The CAG defence audit reports could be better mined for information on schedule performance (88 cases) than cost performance (30 cases) or technical performance. Although schedule performance is important and interesting by itself, addressing only schedule performance is a preliminary and partial approach to the study of defence procurement performance.
- vi India's 2016 defence audit report made reference to several projects of the Indian Air Force and Indian Army where delays had compromised operational capabilities of the military forces. One of the several examples is the delays in the supply of the Advanced Light Helicopter (CAG 2016a, 101) .
- vii India's 2014 defence audit report noted that delays in indigenous projects led to purchases from abroad which contributed to 'failure in actual induction of indigenously developed capability' (CAG 2014, 134).
- viii There is one contract in the dataset which was initiated in 1987 and 4 contracts between 1996 and 1999 (inclusive), thus not being strictly 21st century projects.
- ix Global contracts, or contracts with multiple activities, were not usually found in the dataset. Contracts have therefore been noted based on single tasks.
- x The data did not allow coding according to different weights because it was difficult to ascertain the share of delay caused by each of the different reasons in the overall activity.
- xi The classification is non-overlapping in this dataset, as explained in the previous note.

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- ^{xii} 1 contract delayed in the design phase and 11 contracts delayed in the production phase are the 12 contracts in the dataset for which a cause of delay could not be established.
- ^{xiii} The four remaining contracts referred to contractual activities that were to take place between different branches of the Ministry of Defence. They have been excluded in the supply-side analysis to avoid confusion.
- ^{xiv} Two cases of delay faced technological risks in the shape of both changes in design and teething problems of indigenization efforts.
- ^{xv} Names of interviewees have been substituted for alphabets to preserve the ease of reading while protecting the privacy of the individuals.
- ^{xvi} I am grateful to one of the anonymous reviewers for pointing out the validity concerns around Cohen and Dasgupta's claims. The dataset used in this study has one case of delay being caused due to coordination problems which involved the DRDO. Therefore, it is possible that the existing literature and interviews suggest a larger role for the DRDO than it actually is.
- ^{xvii} I am grateful to one of the anonymous reviewers for suggesting some of these directions through their comments.

Risks in defence procurement: India in the 21st century

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Risks in defence procurement: India in the 21st century

Although there exist several remarkable theories that facilitate the understanding of procurement risks in imperfect market conditions, methods to quantify the impact and identify the most severe risks are less well-known. This paper uses the method of risk analysis to discuss defence procurement challenges in India. An original dataset of 88 contracts has been created to identify the most probable and the most severe causes for poor procurement performance. A schedule performance parameter has been constructed to quantify the impact of different adverse events. The findings display a high probability of technological risks followed by contractual risks as the cause for delays in Indian defence procurement. Technological risks are concentrated in cases of indigenous procurement due to a lack of infrastructure and resources while contractual risks mostly occur in contracts where the Ministry of Defence deals with external agents like foreign suppliers. This indicates frictions and transaction costs. These and other findings from the quantitative data on procurement performance are supplemented by insights from an extensive fieldwork in India which included 53 interviews.

Keywords: defence procurement; risk analysis; India; defence-industrial complex; transaction cost economics

JEL: H57; N45; O14; D23

Introduction

In 1952, the economist John Perry Miller at Yale predicted the need for economic analysis in military procurement, because unlike the two world wars where economic mobilization for war had been a temporary event, the Cold War created a situation where there was ‘a possibility of a large procurement program lasting possibly for decades’ (Miller 1952, 453).

The identification of risks in defence procurement has assumed greater importance since the end of Cold War because of globalisation of defence production. Globalisation in the 21st century exposes the costs of internal arming- the diversion of resources from activities which voters may have greater preference for (health, education, infrastructure), the inefficiencies of

1 industrial protectionism, and the comparative advantage of importing weapons when they are
2 of superior quality (Kapstein 2002, 146).
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5 There exist several remarkable theories that help us to understand the challenges of
6 defence procurement. For example, the agency theory posits the challenge of public
7 procurement (and defence procurement is a form of public procurement) as one where the
8 incentives for the agent are not sufficient to make them act in the interests of the principal
9 (Rogerson 1991; Reichelstein 1992; McCue and Prier 2008). Transaction cost economics
10 assumes that there are non-pecuniary costs to contracts and some of the parties in a contract
11 behave opportunistically, selfishly and with guile, which is the reason for problems in
12 contract negotiation and execution (Williamson 1979; Oudot 2010). In a more general sense,
13 defence procurement occurs in imperfect market conditions, if one considers the procurement
14 of non-standardized, technologically complex items, sometimes unique to military use. Since
15 the market cannot provide full information, generate competition, and mediate on the price,
16 the government has to regulate and create a market, sometimes choosing to even take control
17 of production, besides being a buyer (Keisler and Buehring 2005). The research on
18 information asymmetry is also relevant for studying the challenges of defence procurement
19 (Tirole 1986; Laffont and Martimort 2009). Research on organisational behaviour (Manohara
20 1998; Franck and Udis 2017), public choice theory (Cowen and Lee 1992), and industrial
21 policy research (Pugh 1993; Hall, Markowski, and Thomson 1998) have been used to identify
22 the challenges of defence procurement.
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49 A variety of challenges have been identified over time and these can be broadly
50 categorised into three types of risks- technological, contractual, and organisational.
51 Technological risks refer to the rapid rate of innovation and technological change in the face
52 of relatively low technical capabilities and inability to precisely anticipate or comprehend
53 futuristic requirements, engineering, and design issues (Kirkpatrick 1995; Frankenstein and
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1 Gill 1996; Markowski and Hall 1998; Flyvbjerg, Bruzelius, and Rothengatter 2003;
2 Department of Defence 2013; Oxenstierna and Westerlund 2013). Contractual risks involve
3 awarding a contract in a situation of incomplete information (Bower and Osband 1991;
4 Crocker and Reynolds 1993; Hong and Shum 2002; Bulow and Klemperer 2002; Kwak and
5 Smith 2009), opportunism in the formulation and enforcement of contracts (Williamson
6 1985; Klein 1996; Mayer and Argyres 2004; Carson, Madhok, and Wu 2006; Oudot 2010),
7 and inefficiencies resulting from renegotiation of contracts (Tirole 1986; Baron 1988).
8 Organisational risks refer to organisational structure and management that affect procurement
9 performance (Rogerson 1990; Cornish and Dorman 2009; Gray 2009; Franck and Udis
10 2017).

11
12 A method to identify the most critical challenge in procurement to inform
13 policymaking and procurement reform is risk analysis, and it is relatively new and less well-
14 known. Risk analysis involves identifying objectives pursued in the procurement process,
15 determining performance indicators corresponding to the objectives (i.e. the performance
16 parameter), obtaining statistics on the indicators specified and finally explaining the variation
17 in the statistics. Since a performance parameter is associated with the risks, it is possible to
18 identify the probability of occurrence and impact of risks on the procurement performance
19 parameter. Demonstration of the method can be found in government publications of the
20 USA. and the UK. Since 2013, the Department of Defence in USA has been publishing an
21 annual report titled *Performance of the Defence Acquisition System* which calculates cost
22 overruns, delays, and the fulfilment of technical objectives and makes it possible to analyze
23 the severity of different challenges in procurement. In the UK, the National Audit Office
24 publishes an annual *Major Projects Report* that provides information on equipment
25 acquisition. The report discusses cost and time schedules, the difference between projected
26 and actual values in these categories and provides explanations for the performance. Oudot

(2010) uses risk analysis to identify procurement challenges for the French defence sector.

This paper will use the method of risk analysis to identify the challenges of defence procurement in India in the 21st century, demonstrating the advantages of risk assessment and providing an authoritative account of the challenges in Indian defence sectorⁱ.

India provides a fascinating background for studying defence procurement challenges. With the fifth largest military expenditure in the world, India needs little justification in terms of significance for defence economists. India is engaged in military conflicts with Pakistan and China to protect its territory and therefore wishes to achieve self-sufficiency in arms procurement, but at the same time it must contend with an unfulfilled developmental agenda that makes it very hard to invest in military research and specialised productionⁱⁱ. Thus, this study is valuable as an investigation of defence procurement challenges in a resource-constrained economy in the 21st century. Currently, Indian defence procurement is in the midst of policy revisions and increasing its interactions with the rest of the world in the global arms market. In March 2016 the government updated the Defence Procurement Procedure (DPP), a document that provides guidelines for procurement. DPP-2016 describes defence procurement as an industrial policy by favouring indigenous manufacturing and this study is a timely intervention to identify the challenges that may be encounteredⁱⁱⁱ.

The next section describes the defence procurement system in India and the literature on defence procurement challenges. The section on research methods describes risk analysis and gives details about the creation of the dataset used in this study, highlighting its advantages and limitations. The findings and the analysis of the results form separate sections, and the conclusion summarizes the paper.

Defence procurement in India

From an operational perspective, India has been engaged in territorial conflicts since its

1 independence in 1947. The Indian Army and Indian Air Force were called to intervene in
2 securing India's northern frontier in Jammu and Kashmir in 1947-1948. The Indian Army
3 was engaged again in 1962 with China in the northern and eastern border. India and Pakistan
4 fought wars in 1965 and 1971. Indian Peace Keeping Forces were engaged in operations in
5 Sri Lanka from 1987 to 1990. In 1999, India and Pakistan fought over the control of Kargil in
6 the Jammu and Kashmir region for nearly 3 months. India and Pakistan continue to engage in
7 cross-border firings even today. Thus, for India, arms procurement has been large in
8 magnitude and composition, and conflicts have lasted for decades with no plausible end in
9 sight. This makes it important to analyse defence procurement and identify risks in the Indian
10 context.
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25 Despite frequent and continuous military engagements, the Indian military has never
26 harboured political ambitions and is subservient to civilian control. The Ministry of Defence
27 (MoD) is headed by a Member of Parliament nominated by the Prime Minister and most of
28 the executives in the ministry are civilians, members of the Indian Administrative Service
29 (IAS) deputed to serve in the MoD for variable lengths of time. The military's involvement
30 with the MoD occurs through the Service Headquarters located in the national capital. The
31 Ministry has four sub-departments- the Department of Defence, the Department of Ex-
32 Servicemen Welfare, the Department of Defence Production and the Department of Defence
33 Research and Development. Procurement is handled by the Department of Defence in
34 coordination with the Department of Defence Production and the Department of Defence
35 Research and Development.
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54 ***Planning and procurement***

55 Unlike some countries, the Indian government does not publish any white paper on defence.
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58 Defence plans are classified documents and there is no public version, even for the
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1 Parliament's review. There is an expectation that defence plans should be approved by a
2 cabinet committee and be prepared in consultation with the Ministry of Finance, but this is
3
4 not a procedural or statutory requirement and has been rarely attempted. MoD therefore
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6 exercises considerable autonomy in defining the defence strategy, operational requirements,
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8 and choice of equipment, although the lack of coordinated planning and absence of cabinet
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10 approval might reduce the level of government commitment that can be projected for the
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12 plans (Amit Cowshish 2017).
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18 The user service (Indian Air Force/ Indian Army/ Indian Navy) has a dominant role in
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20 the formulation of Service Qualitative Requirements (SQRs) and the issuing of tender
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22 documents like Request for Information (RFI) and Request for Proposal (RFP). The RFP
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24 document invites vendors to supply an item based on the specifications in the SQR. The
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26 SQRs are approved at three stages- the Services Capital Acquisition Plan Categorisation
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28 Committee, the Services Capital Acquisition Higher Categorisation Committee and the
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30 Defence Acquisition Council (DAC). The Categorisation Committees and DAC accord
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32 'Acceptance of Necessity' for procurement. These bodies include representatives from the
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34 concerned service, the finance division of the MoD (MoD Finance), the integrated defence
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36 service headquarter, the Defence Research and Development Organisation (DRDO), the
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38 Department of Defence Production and the Acquisition Wing of MoD. The actual
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40 procurement is processed by the Acquisition Wing. Essentially, the responsibility of
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42 requirement formulation and contract management lies on the service headquarter (SHQ) and
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44 post-contract management and monitoring is conducted by the Acquisition Wing jointly with
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46 the concerned SHQ.
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55 The responses received to an RFP from vendors are then subjected to technical
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57 evaluation, followed by commercial evaluation. Technical evaluation is conducted in two
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1 stages, the first based on the documents provided by the vendor, and the second at the field,
2 with the equipment offered by the vendor. The SHQ is involved in the technical evaluation
3 and the field trial team is composed of members from the SHQ, the Directorate General-
4 Quality Assurance of the respective service, the DRDO and MoD Acquisition Wing. The
5 commercial evaluation and subsequent selection of vendor and finalisation of contract is done
6 in a collegiate manner by the Contract Negotiation Committee (CNC) which involves the
7 MoD, its finance and acquisition wings, and the SHQ. The involvement of MoD Finance is
8 integral in decision making at every stage of the procurement process to accommodate
9 financial concerns (Ghose 2013). While different offices of the MoD are involved in the
10 procurement (MoD Finance, Director General of Acquisitions), the major functions are
11 performed by the SHQ.
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27 The guidelines for procurement are provided in a document called the Defence Procurement
28 Procedure (DPP), first compiled in 1992. It has undergone a number of revisions and the
29 latest version was released in March 2016. The document defines the procedures to be
30 followed for different kinds of capital procurement, the roles and responsibilities of different
31 stakeholders and the policies regarding domestic industry promotion through procurement.
32
33 Defence procurement in India happens in a preferential manner under the following
34 categories: Buy (Indian), Buy and Make (Indian), Make (Indian), Buy and Make, and Buy
35 (Global). The preference order requires that the Services provide a reason for not using a
36 higher category that involves a greater degree of indigenisation during procurement. DPP-
37 2016 introduced a new category for procurement called 'Buy (Indian- Indigenously
38 Designed, Developed and Manufactured)' which has been placed as the most preferred
39 category, placing emphasis on defence industries in India.
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Defence industries

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2 The first defence industries to be set up in India were the Ordnance Factories which supplied
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4 simple arms and ammunition for the British Army's operations in the region when India was
5
6 still a British colony. After independence, these factories formed the core of the state-
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8 controlled defence industry. The 1962 military defeat in the hands of China urged India to
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10 build its defence industry in order to achieve self-reliance, either through licence production
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12 or co-production arrangements with foreign suppliers. But receiving low-interest rate credits
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14 and deferred foreign currency payments for arms imports during the Cold War weakened the
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16 pressure on industrialisation (Hébert 1996).
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23 In 2001, India liberalised the defence sector and private Indian companies began to
24
25 compete for defence contracts. However, private sector participation in defence procurement
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27 is still quite limited. The Ordnance Factories and state-owned Defence Public Sector
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29 Undertakings (DPSU) continue to enjoy a privileged position in the defence industrial base,
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31 partly because defence production has a steep learning curve and prohibitive costs because of
32
33 its specificity. Companies that have been in the industry longer have advantages over new
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35 entrants, especially for major projects. Private industries in India hoping to enter the defence
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37 sector face conflicting incentives- while the government is vocal about enhancing indigenous
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39 capacity, the Buy/ Make hierarchy is more of a curse than a boon since it imposes indigenous
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41 requirements that are costlier to meet for private enterprises (Behera 2011). Liberalisation has
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44 not led to desired results.
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51 Neither has defence industrialisation benefitted from technology transfers from
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53 abroad. This is attributed to the structural weaknesses in Indian defence industries- a risk-
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55 averse, state-centric, bureaucratic attitude that resists efforts at revitalization (Bitzinger 2015,
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57 537). An offset policy was formally announced in 2005. Before this, India's offsets policy
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59 had been an undefined territory that witnessed licensed production, deferred payment for
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1 imports, and countertrade, but these failed to develop India's defence industries because
2 suppliers always withheld core technologies and countertrade mainly involved non-military
3 goods (Baskaran 2004). In the 2005 offset policy, it was stipulated that for contracts with a
4 value of more than 300 crore INR (approximately 42 million USD), a 30% offset would be
5 mandatory. The policy was supplemented with information on the methods of executing
6 offsets- direct purchase of Indian defence products and investments in India's defence
7 industry or R&D capacity. The 2008 revision of the policy included a 'banking provision'
8 that allowed the transfer of excess value of offset from one contract to future contracts. The
9 2013 revision included a multiplier to create incentives for purchase from small industries
10 located in India. In 2016, MoD changed the threshold at which offsets become mandatory
11 from 300 crore INR to 2000 crore INR (approximately 282 million USD). All these changes
12 are yet to yield substantial results. Absence of an explicit intellectual property rights policy
13 hampers technology transfers from abroad (Gupta 2008). Indian industries also lack the
14 capacity to absorb technology (Behera and Balachandran 2018, 340).
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35 It is possible to execute offsets by transferring technology to the Defence Research
36 and Development Organisation (DRDO) as well. DRDO was formed in 1958 to function as
37 India's military innovation lab, but DRDO only got a major boost in resources during the
38 1980s when it was asked to undertake ambitious projects like development of a fighter
39 aircraft, main battle tank, torpedoes and missile systems. Currently the DRDO is involved in
40 all procurement projects to identify opportunities for indigenous technological development.
41 DRDO has its headquarters in New Delhi, at close proximity with the Ministry of Defence.
42 The Scientific Advisor to the Defence Minister is usually a senior DRDO scientist and has a
43 say in the formulation of the Request for Proposal document and choice of categorisation for
44 procurement (Buy/ Buy and Make/ Make).
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Defence procurement challenges in India

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2 India's defence procurement performance is far from perfect. The book *Arming without*
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4 *Aiming* describes India's struggle with military modernisation and is replete with examples of
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6 delayed acquisition (Cohen and Dasgupta 2013). The sources of risk are to be found in a
7
8 variety of places: lack of review in the acquisition process to enforce time and cost discipline
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10 (Raghunath 2013), a distortionary budgeting process that is not outcome-oriented (Sisodia
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12 and Cowshish 2015), the lack of organisational capacity to cope with the volume of work
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14 associated with procurement (Khan and Jhajj 2013), continually changing priorities of the
15
16 military services (Rai 2000), low levels of resources and scientific expertise (Behera and
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18 Misra 2012), ambiguous Service Qualitative Requirement documents (Suman 2006),
19
20 infrastructural limitations of defence industries (Arora 2013), and poor enforcement of
21
22 contracts with foreign suppliers (Bakshi 2006). Much of this work comes from the Institute of
23
24 Defence Studies and Analyses, an Indian MoD thinktank where researchers from different
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26 backgrounds provide expertise and advice to the government on reforming its procurement
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28 system.
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37 It is important to note that there is an unfortunate lack of academic attention to the
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39 study of defence procurement challenges in India. A search query^{iv} on Scopus and Web of
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41 Science finds not more than 20 relevant articles, commentaries, and book chapters, few of
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43 which discuss the risks associated with defence procurement. The three research articles that
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45 do also varied in their attention. Pant (2010, 138) discusses defence policy and India's
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47 relationship with different countries in the military domain and explains the need to simplify
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49 procedures and organisational structures to make procurement a smoother experience for all
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51 concerned parties. Cowshish's (2017) primary concern is India-Israel defence trade and his
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53 argument for improving the ease of doing business includes a description of the procurement
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55 challenges that emerge from withholding information and the Ministry's intentional
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1 ambiguity about defence requirements. It is only Behera (2012) who explicitly and
2 exclusively focussed on the procurement system and procurement reforms in India,
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4 explaining the reasons for poor procurement performance, one of which is the lack of
5
6 knowledge and experience about contract negotiation in the MoD.
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10 Behera's 2012 article is also exceptional for stating the research methods that have led
11 to the findings and conclusion. Much of the existing knowledge on defence procurement
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13 challenges in India seems to be based on observations and experiences of the authors and this
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15 has resulted in a large number of conjectures and impassioned policy guidance. Navigating
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17 through this literature establishes the methodological gap that this paper seeks to address by
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19 using risk analysis.
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26 **Method and data**

27 Risk analysis is the method of assessing differences between objectives pursued and results
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29 achieved and attributing the difference to events or risks. The method is implemented in four
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31 steps- (1) identification of objectives pursued in the procurement process, (2) determination
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33 of performance indicators corresponding to the objectives, (3) curation of statistics on
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35 performance indicators, and (4) explanation for the variation in statistics. There are several
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37 advantages in using risk analysis as a method to identify challenges. Performance parameters
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39 can be calculated for a wide variety of projects and contracts and without relying on
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41 comparable case studies or benchmarks to define poor performance and determine its causes.
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43 Additionally, the use of statistics allows quantification of the impact of adverse events in the
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45 procurement process.
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54 Risk analysis has been used to discuss procurement challenges in the French defence
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56 sector by Oudot (2010) but it is difficult to find references of this technique in academic
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58 writings elsewhere. In the last few years, governments have started presenting their data in
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1 formats that facilitate the use of risk analysis to identify procurement challenges. For
2 example, since 2013, the Department of Defence in USA has been publishing an annual
3 report titled *Performance of the Defence Acquisition System* which calculates cost overruns,
4 delays, and the fulfilment of technical objectives and makes it possible to analyze critical
5 challenges to performance. In the UK, the National Audit Office publishes an annual *Major*
6 *Projects Report* that provides information on equipment acquisition, compares the actual
7 progress with the initial plans and provides explanations for differences in the two, if any. In
8 India, the Comptroller and Auditor General (CAG) performs this function and its annual
9 reports provide data that can be used to measure the performance of procurement projects and
10 identify risks.
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25 An overall procurement performance measure would refer to cost performance,
26 schedule performance, and technical performance of the final product. This study is based on
27 the analysis of schedule performance^v. Schedule performance can be considered as a
28 transversal variable for operational, strategic (autonomy, security of supply), and economic
29 objectives of defence procurement. Delays have an adverse impact of operational readiness^{vi},
30 they can jeopardise long term strategic plans^{vii}, and from an economic perspective, non-
31 adherence to planned deadlines increases the risk of cost escalation through inflation,
32 exchange rate variation, deterioration of bargaining position, and the cost of maintaining
33 facilities and teams dedicated to the projects. Therefore, the research question is:
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47 What are the challenges to timely defence procurement in India?
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52 ***Data***

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54 Data for this research was obtained by mining and coding information on defence
55 procurement contracts from 28 defence audit reports, published between 2005 and 2016 and
56 available on the website of the Comptroller and Auditor General of India (CAG). CAG is an
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1 autonomous institution mandated by the Constitution of India to audit all receipts and
2 expenditure of the Indian government and its audit reports provide reliable and impartial
3 information of public expenditure activities of the government. Surveying defence audit
4 reports is possibly the best method to collect data on procurement contracts since the CAG
5 can access project files, contract agreements, and request responses from the Ministry of
6 Defence (MoD) in a way few researchers can.
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15 Information on schedule performance could be obtained for 88 contracts signed by the
16 MoD in India, initiated mostly in the 21st century^{viii}. This original dataset forms the basis of
17 the study and includes information on the cause of delay, the procurement phase in which
18 delay occurred, the nature of the project, the contractor or partner agency, and the military
19 service for whom the contract was being pursued. While the dataset is neither an exhaustive
20 list of all MoD contracts, nor a random sample of Indian defence contracts (CAG only
21 publishes information of contracts that display deviation), it covers a wide range of
22 procurement activities (like development, production, off-the-shelf procurement,
23 maintenance and upgrade^{ix}) and actors (defence laboratories, defence public sector
24 undertakings, foreign companies, and Indian private companies). Table 1 provides the
25 composition of the dataset in terms of type of activity and actors.
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46 In addition, 53 semi-structured interviews were conducted in India between August
47 and October 2016 to appreciate the complexity and nuances, cross-check points of view,
48 ideas and conclusions, and gain additional stakeholder perspective. The interviewees were
49 identified on the basis of their involvement in an executive capacity in defence procurement
50 in recent years, either in the government or industry, and through snowball sampling.
51 Interviews were conducted with 4 civilian bureaucrats from the Ministry of Defence, 14
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1 officers from the Indian Air Force, 13 officers from the Indian Army, 10 officers from the
2 Indian Navy, 7 executives from Indian defence public sector undertakings, and 5 from
3 private-sector defence companies. The interviews were conducted with the aid of a
4 questionnaire that contained both open-ended and closed questions. The questionnaire was
5 shared with participants prior to the interview. The responses were transcribed and
6 contributed in the analysis of the information obtained from the CAG defence audit reports.
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15 A mixed method approach has been used in this study by combining quantitative data
16 on contract performance and qualitative data from interviews. The motive behind using
17 mixed methods in this study is to enhance the level of comprehension and analysis than what
18 would have been possible only with a single source of data (Jick 1979). It is not an attempt at
19 triangulation- both sources of data (audit reports and interviews) may not be representative
20 samples of the population. The CAG defence audits do not offer information on every
21 contract undertaken by the MoD but only those that display deviation from initial plans.
22 Snowball sampling, while suitable for recruiting respondents from populations that are
23 secretive and hard to access (like people working for the military), can rarely claim to be
24 representative (Atkinson and Flint 2011).
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41 *Calculating schedule performance*

42 Delay is the percentage of excess time taken with respect to the planned duration of the
43 activity. The planned duration is pre-determined by guidelines and approved by the Ministry
44 before undertaking any activity. Thus, if an activity was supposed to take 12 months to
45 complete and instead took 24 months, the schedule performance parameter will show a delay
46 of 100%. The distribution of delays is presented in Table 2.
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57 [Table 2 here]
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1 The average delay is 180.05%, with a minimum of 4.17% and a maximum of 1660%.
2 The wide range is ideal for exploring the types of risks and their frequency distribution. The
3 descriptive statistics of the dataset are provided in Table 3.
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8 [Table 3 here]
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11 *Categorizing contracts according to sources of risk*
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13 CAG defence audit reports provided the reason for delay in 76 of the 88 contracts. In cases
14 where there were multiple reasons for delay, each reason was considered for coding
15 purposes^x. For methodological and analytical ease, the reasons for delay were categorized
16 into three sources of risk- technological, contractual, and organizational.
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26 A contract is said to have faced ‘technological challenges’ when the delay was due to
27 the lack of technological skills, resources, and infrastructure relative to the technological
28 complexity of the project, or because of changes in design. A contract is said to have faced
29 ‘contractual challenges’ if the schedule performance was affected by delays in negotiation
30 and writing of contracts, compliance to design requirements, lack of response from the
31 supplier, non-adherence to contract by supplier, or non-enforcement of contracts. A contract
32 is said to have faced ‘organizational challenges’ when there were delays in authorization,
33 delegation of tasks, coordination, or because of ambiguity of regulations and procedures,
34 conflicting reports from different executive branches involved in the project, or even
35 organizational capacity (overworked and understaffed organizations).
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Findings

Risks according to probability

Technological challenges are the most probable of defence procurement challenges in India when discussing delays in procurement. These affected 39 contracts in the dataset. This is followed by contractual challenges, which affected 30 contracts and finally organizational challenges (20 contracts). No cause for delay could be established for 12 contracts in the dataset.

Risks according to impact

Figure 1 shows the distribution of the sources of risk in 6 broad intervals of the performance indicator. It is interesting to note that although technological risks are the most probable cause for delays, the observations displaying worse schedule performance (delays greater than 300%) were affected by contractual and organizational risks. Contractual risks emerge as the source of risk having greatest impact on performance, affecting 9 of the 15 contracts facing delays greater than 300%. Contractual risks also become more probable than technological risks when delays are greater than 100%: in the 46 contracts where delays are greater than 100%, 19 are affected by contractual risks in comparison to 16 affected by technological risks. The average delay caused by contractual risks is much higher than any other source of risk, although organizational risks follow closely behind (Table 4).

[Figure 1 here]

[Table 4 here]

Risks according to phases of procurement

Rogerson (1994) divides the life cycle of a defence procurement program into 3 phases- design, which is associated with specification of requirements and multiple firms pursuing competing designs; sole-source selection, where firms submit their plans, bid for the contract, and the negotiation of the contract with the vendor takes place; and production, the phase in which production, supply and sometimes renegotiation of the contract takes place.

In the dataset, delays occurred mostly in the production phase (48 contracts), followed by the design phase (24 contracts), and finally the selection phase (16 contracts)^{xi}. Figure 2 shows the sources of risk in the three phases of procurement. Technological risks are prevalent in the design phase (19 of 24 contracts) and organizational risks in the selection phase (11 of 16 contracts). In the production and supply phase, technological and contractual risks help to explain a high share of delays^{xii}.

[Figure 2 here]

Risks according to partner agency

Partner agency here refers to the supply-side organization with whom the Ministry of Defence signed the contract. The various supply-side organizations are the Defence Research and Development Organisation (DRDO), the government-owned defence companies (defence public sector undertakings or PSUs), privately-owned Indian defence companies (Indian private company), and foreign firms. Of the 76 contracts where a reason for delay was mentioned, 10 involved DRDO on the supply-side, 35 involved DPSUs, 23 involved foreign firms, and 4 involved Indian private companies^{xiii}.

[Figure 3 here]

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Figure 3 associates procurement challenges with different suppliers. Technological risks prominently feature in contracts with the DRDO, India's research and development organization (all 10 DRDO contracts). Technological challenges are also prominent in the contracts with defence public sector companies (26 of 35 contracts involving DPSUs). On the other hand, contractual challenges are prominent when an Indian private company or a foreign firm is on the supply side (19 of 27 contracts). This is possibly an illustration of transaction cost economics where the Ministry of Defence incurs high transaction costs when dealing with external agents.

Risks according to military service

On the demand-side, it is possible to note the occurrence of adverse events for the different military services that are involved in the contract. The user-service (Indian Air Force/ Indian Army/ Indian Navy) in India, through the service headquarter (SHQ), have a dominant role in the formulation of Service Qualitative Requirements and the issuing of Request for Information and Request for Proposal that invites vendors. The concerned service headquarter is also involved in the technical and commercial evaluation of the bids. Of the 76 contracts where procurement challenges could be identified, 21 involved the Indian Air Force, 20 involved the Indian Army, and 34 involved the Indian Navy. Figure 4 leads to two interesting observations- the prevalence of technological risks in Indian Navy contracts (23 of 34 contracts) and contractual risks in the contracts of the Indian Army (11 of 20 contracts).

[Figure 4 here]

Analysis

Technological risks in indigenous procurement

Technological risks emerged as the most probable source of risk that caused delays in this dataset. Further analysis of the 39 contracts which faced technological risks shows 19 cases of delay due to lack of infrastructure or raw materials, 14 cases of delay due to changes in design and re-development, and 8 cases of delay due to initial teething problems of an indigenization effort^{xiv}. While revisions of technological requirements and delays in indigenously developing a new technology can be imagined easily, illustrative examples of the lack of raw materials and infrastructure can be truly astounding. The production of the Indian Aircraft Carrier was delayed because the necessary steel could not be procured (CAG 2016b, 40). The Parachutes (PARA) Special Forces battalions of the Indian Army did not have parachutes for over a decade because MoD had ordained that parachutes must be procured indigenously but Ordnance Parachutes Factory in Kanpur could not supply the required quantity due to lack of fabric (CAG 2015b, 44–45).

The lack of infrastructure and raw materials was described by some of the interviewees in detail. For example, Rear Admiral H^{xv} remarked:

As far as the Navy is concerned, the conceptualization phase is not a problem since the requirements are frozen prior to accord of AoN [Acceptance of Necessity]. The time allocated for the issue of RFP [Request for Proposal] is also defined in the Defence Procurement Procedure and the vendors are also well known. Only the actual production phase faces delays, and this is due to delays in availability of docks, nominated systems, spares, etc. (author interviews, 13 September 2016)

A senior executive in Hindustan Aeronautics Limited (HAL), India's biggest state-owned aerospace and defence company, expressed that fragmented budgets led to a lack of infrastructure and associated delays- 'most often the funds are released at a bare minimum

1 level, without rational comparison with similar projects elsewhere. This leads to fragmented
2 development work and inadequate infrastructure' (author interviews, 30 August 2016). This
3 also explains why technological risks are prominent in the production phase (Figure 2),
4 besides being common in the design phase where delays due to technological risks are found
5 because of difficulties in designing and specifying requirements.
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13 What is perhaps more interesting and relevant is the concentration of technological
14 risks in contracts where the DRDO or DPSUs are on the supply-side (Figure 3). This could be
15 due to lack of technological skills and resources in the Indian defence sector. Technological
16 risks prominently feature in contracts with the DRDO, India's government-run research and
17 development organization. Behera (2016, 95–97) explains that the shortage of scientists
18 coupled with high attrition rates is the source of technological challenges in the DRDO. A
19 Parliamentary Committee report revealed that only 10% of DRDO's scientists have a PhD
20 degree (Ministry of Defence 2008). Technological challenges are also very prominent in the
21 contracts with defence public sector companies.
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36 The association of technological challenges in cases of indigenous procurement is an
37 important finding with respect to India's interest in using defence procurement as an
38 industrial policy. The 39 Ordnance Factories and 9 Defence Public Sector undertakings under
39 the administrative control of the Ministry of Defence form the backbone of India's defence
40 industrial base and is claimed to be one of the largest defence industrial complexes in the
41 developing world. However, this large system has not allowed India to reduce its import
42 dependence, even for low technology items.
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54 Technological risks are to be found in all the three services but affects the
55 procurement of the Indian Navy the most. This may be because the Indian Navy has a more
56 indigenous procurement portfolio than the other services. This was suggested by some of the
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1 interviewees and has also been articulated in a commentary by Srivastava (1999, 205),
2 attributing the higher level of indigenization to the Indian Navy's ability to invest in the same
3 since the 1970s because the service was not expected to play a critical role in any armed
4 conflict.
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10 ***Frictions and opportunism in international procurement***

11 Contractual risks are second in order of probability but have the highest impact on schedule
12 performance (Table 3). Risk analysis would therefore identify contractual risks as the most
13 critical risk for India's defence procurement. Further analysis of the 30 contracts facing
14 contractual challenges reveals non-compliance to contractual terms and difficulty in contract
15 enforcement as the most commonly cited cause of delay (17 cases). Challenges in negotiation
16 is found in 9 cases and delays due to subcontractor management in 5 cases. Enforcing
17 contracts in a non-competitive market is not straightforward and the findings suggests paying
18 greater attention to this aspect for improving schedule performance of defence procurement
19 in India. In some of the contracts, like the production of Kolkata-class destroyer and
20 Shivalik-class frigate for the Indian Navy, the audit report notes that the absence of
21 contractually agreed timelines made it difficult to monitor and arrest delays (CAG 2010, 46).
22 This may be the reason why delays in the production and supply phase seem to have a high
23 share of contracts affected by contractual risks (Figure 2). Contractual risks emerge after the
24 signing of the contract, i.e. ex post, which implies opportunistic behavior on the part of the
25 suppliers.
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51 At the heart of the issue lies the lack of skills in the Indian procurement system to
52 negotiate and enforce contracts. According to Air Marshal A:
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57 Most people involved in defence procurement have no formal training, and feel their way
58 around the policy and processes, [thereby] causing delays. With limited tenures, both in the MoD and
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2 in SHQs, a lot of time is wasted in learning the process while there is little handing over of the skills
3 and knowledge acquired by predecessors. (author interviews, 24 August 2016)
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5 That India lacks a trained cadre of defence contract specialists has been noted in the
6 literature (Suman 2006) and was highlighted by the interviewees. Brigadier M expanded
7 upon tenure problems in the Ministry of Defence to show the lack of informed decision-
8 making:
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11 In the Army, officers need to go to different places to get their next rank. But we need
12 experts. We need to identify specialists and keep them there. We need to give them an environment to
13 remain and not get sentimental about them staying in one place. For the Army in MoD, the hierarchy
14 is affected because the real expert is the Colonel who has been in the Headquarters for 3 years, rather
15 than the Lieutenant General who is here for 6 months. This affects the quality of discussion and
16 decision-making. (author interviews, 19 October 2016)
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20 This lack of skills is put to special test when interacting with foreign firms. Some
21 interviewees called this 'colonial hangover' - contract enforcement is relaxed for foreign
22 entities because of India's long history of colonial subjugation. However, another line of
23 thinking stresses on the strategic nature of defence purchases and that the buyer's (here
24 India's) attitude has little say in the outcome. In certain cases, reputation and performance
25 may be of little consequence when the supplier is able to get a captive buyer. This is often the
26 case in international arms market where competition is limited for complex and advanced
27 weapons system and the choice of supplier is guided by strategic considerations. Air Marshal
28 B gives an example of the nature of this problem:
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32 We are grossly dependent on the suppliers, you know. Take the cases where we bought from
33 Russia. We have always approached them with a begging bowl full of money. And they never stuck
34 to contracts, but they were dependable friends, dependable suppliers. At least compared to the others.
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1 Not that Russians are saints. There is no kind of incentive that makes them deliver as per schedule.
2 And then of course, there is the language barrier and translation issues, and they have always taken
3 benefit of the confusion. (author interviews, 23 August 2016)
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7 Contractual risks are most prominent in international procurement and in the small
8 number of contracts that the MoD signs with privately-owned (non-government) Indian
9 defence companies (Figure 3). This is possibly an illustration of transaction cost economics
10 where the Ministry of Defence is unable to control the transaction costs associated with
11 dealing with external agents. Contractual risks were a source of delay in 26% of contracts
12 with a public-sector firm but 58% of contracts with foreign firms and all the contracts with
13 Indian private enterprises. Of the 19 cases of procurement from international and private
14 Indian companies which experienced poor schedule performance due to contractual risks, 11
15 occurred in the production and supply phase, i.e. ex post. One of the behavioural assumptions
16 of transaction cost economics is that parties behave opportunistically (Williamson 1993).
17 Transaction cost economics, which emphasizes on both pre-contract and post-contract
18 periods, is therefore a useful perspective to adopt while analyzing procurement challenges in
19 such cases.
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40 India continues to be one of the largest arms importer in the world and in recent years,
41 the government has been encouraging private defence companies in India (rather than the
42 DPSUs) to compete for defence contracts through its 'Make in India' initiative. Therefore,
43 contractual challenges, which occur particularly with these agencies, should be given greater
44 attention. Finding contractual risks in a high share of contracts of the Indian Army (Figure 4)
45 is another reason to emphasize on contractual challenges in Indian defence procurement
46 because the Indian Army is the largest and most pro-active of the three services. Through the
47 Indian Army, contractual risks have a serious impact on operational readiness.
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Organisational challenges in the procurement system

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3 Organisational risks, although relatively low in probability have a high impact on schedule
4 performance (Table 3). Organisational risks found in the dataset include delays due to lack of
5 organisational capacity to process procurement (8 cases), delay due to conflict in procedures
6 (8 cases), and delays due to problems in coordination with different agencies (4 cases). Some
7 of the contracts reported clearly display the procurement system's lack of capacity to process
8 and complete tasks within stipulated timelines and one of the interviewees commented that
9 'the procurement branch in Ministry of Defence is overworked' (author interviews, 26
10 September 2016). It is difficult to find evidence to support this statement, but it may be noted
11 that based on the Kargil Review Committee Report (Subrahmanyam et al. 2000), the Group of
12 Ministers recommended the creation of the Defence Procurement Organisation, a separate
13 and dedicated institutional structure to facilitate faster procurement. Procedures are solely
14 responsible for leading to adverse schedule performance in 4 cases. An illustrative example
15 of this is the production order for low level light weight radar 'Aslesha' for the Indian Air
16 Force (IAF). During user acceptance trials, IAF suggested improvements that led to increase
17 in the weight of the radar from 190 kg to 205 kg. Although the increase in weight was
18 acceptable to the IAF, the delivery was withheld pending amendment to contractual
19 specifications, which delayed the programme by 23 months (CAG 2015a, 117–18).
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45 Another important finding is the occurrence of organisational risks in the selection
46 phase (Figure 2). Many of the interviewees claimed that schedule performance in the
47 selection phase was affected because of isolation between different organisations of the MoD
48 during planning and decision making, rigidities in cooperation, procedures that are inefficient
49 to follow, and the lack of incentives to perform. Besides these, relations between
50 organisations are sometimes so poor that they cannot work in harmony. Brigadier R describes
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1 the 'blame game' that occurs between DRDO, the manufacturer and the user whenever an
2 enquiry takes place, to the extent that it makes identification of the actual cause impossible:
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5 We once had a problem where the ammunition would explode in its casing. The manufacturer
6 blamed the design, claiming the barrel was too thin. DRDO blamed the user [Indian Army], that you
7 did not clean the barrel. At the end of the day, the cause is never identified. (author interviews, 24
8 September 2016)
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15 According to some of the interviewees, DRDO faces a conflict of interest- it is the
16 supplier of technology as well as the evaluator for import decisions and therefore has an
17 incentive to promote its growth and interest. DRDO 'has power to kill any procurement
18 proposal from the armed forces without being accountable for performance of the project'
19 (Cohen and Dasgupta 2010, 32). If this is true, then in the words of some of the interviewees
20 DRDO engages in a 'foot-in-the-door policy' to maintain their participation^{xvi}. Air Marshal
21 AL described a meeting where the DRDO representative was enthusiastic to be the partner:
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33 My response was, "I cannot take you for your word, sir!" DRDO has to substantiate its claims
34 to produce! (author interviews, 26 September 2016)
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39 One possible solution could be a collegiate system of decision-making. A review of
40 Defence Procurement Procedure 2013 identified the lack of trust in the basic architecture for
41 defence procurement and noted that 'entities work in their own silos, leading to conflicts and
42 delays' (Singh 2015, para. 4.2.04). The new Defence Procurement Procedure 2016 has
43 attempted to address the lack of coordination by stipulating that the Request for Information
44 (RFI) document needs to be formulated by the concerned Service Headquarter in consultation
45 with other stakeholders like DRDO and the Department of Defence Production so that varied
46 concerns can be dealt with at the very beginning of procurement.
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Conclusion

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3 Military engagements are nowhere near abatement, especially in the Indian sub-continent,
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5 and identifying defence procurement challenges continues to be of interest to defence
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7 economists. Indian defence procurement, despite its size and participation in the international
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9 arms market, has not received the attention it is due, and this paper contributes by shedding
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11 some light on the topic. India's defence procurement policy has been revised and updated in
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13 recent years to respond to changes in operational, strategic, and economic circumstances and
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15 it is important to identify the challenges that can occur in Indian defence procurement to help
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17 inform such policy revisions. In this paper, the identification of challenges is based on
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19 evidence of defence procurement activities in India in the 21st century that can be found in
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21 defence audit reports. The risk assessment method used in this paper has two key advantages-
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23 it is testable (falsifiable) and can be applied to an updated dataset if more data becomes
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25 available (for example, with every subsequent CAG audit report). The findings from the
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27 numerical data have been supplemented by several interviews with executives in government
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29 and industry in India to add context.
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38 In this study it was found that delays in procurement occur for many reasons in India,
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40 but the most probable cause for delays are technological challenges. These can be attributed
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42 to the technical complexity of the systems being procured, but often in the case of a resource-
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44 constrained economy like India, technological challenges include a lack of infrastructure and
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46 raw materials. The Indian government is interested in promoting manufacturing in India
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48 under its 'Make in India' initiative and has instituted steps that will favour defence
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50 production undertaken within the country as opposed to production and assembly overseas.
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52 However, if the issue of industrial capacity and resources is not addressed, such policies
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54 would fail to yield positive results and possibly aggravate the Indian military by causing
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56 delays that harm strategic objectives and operational readiness. Contractual challenges are
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1 most critical when the average delay caused by the risk is combined with its probability of
2 occurrence. They are prominent in the production and delivery stages of procurement, i.e.
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4 after the signing of the contract, and happen to be the most common cause for delay in
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6 procurement contracts with foreign firms and Indian private companies, i.e. organisations
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8 external to the Ministry of Defence. These empirical observations confirm the existence of
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10 transaction costs in Indian defence procurement and the behavioural assumptions of
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12 opportunism in transaction costs economics.
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18 Although several steps are being taken to improve defence procurement performance
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20 in India, especially directed at the organisational level, there is little evidence to show that the
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22 government is aware of technological challenges in indigenous procurement and the
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24 transaction costs it incurs whenever the MoD interacts with international or private Indian
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26 suppliers. It is therefore hoped that this research with its use of risk analysis will help in
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28 generating attention towards the other, and based on existing data more critical, risks in
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30 Indian defence procurement.
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36 At least three directions for further research can be identified^{xvii}. The first can be a
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38 more in-depth quantitative analysis, possibly using techniques like probit modelling to
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40 identify the probability of a technological, contractual, and/or organisational risk occurring
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42 because of the presence of certain actors and types of activities. The second is a more in-
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44 depth qualitative analysis based on a detailed case study of ongoing defence procurement
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46 programmes in India, applying the knowledge gained from this study to identify likely
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48 challenges for a particular case. Finally, it would be interesting to replicate the risk
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50 assessment method in other countries and note commonalities and differences in defence
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52 procurement challenges in different institutional contexts.
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References

- 1
2 Arora, R. K. 2013. 'Indian Experience in Contracting/Post Contract Implementation and
3 Project Management Challenges'. In *Defence Acquisition: International Best
4 Practices*, edited by Laxman Kumar Behera and Vinay Kaushal.
5
6
7 Atkinson, Rowland, and John Flint. 2011. 'Snowball Sampling'. In *The SAGE Encyclopedia
8 of Social Science Research Methods*, edited by Michael Lewis-Beck, Alan Bryman,
9 and Tim Futing Liao, 1044. SAGE.
10
11 Bakshi, J. 2006. 'India-Russia Defence Co-Operation'. *Strategic Analysis* 30 (2): 449–66.
12
13 Baron, David P. 1988. 'Procurement Contracting: Efficiency, Renegotiation and Performance
14 Evaluation'. *Information Economics and Policy* 3 (2): 109–42.
15 [https://doi.org/10.1016/0167-6245\(88\)90022-4](https://doi.org/10.1016/0167-6245(88)90022-4).
16
17
18 Baskaran, A. 2004. 'The Role of Offsets in Indian Defense Procurement Policy'. In *Arms
19 Trade and Economic Development: Theory, Policy and Cases in Arms Trade Offsets*,
20 edited by Jurgen Brauer and John Paul Dunne, 212–22. Routledge Taylor & Francis
21 Group. <https://doi.org/10.4324/9780203392300>.
22
23
24 Behera, Laxman K. 2016. *Indian Defence Industry: An Agenda for Making in India*.
25 Pentagon Press.
26
27
28 Behera, Laxman K., and S. N. Misra. 2012. 'India's Naval Shipbuilding Industry: Key Gaps
29 and Policy Options'. *Defence Studies* 12 (3): 434–51.
30
31
32 Behera, Laxman K. 2011. 'Enhancing Private Sector Participation in India's Defense
33 Production'. *Defense and Security Analysis* 27 (3): 251–65.
34 <https://doi.org/10.1080/14751798.2011.604485>.
35
36
37 Behera, Laxman K. 2012. 'India's Defense Acquisition System: Need for Further Reforms'.
38 *Korean Journal of Defense Analysis* 24 (1): 89–105.
39
40
41 Behera, Laxman K., and G. Balachandran. 2018. 'Indo-US Defence Industry Cooperation: A
42 Prognosis'. *India Quarterly* 74 (3): 337–42.
43 <https://doi.org/10.1177/0974928418785455>.
44
45
46 Bitzinger, Richard A. 2015. 'Comparing Defense Industry Reforms in China and India'.
47 *Asian Politics and Policy* 7 (4): 531–53. <https://doi.org/10.1111/aspp.12221>.
48
49
50 Bower, Anthony G., and Kent Osband. 1991. 'When More Is Less: Defense Profit Policy in a
51 Competitive Environment'. *The RAND Journal of Economics* 22 (1): 107–19.
52 <https://doi.org/10.2307/2601010>.
53
54
55 Bulow, Jeremy, and Paul Klemperer. 2002. 'Prices and the Winner's Curse'. *The RAND
56 Journal of Economics* 33 (1): 1–21. <https://doi.org/10.2307/2696372>.
57
58
59 CAG. 2010. 'Performance Audit of the Indigenous Construction of Indian Naval Warships'.
60 Audit report 32. Comptroller and Auditor General of India.
61
62
63
64
65

- 1 CAG. 2015a. 'Union Government (Defence Services) Air Force'. Audit report 44.
2 Comptroller and Auditor General of India.
- 3 CAG. 2015b. 'Union Government (Defence Services) Army, Ordnance Factories and
4 Defence Public Sector Undertakings'. Audit report 44. Comptroller and Auditor
5 General of India.
6
- 7 CAG. 2016a. 'Union Government (Defence Services) Army, Ordnance Factories and
8 Defence Public Sector Undertakings'. Audit report 19. Comptroller and Auditor
9 General of India.
10
- 11 CAG. 2016b. 'Union Government (Defence Services) Navy and Coast Guard'. Audit report
12 17. Comptroller and Auditor General of India.
13
- 14 Carson, Stephen J., Anoop Madhok, and Tao Wu. 2006. 'Uncertainty, Opportunism, and
15 Governance: The Effects of Volatility and Ambiguity on Formal and Relational
16 Contracting'. *Academy of Management Journal* 49 (5): 1058–77.
17 <https://doi.org/10.5465/amj.2006.22798187>.
18
- 19 Cohen, Stephen P., and Sunil Dasgupta. 2013. *Arming without Aiming: India's Military
20 Modernization*. Brookings Institution Press.
21
- 22 Cornish, Paul, and Andrew Dorman. 2009. 'National Defence in the Age of Austerity'.
23 *International Affairs* 85 (4): 733–53. [https://doi.org/10.1111/j.1468-
24 2346.2009.00825.x](https://doi.org/10.1111/j.1468-2346.2009.00825.x).
25
- 26 Cowen, Tyler, and Dwight Lee. 1992. 'The Usefulness of Inefficient Procurement'. *Defence
27 Economics* 3 (3): 219–27. <https://doi.org/10.1080/10430719208404730>.
28
- 29 Cowshish, Amit. 2017. 'India–Israel Defence Trade: Issues and Challenges'. *Strategic
30 Analysis* 41 (4): 401–12. <https://doi.org/10.1080/09700161.2017.1330445>.
31
- 32 Cowshish, Amit. 2017. '13th Five-Year Defence Plan (2017-22) – A Re-Run of the Past'.
33 *Indian Defence Review* (blog). 31 July 2017.
34 [http://www.indiandefencereview.com/13th-five-year-defence-plan-2017-22-a-re-run-
35 of-the-past/](http://www.indiandefencereview.com/13th-five-year-defence-plan-2017-22-a-re-run-of-the-past/).
36
- 37 Crocker, Keith J., and Kenneth J. Reynolds. 1993. 'The Efficiency of Incomplete Contracts:
38 An Empirical Analysis of Air Force Engine Procurement'. *The RAND Journal of
39 Economics* 24 (1): 126–46. <https://doi.org/10.2307/2555956>.
40
- 41 Department of Defence. 2013. 'Performance of Defense Acquisition System Annual Report'.
42 Office of the Under Secretary of Defense Under Secretary of Defense, Acquisition,
43 Technology, and Logistics.
44
- 45 Flyvbjerg, Bent, Nils Bruzelius, and Werner Rothengatter. 2003. *Megaprojects and Risk: An
46 Anatomy of Ambition*. Cambridge University Press.
47
- 48 Franck, Raymond, and Bernard Udis. 2017. 'Quarrelsome Committees in US Defense
49 Acquisition: The KC-X Case'. *Defence and Peace Economics* 28 (3): 344–66.
50 <https://doi.org/10.1080/10242694.2015.1073488>.
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65
- Frankenstein, John, and Bates Gill. 1996. 'Current and Future Challenges Facing Chinese Defence Industries'. *The China Quarterly*, no. 146: 394–427.
- Ghose, R.K. 2013. 'Towards an Optimal Procedural Framework: The Indian Experience'. In *Defence Acquisition: International Best Practices*, edited by Laxman Kumar Behera and Vinay Kaushal, 41–54. New Delhi: Pentagon Press.
- Gray, Bernard. 2009. 'Review of Acquisition for the Secretary of State for Defence: An Independent Report'. Ministry of Defence.
- Gupta, V.K. 2008. 'India: IPr and the National Security'. *Journal of Intellectual Property Rights* 13 (4): 318–25.
- Hall, Peter, Stefan Markowski, and Douglas Thomson. 1998. 'Defence Procurement and Domestic Industry: The Australian Experience'. *Defence and Peace Economics* 9 (1–2): 137–65. <https://doi.org/10.1080/10430719808404898>.
- Hébert, J.P. 1996. 'Offsets and French Arms Exports'. In *Defence Procurement and Countertrade*, edited by S. Martin, 139–62. Routledge.
- Hong, Han, and Matthew Shum. 2002. 'Increasing Competition and the Winner's Curse: Evidence from Procurement'. *The Review of Economic Studies* 69 (4): 871–98. <https://doi.org/10.1111/1467-937X.00229>.
- Jick, Todd D. 1979. 'Mixing Qualitative and Quantitative Methods: Triangulation in Action'. *Administrative Science Quarterly* 24 (4): 602–11. <https://doi.org/10.2307/2392366>.
- Kapstein, Ethan B. 2002. 'Allies and Armaments'. *Survival* 44 (2): 141–55. <https://doi.org/10.1093/survival/44.2.141>.
- Keisler, Jeffrey M., and William A. Buehring. 2005. 'How Many Vendors Does It Take to Screw down a Price? A Primer on Competition'. *Journal of Public Procurement* 5 (3): 291–317. <https://doi.org/10.1108/JOPP-05-03-2005-B001>.
- Khan, A., and H.S. Jhajj. 2013. 'Challenges of Defence Procurement: A User Perspective'. In *Defence Acquisition: International Best Practices*, edited by Laxman Kumar Behera and Vinay Kaushal, 88–98. Pentagon Press.
- Kirkpatrick, David L. I. 1995. 'The Rising Unit Cost of Defence Equipment — The Reasons and the Results'. *Defence and Peace Economics* 6 (4): 263–88. <https://doi.org/10.1080/10430719508404831>.
- Klein, Benjamin. 1996. 'Why Hold-ups Occur: The Self-enforcing Range of Contractual Relationships'. *Economic Inquiry* 34 (3): 444–63. <https://doi.org/10.1111/j.1465-7295.1996.tb01388.x>.
- Kwak, Young H., and Brian M. Smith. 2009. 'Managing Risks in Mega Defense Acquisition Projects: Performance, Policy, and Opportunities'. *International Journal of Project Management* 27 (8): 812–20. <https://doi.org/10.1016/j.ijproman.2009.02.002>.
- Laffont, Jean-Jacques, and David Martimort. 2009. *The Theory of Incentives: The Principal-Agent Model*. Princeton University Press.

- 1 Manohara, Chinniah. 1998. 'Defence Procurement and Industry Policy - A Singapore
2 Perspective'. *Defence and Peace Economics* 9 (1-2): 119-36.
3 <https://doi.org/10.1080/10430719808404897>.
- 4 Markowski, Stefan, and Peter Hall. 1998. 'Challenges of Defence Procurement'. *Defence and
5 Peace Economics* 9 (1-2): 3-37. <https://doi.org/10.1080/10430719808404892>.
- 6
7
8 Mayer, Kyle J., and Nicholas S. Argyres. 2004. 'Learning to Contract: Evidence from the
9 Personal Computer Industry'. *Organization Science* 15 (4): 394-410.
10 <https://doi.org/10.1287/orsc.1040.0074>.
- 11
12
13 McCue, Cliff, and Eric Prier. 2008. 'Using Agency Theory to Model Cooperative Public
14 Purchasing'. *Journal of Public Procurement* 8 (1): 1-35.
15 <https://doi.org/10.1108/JOPP-08-01-2008-B001>.
- 16
17
18 Miller, John P. 1952. 'Military Procurement Policies: World War II and Today'. *The
19 American Economic Review* 42 (2): 453-75.
- 20
21 Ministry of Defence. 2008. 'Recommendations of Rama Rao Committee on DRDO'.
22 Technical report. Government of India.
- 23
24
25 Oudot, Jean-Michel. 2010. 'Performance and Risks in the Defense Procurement Sector'.
26 *Journal of Public Policy* 30 (2): 201-18.
27 <https://doi.org/10.1017/S0143814X10000073>.
- 28
29
30 Oxenstierna, S., and F. Westerlund. 2013. 'Arms Procurement and the Russian Defense
31 Industry: Challenges up to 2020'. *Journal of Slavic Military Studies* 26 (1): 1-24.
32 <https://doi.org/10.1080/13518046.2013.757135>.
- 33
34
35 Pant, H.V. 2010. 'Indian Defense Policy at a Crossroads'. *Asia-Pacific Review* 17 (1): 124-
36 44. <https://doi.org/10.1080/13439006.2010.482759>.
- 37
38
39 Pugh, P. G. 1993. 'The Procurement Nexus'. *Defence Economics* 4 (2): 179-94.
40 <https://doi.org/10.1080/10430719308404758>.
- 41
42
43 Raghunath, P. R. 2013. 'Defence Acquisition: A Shipyard Perspective'. In *Defence
44 Acquisition: International Best Practices*, edited by Laxman Kumar Behera and Vinay
45 Kaushal, 289-300. Pentagon Press.
- 46
47
48 Rai, A. K. 2000. 'Defence Budget 2000-01: Some Observations'. *Strategic Analysis* 24 (4):
49 841-45.
- 50
51
52 Reichelstein, Stefan. 1992. 'Constructing Incentive Schemes for Government Contracts: An
53 Application of Agency Theory'. *The Accounting Review* 67 (4): 712-31.
- 54
55
56 Rogerson, William P. 1990. 'Quality vs. Quantity in Military Procurement'. *The American
57 Economic Review* 80 (1): 83-92.
- 58
59
60 Rogerson, William P. 1991. 'Incentives, the Budgetary Process, and Inefficiently Low
61 Production Rates in Defence Procurement'. *Defence Economics* 3 (1): 1-18.
62 <https://doi.org/10.1080/10430719108404711>.
- 63
64
65

- 1 Rogerson, William P. 1994. 'Economic Incentives and the Defense Procurement Process'.
2 *Journal of Economic Perspectives* 8 (4): 65–90. <https://doi.org/10.1257/jep.8.4.65>.
- 3 Singh, Dharendra. 2015. 'Report of Expert Committee for Amendment to DPP-2013'.
4 Technical report. Government of India.
- 5
6
7 Sisodia, N. S., and Amit Cowshish. 2015. 'Defence Planning, Programming, and Budgeting:
8 An Agenda for Reform'. In *Core Concerns in Indian Defence and the Imperatives for*
9 *Reform*, edited by V. Misra, 101–20. Pentagon Press.
- 10
11
12 Srivastava, A. 1999. 'Indo-Russian Military Technical Cooperation: Implications for
13 Southern Asia'. *World Affairs* 161 (4): 200–210.
- 14
15 Subrahmanyam, K., K. Hazari, B. Verghese, and S. Chandra. 2000. 'Kargil Review
16 Committee Report'. Technical report. Government of India.
- 17
18
19 Suman, M. 2006. 'Weapons Procurement: Qualitative Requirements and Transparency in
20 Evaluation'. *Strategic Analysis* 30 (4): 724–44.
- 21
22
23 Tirole, Jean. 1986. 'Procurement and Renegotiation'. *Journal of Political Economy* 94 (2):
24 235–59. <https://doi.org/10.1086/261372>.
- 25
26
27 Williamson, Oliver E. 1979. 'Transaction-Cost Economics: The Governance of Contractual
28 Relations'. *The Journal of Law and Economics* 22 (2): 233–61.
29 <https://doi.org/10.1086/466942>.
- 30
31
32 Williamson, Oliver E. 1985. *The Economic Institutions of Capitalism: Firms, Markets,*
33 *Relational Contracting*. Free Press.
- 34
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Table 1: Composition of the dataset by types of contracts and partner agency

Table 2: Distribution of schedule performance parameter

Table 3: Descriptive statistics of the dataset

Table 4: Risk probability and impact

Table 1: Composition of the dataset by types of contracts and partner agency

	DPSU	DRDO	Foreign	Indian private company	Internal*	Total
Development	3	11	1			15
Off-the-shelf procurement	1		11			12
Production	16		7	1		24
Repair	6		5	1	1	13
Upgrade	13		2			15
Infrastructure	3			2	4	9
Total	42	11	26	4	5	88

*Internal agent refers to different branches of the Ministry of Defence. These are observations where two or more branches within the MoD failed to prevent delay.

Table 2: Distribution of schedule performance parameter

Delay	Number of observations
Less than or equal to 50%	21
50% - 100%	21
100% - 200%	22
200% - 300%	09
300% - 500%	11
Greater than 500%	04
Total	88

Table 3: Descriptive statistics of the dataset

	Number of observations	Mean	Median	Mode	Standard deviation	Min	Max
Start year	72	2004.6	2005	2002	4.25	1987	2012
End year	72	2010.4	2010	2010	3.80	2002	2016
Planned duration (in months)	88	30.21	24	24	24.55	2.5	114
Actual duration (in months)	88	65.62	49	46	47.12	11.25	291
Delay (in %age)	88	180.05	117.69	500	217.61	4.17	1660

Table 4: Risk probability and impact

Risk	Probability	Average delay in %age
Technological	0.4432	125.828
Contractual	0.3409	260.294
Organizational	0.2273	239.174

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Figure 2: Sources of risk associated with phases of procurement

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Figure 1: Distribution of sources of risk according to delays

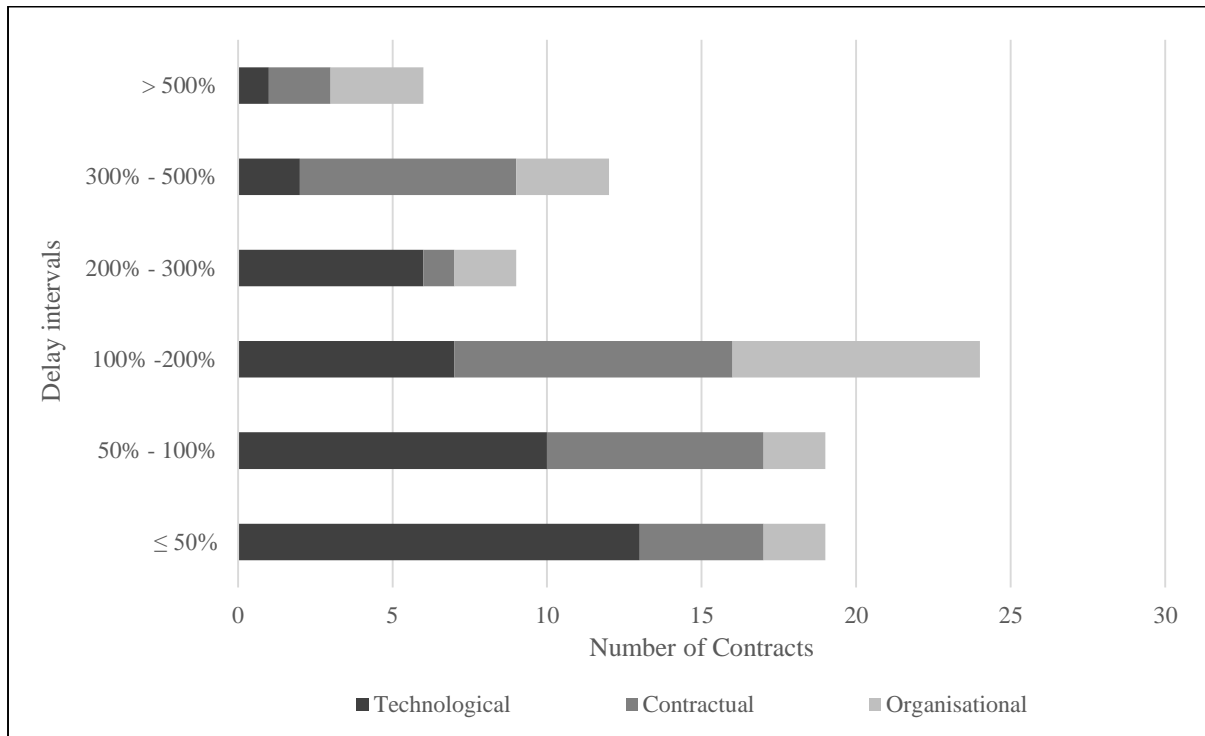


Figure 2: Sources of risk associated with phases of procurement

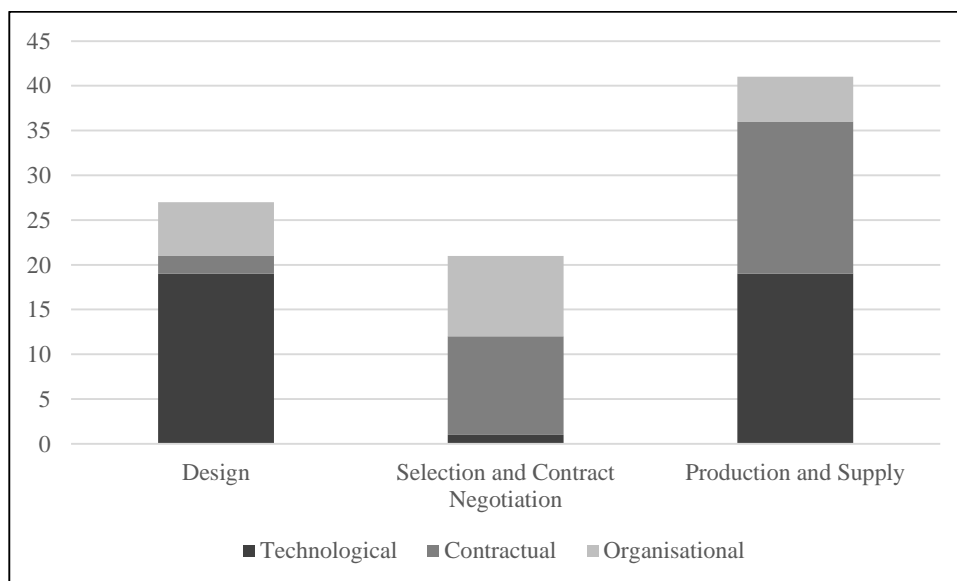


Figure 3: Sources of risk associated with suppliers

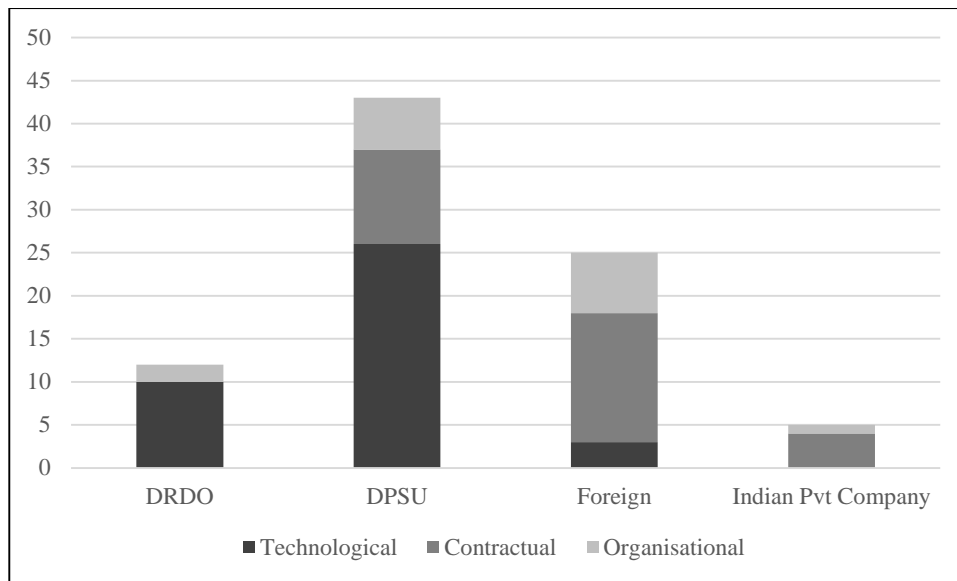
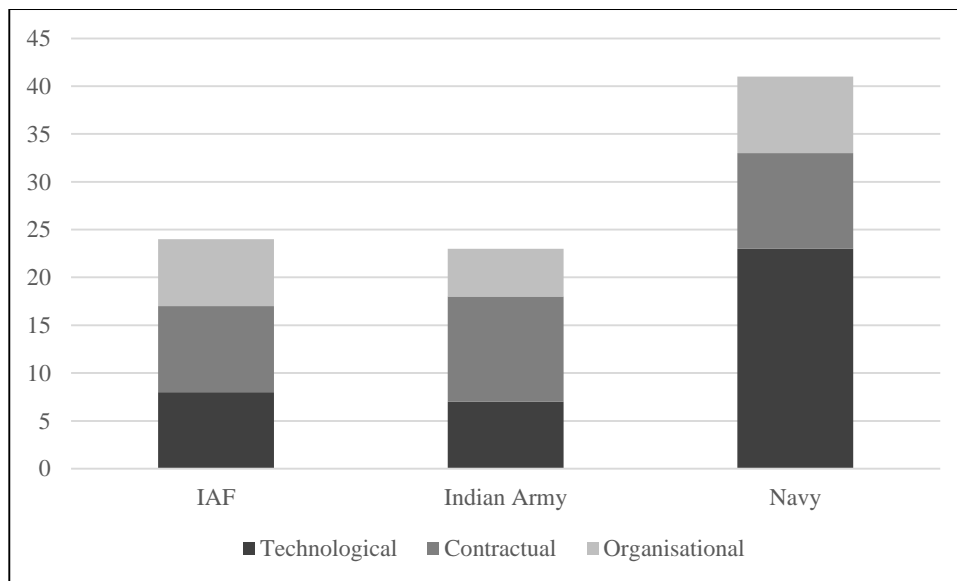


Figure 4: Sources of risk associated with military service



ⁱ While the method can be extended to achieve a complete construct which would include not just calculating the likelihood and impact of risks, but also devising risk mitigation, risk reduction, and risk monitoring measures, the current paper focusses only on the risk analysis component as a first step in a larger research project.

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- ii India ranks 130 in the UN Human Development Index 2018. Development statistics for the country are appalling. High levels of inequality lead to a confusing picture. Drèze and Sen (2013) can be consulted to make some sense of the confusion and to get a comparative picture of India's development with respect to the rest of the world.
 - iii Molas- Gallart (1998) has a similar motivation for discussing the Spanish attempt to use defence procurement as an industrial policy.
 - iv Search query: (defence OR military) AND (procurement OR acquisition) AND (India) in Title, Abstract, or Keywords.
 - v The CAG defence audit reports could be better mined for information on schedule performance (88 cases) than cost performance (30 cases) or technical performance. Although schedule performance is important and interesting by itself, addressing only schedule performance is a preliminary and partial approach to the study of defence procurement performance.
 - vi India's 2016 defence audit report made reference to several projects of the Indian Air Force and Indian Army where delays had compromised operational capabilities of the military forces. One of the several examples is the delays in the supply of the Advanced Light Helicopter (CAG 2016a, 101) .
 - vii India's 2014 defence audit report noted that delays in indigenous projects led to purchases from abroad which contributed to 'failure in actual induction of indigenously developed capability' (CAG 2014, 134).
 - viii There is one contract in the dataset which was initiated in 1987 and 4 contracts between 1996 and 1999 (inclusive), thus not being strictly 21st century projects.
 - ix Global contracts, or contracts with multiple activities, were not usually found in the dataset. Contracts have therefore been noted based on single tasks.
 - x The data did not allow coding according to different weights because it was difficult to ascertain the share of delay caused by each of the different reasons in the overall activity.
 - xi The classification is non-overlapping in this dataset, as explained in the previous note.

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2 ^{xii} 1 contract delayed in the design phase and 11 contracts delayed in the production phase are the 12
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4 contracts in the dataset for which a cause of delay could not be established.
5

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7 ^{xiii} The four remaining contracts referred to contractual activities that were to take place between
8
9 different branches of the Ministry of Defence. They have been excluded in the supply-side analysis
10
11 to avoid confusion.
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14 ^{xiv} Two cases of delay faced technological risks in the shape of both changes in design and teething
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16 problems of indigenization efforts.
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19 ^{xv} Names of interviewees have been substituted for alphabets to preserve the ease of reading while
20
21 protecting the privacy of the individuals.
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24 ^{xvi} I am grateful to one of the anonymous reviewers for pointing out the validity concerns around
25
26 Cohen and Dasgupta's claims. The dataset used in this study has one case of delay being caused
27
28 due to coordination problems which involved the DRDO. Therefore, it is possible that the existing
29
30 literature and interviews suggest a larger role for the DRDO than it actually is.
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33 ^{xvii} I am grateful to one of the anonymous reviewers for suggesting some of these directions through
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35 their comments.
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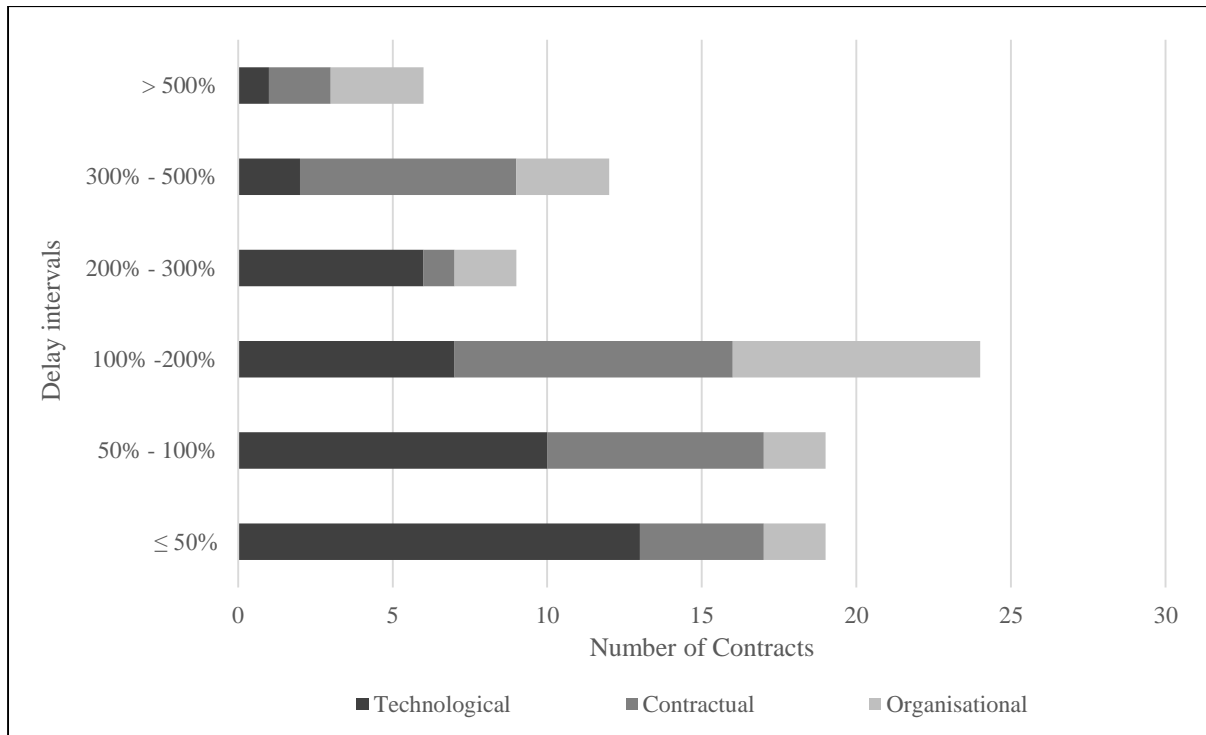


Figure 2: Sources of risk associated with phases of procurement

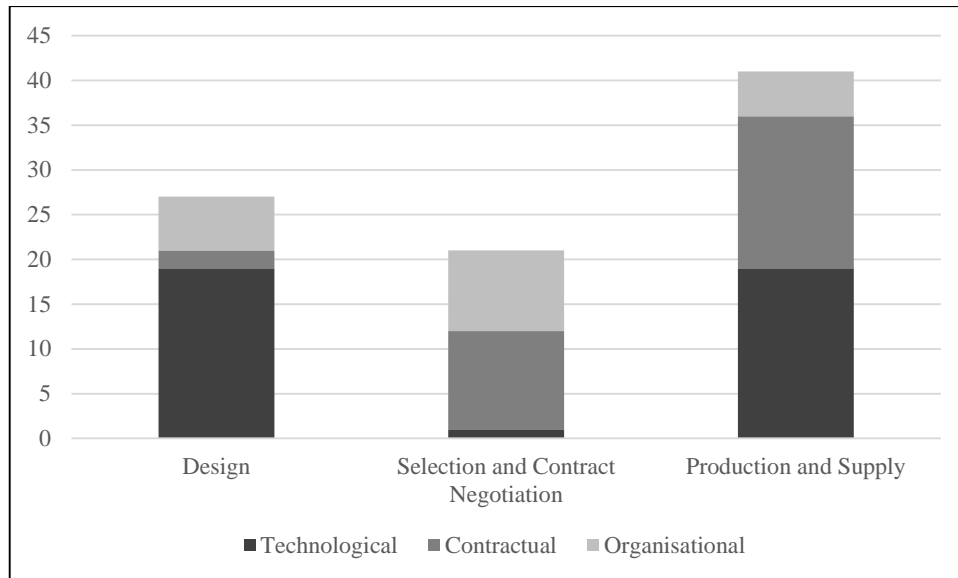


Figure 3: Sources of risk associated with suppliers

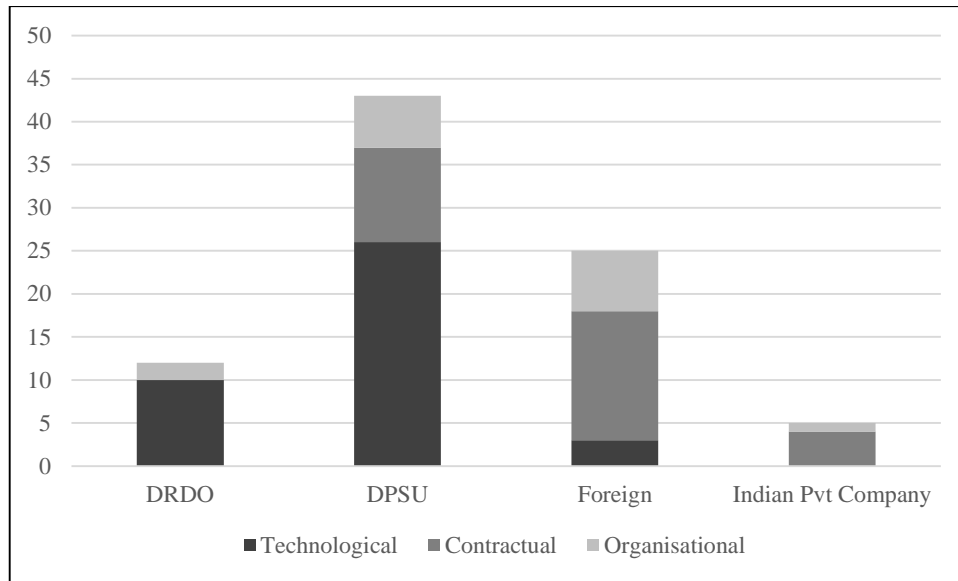


Figure 4: Sources of risk associated with military service

