The Russian Defence Industrial Base

A Critical Assessment

Prepared By:
Michael Stocker
Contract Project Manager: Robert M.H. Burton
PWGSC Contract Number: RMCC Serial #2009-0302-SLA
CSA: Tania Yazbeck, Defence Economics Team

DRDC CORA CR 2012-057
March 2012

Defence R&D Canada
Centre for Operational Research and Analysis

Defence Economics Team

National Defence Défense nationale

Canada

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Contract Report

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Author

Original Signed By M. Stocker

M. Stocker

Approved by

Original Signed By R.M.H. Burton

R.M.H Burton
Section Head, Joint Systems Analysis

Approved for release by

Original Signed By P. Comeau

Paul Comeau
Chief Scientist

Abstract

After a decade of strong economic growth, the Russian government has embarked on a series of defence modernization programmes centered on the procurement of new and modernized equipment for all branches of the armed forces. Linked to these ambitious spending goals is a reform programme for investing in the modernization of the domestic defence industrial base which had been neglected during Russia's post-Soviet decade. This study employs a methodological approach known as SWOT (strengths, weaknesses, opportunities and threats) to provide a snapshot of current industrial base competitiveness as well as a framework to evaluate the impact of various endogenous and exogenous forces which affect the industrial environment. The study also provides an analysis of key defence industries and sectors, specifically the aerospace, shipbuilding, and information communications technology industries. The project is the second of a two-phase analysis of the Russian defence economy initiated by the Defence Economics Team of the Centre for Operational Research and Analysis.

Résumé

Après une décennie de forte croissance économique en Russie, le gouvernement de ce pays a amorcé une série de programmes de modernisation du système de la défense axés sur l'acquisition de nouveau matériel moderne pour tous les services des forces armées. Ces dépenses considérables seront engagées notamment dans un programme de modernisation de l'infrastructure industrielle de défense nationale, négligée durant la décennie suivant la chute du régime soviétique. La méthodologie employée pour l'analyse est celle des forces, faiblesses, possibilités et menaces (FFPM), laquelle permet de donner un aperçu de la concurrence actuelle dans le domaine des infrastructures industrielles ainsi que d'établir le cadre d'évaluation de l'incidence des diverses forces endogènes et exogènes qui influent sur le contexte industriel. L'étude fournit aussi une analyse des principales industries de la défense, particulièrement celles de l'aérospatiale, de la construction navale et des technologies de l'information et des communications. Il s'agit du second rapport d'une analyse en deux volets de l'économie russe de la défense effectuée par l'équipe d'analyse de l'économie de la défense du Centre de recherche opérationnelle et d'analyse.

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Executive summary

The Russian Defence Industrial Base: A Critical Assessment
M. Stocker; Defence R&D Canada - CORA CR 2012-057; March 2012.

Context

Despite the tumult brought about by the global economic crisis, the defence budget of the Russian Federation has emerged relatively unscathed. The preceding decade of strong economic growth allowed the government to embark on a series of defence modernization programmes centered on the procurement of new and modernized equipment for all branches of the armed forces. Linked to these ambitious spending goals was a reform programme for investing in the modernization of the domestic defence industrial base which had been neglected during Russia's first post-Soviet decade. It was not until the mid 2000s when state defence orders grew significantly, and eventually eclipsed export demand, that attention was paid to the defence industrial base. Its repeated failure to meet domestic production orders motivated a major consolidation and reinvestment effort on the part of the government. In recent years, the defence industry has witnessed some progress in terms of production volume and technological sophistication; however, these gains were based on Soviet-era industrial capacity and defence technology as opposed to being the result of new or modernized industrial processes and technology. Within this context, this study will examine the current state of the Russian defence industrial base and its potential to provide customers, both foreign and domestic, with the types of weapon systems likely to be in demand in the future.

The Centre for Operational Research and Analysis (CORA)'s new Defence Economics Team has undertaken a project to study the current state and future potential of the Russian defence industrial base. This study is the second of a two-phase analysis of the Russian defence economy.

The Defence Industrial Base: Past and Present

The Russian defence industrial base retains many Soviet-era features although it is considerably smaller in terms of financial and human resources and output. Foreign sales during the 1990s provided a bridge for industry until government orders accelerated in the early 2000s. However, current production relies on research and development (R&D) carried out in the 1970s and 1980s and therefore raises the question of whether the defence industry is capable of producing revolutionary capability enhancements as opposed to just evolutionary or incremental improvements to existing technologies and platforms. A preference for procurement over R&D as expressed in numerous state armament programmes (SAP) over the past ten years suggests the technological proficiency gap between Russia and its competitors is growing rather than narrowing.

The current state armament programme, SAP-2020, is the most ambitious to date. Spending will be directed toward increasing the share of modernized equipment and systems (70%

by 2020) used by the Russian Armed Forces. Driving this spending programme is the need for Russia to develop and deploy RMA-type [1] systems which it lacked in its war with Georgia in 2008. Coupled with the failure of previous SAPs to meet procurement objectives, the Russian government is taking unprecedented steps to gap-fill capability deficiencies by purchasing foreign made systems like the French Mistral-class assault ships.

SWOT Analysis of the Russian Defence Industrial Base

This study employs a methodological approach known as SWOT (strengths, weaknesses, opportunities and threats) to provide a snapshot of current industrial base competitiveness as well as a framework to evaluate the impact of various endogenous and exogenous forces which affect the industrial environment. The strengths of the Russian defence industrial base include the inheritance of the Soviet industrial and scientific base, maintaining areas of excellence and niche systems, global exports and the emergence of next-generation systems. The weaknesses of the defence industrial base include executive control and the dominance of state industrial conglomerates, the absence of resources available for long-term investment in defence industrial modernization and the skills deficit of its labour force. The areas of opportunity for the defence industrial base include meeting strong domestic and export demand for its products, joint ventures and international collaboration and regional and global economic integration. Lastly, the threats faced by the defence industrial base include economic protectionism, reliance on energy exports as a source of government revenues, the changing profile of new and old export customers, and competition from developing states such as China and India.

Industry-Sector Analysis

This study also provides an analysis of key defence industries and sectors. The varying competitiveness of these sectors closely reflects defence budget priorities and areas of historical strength and proficiency. Specifically, the aerospace, shipbuilding, and information communications technology industries are examined using a similar SWOT approach.

Conclusion

Over the next decade, the effects of a decade of defence industrial reform should become more readily apparent. Three metrics will be especially useful to assess whether the reform programme has been a success or failure. First, by analyzing the proportion of the SAP procurement objectives met, we can gain a sense of the defence industry's capacity for serial production of current and next-generation systems. Second, by analyzing export customer feedback and Russia's position among the world's top arms exporters, we can gain a sense of the quality of defence exports and a rough estimate of industry-sector capacity utilization (i.e. the quantity of arms which could be redirected to the home market in a crisis). Finally, by monitoring the volume and type of defence equipment Russia imports, we can estimate whether the foreign import, gap-filler trend is either accelerating (implying a further deterioration of the defence industrial base) or reversing (implying improvement in the defence industrial base).

[1] Revolution in Military Affairs

Sommaire

The Russian Defence Industrial Base : A Critical Assessment

M. Stocker ; R&D pour la défense Canada - CARO CR 2012-057 ; Mars 2012.

Contexte

Le budget de la défense de la Fédération de Russie a été relativement épargné des turbulences de la crise économique mondiale. La forte croissance économique enregistrée au cours des dix années ayant précédé a permis au gouvernement d'amorcer une série de programmes de modernisation du système de la défense axés sur l'acquisition de nouveau matériel moderne pour tous les services des forces armées. Ces dépenses considérables seront engagées notamment dans un programme de modernisation de l'infrastructure industrielle de défense nationale, négligée durant la décennie suivant la chute du régime soviétique. Ce n'est pas avant le milieu des années 2000, lorsque les commandes nationales de matériel de défense ont fortement augmenté et, en définitive, surpassé la demande à l'exportation, que l'infrastructure industrielle de défense a été examinée. Comme cette dernière ne pouvait souvent plus remplir les commandes intérieures, le gouvernement a décidé d'intervenir massivement pour y réinvestir et la consolider. Au cours des dernières années, l'industrie de la défense a réalisé certains progrès sur le plan du volume de production et du perfectionnement technologique, mais ces gains ont été obtenus grâce à la capacité industrielle et la technologie de défense de l'ère soviétique et non grâce à des technologies et des procédés industriels nouveaux ou modernes. Dans ce contexte, l'étude examine l'état actuel de l'infrastructure industrielle de défense russe et les possibilités qu'elle représente pour fournir à des clients, tant étrangers que russes, les types de systèmes d'arme qui devraient faire l'objet d'une demande dans l'avenir. La nouvelle équipe d'analyse de l'économie de la défense du Centre de recherche opérationnelle et d'analyse a entrepris d'étudier l'état actuel et les débouchés de l'infrastructure industrielle de défense de la Russie. Il s'agit du second rapport d'une analyse en deux volets de l'économie russe de la défense.

L'infrastructure industrielle de défense, d'hier à aujourd'hui

L'infrastructure industrielle de défense de la Russie comporte toujours plusieurs des éléments de l'ère soviétique, mais les ressources financières et humaines qui lui sont consacrées ainsi que sa capacité de production sont considérablement réduites. Les ventes à l'étranger dans les années 1990 ont permis à l'industrie de survivre jusqu'à ce que les commandes du gouvernement augmentent au début des années 2000. Toutefois, la production actuelle se fonde sur la recherche développement (R–D) réalisée dans les années 1970 et 1980, ce qui soulève la question de savoir si l'industrie de la défense peut proposer de nouvelles façons d'améliorer les capacités plutôt que de simplement améliorer progressivement les technologies et procédés existants. La préférence accordée à l'approvisionnement plutôt qu'à la R-D dans de nombreux programmes nationaux d'armement au cours des dix dernières années donne à penser que l'écart dans les compétences technologiques de la Russie et celles de ses concurrents se creuse et non l'inverse.

Le programme national d'armement actuel (SAP 2020) est le plus ambitieux à ce jour. Les dépenses viseront la hausse de la proportion de matériel et de systèmes modernes (70% d'ici 2020) utilisés par les forces armées russes. Ce programme de dépenses a été motivé par le besoin de la Russie d'élaborer et de mettre en œuvre des systèmes de type RAM [1], dont elle ne disposait pas dans sa guerre contre la Géorgie en 2008. Comme les programmes nationaux d'armement n'ont en outre pas permis d'atteindre les objectifs d'approvisionnement, le gouvernement russe a adopté des mesures sans précédent pour combler les lacunes à cet égard en achetant de l'équipement étranger comme les navires d'assaut français de classe Mistral.

Analyse des FFPM de l'infrastructure industrielle de défense de la Russie

La méthodologie employée pour l'analyse est celle des forces, faiblesses, possibilités et menaces (FFPM), laquelle permet de donner un aperçu de la concurrence actuelle dans le domaine des infrastructures industrielles ainsi que d'établir le cadre d'évaluation de l'incidence des diverses forces endogènes et exogènes qui influent sur le contexte industriel. Les forces de l'infrastructure industrielle de défense de la Russie comprennent les fondements industriels et scientifiques de l'ère soviétique, les domaines d'excellence et les créneaux, les exportations mondiales et l'avènement de systèmes de nouvelle génération. Parmi les faiblesses de cette infrastructure figurent le contrôle par le pouvoir exécutif et la domination des conglomérats industriels publics, l'absence de ressources pour les investissements à long terme destinés à la modernisation de l'industrie de la défense et la pénurie de main d'œuvre compétente. Par ailleurs, des possibilités se présentent entre autres sur les plans de la demande intérieure et de la demande à l'exportation des produits militaires fabriqués en Russie, des coentreprises, de la collaboration avec les pays étrangers et de l'intégration économique régionale et mondiale. Enfin, les menaces qui pèsent sur l'infrastructure industrielle de défense comprennent le protectionnisme, l'utilisation des exportations d'énergie comme principale source de revenus pour l'état, l'évolution des caractéristiques des nouveaux et des anciens clients des marchés d'exportation et la concurrence des pays en développement comme la Chine et l'Inde.

Analyse des industries

L'étude fournit aussi une analyse des principales industries de la défense. Les écarts sur le plan de la concurrence dans ces industries ainsi que les forces et les compétences qu'elles ont affichées par le passé se reflètent dans les priorités budgétaires liées à la défense. Les industries de l'aérospatiale, de la construction navale et des technologies de l'information et des communications font l'objet d'une analyse des FFPM en particulier.

Conclusion

Les effets de la réforme de l'infrastructure industrielle de défense devraient ressortir clairement au fil des dix prochaines années. Trois mesures seront particulièrement utiles pour évaluer si le programme de modernisation est une réussite ou un échec. Tout d'abord, en déterminant si la proportion de matériel et de systèmes modernes atteint celle visée par le

[1] Révolution dans les affaires militaires.

programme national d'armement, nous pouvons avoir une idée de la capacité de production en série de l'industrie de la défense, tant pour les systèmes actuels et que pour ceux de nouvelle génération. Ensuite, en analysant les commentaires des clients des marchés d'exportation et selon le classement de la Russie parmi les principaux exportateurs mondiaux d'armes, nous pouvons avoir une idée de la qualité des exportations de matériel militaire et une estimation de l'utilisation de la capacité du secteur (c'est à dire la quantité d'armes qui pourraient être réacheminées vers le marché intérieur en cas de crise). Enfin, en surveillant le volume et le type de matériel militaire importé par la Russie, nous pouvons évaluer si les importations destinées à combler les lacunes s'accroissent (signe que l'infrastructure industrielle de défense se détériore) ou se contractent (signe que l'infrastructure industrielle de défense s'améliore).

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1 Introduction

1.1 Context of Study

Despite the tumult brought about by the global economic crisis, the defence budget of the Russian Federation has emerged relatively unscathed. The preceding decade of strong economic growth allowed the government to embark on a series of defence modernization programmes centered on the procurement of new and modernized equipment for all branches of the armed forces. Linked to these ambitious spending goals was a reform programme for investing in the modernization of the domestic defence industrial base which had been neglected during Russia's first post-Soviet decade. The size of the defence industrial base relative to Russia's GDP (Gross Domestic Product) meant domestic spending alone would be insufficient to maintain, let alone modernize, the industrial base. Financing obtained through the export of defence systems provided a lifeline to the industrial base but that too would prove to be insufficient. It was not until the mid 2000s when state defence orders [1] grew significantly, and eventually eclipsed export demand, that attention was paid to the defence industrial base. Its repeated failure to meet domestic production orders motivated a major consolidation and reinvestment effort on the part of the government. In recent years, the defence industry has witnessed some progress in terms of production volume and technological sophistication; however, these gains were based on Soviet-era industrial capacity and defence technology as opposed to being the result of new or modernized industrial processes and technology.

The current stock of Russian defence products will remain relevant throughout this decade but doubts as to the future viability of the industry are emerging. Competition from developed and developing states is fierce and there is a clear bias toward the procurement of those technologically sophisticated systems needed for the future RMA (revolution in military affairs) conflict environment. Within this context, this study will examine the current state of the Russian defence industrial base and its potential to provide customers, both foreign and domestic, with the types of weapon systems likely to be in demand in the future.

The Centre for Operational Research and Analysis (CORA)'s new Defence Economics Team has undertaken a project to study the Russian economy and resources available for defence in order to assess the potential of Russian military procurement plans to become reality. This study is the second of a two-phase analysis of the Russian defence economy. The project is part of CORA's Applied Research programme (ARP) "Defence Economics Country Surveys", and is intended for all partners within the Canadian Department of National Defence as well as the defence analysis community.

1.2 Methodology: SWOT Analysis

In this paper, a SWOT methodology will be used to analyze the state of the Russian defence industrial base. This method of analysis is particularly suited to address the various research questions posed above because it provides a snapshot of current industrial base

[1] "state defence orders" refer to the procurement plan of the Russian Armed Forces.

competitiveness as well as a framework to evaluate the impact of various endogenous and exogenous forces which affect the industrial environment.

SWOT analysis is a strategic planning method used to evaluate the Strengths, Weaknesses or Limitations, Opportunities, and Threats involved in a project or in a business venture. It involves specifying the objectives of the business venture or project and identifying the internal and external factors that are favorable and unfavorable to achieve those objectives. Also, it is particularly helpful in identifying areas for development.

Category definitions are quite straightforward: “strengths” refers to those characteristics of the organization that give it an advantage over competitors; “weaknesses” (or limitations) refers to those characteristics that place the organization at a disadvantage relative to others; “opportunities” refers to internal and external factors which might improve performance or capability; “threats” refers to internal or external factors which could reduce performance or capability.

1.3 Structure of the Report

This report first provides a brief review of the Russian defence industrial base as it emerged from the collapse of the Soviet Union and where it stands today (Section 2.1). This section is followed with an analysis of the defence industrial base in the context of the recently announced State Armaments Programme 2020 (Section 2.2).

The third section of this report employs a SWOT methodology to provide a snapshot of the defence industrial base and the trends and forces currently being exerted upon it. Each subsection will address an element of SWOT analysis such that strengths, weaknesses, opportunities and threats are each examined in a clear and deliberate fashion (Section 3.1-3.4).

Following the SWOT analysis section, an examination of the principal industrial sectors of the defence industrial base will be undertaken with particular attention paid to sector champions, i.e., the most competitive and innovative firms in the sector (Section 4).

Finally, a conclusion will be offered that addresses the fundamental research question of this study (Section 5): given the current state and future trajectory of the defence industrial base, can the defence industrial base provide customers, both foreign and domestic, with the types of weapon systems likely to be in demand in the future.

2 Russia's Defence Industrial Base in Context

2.1 The Defence Industrial Base: Past and Present

Russia's defence industrial complex, *Oboronnyi-promyshennyi kompleks* (OPK), in many ways resembles its Soviet-era predecessor. At the end of the 1980s, the defence industrial complex consisted of approximately 4,000 research institutions, design organizations and production facilities, employed as many as 6 million citizens and consumed nearly 50% of the federal budget.[2] Although Russia inherited 85% of the Soviet Union's military potential, it inherited just 60% of its GDP. By 1997 Russian GDP had shrunk further to 25% of the USSR's but the government had retained nearly 40% of the Soviet Army and Navy. Correspondingly, the Russian defence industrial base reached its historical nadir with industrial production falling to 10% of its 1991 level.[3] In the absence of sufficient domestic demand for their products, individual enterprises within the defence complex sought out foreign customers, principally China and India, sales to whom would provide just enough financing to maintain existing production facilities and skeleton work forces. Foreign sales were insufficient to maintain the entire defence industrial complex; rather, they merely propped up the most competitive individual enterprises like fighter aircraft producers or the St. Petersburg shipyards. As it later emerged, foreign sales bought the OPK just enough time to allow Russia's economic recovery of the late 1990s to translate into growing state defence orders. Since the 1997 low, the OPK has seen annual production grow 16% on average through a combination of export sales and domestic orders. In recent years however this growth rate has slackened due to the global economic crisis.[4]

The OPK has been the subject of several rounds of reform since 1991. Reform policy has revolved around two main themes: privatization and conversion. Presidents Gorbachev and Yeltsin instituted a partial privatization of the OPK such that by 1997 approximately 800 defence industrial enterprises were joint-stock [5] or private, although 400 remained under full state control, while for another 1,000 companies the state had a golden share or controlling ownership.[6] A second policy theme was a determination to "convert" the OPK to produce civilian "high-technology" goods which came to include washing machines, televisions, cameras, and more recently computers and applied electronics. However, the OPK had neither the interest nor the competitive production processes necessary to produce these

[2] "The Russian Military Complex", *Globalsecurity.org*, available at http://www.globalsecurity.org/military/library/report/1998/TheMilitaryIndustrialComplex.htm; Cordesman, Anthony H. (April 1999) "The Strategic Impact of Russian Arms Sales and Technology Transfers", Center for Strategic and International Studies, Washington, D.C., pp. 10-11, available at http://www.csis.org/media/csis/oubs/atstratimpofrussarmsale%5B1%5D.pdf

[3] Bystrova, Irina. (2011) Russian Military-Industrial Complex. Aleksanteri Papers (2), p. 13, available at www.helsinki.fi/aleksanteri/julkaisut/tiedostot/ap_2-2011.pdf

[4] Cameron, Mitchell. (2009) Phoenix from the ashes? Russia's defence industrial complex and its arms exports. Canberra Papers on Strategy and Defence, ANU E Press. Canberra, Australia.

[5] A joint-stock company (JSC) is a type of corporation or partnership involving two or more individuals that own shares of stock in the company. Certificates of ownership ("shares") are issued by the company in return for each financial contribution, and the shareholders are free to transfer their ownership interest at any time by selling their shareholding to others. (definition from Wikipedia "Joint-Stock company")

[6] Bystrova, p. 14.

goods at quality levels comparable to their foreign import rivals. In fact, the failure to invest in both the military and civilian research and development (R&D) in the 1990s has produced "irrecoverable technology gaps in high technology consumer electronics, instrument making, and machine tool building".[7]

Today, the OPK is composed of fewer than 1,500 firms, 43% of which are mainly private (the state has less than a 25% stake), 40% are fully state owned and the remaining 17% have sizeable state ownership stakes.[8] The resurgence of the state in the OPK was a central goal of President Putin's military reforms when he came to power. He viewed the OPK as being fractured where disparate industrial centers stretched state resources and led to in-country and export sale-price competition. A renationalization drive produced major consolidations throughout the OPK creating vertical and horizontal integrated holding companies that contain ownership stakes in dozens to hundreds of smaller enterprises.

According to defence analyst Irina Isakova [9]:

> *The creation of vertical integrated holdings in specialized sectors such as aviation, shipbuilding, IT, automobile and tank building, and radio electronics is central for restructuring the defense industry. These holding companies provide viable channels for private, including foreign, investments into the defense sector. Through mergers and acquisitions, about 40-45 integrated holding companies are expected to be created from the existing 579 state-owned enterprises and 428 shareholding firms within the next five to seven years. The reform primarily focuses on the economic sectors where state funding and business initiatives could most effectively contribute to a rapid revival of the national industry and the defense industrial complex.*

Several recent examples substantiate this consolidation trend such as the creation of *Oboronprom*, a closed joint stock company which was formed as a vehicle for consolidation of the rotary wing industry. Similar consolidations occurred with the electronic warfare group in 2006, and aircraft engines, aircraft makers and shipbuilding in 2008. When once 40 or so defence companies carried out their own export sales activities, today only one state corporation *Rosoboroneksport* administers all foreign military sales. In 2007, the state transferred its ownership stakes in 439 companies, including *Rosoboroneksport* and *Oboronprom*, to another new state controlled entity *Rostechnologii* which unites all aspects of Russia's arms industry, from research and development to international distribution.

Lastly, in 2008 a new Military-Industrial Commission was established to provide a basis for civilian control of procurement and remove it from the purview of the General Staff at the Ministry of Defense (MOD). The role of this agency is to place state military and

[7] Sal'nikov, V.A. and D.I. Galimov. (2006). The Competitiveness of Russian Industries: Current State and Outlook, Studies on Russian Economic Development, 17(2), p. 151. - note: quotation edited to correct spelling error, i.e. "non-recompensible".

[8] Cameron, p. 38.

[9] Isakova, Irina. (2007). The Russian Defence Reform, *China and Eurasia Forum Quarterly*, 5(1) p. 79.

defence orders across all power institutions, prepare and sign contracts, conduct funding, monitoring and accounting. Although this new system will undoubtedly reduce the number of procurement agencies throughout the Russian defence and security sector, it is unclear whether a unified procurement system will actually reduce costs, improve quality, effectiveness and efficiency, and improve transparency.

2.2 OPK and the State Armaments Programme

In early 2011, the Ministry of Defense announced a new military spending programme for the 2011-2020 period. The State Armaments Programme (SAP) 2011-2020 calls for spending 19 trillion rubles (approximately $600 billion (USD) using current exchange rates) on the armed forces over the next ten years and is heavily biased toward procurement (as opposed to R&D) to meet President Medvedev's goal of raising the share of modern weapons in the Russian military from an estimated 10 percent now, to 30 percent by 2015 and 70-80 percent by 2020. Approximately 80 percent of these MOD funds are to go toward purchasing weapons including 100 ships, 600 fixed-wing aircraft, 1,000 helicopters, eight nuclear submarines, and 10 new generation air-defence systems, while just 10 percent will support scientific research and development.[10] This spending bias has been accelerating since 2007 owing to general dissatisfaction with the R&D system. The Stockholm International Peace Research Institute (SIPRI) reports that, in some cases projects were undertaken for 10-15 years without any meaningful results.[11] As well, there was a growing belief among Russian defence planners that given the impact of the financial crisis, a full rationalization of R&D funding was in the offing. In April 2009, the deputy defence minister for armaments, revealed that work had been stopped on 300 R&D projects.[12]

The ambitious objectives and spending biases outlined in SAP-2020 can be viewed as a byproduct of two recent events: the failure of the previous SAP (2007-2015) to reach its delivery goals and the manner in which the Russian Armed Forces conducted the 2008 war with Georgia. The recent history of SAPs suggests that the full realization of SAP-2020 objectives is unlikely given that the last SAP (2007-2015) was scrapped in 2010 after it became apparent that no more than 70% of arms orders would actually be produced and delivered.[13] Often cited limiting factors, including insufficient financing, corruption and the generally poor state of the defence industry, suggest that fulfilling SAP-2020 is highly unlikely unlesss economic circumstances change drastically for the better. Indeed, all previous SAPs (2005, 2010) have had to be abandoned when it was found that they had been based on unrealistic expectations with respect to economic growth prospects, funding on defence, and on the cost of new weapon systems. Given that work on SAP-2020 began at the time economic forecasts to 2020 were being prepared, it is reasonable to assume that

[10] RIA Novosti (February 24 2011) Russia to Buy 1,000 Helicopters by 2020. http://en.rian.ru/mlitary_news/20110224/162739409.html

[11] Cooper, Julian. (2009) Military expenditure in the Russian Federation, 2007 - 2009: a research note, *Stockholm International Peace Research Institute*, p. 10.

[12] Ibid.

[13] Russian Military Reform (March 11 2011) The Fate of the Last State Armaments Programme. http://russiamil.wordpress.com/2011/03/11/the-fate-of-the-last-state-armaments-program/

the same assumptions were being employed.

Secondly, despite Russia's overwhelming use of high-end conventional forces and the many months (but more likely years) of planning that went into preparing for the invasion of Georgia, the war itself exposed fundamental weaknesses and shortcomings in Russia's armed forces, reinforcing conditions that were already known and possibly served as a catalyst for a reoriented SAP. For example, Russian military leaders pointed out the slow pace of naval and ship-to-shore deployments in the Georgian war and suggested a radical way to address the drawback, i.e., the purchase of the French-built Mistral assault ship. This suggests that the deterioration of the Soviet-era industrial base has been so severe that indigenous naval-building capacities cannot be relied upon to develop major surface combatants in a timely and efficient manner. The war also impressed upon the General Staff the need for RMA-type forces which emphasize rapid deployment, information sharing and precision strike.[14] The new SAP which emphasizes high-end conventional forces procurement is clearly meant as a step in the direction and the absence of R&D funding suggests a growing proclivity to purchase specialty foreign-built weapons.

[14]Cohen, Ariel and Robert E. Hamilton. (2011). "The Russian Military and the Georgian War: Lessons and Implications", Strategic Studies Institute - ERAP Monograph. Available at http://www.strategicstudiesinstitute.army.mil/pdffiles/PUB1069.pdf ; McDermott, R. N. (2009). Russia's Conventional Armed Forces and the Georgian War, Parameters, Vol. 39, p. 66. Available at http://www.carlisle.army.mil/usawc/Parameters/Articles/09spring/mcdermott.pdf

3 SWOT Analysis

3.1 Strengths

Inheritance of Soviet Industrial and Research Base

Russia's OPK has demonstrated a degree of resilience since the dissolution of the Soviet Union. Many analysts (including Russian analysts) predicted a collapse of the OPK in the 1990s owing to a combination of endemic corruption, insufficient government financing, a "brain drain" of its top researchers to other countries, and the eventual effects resulting from a neglect of the R&D sectors of OPK.[15] Clearly, this collapse never occurred because OPK still maintains the ability to produce first-class weapons of a quality that approaches, equals or in some cases exceeds those of U.S. and European origin.

At the end of the 1980s, the defence industrial complex consisted of approximately 4,000 research institutions, design organizations and production facilities, employed as many as 6 million citizens and consumed nearly 50% of the federal budget.[16] In total, Russia inherited 85% of the Soviet Union's military potential and with it the enormous defence industrial base including thousands of defence-related enterprises and R&D centres. The OPK that Russia inherited from the Soviet Union was at the height of its technological proficiency thanks to investments made during the 1970s and 1980s.

According to Middleton et. al., a military should expect a delay of 10-25 years between the time of R&D investment and the point at which the highest benefits in terms of military equipment quality are observed.[17] The next-generation fighter program provides a useful illustration of this "quality-delay" prediction. In response to the U.S. Advanced Tactical Fighter (ATF) program of the early 1980s, Russia initiated its own next-generation fighter competition soon after. Two technology demonstrators, the Sukhoi Su-47 and Mikoyan Project 1.44, competed for this program, with the Sukhoi finalist selected in 2002.[18] The majority of R&D spending needed for the development of both prototype demonstrators occurred during the 1980s. If Middleton's estimate holds true in Russia, defence planners can expect that during this decade, new defence systems based on R&D spending during the 1980s will emerge which exhibit quality and capability characteristics not seen in Russia's currently deployed, legacy systems.

[15] Shlykov, Vitaly V. (2004). *The Russian Military: Power and Policy*, MIT Press, Cambridge, MA.; Blank, Stephen J. (1995) *Reform and the Revolution in Russian Defense Economics*, Strategic Studies Institute, US Army War College, Carlisle, PA.

[16] "The Russian Military Complex", *Globalsecurity.org*, available at: http://www.globalsecurity.org/military/library/report/1998/TheMilitaryIndustrialComplex.htm.; Cordesman, (1999), pp. 10-11, available at: http://www.csis.org/media/csis/pubs/atstratimpofrussarmsale%5B1%5D.pdf

[17] Middleton and al.(2006), The effects of defence R&D on military equipment quality, *Defence and Peace Economics*, 17(2), p.137

[18] RIA Novosti (April 20, 2010) Premier Putin satisfied with Russian fifth-generation fighter tests. http://en.rian.ru/russia/20100420/158666082.html

Areas of Excellence and Niche Systems

In a 2009 study, defence analyst Mitchell Cameron identified several areas of Russian defence equipment excellence [19] :

> *Russian missile technologies, specifically air-to-air, surface-to-air and anti-ship varieties, are widely regarded as being in a class of their own [. . .] thermobaric munitions and thrust-vector technologies (TVT) for aircraft engines are fields in which many experts regard as Russia as master. [. . .] all-aspect TVT [. . .] is a field in which Russia excels - US experimentation with TVT still only enables vertical movement (as on the F-35 Joint Strike Fighter short takeoff/vertical landing (STOVL) variant). This technology has been fitted on late-model Sukhoi Flanker variants, and the MiG-35 Fulcrum. TVT enables 'super-maneuverability' which aids dog-fighting, anti-missile maneuvers and safety at low air speeds.*

These technologies and others helped Russia carve out a niche in the global defence export market, sales to which provided a lifeline to the entire industry when state orders decreased substantially. Russian weapon systems offer excellent "value for money" because they are competitively priced and technologically advanced and, unlike many western equivalents, Russian fighter aircraft and helicopters are durable and inexpensive to maintain. Among the most ubiquitous export items Russia has sold, the T-72, T-80 and T-90 main battle tanks (MBTs) stand out, as does the new generation of wheeled BTR family armoured personnel carriers (APCs), and tracked BMP family APCs. However, sales in higher-end niche systems have today far surpassed their Soviet-era export levels. Among these, the Kilo class submarine, the Sukhoi Su-27-30 Flanker and MiG-29 Fulcrum family of fighters, air-defence systems, and Mi-8/17 helicopters.[20] Again, these systems are popular because of their comparatively low cost, technological sophistication, low life-cycle burden and the ease with which new components and sub-systems can be integrated to enhance the capabilities of legacy systems.

Global Exports

In a bid to optimize the efficiency and revenue potential of Russia's defence exports, President Putin created a centralized export agency (effectively a legal monopoly) known as *Rosoboronexport* (ROE) to oversee all major foreign military sales. In 2010, Russia's arms exports totaled approximately $10 billion (USD) of which ROE's share was $8.6 billion.[21] Independent supplies of after-market maintenance and spare parts made up the difference. According to the Moscow-based independent defence think-tank Centre for Analysis of Strategies and Technologies, the share of different weapon types in exports was the following: 61% Aerospace, 21% Ground, 9% Naval, 8% Air Defense and 1% other. Algeria was

[19] Cameron, p.20.

[20] Cameron, p.20.

[21] Centre for Analysis of Strategies and Technologies (CAST) (2011). Russian defense industry and arms trade: facts and figures. p. 3.

the top customer with an export share of 29%, followed by India (25%) and China (10%).[22] Vietnam became Russia's largest weapons customer in terms of new contracts signed in 2009, especially due to a large order for six Project 636M Kilo-class submarines.[23] In total Russia sells weapons to 82 countries and enjoys an aggregated export backlog of nearly $48 billion.[24]

Historically, China and India were the largest customers for Russia's weapon systems, together accounting for 70% of all arms transfers on average.[25] However, both China and India have expressed a desire to develop their own indigenous defence industrial base, meaning they will eventually become competitors to Russia, such that the share of total exports to these countries will decline in all but the most advanced system categories, for example jet turbine engines.[26] In response, Russia embarked on a strategy targeting the "emerging market triangle" which includes South East Asia, the Middle East and South America. Russia enjoys distinct advantages when it comes to arms exports to the developing world. First, approximately 40 countries around the world own Soviet-era weapons stocks that are at or near the end of the service life. Secondly, Russia does not hesitate to sell weapons to countries with questionable democratic and human rights records or who are otherwise subject to western arms embargoes. In addition, Russia offers creative financing arrangements and payment options such as zero interest loans, billion dollar export credits, debt-forgiveness and swapping, offsets, counter-trade (arms for oil) and licensed production.[27] Although these markets can pose risks, it shows a willingness on the part of the Russian government to maintain a global influence through creative arms transfer agreements.

Emergence of Next-Generation Systems

A final example of the resilient strength of the OPK can be seen in the development of next generation weapon systems. Although it is unclear to what extent post-Cold War R&D work contributed to the development of these next generation systems, recent production announcements relating to the PAK FA/T-50 stealth fighter jet, the Borey-class nuclear missile submarine and S-400/500 air defence system demonstrate Russia's ability to develop new sophisticated platforms, by relying on incremental or evolutionary technological improvements to its legacy systems.

[22] Reuters (March 28 2011) Russian arms exports are expected to stay at records levels of around $10 billion a year. http://www.cast.ru/eng/comments/?id=412; Reuters (February 26 2010) Russia arms exports thrive, output barely keeps up. http://www.cast.ru/eng/comments/?id=366

[23] Jane's Navy International (2010) Vietnam's purchase of Russian Kilos nearly doubles in price. http://www.cast.ru/eng/comments/?id=383

[24] Rubstov, Yuri. (April 2 2011) Russia remains 2nd world largest arms exporter [sic]. *Strategic Culture Foundation*. http://www.strategic-culture.org/news/2011/02/04/russia-remains-2-nd-world-largest-arms-exporter.html

[25] The International Institute for Strategic Studies (IISS) (2010). *The Military Balance 2010*. Routledge Journals, London, U.K. p. 219.

[26] Makienko, Konstantin. (2008) "Once the largest customer of Russian weapons, China is rapidly turning into a formidable rival in the arms market," *Russia & CIS Observer* 4(23). http://www.cast.ru/eng/comments/?id=329

[27] Grimmett, Richard F. (2009) Conventional Arms Transfers to Developing Nations, 2001-2008. p. 5. http://assets.opencrs.com/rpts/R40796_20090904.pdf

3.2 Weaknesses

Executive Control and the Dominance of State Industries

In many ways, the OPK of today resembles its Soviet-era forbearer despite repeated attempts at military and defence industrial reform. The first Putin administration sought to bring order to a partially deregulated defence complex that was seen as fractured and duplicative, possessing excess capacity in some areas and a total absence in others. The overall level of profitability and competitiveness was so poor, a series of bureaucratic and industrial consolidations came to be viewed as the optimal structure of the defence complex that would, first and foremost, reassert government control over the procurement-production process. To that end, the government created a unified procurement agency, accelerated integration of defence industries into vertical and horizontal holding companies under state control, and established a military-industrial commission (MIC). However, these reforms were motivated by political incentives rather than economic ones, and resulted in structural inefficiencies such as bureaucratic infighting and corruption, incapacity to meet production demands, and persistently low levels of innovation.

The establishment of a single, civilian-led procurement agency was thought to provide enhanced coordination of current and long-term programmes for the production of military equipment for domestic and foreign customers. It was placed under the control of the MIC in 2008 and was responsible for placing the defence orders of all "power" ministries, prepare and sign contracts and manage funding, monitoring and accounting. The central goal of this reform was to reduce corruption occurring between the "power" ministries, specifically the Ministry of Defence, and numerous individual procurement agencies which tended to channel procurement funds to dubious or ill-equipped enterprises. However, leadership of the procurement agency was given a former colleague of MIC-head Sergei Ivanov, both long-time allies of the ruling party. As well, the procurement agency is accountable to the MIC alone, and the MIC is directly accountable only to the Office of the President. The result of this bureaucratic arrangement is a further reduction in transparency and, therefore, an increasing likelihood of procurement-related corruption.

The creation of vertical and horizontal holding companies is highly reminiscent of the Soviet-era defence complex. These firms are assembled, based on end products and the profile technologies and components used in their construction. They are also required to produce high-technology civilian goods even though their production equipment is of Soviet vintage. The consolidation of approximately 1,000 state and partially state-owned firms into 40 holding companies is nearing completion given that the major defence sectors such as fixed-wing aircraft, rotary-wing aircraft, shipbuilding, space systems, land systems, and missiles and ammunition have already been formed. The goals of these consolidations are to eliminate duplication, cost overruns, corruption, wasteful investment activities and to meet domestic and foreign production orders. However, the performance of these firms in meeting export demands and long-past SAP goals is questionable. Rather, these holding firms are so large that top managers risk losing control over the myriad constituent firms they oversee, recreating the possibility of duplication and opening the door to large-scale inefficiencies and corruption. Financial transparency is not broadly applied because while

some individual firms within the holding companies produce financial reports, the holding companies themselves do not, meaning there is no way to judge the overall profitability and competitiveness of these firms.[28]

In 1999, the MIC was given broad powers to oversee the country's defence industry and associated civilian activity, yet stands outside the regular government and reports directly to the President. There exists no Parliamentary or public accountability mechanism to oversee the MIC. Furthermore, the MIC possesses the power, among others, to draft state defence orders before the Finance Ministry drafts a state budget. This gives the MIC undeniable priority and privilege in the budget and budget process. In total, over one-half of Russia's entire budget falls under the responsibility of the MIC.[29] Similarly, the MIC is becoming dominant in the civilian economy because defence enterprises within it are required to produce consumer products as well as military ones. Even so-called "national projects" like the multi-billion dollar nanotechnology investment programme are being administered by the MIC which implies that even civilian activities which have broad applicability are being removed from public access and accountability. Not surprisingly then, the MIC is viewed by the Russian government as the principal engine of economic modernization.[30] Such a statement is not so aloof when one considers that 75% of the country's research and development activity (including high-technology sectors) is carried out by the MIC and a further 50% of scientific output and scientific employment are housed under its auspices.[31] State funding for R&D enjoyed annual increases of 15-20% from 2003-2008, however through 2008-2009 the R&D budget declined a staggering 30% due in part to the economic crisis and the resulting budget strain.[32] The R&D component of federal spending stands at 1.03% of GDP which is well below the OECD average of 2.33%.[33]

Private sector R&D is generally low across the economy with exceptions found in the information technology, oil and gas, and chemicals sector. According to the OECD, business expenditures on R&D was a mere 0.7% of GDP compared to the OECD average of 1.6%. Industry-financed R&D was 0.3% of GDP compared to an OECD average of 1.5%.[34] Just 25% of all R&D financing comes from the private sector, with the rest coming from public sources (these proportions are reversed in advanced OECD states).[35] The principal cause

[28]CAST (2011).

[29]Mukhin, Vladimir. (2004). "One-Half of Budget Entrusted to Sergei Ivanov: Defense Ministry Becomes Key Department", *Nezavisimaya Gazeta*, March 11, 2004.

[30] McDermott, R.N. (May 17 2011). Russia defense ministry creates new military science council. *Eurasia Daily Monitor* 8(95). http://www.jamestown.org/single/?no_cache=1&tx_ttnews[tt_news]=37936

[31]Blank, S.J. (2007). The Political Economy of the Russian Defence Sector. In *Russian Power Structures*, Leijonhielm, J. and Fredrik Westerlund (eds.) FOI, Swedish Defence Research Agency, Stockholm. pp. 98, 107.

[32]Organisation for Economic Cooperation and Development (OECD). Reviews of Innovation Policy: Russian Federation. (June 2011). p. 198.

[33]Ibid., p. 101. Russian figures are from 2008.

[34]"Science and Innovation: Country Notes - Russian Federation", *OECD SCIENCE, TECHNOLOGY AND INDUSTRY OUTLOOK*, 2010. p. 214.

[35]OECD, "Main Science and Technology Indicators", Volume 2011/2. p. 18. Available at: http://www.pdfdownload.org/pdf2html/pdf2html.php?url=http%3A%2F%2Fwww.oecd.org%2Fdataoecd%2F27%2F52%2F47406944.pdf\&images=yes

of this low level of private sector R&D is a lack of tax incentives.[36] For much of the past decade, the Russian government provided no specific R&D tax provisions. In fact, federal tax law stipulated that "unsuccessful" R&D activities could only be deducted from business income at a rate of 70% of their total cost.[37] This clearly discourages companies from spending on R&D and creates wasteful legal disputes regarding what constitutes successful or unsuccessul R&D.

Resources for Long Term Investments in Defence Industrial Modernization

Both Russian and non-Russian analysts often cite the decrepit state of industrial infrastructure and production equipment as a major weakness of the OPK. According to Russian military analyst Vladimir Dvorkin, one-third of defence enterprises are effectively bankrupt, investments in R&D are ten times lower than in developed countries, investment in basic capital and personnel training is five times lower than in developed countries, fixed capital asset formation at the OPK enterprises are two to three times lower than in developed countries, 70% of technologies supporting production demands are worn out or obsolete and more than half the machine tool inventory is 100% worn out.[38] These statistics coupled with the economic climate of 2008-2009 exposed the lack of commercial viability of defence-related enterprises. An attempt to partly address these problems arose in 2006 when a joint government-industry programme invested $1.1 billion in the OPK. However these funds were insufficient to resolve all of the OPK's problems.

In 2009, at the height of the economic crisis, the government authorized an emergency state support package of $5.4 billion to relieve a "cash shortage" in the OPK and to keep its military reform programmes on track.[39] Included in the package were measures to increase advanced payments from the state to defence suppliers, the provision of state guarantees for loans, the subsidization of interest payments, equity for finance swaps and bankruptcy protection. Paradoxically, the largest recipients of this aid were defence giants *Rostekhnologii* (which includes *Rosoboronexport*) and the United Aircraft Corporation (which includes Sukhoi) who were supposed to have been the country's most competitive defence firms.

[36]Russia registers a negative value in the so-called B-Index (this figure is positive for OECD average which means there is an economic incentive to invest in R&D). The B-Index measures the generosity of tax incentives to invest in R&D, on the basis of the pre-tax income necessary to cover the initial cost of one dollar R&D spending and pay corporate taxes on one dollar of profit. A value of zero would mean that the tax concession for R&D spending is just sufficient to offset the impact of the corporate tax rate. "Country Notes - Russian Federation", *Economic Policy Reforms: Going for Growth*, OECD, 2011, p. 133. Available at: http://www.pdfdownload.org/pdf2html/view_online.php?url=http%3A%2F%2Fwww.oecd.org%2Fdataoecd%2F26%2F16%2F47471808.pdf For data analysis, see: http://dx.doi.org/10.1787/888932374198

[37]Gijsbers, Govert and Johannes Roseboom (eds.) "The Russian Innovation System in International Perspective: A Critical Analysis", *Science and Technology Commercialization Project*, 2006. p. 40. Available at: http://www.tno.nl/downloads/Russian%20Innovation%20System%20in%20International%20Perspective.pdf

[38]Quotation taken from Vladimir Dvorkin, nuclear security expert with the Carnegie Endowmnent for International Peace, Moscow. March 2, 2011. Available at http://russiandefpolicy.wordpress.com/tag/vladimir-dvorkin/

[39]Russian Federation - Defence Industry. (2011) *Jane's World Defence Industry*; Defence Production and R&D - Russia and the CIS. (2011) *Jane's Sentinel Security Assessment*.

But in fact, by August 2009, Sukhoi revealed that it would have had to default on $3.7 billion worth of debt had it not been for the government package.[40] At the time, increased government control of the OPK was the only course of action open to the government as financing arrangements such as the issuance of shares and debt had to be delayed given the liquidity problems of Russia's financial sector (for example, the Russian stock market lost 75% of its value in the first five months of 2009). In 2007, Russian defence think-tank LADE (League of Assistance to Defence Enterprises) estimated that Russia needed to spend $5.3 billion per year to retool and modernize the OPK while government figures estimated nearly $20 billion would have been required (with the OPK itself picking up nearly $8 billion of that total).[41] As recently as March 2011, the government claimed it would be investing $100 billion in the OPK through 2021. However, like SAP-2020, this hardly seems a credible figure as it would equate to 0.5% of Russia's GDP per year and would come on top of current spending plans which have a heavy bias toward procurement (as opposed to R&D and infrastructure).[42]

Finding alternative sources of capital for the OPK is an exceedingly difficult challenge. For the purposes of the OPK's modernization, allowing increased foreign direct investment would bring in billions of foreign dollars; however, the government consistently demonstrates a preference to retain control over its defence firms allowing only the most high profile foreign firms to own only minor stakes in their Russian counterparts. Independent sources of domestic capital are practically non-existent; financial-industrial conglomerates like *Rosneftbank* and *Gazprombank* are effectively arms of the state and offer financing only when ordered to, as in the 2009 bail-out package. Unlicensed third-party production of Russia-built weapon systems results in lost sales of $6 billion per year according to *Rosoboronexport*.[43]

Russia's overall inflation rate, which has averaged around 12% over the last ten years, is another source of financial loss to the OPK. As a result of high inflation, the large nominal increases in defence spending by Russia over the last ten years have translated into relatively small *real* increases in the defence budget. In addition, Russia may also be afflicted by the phenomenon of defence-specific inflation, a rate of increase in the price of military equipment that surpasses the rate of inflation of the civilian economy. A number of reasons have been identified for defence-specific inflation in countries such as the United Kingdom.[44] It would be reasonable to assume that similar factors are behind the increasing prices of the Russian military products and the failure to complete state defence orders. In July 2011, Defense Minister Serdyukov told journalists that his ministry failed to conclude

[40] Ibid.

[41] Anderson, Guy. "Aspirations and Feasibility: Can Russia's Defence Industrial Base meet Moscow's Objectives of re-armament by 2025?", *Jane's Defence Weekly*, October, 2007.

[42] Asian Defence News (March 26, 2011). Russia will inject USD100 billion investment in defence industries [sic].

[43] Russian Federation - Defence Industry. (2011) *Jane's World Defence Industry*; Defence Production and R&D - Russia and the CIS. (2011) *Jane's Sentinel Security Assessment*.

[44] Kirkpatrick, D. (October 2008). Is defence inflation really as high as claimed? *Royal United Services Institute (RUSI) Defence Systems*; Kirkpatrick, D. (June 2009) Defence Inflation: Reality or Myth. *Royal United Services Institute (RUSI) Defence Systems*.

around 18% of contracts ($3.9 billion) in the total 2011 state defence order ($20.7 billion), due to soaring prices for military products.[45] The growth of military product prices also comes from the firms themselves. Many seek to "hedge their bets" against the Ministry of Defense which is often accused of not paying in full or on time on defence contracts already signed. As Russia seeks to procure ever more sophisticated systems, the cost of military products will become an increasingly acute problem.

Lastly, the problem of rampant corruption and criminality in the Russian Armed Forces and the OPK is a major source of lost financing. Estimates vary, but even Russian officials suggest 20% of the defence budget is stolen by corrupt officials and contractors.[46]

Skills Deficit

Russia faces significant challenges in terms of the composition and productivity of its labour force. Between 1990 and 2005 the OPK suffered a massive "brain-drain" where a total of 200,000 scientists and industrial specialists either moved abroad or into different sectors of the economy which amounted to a halving of the Russian scientific community.[47] The average age of the defence industry labour force is 50 and workers become eligible for retirement at 60.[48] In the R&D community the figures are even more stark, as one-quarter of researchers are 60 years of age, or older. The reasons for this are well-known: relatively low salaries, antiquated research facilities and equipment, too few resources to fund research and better employment opportunities in other parts of the economy and overseas.[49] Few technical-college graduates are in a hurry to join the defence industry because of low wages and insufficient career opportunities. Moreover, there is extreme internal and external competition for high-end professionals like scientists, engineers and computer programmers. For these professionals, wages in the defence industry are lower than in the banking or energy sectors. Also, the government has long ceased to build employee housing which had been a historical perk for workers.

This has produced a gap between those with "know how" and the junior workers who are coming in to replace them. For example, in order to become highly qualified in the missile, aircraft or ammunition sectors, one would need to have worked for at least 10 to 12 years. The younger workers employed or considering employment in the defence industry do not have the time needed to absorb the expertise of their senior colleagues. The failure to recruit and retain qualified personnel coupled with a lack of up-to-date production equipment (outdated machine tools are estimated to represent 90% of the equipment in some sectors) [50] will inevitably impair product quality.

[45] RIA Novosti (July 26 2011) Russia needs a military-industrial complex. http://en.rian.ru/analysis/20110726/165403085.html

[46] Financial Times (May 24 2011) Russian military budget sapped by corruption. http://cachef.ft.com/cms/s/0/961668be-8628-11e0-9e2c-00144feabdc0.html#axzz1dQyRVEd9

[47] Russian Federation - Defence Industry. (2011) *Jane's World Defence Industry*; Defence Production and R&D - Russia and the CIS. (2011) *Jane's Sentinel Security Assessment*.

[48] Quotation taken from Vladimir Dvorkin. Available at http://russiandefpolicy.wordpress.com/tag/gpv/

[49] OECD, p. 171.

[50] McDermott, R.N. (May 24 2011). The Generational Crisis in Russia's Defense Industry. *Eurasia Daily*

In the context of these labour force dynamics, it is not surprising that Russia's labour productivity is around 26% of the U.S. level.[51] That is an improvement compared to 10 years ago, when McKinsey estimated Russian productivity at 18% that of the U.S., however widespread inefficiencies remain. For example, it takes three times as many workers to produce a ton of steel in Russia as it does in the U.S. In shipbuilding, labour productivity at Russian yards was 3 to 5 times lower than in other countries, and Russian yards took from 2 to 2.5 times longer to build similar ships.[52] Russia's productivity looks bad even in comparison with other emerging markets. In 2007, the World Bank estimated that revenues per worker in Russia were only around $7,000 per head per year which is around 20% lower than in India, and 40% lower than in China. Improvements to the OPK's productivity are further imperiled by the short production runs of firms fulfilling state procurement orders. In these cases, serial production "learning" cannot take place which deprives the OPK of the benefits of decreasing marginal production costs.

3.3 Opportunities

Meeting Strong Domestic and External Demand

Russia has taken major steps in the past decade to consolidate the defence industry and its control over it. Continuing to link military reform (ends) with the restructuring of the OPK (means) will improve the efficiency and effectiveness of Russian military expenditures. The creation of vertical holding companies in various industrial sectors has the potential to create internationally competitive national champions in the fighter aircraft and missile markets. With enough serial production, economies of scales can be achieved and production "learning" can take place thereby increasing the efficiency with which domestic producers operate. This would not only enhance the economic viability of the OPK but would produce spill-over effects into the broader economy such as commercial spin-offs, enhanced management proficiency and significant productivity gains.

However, this scenario hinges on obtaining large contracts (in terms of both volume and value) at home and winning them abroad. Russian leaders have stated repeatedly that modernization of the armed forces is a top priority and is the focus of SAP 2020 (the often quoted objective is to have 70% of the forces' equipment modern in 2020).[53] Therefore, assuming Russia maintains its high degree of defence production autarky and continues to grow the defence budget in at least nominal terms, the 2020 modernization drive will present the OPK with its most lucrative business opportunity in Russia's post-Cold War history. The other half of the coin, winning contracts abroad, is a Russian specialty owing to its many comparative advantages (see the arms exports discussion in section 3.1). The Soviet-era arms market is worth hundreds of billions of dollars spread across dozens

Monitor 8(100).

[51] McKinsey Global Institute (April 2009). Lean Russia: Sustaining economic growth through improved productivity.

[52] "Russian Shipbuilding Agency". *GlobalSecurity.org.*

[53] The Military Balance 2010, p. 213

of countries, meaning there is less of an urgency to win "contracts of the century" [54] [55] (essentially "must win" contracts upon which the future viability of an entire industry may rest). At home and abroad, then, there exists the opportunity to obtain large contracts which could make OPK an economic and technological success.

Joint Ventures and International Collaboration

Russia's historical preference for defence production autarky implies significant implicit and explicit costs which include but are not limited to: less than state-of-the-art technology levels, slow technological diffusion and adoption, unsophisticated management practices, and high thresholds to achieve the "minimum efficient scale" of production. Conversely, any moderation of this tenet of defence policy will provide the OPK with opportunities to regain lost ground in each of these areas. In fact, recent government decisions to purchase select foreign weapon systems and to co-produce others suggest a willingness to open up, however slightly, to the globalized defence market. However, it is exceedingly likely that foreign cooperation is an attempt to both "gap fill" capability deficiencies in their armed forces and pressure the MIC to fight corruption and lower their prices. Some of the more noteworthy foreign purchases and co-production agreements include: French-built Mistral assault ships [56], Israeli-built unmanned aerial vehicles (UAVs) [57], Italian-built armored vehicles [58] and helicopters [59], and cooperation with India on the BrahMos missile family [60], medium range transport aircraft [61] and the PAK FA/T-50 fighter aircraft [62].

If the trend toward greater international cooperation continues, the OPK should realize a net benefit: technology transfer and production efficiency gains (diffuse benefits) should compensate the OPK for the loss of several multi-billion dollar procurements (concentrated losses). Even greater benefits should accrue to the OPK if it can expand its role in the global supply chain of western aerospace firms beyond the few widely published initial agreements

[54] Defense News (April 29 2011). India Rejects Russia's Fighter Jet Bid. http://www.defensenews.com/story.php?i=6371119

[55] RIA Novosti (October 10 2011) Russia loses $600 mln Indian attack helicopter tender. http://en.ria.ru/world/20111025/168096811.html

[56] Defense News (September 21 2010) Russia Agrees to Buy France's Mistral Ship: Report. http://www.defensenews.com/story.php?i=4785980

[57] Flightglobal (May 24 2011) First Glimpse of Searcher II UAS. http://www.flightglobal.com/news/articles/picture-first-glimpse-of-russian-searcher-ii-uas-357110/

[58] Defense News (December 6 2010) Italian Armored vehicle to be built in Russia. http://www.defensenews.com/story.php?i=5176957

[59] Defense News (January 31 2011) Russia picks Italy's Lynx over domestic Tigr. http://www.defensenews.com/story.php?i=5579794

[60] Aviation Week (May 27 2010) Hypersonic BrahMos Missile Ready for testing by 2015: CEO. http://www.aviationweek.com/aw/blogs/defense/index.jsp?plckController=Blog&plckScript=blogScript&plckElementId=blogDest&plckBlogPage=BlogViewPost&plckPostId=Blog%3A27ec4a53-dcc8-42d0-bd3a-01329aef79a7Post%3Af09651dc-a95d-4230-b87a-34f27288d46c

[61] Defense Industry Daily (September 12 2010) MRTA: Hal and Irkut's Joint Tactical Transport Project. http://www.defenseindustrydaily.com/hal-and-irkuts-joint-tactical-transport-project-02931/

[62] Defense Industry Daily (September 8 2011) PAK FA: India, Russia Cooperating re: 5th generation fighter. http://www.defenseindustrydaily.com/india-russia-in-negotiations-re-nextgeneration-fighter-03133/#readings

such as EADS-Irkut, Finmeccanica-Oboronprom, and Boeing-UAC. Thus far, however, the government has permitted foreign companies to own minor stakes in their Russian counterparts. To realize the full benefits of co-production and supply chain integration, Russia will have to come to terms with the essential paradox of its defence autarky policy: the desire to maintain control over "strategic" defence technologies and enterprises and the need to attract foreign direct investment (FDI) to finance new business opportunities and areas of scientific research.

Regional and Global Economic Integration

Under-appreciated in their potential benefit to the OPK are two international trade issues: Russia's bid to join the World Trade Organization (WTO) and the requirement for Russian exports to meet new European Union certification and examination standards. Reports that Russia's long-awaited ascension to the WTO is imminent [63] imply a moderation of its import substitution strategy in the near future. As is often the case with geographically large, developing states, the preference to impose quotas and levies on foreign imports as an economic development strategy results in the opposite intended effect. Allowing Russia's inefficient and outdated industries to either compete or fail will free up financial and human capital resources for more productive ventures (which include certain sectors of the OPK). Similarly, new European Union (EU) regulations governing, for example, chemical production and carbon emissions will force Russian exporters to raise the quality of their goods or risk being shut out of the world's single largest market. Although Russia tends to see these regulatory developments as being a form of EU protectionism, it will nevertheless necessitate greater expenditures on research, development, testing and evaluation among Russia's exporters. Most importantly, both venues will give Russia a chance to integrate its companies into the global supply chains of large multinational firms.

Industrial intelligence gathering

Few analysts doubt that Russia possesses the tools required for extensive collection of S&T intelligence abroad. Such activities could lead to enhanced technological sophistication and could be said to represent a potential "opportunity" from the point of view of Russian defence industries. However, an underdeveloped industrial infrastructure and lack of a satisfactory business and innovation climate dilutes the benefits of a successful transfer of know-how from Russian intelligence services, regardless of their efficiency.[64]

3.4 Threats

Closed Markets and Protectionism

In 2008, Russia's foreign economic policy took a protectionist turn as a result of the war with Georgia. Russia suspended its WTO membership talks (they have since restarted) and

[63] BBC (October 30, 2011) Russia closing on WTO membership. http://www.bbc.co.uk/news/business-15513406

[64] Westerlund, Fredrik. (April 2010) "Russian Intelligence Gathering for Domestic R&D - Short Cut or Dead End for Modernization", *Swedish Defence Research Agency*, FOI Memo 2126. Stockholm.

imposed sanctions on countries who sold arms to Georgia including Turkey, Ukraine and the United States. As the effects of the global financial crisis began to be felt in Russia, the government imposed a a variety of export tariffs on sectors which, ironically, stood to benefit the most from liberalization such as the chemicals and metals sectors.[65] This last move was especially troubling because as global demand for commodities decreased, market access for Russian exporters fell in lock-step. Although market access was not a problem prior to the global financial crisis, thanks to strong global demand, these restrictive policies aimed at curbing exports had negative effects on Russian producers who were shut out of foreign market at the same time as world prices for commodities began to fall.

The Russian economy remains in a state of transition. If trade and capital liberalization reforms are rolled back in favor of domestic production (import substitution) and self-financing, the amount of resources available to the OPK and the broader R&D community will decrease. Broadly applied protectionist policies such as those described above will deprive the Russian economy of inexpensive high quality imports, reduce the rate of technology transfer, increase the cost of borrowing and the rate of inflation, lower returns on investments (ROI) across all industries and diminish any innovation activity that may be occurring within the business community.

Single Source Reliance on Energy

Russia remains reliant on commodities exports as its main source of government income. Although the price of oil and other commodities have regained some ground since their 2008 lows, at present the world is enduring its fourth year of the global economic crisis with few signs of growth on the horizon. From 2007 to 2011, government spending increased and low world prices pushed the fiscal budget break-even price of oil from $60 to $120 per barrel.[66] Moreover, the capital intensity (costs of inputs, i.e., specialized equipment, electricity, and transportation) of oil and gas exploration, production and distribution is increasing significantly as Russia's domestic producers look further afield (to the Arctic and non-traditional forms of oil) to compensate for production declines in the oldest and richest fields of Siberia and Central Asia.[67] As the capital intensity of production increases, the return on investment (profitability) decreases, which discourages future investments and thus lowers future export volumes which, in turn, reduces government income.

Since the early 2000s, the price of oil has been an indirect enabler of Russian defence spending [68]; if faced with decreasing oil revenues, the government would have to make significant cuts to spending elsewhere in the budget (which could threaten domestic political support) or risk embarking on a prolonged period of deficit spending (which is not a popular

[65] Tarr, David G. and Natalya Volchkova (June 2010), "Foreign Economic Policy at a Crossroads", in *Russia after the Global Economic Crisis*, Aslund, A., Andrew Kuchins and Sergei Guriev (eds) *Peterson Institute for International Economics*, p. 204.

[66] RT (August 5 2011) Russia in the face of global economic volatility. http://rt.com/business/news/russia-economic-volatility-effect/

[67] Belousov, D., Sal'nikov, V., Apokin, A., & Frolov, I. (2008a). Technological modernization trends of leading branches of Russian industry. *Studies on Russian Economic Development*, 19(6). p. 570.

[68] Szrom, Charlie and Thomas Brugato. (February 22 2008) Liquid Courage. *The American*. http://www.american.com/archive/2008/february-02-08/liquid-courage

policy track given the experiences of the 1990s). Russia may choose to reduce nominal defence spending during this period by scrapping SAP 2020 in favor of a less ambitious procurement plan.

Changing Customer Profiles and Emerging Competitors

Only recently have the Russian Armed Forces overtaken the aggregate export market as the largest customer of the OPK.[69] Until recently, the OPK was oriented to serve the needs of export customers, principally China and India, but as early as 2007 it became apparent that the share of exports to China and India were declining significantly. In 2000, these two countries accounted for 70% of all Russian arms exports but by 2010 that share had fallen to 35%.[70] India has a stated aim of increased self-reliance, a willingness to "shop globally" and a desire to move from customer to partner when procuring internationally. China wants to move toward greater military technological sophistication and ultimately reduce its reliance on Russian products given the context of their regional rivalry. The flattening of arms sales to China and India is expected to be a permanent feature of the future arms export market. Some trade in weapons will continue, but the technological sophistication of the products to be traded will increasingly be of the high-end variety. For example, expected future sales to China could include high performance aircraft engines, aerial refueling tankers, aircraft for intelligence, surveillance and reconnaissance (ISR) and target detection, and strategic bombers.[71] India will be a buyer and co-producer of several systems including the PAK-FA/T-50 fighter, major surface and sub-surface combatants, transport aircraft, advanced air-defence systems (including non-lethal microwave-beam weapons that can counteract the proposed US missile-defence shield).[72]

The move toward the export of high-end systems poses several problems for Russia. On the one hand, higher-end systems demand higher prices; on the other hand, selling top line systems means giving competitors technological secrets that were developed at tremendous cost. For example, after the U.S. arms embargo was lifted in 2001, the potential for U.S.-Russian competition in the India defence market led Russia to offer a plethora of high-profile, decade-long commitments to sell and co-produce a variety of high-end systems with India. The gamble worked, as today India remains heavily reliant upon Russian-sourced weapon systems. However, India's indigenous production could develop rapidly given its co-production experience and greater access to technologically advanced systems and weapons due to emerging US interests in the region. In 10 to 20 years, India is expected to be capable of manufacturing its own weapons thereby undermining Russia's position.

This scenario is already playing out regarding China. By the middle of the last decade, a strong consensus began to emerge among Russian defence planners that "the Chinese conventional potential exceeds that of the Russian Federation and in case of a conventional military conflict with China, Russia is bound to lose".[73] It was also increasingly recog-

[69] CAST (2011).
[70] Ibid.
[71] Annual Report to Congress: Military Power of the People's Republic of China 2006 (May 2006). p. 2.
[72] Cameron, pp. 82-85.
[73] Shoumikhin, Andrei. (2011) "Guns and Butter", *The Journal of International Security Affairs*,

nized that those transfers were helping turn China into Russia's competitor in arms markets that were traditionally havens for Russian exports. The expert recommendations to the Russian government were clear: refrain from selling the most advanced military technologies to Beijing for fear of reducing the attractiveness of Russian weapons abroad, and to prevent arming a potential adversary. Recent evidence suggests Russia is sending China only weapon systems based on Soviet-era technology, and refuses to sell China its most advanced weapons.[74] In contrast, China has largely stopped buying complete weapon systems from Russia, primarily because the Chinese defence industry can now match Soviet-era technologies at lower prices.

Small Markets, Sanctions and Lost Sales

Russia's strategy of diversification to the "export triangle" of the Middle East, South East Asia and South America presents several risks owing principally to the size of these new markets. Unlike their large, established clients, purchases by new markets tend to be highly volatile because of their relatively small procurement budgets and susceptibility to "saturation". For example, a small country may wish to purchase a squadron of fighter aircraft which Russia will happily oblige. However, the sale will crowd out resources available for the purchase of other systems the country may require and which Russia can provide; as well, once a major sale is complete, that small country may not need to replace that portion of its inventory for decades. Both of these effects then produce a decrease of sales over the long-run. Moreover, Russia's divided focus between large and small export clients has resulted in some recent setbacks, most notably the rejection of the MiG-35 and MiG-28 for India's multi-role combat aircraft and combat helicopter competition.[75] [76]

Russia's tendency to sell arms to states with questionable democratic credentials and dubious human rights records leaves it acutely vulnerable to sanctions and arms embargo regimes imposed by the United Nations. For example, in 2010 the United Nations imposed a new round of sanctions on Iran; among the products forbidden by the embargo was the $100 million S-300 air defence system. Recent unrest in the Middle East has toppled or threatens to topple several governments that are longtime customers of the OPK. Recent statements from *Rosoboroneksport* suggest total lost sales to the Middle East could reach $10 billion [77], $4 billion of which was lost owing to the Libyan revolution. [78]

Spring/Summer, Vol 20. http://www.securityaffairs.org/issues/2011/20/shoumikhin.php

[74]Weitz, Richard. (April 2010) "Why China Snubs Russian Arms", *The Diplomat*.http://the-diplomat.com/2010/04/05/why-china-snubs-russian-arms/

[75]Defense News (April 29 2011). India Rejects Russia's Fighter Jet Bid. http://www.defensenews.com/story.php?i=6371119

[76]RIA Novosti (October 10 2011) Russia loses $600 mln Indian attack helicopter tender. http://en.ria.ru/world/20111025/168096811.html

[77]New York Times (March 4 2011) Unrest in Libya and the Middle East is Costing the Russian Arms Industry. http://www.nytimes.com/2011/03/05/world/europe/05russia.html?_r=1

[78]RT (September 8, 2011) $4 bln down the drain: Libyan rebels won't buy Russian arms http://rt.com/news/arms-russia-contracts-libya-099

4 Analysis by Industry and Sector

4.1 Aerospace Industry

Orbital Launch

The Russian aerospace industry includes civilian and military aircraft, carriers (rockets, missiles including launch platforms) and space satellites. Russia's space systems are well respected worldwide where they retain a particular strength in orbital launch as demonstrated by the use of the Proton rocket-Soyuz capsule system as the only well-tested launch system capable of transferring people and payloads to orbit since the retirement of the U.S. space shuttle fleet in 2011.[79] Although government spending on the space programme is relatively small compared to other space powers, $2.5 billion in 2009 [80], commercial launch contracts and collaboration with foreign firms provided a lifeline to the industry especially during the 1990s when funding shortages were particularly acute. The majority of the space industry remains under government control by way of the Russian Federal Space Agency (RKA) and two state-owned companies, Khrunichev State Research and Production Space Center, which produces spacecraft and space launch systems and TsSKB-Progress, which manufactures rockets. RKK Energiya which is majority owned by private shareholders is a prime-developer producing spacecraft and space station components and is also majority owner of Sea Launch.

Satellites

Russia also has a long history of producing space-based communications, earth-observation, and positioning, navigation and timing (PNT) satellites. Here, however, Russia is not as competitive internationally. For example, Russia's long awaited next generation PNT constellation GLONASS has experienced major delays throughout its development. Of 26 satellites currently in orbit, at least four are non-operational and another three were lost in last year's widely publicized launch failure.[81] Industry observers point to Russia's inferior production quality and high cost of GLONASS receivers as the primary impediment to greater competitiveness. Efforts to commercialize the system have been unsuccessful and a minimalist funding strategy means the system has been kept in operation, but the number of working satellites is rarely higher than ten thus providing insufficiently accurate PNT data.[82] Moreover, GLONASS faces intense competition in the global civilian PNT market given the dominant market position of the current U.S. GPS system, and forthcoming competition from Europe's GALILEO and China's COMPASS systems and the next generation

[79] However a series of public failures (5 in 2011) is leading some analysts to conclude that years of chronic underinvestment in Russia's space launch infrastructure is now manifesting itself in a steadily deteriorating performance record. http://www.space.com/14193-russia-phobos-grunt-space-failures-foul-play.html

[80] Crane, Keith and Arthur Usanov. (2010) "Role of High-Technology Industries", in *Russia after the Global Economic Crisis*. Aslund, A., Andrew Kuchins and Sergei Guriev (eds.) *Peterson Institute for International Economics*, Washington, D.C., p. 111

[81] BBC News (February 26 2011) Russia launches satellite for global navigation system. http://www.bbc.co.uk/news/world-europe-12587238

[82] Aruvian Research (2010) Analyzing the Russian Aerospace and Defence Industry. p. 69

U.S. GPS III system.

Civil Aviation

The aviation industry has survived the past two decades by maintaining its dominant position in the domestic market for civilian transport aircraft and by meeting the needs of military export clients. The civilian aircraft industry has not fared well since the collapse of the Soviet Union. Soviet-era civilian aircraft were not fuel efficient, lacked modern amenities and possessed inferior control and avionics systems.[83] Russia's United Aircraft Corporation (UAC) has since attempted to reenter the civilian market with new aircraft, the Sukhoi SuperJet for example, which is being developed with Italian and French partners providing mechanical control and power plant systems. This cooperation is indicative of Russia's weaknesses in engine fuel consumption, emission control and noise reduction.[84] Russia is attempting to close these gaps by cooperating with U.S. defence giants Pratt and Whitney and Boeing who will invest in Russia's aircraft engine turbine manufacturers (NPO Saturn) and construction materials group, respectively. Additionally, Russia's lack of modernized design and engineering processes such as computer-aided design (CAD) extends the time gap required to design and produce aircraft which therefore makes such products less competitive internationally. However, domestic opportunities abound given that Russia still maintains high VAT (value added tax) on foreign aircraft imports and approximately 80% of the entire civilian airline and cargo fleet of 3,800 aircraft and 2,000 helicopters will reach the end of their service life (i.e. 30 or more years in operation) by 2015.[85]

Military Aviation

Domestic orders for military aircraft are now increasing but for much of the post Cold War period the major military aircraft producers derived most of their financing from exports to former Soviet-allied states. Development of a 5th generation fighter (the T-50/PAK FA programme) and possibly a next-generation strategic bomber in the 2025 timeframe (PAK DA) are high priorities for Russia's state aviation holding firm, UAC. The firm is also developing a medium range transport aircraft, unmanned aerial vehicles and hypersonic vehicles. Little information exists in the public realm regarding the state of these technologies however one can make generalized inferences based on Russian co-operation with foreign firms and technology imports.[86] India is the only country co-operating with Russia on sophisticated weapon systems such as the PAK FA. This suggests that Russia is in need of Indian technological proficiency in aerospace electronics and information technology which would confirm analysts' suspicions of Russia's indigenous weaknesses in these areas.

[83] Crane and Usanov, p. 112

[84] Belousov et al., footnote p. 571.

[85] Frost and Sullivan. (2006) Country-Industry Forecast - The Russian Defense Industry. ch. 2, p. 2.

[86] Report on Technology Horizons: A Vision for Air Force Science & Technology During 2010-2030 Volume 1. (May 2010) *United States Air Force - Office of the Chief Scientist*. pp. 18-24. http://www.aviationweek.com/media/pdf/Check6/USAF_Technology_Horizons_report.pdf

Missiles

Russian missile capabilities are highly regarded worldwide with particular expertise regarding tactical and strategic ballistic missiles, cruise missiles, air-to-air and surface-to-air missiles.[87] Significant resources are to be expended in this sector with Russia planning to spend $70 billion (USD) by 2020 on its nuclear triad including: introduction of the new RS-24 road mobile ICBM (intercontinental ballistic missile) with multiple warheads (and an entirely new class of MIRVed (multiple independent re-entry vehicle) ICBMs by 2018), improvements to the Sineva SLBM (submarine launched ballistic missile), deployment of the new Bulava SLBM with ranges up to 9,000 km, and a new short-range ICBM to follow the Iskander system.[88] Development of new nuclear delivery systems is part of a modernization drive to reduce the size of the overall stockpile but enhance the sophistication of those weapons deployed. Russia will also be spending billions (USD) to increase the production capacity of the Votkinsk missile facility. Although there were numerous embarrassing test failures during the development of Bulava, the programme now seems well underway assuming its carrier, the new Borey-class SSBN, can be delivered on time.[89] State firms Tactical Missile Corporation and Almaz-Antey Air Defense Concern are dominant in this sector; in fact, Almaz-Antey is Russia's largest state owned defence firm with $4.4 billion (USD) in revenue in 2010 [90] which helped it to secure the 18th spot among the world's largest defence companies.[91]

4.2 Shipbuilding Industry

Today, the Russian shipbuilding industry is in dire circumstances. Among the armed services, it was probably the most neglected since the collapse of the Soviet Union. Russia has yet to launch one first-class surface ship since then which includes exports whose keels were laid in the 1980s. A crisis situation emerged by the mid 2000s such that by 2007, Russia formed the United Shipbuilding Corporation (USC) by consolidating 31 enterprises and their 80,000 employees. There have been few signs of improvement since; a widely published report by the *Independent Military Review* in 2009 alleged that the Russian navy was facing "irreversible collapse" due to the poor state of the industry which was characterized as being "incapable of producing warships in either the quantity or at the level of quality required".[92] A dearth of domestic orders sent USC searching for alternative sources of business. Some attempts have been made at civilian conversion given the enormous excess production capacity of Russian yards. However, USC production methods and equipment are so out of date that it costs three to four times more per ton to build a ship in Russia

[87] Ibid., p. 9.

[88] Kearns, Ian. (2011) "Beyond the United Kingdom: Trends in the Other Nuclear Armed States", *BASIC Trident Commission*. p. 4.

[89] Space Daily (June 28 2011) Russia test launches Bulava missile. http://www.spacedaily.com/reports/Russia_test_launches_Bulava_strategic_missile_999.html

[90] CAST (2011), p. 19.

[91] Defense News (April 11 2010) SIPRI Rankings Say BAE World's Biggest Weapons Firm. http://www.defensenews.com/story.php?i=4578461

[92] The Military Balance 2010, p. 218

than in South Korea.[93] The state Shipbuilding Development Strategy articulates some lofty goals such as a new generation of ice-breaking oil tankers and even floatable nuclear power stations, but production deficiencies and insufficient reliability in high-power gas turbine plants [94] will reduce the international demand for Russian ships. Evidence of this conversion effort is somewhat mixed however as USC still derives 70% of its revenues from state defence orders.[95]

The new SAP-2020 gives some priority to the Navy perhaps in recognition of the fact that the shipbuilding situation has nearly collapsed. Over the course of the SAP, 100 ships are to be procured with the strategic submarine force maintaining top priority. Financing for other projects, especially the large and expensive surface combatants is more uncertain and will be based on whatever funds remain after the submarine purchase. Included in the SAP is funding for the purchase of two French-built Mistral amphibious assault ships and the construction (in Russia) of two more. Clearly Russia feels its own industry is incapable of producing this class of ship at reasonable cost although the deal was nearly scuttled over technology transfer issues with particular focus on the Mistral's combat information control system which Russia insists be included.[96] Because the technology transfer arrangement was essential to the deal, one can confidently state that Russian naval technologies are not keeping pace with western rivals.

4.3 Information Communication Technology (ICT) Industry

Generally thought of as an area of Soviet weaknesses which, in turn, Russia inherited, the ICT sector is among Russia's fastest growing and most competitive industries. Substantial R&D investments coupled with a more favorable business climate (including special economics zones, tax incentives, and intellectual property accords) have successfully lured many of the world's leading ICT firms who seek to capitalize on Russia's tech-savvy professionals and comparatively low labour costs.[97] The industry's strength is derived from its young, entrepreneurial workforce, strong state support for R&D and infrastructure (through the Ministry of Communications and Mass Media), absence of legacy capital assets, and its small size - the government did not bother to regulate it, which would likely have hindered its growth. Consequently, ICT is one of Russia's most open industries. In 1999, labour productivity in ICT stood at 38% of the U.S. level [98], double the average of the ten other sectors studied, and higher than the 2008 economy-wide average of 26%.[99] Half of the industry's revenues of $5.5 billion are earned from exports which demonstrates the strong

[93] Karnazov, Vladimir. (2009) "Restructuring Russia's Entire Industry", *Asia Pacific Defence Reporter*, p. 32.

[94] Belousov et al., p. 372.

[95] CAST (2011), p. 19.

[96] McDermott, R. N. (2011). "Mist Hangs over Franco-Russian Mistral Deal", *Eurasia Daily Monitor* 8(90). http://global-security-news.com/2011/05/24/mist-hangs-over-franco-russian-mistral-deal/

[97] OECD, p. 77.

[98] Crane and Usanov, p. 101.

[99] McKinsey Global Institute (2009). Unfortunately, the ICT sector was dropped from the ten year follow-on study quoted from above.

international competitiveness of the sector.[100]

The strength of this sector enhanced Russia's growth rate and productivity over the past ten years however it is not clear to what extent ICT has been improved in the defence industrial sphere. In studies carried out by the OECD and IBM, slow technological diffusion and absorption were cited as the principal causes of technological backwardness in the Russian economy.[101] For example, Russia ranked 105th out of 134 countries in 2008 for firm-level technology absorption (i.e., the ability to absorb new technology), down from the 90th position in 2007. Russia's score on technical skills of the workforce reflects inconsistent computer literacy teaching in schools, with many older workers fearful of technology. As well, technically skilled professionals are available but at a high price, and technology training is available only for a fraction of the workforce. These trends are consistent with what is known about the pattern of work in the OPK, Russia's defence industries are deficient in ICT and thus seek foreign imports to fill capability gaps.

[100]Crane and Usanov, p. 101.

[101]Dirks, Suzanne and Mary Keeling. (2010). "Russia's Productivity Imperative: Leveraging Technology and Innovation to Drive Growth", *IBM Global Business Services*, p. 6; OECD, p. 76.

5 Conclusion

Russia's defence industrial base, like its Armed Forces, is undergoing an extended period of reform and rationalization. A significant increase in domestic defence spending, centered on the procurement of new and modernized equipment, is forcing the defence industrial base to produce products of a quality and quantity that it has not witnessed since the Cold War era. To facilitate the fulfillment of these production demands, the Russian government implemented a series of defence industrial reforms, the principal mechanism of which is the vertical and horizontal integration of firms who occupy the same production supply chain. Estimating the success of the reform programme based on recent defence industrial output is a difficult task at this early stage. Recently, the defence industry has witnessed some progress in terms of production volume and technological sophistication; however, these gains were based on Soviet-era industrial capacity and technology as opposed to being the result of new or modernized industrial processes and technology. The aggregate share of modernized industry to legacy industry is growing but output targets are not being met at the rate the government had anticipated (which can be approximated by looking at the degree to which past and present SAP objectives have been satisfied). Thus far, the various tactics employed by the government to modernize the defence industry are producing decidedly mixed results.

Owing to its inheritance of the vast majority of the Soviet defence industrial base, Russia retains a scientific and research and development base that is unequaled in the world, save for the United States. As a result, Russia retains a high degree of proficiency in the production of several Soviet-era weapon systems which are technologically sophisticated, incur low life cycle management costs, and have comparatively low "fly-away" costs. The result of these strengths is that Russian fighter aircraft, combat helicopters, land and air-defence systems are in high demand around the world and will continue to be relevant through the next two decades. The income derived from these exports has allowed Russia to develop a "next-generation" family of systems such as the T-50 fighter, Borey-class submarine and Bulava missile, and the S-400/500 air-defence system. Whether or not these systems truly possess next-generation capabilities will be a matter of debate until their actual combat environment capabilities can be accurately assessed.

The manner in which reform of the defence industrial base has been carried out, through industrial consolidations and greater government involvement, is highly reminiscent of the Soviet model. This "re-regulated" system is one optimized for executive control and mass weapons production and is thus at odds with the prevailing free-market approach long-since adopted by the developed world. In fact, control over vast industrial complexes like Russia's state owned enterprises is imperiled by the absence of competitiveness metrics, of which price signals are the most efficient for allocating resources. Instead of investing in qualitative, value-added pursuits which would build on existing comparative advantages, state firms and their managers will be incentivised to grow by volume, that is, by increasing production of *existing* products. Under this system, R&D risks becoming simply a "rhetorical" priority as spending on procurement will gradually crowd-out resources available for R&D and its related human capital needs. Revitalizing the S&T capacity with new financial

and personnel resources is necessary in order to avoid the inevitable erosion of S&T output (in terms of both quality and quantity) which results from long periods of underinvestment. Over the course of the current SAP, it should become clear whether the recent drop in defence R&D spending is a cyclical (temporary) anomaly or the start of a secular (structural) trend.

Russia's defence industry faces an enormous challenge if it is to avoid a further decline into "second-class" status. Traditional export "safe zones" such as India and China are unlikely to maintain their dependence on Russian built systems indefinitely. In fact, in a 10 to 20 year horizon, they will emerge as competitors to Russia in the international arms market, evidence of which is already apparent with respect to China. A shift toward smaller, emerging market customers is a shrewd strategy but presents risks and is unlikely to stem the inevitable drop-off in sales volume to the world's two largest arms importers. Adherence to a policy of defence production autarky will produce the same negative effects which result from import substitution policies: technology levels will be low and diffuse slowly, productivity will stagnate, and new areas of research will go unexplored. The nature of Russia's strategic partnerships with foreign firms is indicative of a minimalist approach which, in the end, will not capture the market efficiencies the government is hoping to acquire. Instead of regarding international collaboration and regional and global economic integration as opportunities to be exploited, Russia regards them as threats to be defended against. The paradox of control versus foreign direct investment will continue to bedevil the Russian government for the foreseeable future.

In the coming years, as the SAP production orders come due, the effects of a decade of defence industrial reform should become more readily apparent. Three metrics will be especially useful to assess whether the reform programme has been a success or failure. First, by analyzing the proportion of the SAP procurement objectives met, we can gain a sense of the defence industry's capacity for serial production of current and next-generation systems. Second, by analyzing export customer feedback and Russia's position among the world's top arms exporters, we can gain a sense of the quality of defence exports (i.e. whether they cut corners for export customers) and a rough estimate of industry-sector capacity utilization (i.e. the quantity of arms which could be redirected to the home market in a crisis). Finally, by monitoring the volume and type of defence equipment Russia imports, we can estimate whether the foreign import, gap-filler trend is either accelerating (implying a further deterioration of the defence industrial base) or reversing (implying improvement in the defence industrial base).

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List of abbreviations

ANU	Australia National University
ARP	Applied Research Programme
APC	Armoured personnel carrier
BAE	British Aerospace
BASIC	British American Security Information Council
BBC	British Broadcasting Corporation
bln	billion
BMP	Russian infantry combat vehicles
CAD	Computer-aided design
CAST	Centre for the Analysis of Strategies and Technologies
CEO	Chief Executive Officer
CIS	Commonwealth of Independent States
COMPASS	Chinese Satellite Navigation System
CORA	Centre for Operational Research and Analysis
CR	Contract Report
CRS	Congressional Research Services
CSA	Contract Scientific Authority
DND	Department of National Defence
DRDC	Defence Research and Development Canada
EADS	European Aeronautic Defence and Space Company
ERAP	External Research Associates Program (SSI)
EU	European Union
FDI	Foreign direct investment
FOI	Swedish Defence Research Agency
GALILEO	European Satellite Navigation System
GDP	Gross Domestic Product
GLONASS	Russian Satellite Navigation System
GNI	Gross National Income
GPS	Global positioning system
ICBM	Intercontinental ballistic missile
ICT	Information Communication Technology
IISS	International Institute of Strategic Studies
ISR	Intelligence, Surveillance and Reconnaissance
IT	Information Technology
LADE	League of Assistance to Defence Enterprises
MBT	Main battle tank
MGI	McKinsey Global Institute
Mi	Mil Moscow Helicopter Plant
MIC	Military-Industrial Commission
MiG	Mikoyan
MIRVed	Multiple independent re-entry vehicle
MIT	Massachusetts Institute of Technology

mln	million
MOD	Russian Ministry of Defence
MRTA	Multi-role Transport Aircraft
OECD	Organisation for Economic Cooperation and Development
OPK	Russian defence industrial complex
PAK FA	*Perspectivny Aviatsionny Kompleks Frontovoy Aviatsii* (Future Frontline Aircraft System)
PAK DA	*Perspektivny Aviatsionny Kompleks Dalney Aviatsyi* (Next generation strategic bomber)
PNT	Positioning, navigation and timing
PWGSC	Public Works and Government Services Canada
R&D	Research and Development
RKA	Russian Federal Space Agency
RMA	Revolution in military affairs
ROE	*Rosoboronexport*
ROI	Return on investment
RUSI	Royal United Services Institute
SAP	State Armament Programme
SAP-2020	State Armament Programme 2011-2020
SIPRI	Stockholm International Peace Research Institute
SLBM	Submarine-launched ballistic missile
SSBN	nuclear-powered, ballistic nuclear missile-carrying submarine
SSI	Strategic Studies Institute
S&T	Science and Technology
STOVL	Short Take Off Vertical Landing
Su	Sukhoi
SWOT	Strengths, Weaknesses, Opportunities and Threats
TVT	Thrust-Vector Technology
UAC	United Aircraft Corporation
UAV	Unmanned Aerial Vehicles
U.S.	United States of America
USC	United Shipbuilding Corporation
USD	U.S. dollar
USSR	Union of Soviet Socialist Republics
VAT	Value-added tax
WTO	World Trade Organisation

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After a decade of strong economic growth, the Russian government has embarked on a series of defence modernization programmes centered on the procurement of new and modernized equipment for all branches of the armed forces. Linked to these ambitious spending goals is a reform programme for investing in the modernization of the domestic defence industrial base which had been neglected during Russia's post-Soviet decade. This study employs a methodological approach known as SWOT (strengths, weaknesses, opportunities and threats) to provide a snapshot of current industrial base competitiveness as well as a framework to evaluate the impact of various endogenous and exogenous forces which affect the industrial environment. The study also provides an analysis of key defence industries and sectors, specifically the aerospace, shipbuilding, and information communications technology industries. The project is the second of a two-phase analysis of the Russian defence economy initiated by the Defence Economics Team of the Centre for Operational Research and Analysis.

Après une décennie de forte croissance économique en Russie, le gouvernement de ce pays a amorcé une série de programmes de modernisation du système de la défense axés sur l'acquisition de nouveau matériel moderne pour tous les services des forces armées. Ces dépenses considérables seront engagées notamment dans un programme de modernisation de l'infrastructure industrielle de défense nationale, négligée durant la décennie suivant la chute du régime soviétique. La méthodologie employée pour l'analyse est celle des forces, faiblesses, possibilités et menaces (FFPM), laquelle permet de donner un aperçu de la concurrence actuelle dans le domaine des infrastructures industrielles ainsi que d'établir le cadre d'évaluation de l'incidence des diverses forces endogènes et exogènes qui influent sur le contexte industriel. L'étude fournit aussi une analyse des principales industries de la défense, particulièrement celles de l'aérospatiale, de la construction navale et des technologies de l'information et des communications. Il s'agit du second rapport d'une analyse en deux volets de l'économie russe de la défense effectuée par l'équipe d'analyse de l'économie de la défense du Centre de recherche opérationnelle et d'analyse.

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