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**Study on R&D/R&T Contracting Policies in
Support of Small and Medium Sized
Enterprises**

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EXECUTIVE SUMMARY

- 1 The main objective of this study is to identify contracting policies that would be most effective in raising the participation of defence-related small and medium sized enterprises (SMEs) in R&D/R&T programmes and defence equipment development projects. In particular, the study is required to examine the following three contracting policies:
 - (a) incentivising SME participation in co-financed (government and industry) national R&D/R&T programmes;
 - (b) establishing a common requirement in national R&D/R&T contracts to integrate an SME when contracts exceed a certain threshold; and
 - (c) requiring or persuading primes and higher tier suppliers to open a percentage of their sub-contract business to SMEs and non-traditional suppliers.
- 2 This report applies both theoretical concepts and empirical evidence to identify contracting policies that will most effectively raise the participation of defence-related SMEs in R&D/R&T.

What can theory tell us about increasing SME participation?

- 3 Since the most effective policies are likely to be those that address market failures, it is important to understand what market features might limit SME involvement in R&D/R&T programmes.
- 4 SMEs lack both the economies of scale and scope to develop complete systems. Their role is largely focused on selling their knowledge to national authorities or larger downstream companies, either as research contractors or by developing sub-systems. Regrettably, markets in knowledge do not always work well.
- 5 A key problem associated with sub-contracting in R&D is the cost of conducting commercial transactions. The imprecise nature of research makes it very difficult to construct contracts between customers and suppliers. In economists' language, such contracts are likely to be "incomplete", in the sense that they cannot cater for all eventualities. The specificity of the assets that such contracts can involve and the hold-up problems associated with over-runs exacerbate this issue. As a general rule the benefits to be derived from buying-in rather than performing in-house are likely to be greatest when assets are general and there are economies of scale and scope. A transaction costs approach may explain why Primes might prefer to do much of their own R&D, rather than buying more of it from sub-contractors.
- 6 Incentive contracts, such as fixed price contracts, generally push Primes to seek lower-cost solutions, including sub-contracting to SMEs. However, fixed price contracts may be less effective in R&D. Such contracts transfer all the risk on to the company, and hold the largest payment until the end of the contract (and can ultimately be withheld). These



terms are particularly problematic for SMEs involved in R&D. The fact that the contractor under fixed price contracts bears the bulk of the risk can actually increase the incentives upon larger companies to conduct R&D in-house, where it is more easily monitored and managed.

- 7 There is also a problem of “appropriability” with the results of R&D. Patents are not particularly effective in defence industries. In civil markets, innovators that face weak patenting systems rely on speed-to-market and learning curves to exploit their inventions. Their ability to produce the product at lower unit cost than their imitators gives them a competitive advantage. This option, however, is not available when the product has a defence-specific function, because their markets are determined by Ministries of Defence and the scope to take the product to wider markets is limited.
- 8 These theoretical observations accurately predict some aspects of defence R&D. Although SMEs make important contributions to defence R&D, their share of defence work is quite modest. They are more likely to succeed as specialists than as “jobbing” R&D companies. Their market share is likely to be constrained by the high transaction costs in R&D markets and by problems in securing rewards from their ideas.
- 9 There are a variety of policy models that might be employed to address these issues. However, incentive- and rules-based requirements operate through very different mechanisms, each with their respective advantages and disadvantages. Incentives are generally less certain in their effects, but pose fewer economic risks. Rules-based approaches (e.g. requiring particular levels of SME participation in defence development contracts) would have greater certainty of effect, but would pose greater economic and technical risks.
- 10 Co-financing schemes, including co-operative arrangements and government-funded R&D competitions, provide one option. To determine how effective such initiatives might be it is important to understand the end result. An SME’s competitive advantage is most likely to lie at the research stage. The Prime has viable options in both development and production stages. It follows that, even if the SME succeeds in demonstrating its technology, its bargaining position at the end of the feasibility stage is likely to be weak - all the more so because of a lack of patent protection in defence technologies. If the SME cannot credibly present itself as a potential competitor at the production stage, it may have little motive to compete independently at the development stage
- 11 A key question for co-financing arrangements, therefore, is who owns the IPR. An applicant who owns the IPR is incentivised to engage in such programmes: at the procurement stage of the project (if there is one), it could bid independently, or in partnership with a Prime, or it could sell the IPR. If, on the other hand, the customer retains either the IPR or user rights, then, unless the financing covers 100 per cent of the costs, the applicant is likely to be only weakly incentivised to participate.
- 12 Policies aimed at requiring SME content would be effective in raising SME participation in a statistical sense. However, part of this effect might be a purely organisational response,



for example if Primes chose to comply by acquiring SMEs or by spinning off small subsidiaries. And would these policies reduce costs? If Primes are already incentivised to achieve value for money, under standard contracting arrangements that most national authorities employ, they would already be sub-contracting R&D to SMEs at an efficient level.

- 13 If larger companies are forced beyond the efficient level of sub-contracting, this may raise risk and thus cost. It may also weaken SMEs' incentives to reduce costs, and to grow beyond the upper SME size limit attached to any such policy. Those who expect that such a requirement would result in more innovative and cheaper defence systems would probably be disappointed.

Empirical evidence on the effectiveness of policies

- 14 Participating Member States have adopted a variety of policies, ranging from support for SMEs in general to support specifically for R&D by defence-related SMEs. However, only three Member States appear have adopted the latter approach in a determined fashion – France, the Netherlands and the UK. Unfortunately the majority of these policies have been introduced relatively recently so quantitative data on their impacts are limited. The empirical evidence was, therefore, gathered largely through meetings with representatives of SMEs, large Prime or Tier 1 defence companies, and the national defence authorities.
- 15 IPR ownership and user rights, and the delay between initial investment by an SME and seeing a return, represent key challenges for SMEs in defence. Consequently, technologies that offer greater scope for dual (defence/civil) use, for example security or information systems, offer the most attractive opportunities for defence-related SMEs to engage in R&D.
- 16 A lack of understanding about the national defence authorities' future capability requirements also limits the scope for SME involvement in defence R&D.
- 17 There appears to be some consensus across industry and with the national authorities, as to what effective policies should involve. Appropriately targeted co-financing initiatives, that address IPR and user rights issues, represent one important element. Access to finance is important for innovative SMEs. However, evidence from the EDA's Joint Investment Programme suggests that in the absence of strong restrictions on disclosure and the use of information by the customer, the incentives for SMEs to apply is likely to be driven by a desire to raise their profile or to gain access to restricted materials. Such schemes are unlikely to result in cutting edge technology. Evidence from the Centre for Defence Enterprise (CDE) suggests that when R&D involves defence-specific products or technology, co-financing is insufficient, and 100 per cent external financing is required.
- 18 In contrast, schemes such as the new RAPID programme in France, which focuses on dual-use technologies, offer a more promising model. R&D focused on dual-use technologies allows SMEs to supply a number of customers and thus more fully exploit



their investment. At the same time, the risk faced by larger companies is lower than when they are an SME's sole customer.

- 19 Rules-based policies may have a place, but they imply important costs. Though opinion is divided on the applicability of rules-based approaches, the message overall is that if such policies are employed at all they should be applied case by case, not applied blanket fashion to all procurement programmes. However, it was not merely larger companies that raised concerns about such initiatives. SMEs themselves, and a number of defence authorities, considered them to be an unattractive solution.
- 20 The potential costs of such policies are illustrated by the “Plan d’Acquisition” in France, where the contracts employed have had to be modified to include a bonus for Primes to include SMEs in the programme, and to allow the penalty for a delay to be reduced if the delay stems from the part of the work being undertaken by an SME. Such modifications effectively transfer the cost of employing additional SMEs from the Prime to the authorities.
- 21 Communication and transparency are considered a more effective solution. Because companies and national authorities require specific solutions to fit their strategic objectives, communication with suppliers is extremely important. Policy initiatives such as “les conférences de lancement” in France, that bring together industry within the context of a specific equipment programme, offer the opportunity for such communication to take place. Initiatives like this also help larger companies identify SMEs with relevant skills sets.
- 22 Seminars that facilitate communication between the authorities and innovative SMEs, for example the seminars held through the CDE in the UK and the annual R&T seminars in France run by the DGA, offer SMEs the opportunity to develop a clearer understanding of longer term capability requirements. The Small Business Innovation Research programme (SBIR) in the Netherlands, that provides themed calls for tenders also offers an interesting solution. Evidence from the “Pacte PME” initiative in France indicates that any scheme that brings industry together is constructive, especially when linked with actual projects.
- 23 Industry and the authorities also acknowledge the need for simplified procurement procedures and processes. Clear deadlines and time limits for responses to applications, as is done by the CDE in the UK and RAPID in France, play to the comparative advantage of SMEs, i.e. their agility and ability to respond quickly that makes them well placed to respond to Urgent Operational Requirements (UOR).

Conclusions and recommendations

- 24 Our recommendations are guided both by economic theory and by feedback from industry and defence authorities. We have not limited them to “contracting policies”. A clear distinction needs to be made between (a) policies designed to address market failure and to increase efficiency in the supply chain, and (b) policies aimed at increasing SME participation in R&D as an end in itself.



- 25 If policymakers are determined to achieve a “statistical” impact, rules-based policies are probably the most reliable instrument. Incentives and “softer” measures - such as those directed at greater better-informed defence markets – are inherently less reliable in increasing numbers in the short term. These options address the causes, not just the symptoms, of market failures, and are likely to be more effective in improving the functioning of the market in the long run.
- 26 However, there are potential significant costs associated with rules-based policies. Defence development projects pose enormous technical risks. Primes are more capable than SMEs of bearing them, and are rewarded for doing so. Forcing Primes to take on greater risk by requiring them to sub-contract to SMEs seems likely to raise costs. Knowing that they would be entitled to a guaranteed share of R&D contracts, SMEs would be less incentivised to bid keenly, and indeed to perform. While the intention of such policies might be to encourage the growth of SMEs, their effect might be the reverse. SMEs would be discouraged from growing beyond the upper SME size limit.
- 27 Our recommendations are as follows:
- (a) Be careful about co-financing programmes — co-financing programmes offer a useful means of increasing SME participation in R&D, but there is a need in defence for a clearer understanding of the economics of R&D. The incentives and opportunities for exploiting IPR are of central importance. Yet in defence these are limited: R&D should be funded 100 per cent by the authorities. Co-financing is workable only if there is a prospect of dual-use for the technology. The user rights should vary depending on the level of funding.
 - (b) Promote more and better information — our impression is that there are “market failures” in information in defence. To function effectively in defence, SMEs need to be able to comprehend the interaction between MoDs’ procurement priorities and the latest developments in a range of technologies, and to understand the capability requirements of potential customers. Initiatives such as conferences and seminars that enable this would therefore help improve SMEs involvement.
 - (c) Simplify procurement procedures — SMEs report that procurement procedures are often burdensome, and difficult to understand. Recent measures that have been taken to simplify co-financing have helped to facilitate SME involvement.
 - (d) Encourage capacity-building by defence-related trade associations — Trade associations help defence markets to function, and are particularly helpful to SMEs. Trade associations are poorly developed in the new Member States. Governments are well placed to encourage their development.
- 28 The prospects for implementing these recommendations are likely to vary between Member States depending on a number of factors, including cultural differences, the associated costs, as well as industrial and institutional structures.



1 INTRODUCTION

- 1.1 Most new firms begin as SMEs, and are often originators of new products and services. This observation is consistent with a “romantic” view of innovation, personified by Bill Gates developing software in a garage. This view motivates defence procurement policy in some countries.¹ It also has some academic support. Small firms have been found to be more efficient at conducting R&D. This is because they are in a position to structure contracts so as to reward performance more effectively than large firms are able to do. As a consequence, they may be better placed to attract and retain engineers with higher ability and skill, and induce higher levels of effort from them than do large firms.²
- 1.2 The prospect of harnessing more of SMEs’ innovative potential was the motivation for this study. Commissioned by the European Defence Agency (EDA), this study aims to identify contracting policies that would be most effective in raising the participation of defence-related SMEs in R&D/R&T programmes and defence equipment development projects.³ More specifically, the study aims to evaluate three contracting policies:
- (a) incentivising SME participation in co-financed (government and industry) national R&D/R&T programmes;
 - (b) establishing a common requirement in national R&D/R&T contracts to integrate an SME when bidding for contracts above a certain threshold value; and
 - (c) requiring or persuading primes and higher tier suppliers to open a percentage of their sub-contract business to SMEs and non-traditional suppliers.
- 1.3 Based on this analysis, the study offers recommendations on measures that national authorities might adopt, with the aim of increasing the participation of SMEs in defence R&D/R&T programmes, and defence development projects in general. The study also addresses the prospects that the recommended policies would be implemented by participating Member States (pMS).

Approach to the Study

- 1.4 There are a number of challenges that we faced in conducting the study. The overarching challenge, in policy questions of this kind, is analytical. If it is the case that

¹ For example: “SMEs are a dynamic and competitive supplier base. And that’s why, as far as I’m concerned, Defence has to be truly ‘SME friendly’. I’m confident that my recent decision to radically lower the threshold value for advertising MOD contracts will make a real difference in achieving that.” Speech by Minister for Defence Equipment and Support, Lord Drayson, at the Defence Manufacturers Association reception, 16 May 2007.

² Todd R. Zenger (1994), “Explaining Organisational Diseconomies of Scale in R&D: Agency Problems and the Allocation of Engineering Talent, Ideas and Effort by Firm Size”, *Management Science*, Vol.40, No. 6, June.

³ Since the study focuses on policies to increase SMEs’ participation in R&D/R&T in defence, it covers the R&D stages of defence equipment programmes, but not their production. The production element of the project has only been considered in so far as SMEs’ inability to bring a product to market potentially acts as barrier to accessing R&D projects.



innovative SMEs have only a modest involvement in defence, this could be due to a number of possible reasons, including:

- (a) a contingent lack of competitiveness on their part (i.e. it just happens to be that many of the SMEs in this market are not competitive);
- (b) particular features of the defence market make it difficult for firms below some threshold size to be competitive; or
- (c) some kind of market failure.

1.5 The second possibility does not necessarily imply a market failure. Two large firms, with no possibility of new entry by a small player, might suffice to deliver a competitive/contestable market. SMEs have no “innate right” to be part of a market solution. If a market failure is identified, however, an important question arises as to whether the contracting policies would address it successfully, and whether they would be the most effective policies available.

1.6 There are also a number of practical challenges; in particular, there is very limited data available on defence-related SMEs, in general, and on their involvement in R&D contracts more specifically. Official data exist on the expenditure of all enterprises on R&D, according to their size, and by their broad industry groupings; but the expenditures by SMEs on R&D are not usually disaggregated by industry. In addition, the definition of “SME” itself varies across countries and by data source. Nor do the data disaggregate between the research and development phases of the total R&D process.

1.7 Assessing the effectiveness of alternative contracting policies is also made difficult because of the generally limited experience of their adoption, in defence and in other industries. An understanding of the main factors preventing or limiting SMEs’ involvement in R&D/R&T contracts, and stakeholder feedback (which may not always be forthcoming), are therefore crucial in judging the potential effectiveness of different policies.

1.8 Our approach was developed with these challenges in mind. To conduct the study we used a combination of desk-based research, interviews and a workshop.

Desk-based research

1.9 The first stage of the study involved desk-based research to identify different policy options and the mechanisms through which they would influence SMEs’ involvement in R&D/R&T programmes, and to collect data on where such policies exist and the impacts they have had.

Engaging with stakeholders

1.10 Given the lack of data on the identified policies, engaging with directly stakeholders represented a core element of the work. This allowed us to gather feedback on both the reasons why SMEs may not currently be involved in R&D/R&T programmes and what



sorts of incentives and/or policies might be necessary to increase participation. There were four main elements to this process:

- (a) A survey conducted by the EDA of the pMS — the EDA conducted a survey across all 26 pMS to identify existing policies and the form they take.
- (b) A half-day workshop with Trade Association representatives from across pMS — a half-day workshop with representatives from relevant trade associations from across pMS was hosted at the Europe Economics office in London to discuss the issues facing innovative SMEs and the potential policy solutions. Representatives from Finland, France, the Netherlands, Sweden, and the UK attended, and representatives from Estonia and the Czech Republic who were unable to attend fed comments back in later discussions. Both oral and written contributions were also received from the Aerospace and Defence Industries Association of Europe (ASD).
- (c) A series of phone interviews with selected national defence authorities — conference calls were conducted with a number of pMS that had identified policies of interest in their countries as part of the EDA survey and that were happy to engage with us on these issues. Discussion on the effectiveness of these policies and the issues they face in their individual countries were held with representatives of the national defence authorities from France, the Netherlands, Portugal, Spain and the UK. For those countries that had replied to the EDA survey that we were unable to speak to we conducted further desk-based research into the policies identified.
- (d) Three interviews with Prime contractors — the final element of the stakeholder engagement process was three meetings with representatives from large downstream companies. This allowed a deeper understanding of how they decide whether to sub-contract R&D to SMEs, the issues they face in doing so, their views on the effectiveness of existing policies and their perspective on the three policy initiatives suggested by the EDA in the tender specifications.

Assessing the effectiveness of different policies

- 1.11 Having gathered the information on the different types of policies both from the desk-based research and through engaging with stakeholders, we then assessed the effectiveness of the different policies.

Recommendations

- 1.12 The final stage of the project involved developing our recommendations of which policies would be the most effective, including analysis of the likelihood of such policies being implemented in different pMS.

Structure of the Report

- 1.13 The rest of the report is structured as follows:



- (a) Chapter 2 — sets out a theoretical discussion of SMEs' involvement in R&D and the potential sources for market failure;
 - (b) Chapter 3 — discusses the economics of the various contracting policies and the mechanisms through which they may impact on participation;
 - (c) Chapter 4 — examines the effectiveness of these various policies, based on feedback from key stakeholders and any evidence from countries where such policies have been implemented;
 - (d) Chapter 5 — presents our recommendations based on the analysis in earlier chapters and discusses the scope for implementing such policies in different participating Member States.
- 1.14 A full list of existing policies within the individual pMS that responded to the EDA survey is included in the Appendix.



2 A THEORETICAL PERSPECTIVE ON SMES' INVOLVEMENT IN DEFENCE R&D

2.1 The limited public data available suggests that SMEs account for a smaller share of value added in the EU's defence equipment industries than they do in manufacturing as a whole. In the weapons and ammunition industry, for example, the average SME share of value added⁴ in the seven EU countries that provide data on this (15 per cent in 2006) was one-third as large as it was in manufacturing as a whole (45 per cent).⁵

Table 2.1: SMEs' share of value added in the weapons and ammunition industry (2006)

Country	Industry Total (€million)	Enterprises with more than 250 employees (€million)	SMEs (€million)	SMEs' share
Belgium	53	49	4	7%
Germany	1,050	920	130	13%
France	350	290	60	18%
Italy	420	280	140	34%
Portugal	120	100	10	12%
Sweden	280	220	60	21%
United Kingdom	1,750	1,450	210	12%
Weighted Average				15%

*Note: SMEs are defined here as enterprises with 1-249 employees. Value added is measured at factor cost.
Source: Eurostat, Structural Business Statistics, NACE DK296 – Manufacture of weapons and ammunition.*

2.2 The picture is even less favourable for SMEs in aerospace. This is a point that is sometimes obscured by data on SMEs' share of the total number of defence contracts awarded (e.g. about 50 per cent in the UK). The comparatively modest role played by SMEs in the supply of defence equipment is, in one sense, surprising, in view of the importance that is attached to it. Defence equipment is highly advanced, and depends on massive amounts of R&D. Compare, for example, the share of turnover devoted to R&D in the UK (2007 data):

- (a) Aerospace – 19%
- (b) Shipbuilding – 10%
- (c) Electronics – 9%

⁴ Value added is a national income accounting concept. It measures an industry's output – its contribution to gross domestic product (GDP).

⁵ And in the machinery and equipment sector within which the weapons and ammunition industry resides (NACE 29).

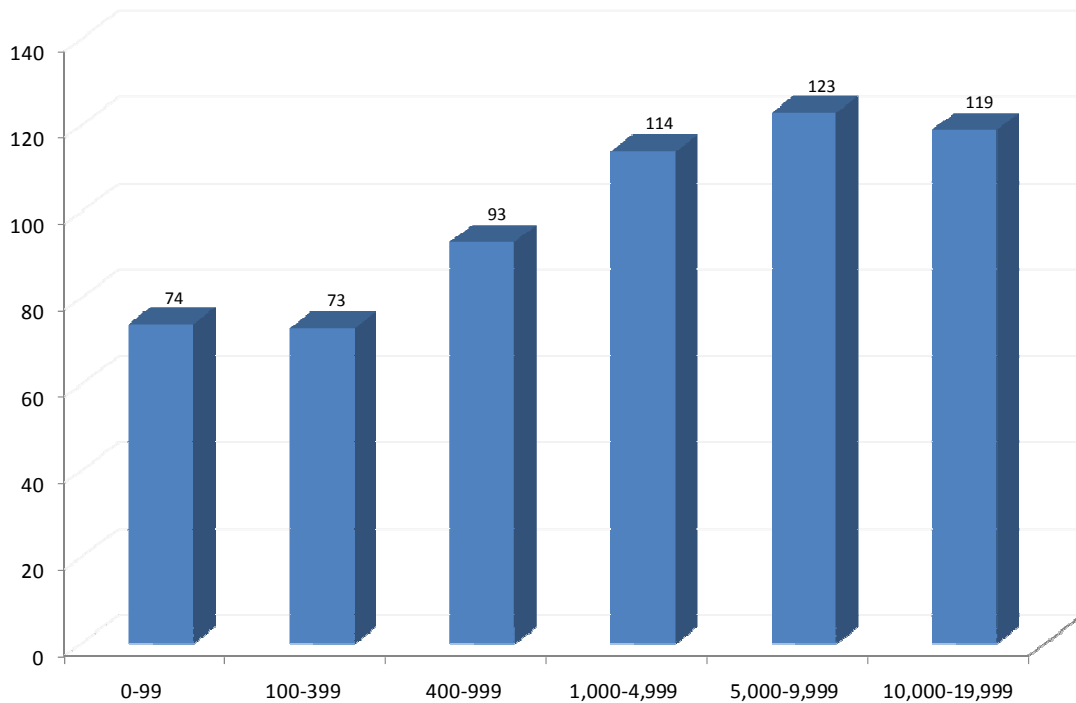


(d) Manufacturing – 4 %

2.3 The R&D-intensive nature of defence equipment might be expected to play to SMEs' strengths — the creativity and flexibility of small teams, managed and operating within less formal structures than those in larger organisations.

2.4 SMEs in general, however, do not appear to be particularly R&D-intensive. In the UK, for example, less than 15 per cent of the R&D performed in UK businesses in 2007 was accounted for by enterprises with less than 250 employees. In Germany, this figure was about 12 per cent in 2006 (see figure 4.1, at paragraph 4.75). SMEs' share of expenditure on R&D is significantly less than their 39 per cent share of the turnover in the UK manufacturing sector (which accounted for 75 per cent of business expenditure on R&D). According to the stricter, EU, definition of SMEs (less than 250 employees *and* independent of a larger enterprise group)⁶, less than four per cent of the R&D performed in UK businesses in 2007 was accounted for by SMEs. Smaller enterprises spend less per employee on R&D than larger enterprises.

Figure 2.1: R&D per employee in UK manufacturing enterprises by company size, 2007 (£ thousands)



Source: UK Office for National Statistics, *Research and Development Expenditure in UK Businesses, 2007*.

⁶ In the European Commission Recommendation (96/280/EC) of 3 April 1996.



- 2.5 One possible explanation is that SMEs are not, in fact, particularly competitive in R&D. There is, in fact, no presumption in the economics of Industrial Organisation – the branch of economics concerned with the way in which industries are organised, and how those organisational forms influence industries' performance, including their rate of innovation - that small enterprises are more innovative than larger ones. On the contrary, one the most enduring - and controversial - propositions in this field was Schumpeter's conjecture in 1942⁷ that large firms, with organised R&D departments, were the principal engines of technical progress. That view has been contested ever since, but not to the point that SMEs are now regarded as the engines of progress. One review of the vast empirical literature that subsequently developed on the relationship between firm size and innovation concluded that "its most notable feature is its inconclusiveness".⁸
- 2.6 A comparison of SMEs' share of value added in weapons and ammunition with their share in another public procurement dominated, R&D-intensive, manufacturing industry – the pharmaceuticals industry – offers further insight into this issue. Table 2.2 shows their share in the 16 Member States that reported this in 2006. The weighted average share was 16 per cent – about the same as in weapons and ammunition.

Table 2.2: SMEs' share of value added in 16 EU pharmaceutical industries, 2006

Country	Value Added (€Million)	SMEs' Share
Bulgaria	100	13%
Czech Republic	390	16%
Germany	14,240	10%
Ireland	2,440	36%
Greece	300	67%
Spain	3,560	25%
France	13,710	14%
Italy	6,470	27%
Lithuania	10	100%
Hungary	1,070	7%
Netherlands	1,410	20%
Austria	1,240	14%
Poland	1,090	22%
Portugal	380	78%
Romania	200	33%
United Kingdom	10,980	7%
Weighted average		16%

Notes: SMEs are defined here as enterprises with 1-249 employees. Value added is measured at factor cost.

Source: Eurostat, Structural Business Statistics, NACE DG244 – Manufacture of pharmaceuticals, medicinal chemicals and botanical products.

⁷ J.A. Schumpeter (1942), "Capitalism, socialism and democracy", New York: Harper.

⁸ W.M. Cohen and R.C. Levin (1998), "Innovation and Market Structure", in Handbook of Industrial Organisation, Vol. 2, Editors, Richard Schmalensee and Robert Willig, North Holland, Edition 5.



- 2.7 Here, it is useful to distinguish between the research and development phases of the total R&D process, and to consider whether defence-related SMEs sit more naturally in research, or in development. In the pharmaceutical industry, SMEs are adept at research, but often lack the resources to carry out the lengthy clinical trials that are necessary to secure clinical approval, and the marketing resources then to explain their products' clinical advantages to medical practitioners. In defence, the situation appears to be more nuanced.
- 2.8 This brief discussion raises an interesting question. If SMEs are so well suited to doing R&D (innovative, responsive), why is their share of value added in the EU's defence industries much lower than their share in manufacturing, when defence is an exceptionally R&D-intensive activity, which could be expected, for that reason, to play to SMEs' reputed strengths? It is important to understand the reasons for SMEs' surprisingly small share of defence-related activities, not out of academic curiosity, interesting as this is, but to establish the problems that policy remedies should seek to solve. Clearly, policies are likely to be more effective if they address those factors that limit SME participation in R&D/R&T programmes.

Possible Sources of Market Inefficiencies

- 2.9 It is difficult to trade knowledge, other than as a licence to use a patent. It is necessary to reveal knowledge in order to trade it, but the act of revealing it itself can give it away. This is part of the more general problem of "spillovers". Even with an effective patent system, the originators of knowledge have difficulty capturing all the commercial benefits that derive from their inventions; some of these benefits "spill over" to their competitors, via imitation. Thus, markets may not work particularly well here. Companies might therefore be expected to under-invest in research (compared with development, where property rights in ideas are more readily established and protected).⁹
- 2.10 The natural market for defence-related SMEs is the Primes: they have the resources to cope with the risks and the working capital requirements of major projects (to carry contractors through what is termed "Death Valley" – the period between completing development and receiving orders for production. Typically, costly defence-specific R&D (especially development work) is funded by Governments via some form of cost-based contract. Primes and SMEs are not competitors in production but they are competitors in research. Here, the distinction between research and development is useful in identifying the competitive advantage of SMEs. SMEs are more likely to be competitive in defence research whilst Primes will in general have a competitive advantage in the large-scale and costly development phase of the total R&D process.

⁹ Property rights in research markets are not uniquely vulnerable: the 'theft' of information about any valuable asset - motor cars, jewellery - cannot be eliminated at reasonable cost.



2.11 There are a number of possible explanations for the position of SMEs in defence markets:

- (a) Structural characteristics: economies of scale and learning are exceptionally important in defence equipment industries. Economies of scale apply to both R&D (especially to development) and production. There are also costs in separating basic research from costly defence development work, and there are possible links from development work to associated defence production as well as possible technical spill-overs from defence to civil markets (e.g. military engines applied to civil airliners) all of which favours large firms in defence work (Primes).
- (b) SMEs may offer lower-cost solutions, but the Primes might prefer their own. One looks to competitive markets to reveal least-cost solutions, but in defence, the mechanisms for revealing least-cost solutions are imperfect: it is in the nature of these highly specialised products that competition is often limited to two or three contenders, if that; and the customer does not have visibility of the contractor's costs.
- (c) Procurement preferences: national defence authorities (NDAs) choose to deal mainly with Primes. Dealing with a small number of well-established Primes, with reputations for completing contracts, are likely to involve lower transaction costs than dealing with large numbers of unknown and less reliable SMEs.
- (d) There are problems inherent in markets for R&D in general and in defence R&D more specifically. These include the possibility that it is difficult to draw up and monitor contracts for R&D, there are problems in raising finance for human capital investments (ideas are vested in individuals which cannot pledge themselves as collateral for loans), buying and selling R&D involve "high transaction costs", compared to, say, buying components or commodities, and that there can be a problem to do with the fact that inventors cannot secure all (or, indeed, much) of the benefits from their inventions.
- (e) In addition to these general problems affecting all R&D markets, there are some problems for defence-specific R&D. Here, defence-specific means R&D which has value to the defence sector only (it has no alternative use value). SMEs (and Primes) will be reluctant to invest substantial funds into R&D which has no alternative use value – i.e. it is required by only one customer (a national Government) and it requires an SME to risk much of its net assets in such a limited market (e.g. technology for nuclear-powered submarines where there is only one customer, requiring only small numbers).
- (f) Entry barriers could also be created by government. For example employing Article 296 and government restrictions on the advertising of defence contracts and on information about tenders.

2.12 In looking for policy solutions to these problems, it is worth asking whether the obstacles that prevent innovative SMEs becoming more involved in defence R&D projects lie on the demand-side (e.g. Primes tend to prefer their own ideas and to ignore those put forward



by SMEs) or, on the supply-side (e.g. SMEs lack the resources (finance, facilities) to develop complete sub-systems).

2.13 If the problem lies on the demand side, one remedy is that national procurement authorities should put more pressure on Primes to involve innovative SMEs. They could do this in two ways:

(a) By insisting that the Primes offer greater value for money, through their make/buy decisions, or by introducing incentive-type contracts for R&D work undertaken by Primes. For example, where Primes prefer their own ideas they might do so because they have received a cost-based R&D contract, which provides no incentive to seek lower-cost solutions (e.g. where lower-costs might require shifting some defence R&D to more competitive SMEs).

(b) By making it a condition that a percentage of the work be sub-contracted to SMEs.

2.14 If, on the other hand, the problem lies on the supply side, a possible remedy might be government support for research by SMEs (e.g. via co-financed programmes such as the EDA's). Alternatively, Member States governments could organise such programmes themselves.

2.15 The Contract Notice invited a contribution that is informed by economic theory. In this section we bring several strands of economic analysis – including industrial organisation, transaction costs economics, and the economics of R&D - to bear on the subject. The last two of these are particularly relevant to this study.

Transaction Cost Economics

2.16 It was once considered that the costs of conducting commercial transactions were nothing more than a little friction in the market mechanism. In the last thirty years it has become apparent that they can be high enough to deter some transactions altogether, and have become a subject in their own right.¹⁰ In this study, they are relevant in two contexts: the first and obvious one is that the cost of preparing bids for defence projects can be considerable, and could be a barrier to entry for SMEs.

2.17 The second context is sub-contracting - SMEs' main access route to major R&D projects. A question to consider here is: why do the Primes carry out R&D themselves, rather than buying it from specialist R&D contractors, as they do in some other high-technology industries, such as biotechnology and pharmaceuticals. In a classic article, the British Nobel Prize winner, Ronald Coase¹¹, posed the question in its most succinct form: given

¹⁰ Transactions-cost economics were first developed by Oliver Williamson thirty years ago - see, for example, O. Williamson (1979), "Transaction cost economics: The governance of contractual relations", *Journal of Law and Economics*, Vol. 22, p 233-261.

¹¹ Ronald H. Coase (1937), "The nature of the firm", *Economica*, Vol. 4, p 386-405.



that there are markets, why are there firms? Would it not be more efficient to use markets, and buy everything from the most competitive sub-contractors available? Some types of firm do this: in the textile industry, one finds “weavers without looms”. In the motor industry, some assemblers are increasingly focussing just on design, marketing and co-ordination. Have defence Primes also been moving in this direction, shifting R&D to sub-contractors? This seems to have happened in the civil aircraft business where Primes, such as Airbus and Boeing, have been shifting R&D, risks and funding to sub-contractors.

- 2.18 The answer has a lot to do with transaction costs – the costs of drawing up, negotiating and checking compliance with contracts. The slippery and unpredictable nature of research, and to a much lesser extent, development¹² makes it difficult to draw up tight contracts. In economists' language, such contracts are likely to be “incomplete”, in the sense that they cannot cater for all the eventualities that are likely to arise. (If this is correct, we would not expect to see many pure research defence organisations, in the private sector.)
- 2.19 These issues become less relevant when products are more straightforward to define and test, such as motor components, than when associated with R&D activities, whose output is inherently less easy to define. This is one of the reasons why R&D is more likely than, say, component manufacture to be performed in-house. It may also be to do with business strategy: R&D is part of a Prime's core business, which determines its competitive advantage.
- 2.20 Another feature that is emphasised by transactions costs theory is whether the assets involved are specific to the activity or not. Once a subcontractor has committed substantial investments that are specific to a contract, it becomes a “hostage” to that contract, and is vulnerable to pressure from its customer for tougher terms. Its customer could “hold it up”. A study of 178 British engineering firms¹³ found that firms were indeed less likely to buy in specialised inputs if the relevant production technology is specific to that activity. Economies of scale or scope encouraged buying-in, but less so if the relevant assets were specific.
- 2.21 This finding, too, has important implications for defence markets. As noted above, one feature of defence equipment is that the technologies involved can be quite specific to defence (and indeed, to a particular type of equipment): they do not always have alternative uses in civilian markets. This in itself would make SMEs cautious about committing large sums to sub-contracts. This also points to a possible solution: buyers and subcontractors can reduce these transaction costs by developing relationships based

¹² It has been put to us that the content of technology demonstrators (Technology Readiness Level 5) can be done in a very precise way. We do not dispute this, but one can envisage ambiguous outcomes: situations in which there might be some disagreement about whether such a project has indeed “demonstrated” such a technology, or whether a failure to do so was due to a fault on the part of the contractor, rather than in the technology.

¹³ Bruce R Lyons (1995), “Specific investment, Economies of Scale, and the Make-or-Buy Decision: A Test of Transaction Cost Theory”, *Journal of Economic Behaviour and Organisation*, May, p 431-43.



on trust, for example via long-term contractual relationships offering SMEs a range of business opportunities.

- 2.22 Another instance of the so-called “hold-up” problem occurs when defence development contracts over-run, on cost and time, as they frequently do. The procurement authority is then faced with the choice of extending such contracts, or finding an alternative contractor. It is frequently the case that the contractor concerned is retained i.e. the contractor successfully “holds-up” the procurement authority. SMEs might consider themselves less able to do this, because the project over-runs would represent a larger proportion of their total assets, and be less inclined to bid than would larger firms, with greater ability to hold-up at the second stage. Effectively, Primes are ‘powerful producer groups’ able to influence the award of contracts and the terms on which these contracts are financed and enforced. There are small numbers of Primes compared with larger numbers of SMEs.
- 2.23 Thus, the application of transaction cost economics would lead us to focus on the imprecise nature of R&D itself, the specificity of the assets that it can involve, and the hold-up problems associated with development projects that over-run, as factors that may explain SMEs’ modest share of value added in the supply of defence equipment. As a general rule the benefits to be derived from buying rather than making are likely to be:
- (a) greatest when the relevant assets are general rather than specific, and there are economies of scale and scope; and
 - (b) least when assets are specific, and there are few economies of scale and scope.¹⁴
- 2.24 SMEs are unlikely to offer economies of scale and scope: these are more likely to be achieved by the Primes, or by large-scale specialist suppliers. The issue for the SMEs is whether the market-versus-bureaucracy benefits work in their favour in the functions in which they excel (e.g. in R&D). It is unfortunate for them that many of the assets that are required for defence research are both specific as well as costly (e.g. wind tunnels, calibrated testing ranges, simulators). Thus, a transaction cost perspective points towards quite a modest role for SMEs in defence.
- 2.25 The possibility also arises that inefficiencies in defence markets reflect the extensive use of cost-based contracts awarded to Primes. Cost-based contracts lack efficiency incentives, including the incentive to search for lower-cost solutions provided by SMEs. In contrast, incentive-type contracts (e.g. fixed price or target cost incentive fee contracts) provide greater incentives for Primes to seek lower-cost solutions, including the use of SMEs to provide any cheaper inputs into the research, development and production process for defence equipment.

¹⁴ Oliver Williamson (1998), “Transaction cost economics”, Handbook of Industrial Organisation, Vol. 1, Editors, Richard Schmalensee and Robert Willig, North Holland, Edition 5.



Capturing the value of R&D

- 2.26 Another important aspect of R&D that is identified by the economics of the subject is “appropriability” — the conditions surrounding an invention that enable its originator to capture its value. Strategies to ensure appropriability include patents, branding, gaining lead time and exploiting a learning curve advantage. Even with patent systems, much of the rewards from successful R&D flow to companies other than the originator (and, of course, to its customers). These “spillover” effects deprive the originators of some of their rewards.
- 2.27 The fact that the social benefits of successful R&D exceed the private benefits provides a rationale for government support of R&D. For most economists, and policymakers, the case for intervention in order to promote R&D has already been demonstrated. However, as Veugelers has pointed out¹⁵, “even in the case of market failure, there is still the risk of government failure to assess. Risk, uncertainty, incomplete and asymmetric information are conditions increasing the likelihood of both market and government failure”. Veugelers noted that government support had not made a crucial difference to 71 per cent of innovators.
- 2.28 How appropriable are the technologies that are most relevant to defence? It has long been appreciated that the value of patent protection rights differs between industries. In their review of the British patent system, Taylor and Silberston (1973)¹⁶ noted that compared to 60 per cent of pharmaceutical R&D, only five per cent of mechanical engineering and a negligible amount of electronics R&D was dependent on patent protection. Mansfield (1986)¹⁷ also found that only pharmaceutical and chemical inventions are substantially dependent on patents.
- 2.29 These findings suggest that the technologies that are most relevant to defence – electronics and mechanical engineering - are among the least appropriable. Defence contractors must then rely for the protection of their knowledge on the relative complexity and demanding requirements of most defence equipment. This protection may not amount to much. Imitation is usually cheaper than original invention. For industry in general, imitation was reported to be over 75 per cent in 40 per cent of cases, but more usually, about 50 per cent of the innovator’s cost (Levin et. al., 1987).
- 2.30 The significance of these observations is that, in the absence of effective patent protection, the innovative company needs to move, and spend, quickly, in order to exploit its first-mover advantage. Secrecy and speed of exploitation, assisted by investments in

¹⁵ R. Veugelers (2008), “The role of SMEs in Innovation in the EU: A Case for Policy Intervention?”, *Review of Business and Economics*, Vol. LIII, No. 3, July-September, p 239-262.

¹⁶ C. T. Taylor and Z. A. Silberston (1973), “The economic impact of the patent system: a study of the British experience”, Cambridge: Cambridge University Press.

¹⁷ E. Mansfield (1986), “Patents and Innovation: An Empirical Study”, *Management Science*, 32: 173-181.



complementary sales and services, have been found to be more effective than patents.¹⁸ By being the first-to-market with their products, innovators hope to create new markets, in which the early-adopters act as the products' promoters.

- 2.31 There are numerous examples of this in civil markets (the Sony Walkman, the mobile phone). Such new markets take off when imitation is powerful (referred to as the "bandwagon effect"), and the innovators reduce their prices, as they are able to do, by exploiting the learning curve, whereby the unit production cost falls by perhaps 20 per cent with each doubling of cumulative volume. A virtuous circle is created: the growth in the market facilitates unit cost reductions, which in turn stimulate further growth in demand. This virtuous circle is the engine which drives, and rewards, innovation, even in industries which knowledge is not well protected by patents.
- 2.32 Defence markets could not be more different. The dynamics of the civil markets' virtuous circles are largely absent. Whereas there is nothing, apart from cost, to prevent an innovator in the civil market from creating and driving its own market, in defence, the innovator must first engage, and interest, the "gatekeepers" in the procurement process – the national defence authorities, or the Primes, with their ideas. It would be difficult for the innovative SME to by-pass these gatekeepers, for the obvious reason that the SME would typically be offering a sub-system – or perhaps just a component – rather than a complete system. In addition, security problems would probably arise if the SME sought to market its product outside Europe. The "Gatekeepers" are a possible source of market failure; if so, this suggests that policy might focus on changing the role of the Gatekeepers.

Conclusions

- 2.33 There are problems for the innovative SME in defence. The transaction costs approach indicated reasons why Primes might prefer to do their own R&D, rather than buy it from sub-contractors. There is also a problem to do with the "appropriability" of the results of R&D. Patents are not particularly effective in the types of industry that are involved in defence. Innovative companies have to rely for the protection of their knowledge on the relative complexity and demanding requirements of most defence equipment. We noted also that defence SMEs are denied the options that are available to their civil counterparts, to exploit the economic potential of their innovations.
- 2.34 These theoretical observations appear to predict some aspects of defence R&D pretty well. There appears to be no place for the "jobbing" R&D company in defence. SMEs' share of defence work is quite modest, despite the alleged strengths of SMEs in R&D, and the R&D-intensive nature of defence equipment.

¹⁸ W.M. Cohen and R.C. Levin (2000), "Innovation and Market Structure", in Handbook of Industrial Organisation, edited by Richard Schmalensee and Robert Willig, Vol. 2, Fifth Impression, North Holland.



- 2.35 Defence SMEs are denied the options that are available to their civil counterparts, to exploit the economic potential their innovations rapidly. The former have to rely for the protection of their knowledge on the relative complexity and demanding requirements of most defence equipment, and on the high security classification of their technologies.



3 THE ECONOMICS OF POLICY INSTRUMENTS

- 3.1 In light of these challenges, three policies have been proposed in the terms of reference of this study to increase the participation of SMEs in R&D/R&T programmes:
- (a) incentivising SME participation in co-financed (government and industry) national R&D/R&T programmes – this policy would, in effect, subsidize SMEs;
 - (b) establishing a common requirement in national R&D/R&T contracts to integrate an SME when bidding for contracts above a certain threshold value; and
 - (c) requiring or persuading Primes and Higher Tier suppliers to open a percentage of their subcontract business to SMEs and non-traditional suppliers.
- 3.2 An important point to note is that these three policy instruments depend on different mechanisms: model (a) operates by offering incentives; model (b) and one version of model (c) would operate by requiring certain outcomes (a rules-based approach). There are important differences here. The first relates to predicting the effects of the policies. The effects of policies that rely upon incentives are difficult to predict. While qualitative predictions about the general direction of change can be made, quantification is difficult, because the policy-maker does not know how many potential applicants will be motivated by the incentives offered by his policy.
- 3.3 The impacts of policies which mandate certain outcomes can be predicted with greater confidence, because such policies impose specific obligations. The issue here is a practical one - whether those affected would seek to evade the spirit of the requirement, in the present context, by setting up, or acquiring, SME subsidiaries and awarding sub-contracts to them. People and organisations adjust to new constraints and the end result might be both unexpected and undesirable.
- 3.4 The second issue concerns the economic risks. This is greater in respect to policies that require certain outcomes, because such policies apply regardless of cost. For example, a work-content requirement of 20 per cent for SMEs in a development stage of a defence system might place an entire project at risk, if the SMEs concerned prove unable to deliver on their contracts. In contrast, an incentive-based policy is less likely to run this risk: if a Prime judges that an incentive is insufficient to justify the additional risks, or costs, associated with engaging SMEs, it could decline to do so.
- 3.5 To sum up this brief discussion, incentives and requirements are very different mechanisms, with their respective advantages and disadvantages. They differ in respect to their certainty of effect, and their potential costs and economic risks. We therefore draw upon the economic concepts discussed above to ask a number of questions about the candidate policy measures, to assess their potential, as well as their possible drawbacks.



Incentivising SME participation in Co-Financed R&D/R&T Programmes

- 3.6 Finance for SMEs in general tends to be 'rationed'. In particular, financing problems occur where the SMEs output is based on the ideas of the owner such as a scientist or researcher, as human capital is not generally accepted as security for finance (i.e. slavery-type contracts are illegal in most societies). Programmes that offer financing to SMEs to help fund their R&D aim to address such problems.
- 3.7 Programmes offering co-financing to innovative SMEs to engage in R&D are employed in a number of countries, such as the Netherlands and the UK. These types of programmes however do not necessarily address the problem of the appropriability of R&D in defence. The design of these programmes has important implications for the types of incentives they create. Programmes that fund only the initial research stage, as in the Netherlands SBIR scheme, represent a departure from mainstream procurement, in which both stages are fully funded. This structure would appear to provide limited incentives, with funding terminating just as the costs begin to mount and the problems arise of obtaining a return on relatively costly development work. If development is costly, SMEs are likely to be reluctant to finance such activities, especially if any subsequent procurement by the authorities is open to competition.
- 3.8 The key to the economics of these types of scheme is the structure of risks and rewards that confront the applicant during the stages through which a technology would progress, through a feasibility study, followed by a development stage, and finally, production. Suppose that an innovative SME is considering whether to bid for a contract to carry out a feasibility study, funded on a fixed fee basis by its national defence authority. The IPR would remain with the contractor. Suppose that all goes well, i.e. the SME demonstrates that its concept is feasible, and is accepted as such by the applicant's national defence authority, as a possible basis for developing a new system. Leaving aside any financial risks involved with the contract (that its costs turn out to exceed the fee), how might the SME assess, at the outset, its options downstream, and their associated risks and rewards?
- 3.9 The key to this is to consider the SME's likely bargaining position vis-à-vis the most likely type of potential customers for its IPR – a Prime and its major suppliers. The options for the SME and the Prime/major suppliers beyond the feasibility stage are:
- (a) Stage 2: Development
- SME: might pursue the development work, but it may lack the expertise and resources and the R&D work might be defence-specific with limited market opportunities; or it could sell its IPR to a Prime or a Prime might acquire the SME. For example, Boeing acquired the US Insitu company which was an SME (with eight employees in 1998) with a reputation in unmanned air systems originally designed for helping tuna fishermen. Insitu is an example of an SME which applied a proven technology to enter the US military acquisition system with no defence reputation but offering a novel technology (now the ScanEagle UAS).



- Prime: the Prime may or may not acquire the SME's IPR, however, separating basic research from the development phase might be costly. Incentives and rules which result in such separation might be inefficient and add to costs (i.e. be market distorting rather than market creating).

(b) Stage 3: Production

- SME: SMEs generally lack the resources and expertise for large-scale defence production work; Primes have an advantage at this stage of the acquisition cycle. This generalisation does not, of course, dismiss the possibility that innovative SMEs could win contracts to research, develop, and then produce, defence systems. As a matter of observation, this seems unlikely. This could be due to both demand and supply side factors. On the demand side - when considering whether to award a production contract to a small company, a ministry of defence would be concerned that the company might no longer be in existence to support the equipment throughout its long service life, and later, to upgrade it. On the supply side, if there is scope only to market the product in the defence market SMEs may feel that they would be insufficient return to warrant the upfront capital investment, especially if the number of units likely to be ordered would be small.
- Prime: the Prime can either produce the product or not.

3.10 There is a clear asymmetry in these options: the SME's options progressively diminish (its competitive advantage lies in the research stage and it might struggle with the development stage, and has little prospect of being able to compete for the production stage). The Prime has viable options in both development and production stages.

3.11 It follows from this that, even if the SME succeeds in demonstrating its technology, its bargaining position at the end of the feasibility stage is likely to be quite weak - all the more so, because of the lack of patent protection in defence technologies noted earlier. The SME cannot credibly present itself as a potential competitor at the production stage (and might struggle even at the development stage), so what is the point of competing independently at the development stage? The Prime could probably judge pretty accurately what the SME's alternative profit stream would be, if it competed successfully at the development stage. This assessment suggests that the rewards that the SME could expect to derive from its IPR would be constrained, unless it could interest several Primes in its technology.

3.12 Two conclusions follow from this – neither very encouraging from SMEs' point of view.

- (a) Schemes that are designed to support R&D by innovative SMEs are likely to attract a limited number of applicants.



- (b) Successful applicants – both in the sense that they win such an award and then demonstrate their technology with it – are not likely to travel with their technology through the subsequent procurement stages.¹⁹ They are more likely to sell their IPR to a Prime, to act as a sub-contractor to a Prime, or to be acquired by prime.
- 3.13 If the SME opted to licence its IPR, this need not be the end of its story: it would have enhanced its reputation as a defence research organisation, and could hope to win further research contracts, from its national defence authority or from Primes and/or major suppliers – these are satisfactory outcomes. What does this suggest for policies to promote R&D by SMEs? It suggests that policy-makers might focus on the market for IPR to assess whether defence SMEs are capturing an adequate return on their R&D investments. For example, are defence SMEs especially vulnerable to copying by rivals and if so, might there be a policy role providing financial contributions to original inventors (e.g. by prizes; bonuses)?
- 3.14 This discussion provides another insight into why SMEs' share of the defence market is so modest, and at the same time, suggests that it might be unrealistic to expect that policies that are designed to promote R&D by defence-related SMEs will radically change the defence industrial landscape. A more realistic objective – and it is itself quite ambitious and important for defence if it proves successful - would be to speed up the rate of innovation in defence.
- 3.15 The key question with these policies, therefore, is whether the IPR that would arise from the project would be owned by the applicant, or by the national defence authority (and even if is owned by the applicant, whether the national defence authority has rights to use the technology). If the IPR is owned by the applicant, the applicant is incentivised: at the next stage of the project (if there is one), it could bid independently, or in partnership with a Prime, or it could sell the IPR.
- 3.16 If, on the other hand, the IPR resides with the national defence authority, the applicant is very weakly incentivised. Economic theory would suggest that, in this case, there is an argument in favour of incentivising the contract further. One possibility would be to offer bonuses: the first, if the applicant demonstrates that the concept is feasible; and a second, if the concept is later adopted as the basis for developing a new system, whether or not the applicant is selected to be involved in that development.
- 3.17 If there were merit in these suggestions, it might be asked whether such bonuses should be offered also in the case where the applicant owns the IPR, and then sells it, noting the conclusion drawn earlier that the applicant might not expect to receive very much if it sold its IPR. The problem here is that most of the bonus would accrue to the Prime, not to the SME. Noting the bonus, the Prime would then offer less (unless the announcement and

¹⁹ This not to deny that it is possible for an innovative defence-related SME to go down the production route and become a major player in its defence speciality, as Martin-Baker did with its ejector seats. However, such cases appear to be exceptional.



amount of any bonus were not published or publication was delayed until after the award of a contract by a Prime).²⁰

- 3.18 Cooperative arrangements address two of the problems that have been identified above:
- (a) they may enable the participants to afford the high fixed costs of research facilities;
 - (b) when patent protection is not completely effective (as is usually the case in defence technologies, to judge from the literature), and thus spillovers arise from innovation, cooperative arrangements at least capture, and internalise, the spillovers that arise between the participants.
- 3.19 However, in order to benefit from any successful research results, the partners may need to move quickly to the next stage. It may not be easy for them to do this, on a joint basis, if, as is likely, they have differing capacities, and access to the necessary resources. In addition, cooperative programmes raise the issue of how the IPR is shared between the individual parties. As noted above, they will also be constrained by the structure of the defence market.
- 3.20 In sum, cooperative research ventures in defence offer two advantages – cost-sharing and a degree of capture of spillovers – but their ability to exploit their innovations could be problematic. Two possible solutions arise, namely, privately-organised cooperative ventures and state-organised cooperative ventures. The case for state intervention arises where private markets fail to organise collective action so that government intervention might be required to ‘correct’ for such market failure.

Requirements that Primes and Higher Tier suppliers involve SMEs

- 3.21 If defence markets functioned in an ideal way, the primes and higher tier suppliers would be appropriately incentivised to involve those SMEs that could reduce the costs of their projects. This measure would address a situation in which defence markets did not function so well, in which the least-cost solution to a development contract would involve an SME (more innovative, lower costs), but that this is not the solution offered by the primes/higher tier suppliers. Market failures of this kind could occur because:
- (a) the customer has difficulty in assessing contractors’ costs; and/or
 - (b) the contractors have dominant positions, which enable them to win contracts, despite adopting inefficient solutions (too little SME involvement); and/or
 - (c) there are major barriers to market entry for SMEs.

²⁰ If the SME were prepared to sell the IPR for €10 m, and receives a bonus of €2m if it did so, The Prime could then secure the IPR by offering something in excess of €8 m.



- 3.22 There are potential problems with defence information markets and whether entry barriers are creating market failures. Questions arise as to whether such information markets are bringing together buyers and sellers. Here, the challenge for SMEs is to obtain information on defence market opportunities enabling them to identify potential buyers of their R&D whilst enabling Primes and major suppliers to identify potential SMEs able to provide lower-cost inputs. Such search processes are not costless, and there might be entry barriers where national defence authorities, Primes and major suppliers place limits on contract advertising and restrict competition to select lists of 'preferred bidders' (where entry to preferred bidder status is either costly for SMEs and/or prevented by potential buyers). Primes and major suppliers might retain such entry barriers where they receive cost-based contracts for development work: they can finance possible inefficiencies through such contracts. In contrast, fixed price contracts provide Primes and major supplier with greater financial incentives to adopt efficient solutions, including the use of more efficient SMEs in their inputs.
- 3.23 A useful comparison is provided by offset policies, notably the policy employed in the Netherlands that require foreign defence equipment suppliers to provide offsets for 100 per cent of the contract value on orders of five million Euros or more that have an R&D dimension. In the Netherlands these offset obligations require foreign suppliers to contribute to the Dutch government's general objective of 20 per cent involvement of SMEs (less than 100 employees, in this context). "Multipliers" are applied in some of these cases, i.e. the total offset obligation is reduced by some multiple of the amount of work placed with SMEs. Multipliers of up to 10 can be applied to defence-related R&D Programs placed with Netherlands knowledge institutes.
- 3.24 A requirement to include an SME when bidding for R&D contracts above a certain threshold, or to sub-contract a certain percentage of R&D contracts to SMEs, might have effects that are similar to those of offset requirements. According to the study financed by the EDA,²¹ most pMS except France and Germany have official offset policies. Over the 2000-2006 period, offsets applied to 50 per cent of the EU's imports of defence equipment and averaged 135 per cent of the value of the contracts concerned (Eriksson, 2007, pages 20 and 21, Table 3.1).
- 3.25 An argument for an SME-content requirement in R&D contracts might run as follows: in its absence, Primes are able to assign R&D to their own research departments, rather than contract it out to SMEs; or that Primes prefer their own technical solutions to the more innovative alternatives that could be offered by SMEs. Thus, opportunities are being missed, either to carry out R&D more efficiently, and hence at lower cost, by an SME, or to use a different, and more effective technology. These opportunities are missed because of a so-called "asymmetric information problem": the Primes know their own

²¹ E. Anders Eriksson (2007), "Study on the effects of offsets on the development of a European Defence Industry and Market", Final Report for the European Defence Agency by FOI and SCS, July, Table 3.1, p 21.



- costs, and those of the SMEs, and other sub-contractors; the national defence authority has no information about these costs.
- 3.26 A fallacy in this argument is that these opportunities are missed because of an “asymmetric information problem”. Whether or not the national defence authority is informed about costs, the Prime is incentivised to contract out R&D if it can be performed at lower costs by sub-contractors. The Prime could increase its profits by so doing, so why would it not do so? Requiring Primes to involve more SMEs than they otherwise would do so runs the risk of raising costs.
- 3.27 This danger should not be overstated: Primes would respond pragmatically to whatever conditions are placed upon them. If the Primes were obliged to put out more work to SMEs, they would no doubt devote resources to enable the SMEs concerned to perform better. Requirements to involve more SMEs in R&D would not, in our view, be disastrous. It would probably raise costs. It would probably not result in more innovative defence systems.
- 3.28 If the issue is rather to do with the choice of technology – the Prime’s or an SME’s – then requiring Primes to involve more SMEs than they otherwise would do so is tantamount to requiring them to adopt technologies that Primes consider less appropriate. These might bring benefits; on the other hand, they might add to technical risks and threaten an entire project. There is more at stake here in the case of R&D than there would be, for example, in a decision about whether a particular component should be produced in one of the Prime’s facilities or in an SME’s. It would be difficult for the national defence authority to over-ride the judgement of a Prime, since it is the Prime that must, in the end, take responsibility for the defence system concerned.
- 3.29 It seems likely, then, that Primes would choose to comply with a requirement to involve more SMEs in R&D by contracting out more R&D to SMEs, rather than by switching from their preferred technologies to those proposed by SMEs. In other words, the requirement is more likely to influence the location of R&D work than the technical solutions that are adopted. In addition, once established, it will be difficult to abolish such ‘preferential trading’ (consider the infant industry argument for tariffs and establishing when the infant had “grown-up”).
- 3.30 Those who expect that such a requirement would result in more innovative and cheaper defence systems would probably be disappointed.²²

²² SMEs would have better prospects if national defence authorities chose to develop more innovative equipment. It would be interesting to see whether SMEs’ share has declined, as the arms race has slowed, following the collapse of the Soviet Union. It may be coincidental that SMEs share of turnover in the UK’s aerospace industry declined sharply, from about 15 per cent in 1995 to about five per cent in 2006.



More general responses to content requirements

- 3.31 More generally, i.e. not specific to R&D, we need also to consider the way in which SME-content requirements could be expected to influence the behaviour, both of the Primes, and of the SMEs that would benefit from them.
- 3.32 Primes might seek to evade the spirit of the requirement by acquiring, or spinning off, SME subsidiaries. How would SME-content requirements be expected to influence SMEs' behaviour? Knowing that Primes would be required to involve more SMEs, the SMEs would bid less keenly for sub-contracts than before, and once they became involved, they would be less motivated to perform well. Primes might struggle to find sufficient SMEs capable of fulfilling – and willing to fulfil – the “SME quota”. Defence R&D is a demanding and risky activity. Existing SME sub-contractors would be discouraged from growing beyond the upper limit of the SME definition. Primes would have to offer more favourable terms to SMEs, to encourage them to come forward. In short, the predicted effect of the SME-content requirements would be to raise the cost of defence R&D – the reverse of the intended effect.

Alternative Solutions

- 3.33 Aside from the three contracting policies set out in the terms of reference, there are other variants of existing defence procurement models that could be adopted, or adopted more widely, for example:
- (a) imposing requirements to advertise all public R&D contracts (currently excluded under the EC procurement directives);
 - (b) lowering the threshold value for advertising R&D sub-contracts;
 - (c) introducing tax incentives for Primes to sub-contract to SMEs;
 - (d) promoting defence information markets at the levels of national defence authorities, Primes and major suppliers;
 - (e) awarding prizes to SMEs for innovative ideas;
 - (f) structuring development projects in a different way e.g. by commissioning smaller, innovative products, from a wider field of candidates.
- 3.34 Economic analysis assesses these policies by identifying the relevant markets (information markets and research markets) and then determining any major market failures and the sources of such failures. Typically, market failures arise from imperfections (e.g. monopolies; entry barriers) and/or from externalities (beneficial externalities such as technology spillovers or harmful externalities such as pollution) or from public goods (e.g. defence). In addition, the merits of these ideas depend largely on their practicalities, for example, whether and by how much would they add to the national procurement authorities' costs.



Award Schemes

- 3.35 Award schemes are, in our view, the most interesting of these alternatives. One example is the UK MoD's scheme to encourage innovative SMEs, the Competition for Ideas, announced on 17 October, December 2006. This £10 million programme was intended "to inspire the best innovators from across Britain" in order "to identify the best ideas in science and technology – whoever has them – in order to meet some of its toughest challenges." Noting that "it is difficult for smaller companies and research laboratories to get large organisations interested in their ideas", the Minister for Defence Procurement, Lord Drayson, stated that the Competition for Ideas "will make it easier for smaller companies and research organisations to approach the MOD".²³
- 3.36 What does economic theory have to say about the rationale for this scheme, and its prospects? As to its rationale, it appears, in comparison with conventional defence procurement timescales, to be a rapid and low-cost method of securing small but innovative items of defence equipment. The variety of paths subsequently followed by the winners suggests that no major IPR problems are encountered. The individual basis of the awards avoids the problems that can be associated with cooperative ventures. By funding, and enhancing the reputations of the award recipients, the MoD helps them to surmount two imperfections in the market for R&D.

Conclusions

- 3.37 This Chapter has drawn on the economic concepts discussed in Chapter 2 to pose a number of questions about the candidate policy measures, to assess their potential, as well as their possible drawbacks. It noted that incentives and requirements are very different mechanisms, with their respective advantages and disadvantages. Incentives are less certain in their effects, but pose fewer economic risks. Rules-based approaches (e.g. requiring a particular SME-content) would have greater certainty of effect, but would pose greater economic risks. The Chapter then considered the prospects of two types of policy - co-financing, including co-operative arrangements, and SME-content requirements.
- 3.38 **Cooperative arrangements** address the problem of the high fixed costs of research facilities, and capture some of the spillovers arise from innovation, but their ability to exploit their innovations could be problematic.
- 3.39 The success of programmes that offer **co-financing to innovative SMEs** to engage in R&D (such as those in France, the Netherlands and the UK) may be limited by the fact that an SME's options progressively diminish (its competitive advantage lies in the

²³ The UK MOD also launched a "Grand Challenge" competition in 2006, inviting teams to come up with highly autonomous flying and ground vehicles, capable of identifying threats such as marksmen, vehicles mounted with heavy weapons, roadside bombs and armed militia. The winner was announced in August 2008 - an integrated system with one high flying UAV (Unmanned Aerial Vehicle), and a UGV (Unmanned Ground Vehicle) with a control station fusing data from visual, thermal and radar sensors.



research stage and it might struggle with the development stage, and has little prospect of being able to compete for the production stage). Hence, its bargaining position at the end of the feasibility stage is likely to be quite weak. The SME cannot credibly present itself as a potential competitor at the production stage. This suggests that schemes that are designed to support R&D by innovative SMEs are more likely to sell their IPR to a Prime, to act as a sub-contractor to a Prime, or to be acquired by prime, than to develop their technology through the subsequent procurement stages.

- 3.40 **SME-content requirements** in R&D contracts could have costly consequences, similar to those of offset requirements. An argument for such a requirement is that opportunities to carry out R&D at lower cost by an SME, or to use a different, and more effective technology proposed by an SME, are being missed because of a so-called “asymmetric information problem”: the Primes know their own costs, and those of the SMEs, and other sub-contractors; but the national defence authority has no information about these costs. The fallacy in this argument is that the Primes are incentivised to contract out R&D if it can be performed at lower costs by sub-contractors.
- 3.41 SME-content requirements might require Primes to adopt technologies that they consider less appropriate, adding to technical risks. However, it would be difficult for the national defence authority to over-ride the judgement of a Prime, since it is the Prime that must, in the end, take responsibility for the defence system concerned. It seems more likely that Primes would choose to comply with a requirement by contracting out more R&D to SMEs. In other words, the requirement is more likely to influence the location of R&D work than the technical solutions that are adopted. Those who expect that such a requirement would result in more innovative and cheaper defence systems would probably be disappointed.
- 3.42 SME content policies might have unintended (adverse) consequences. Primes might seek to evade the spirit of the requirement by acquiring, or spinning off, SME subsidiaries. Knowing that Primes would be required to involve more SMEs, the SMEs would bid less keenly for sub-contracts than before, and once they became involved, they would be less motivated to perform well. SMEs would be discouraged from growing beyond the upper limit of the SME definition. In short, the predicted effect of the SME-content requirements would be to raise the cost of defence R&D – the reverse of the intended effect.
- 3.43 “R&D prizes”, which offer a rapid and low-cost procurement route for innovative items of defence equipment, appear to be a promising business model.



4 HOW EFFECTIVE ARE THESE POLICIES IN INCREASING SME PARTICIPATION?

- 4.1 The Appendix provides a brief summary of relevant policies that have been adopted by pMS, based on responses to the EDA's survey.²⁴ Three features, in particular, are noteworthy:
- (a) a number of these Member States have adopted policies of some kind, in support of SMEs in general, but only five of them appear to have adopted policies directed specifically at defence-related SMEs - Spain, France, Netherlands, Slovenia and the UK;
 - (b) of these five, three Member States appear to have detailed and well-supported policies, specifically in support of R&D by defence-related SMEs – France, Netherlands and the UK; and
 - (c) two countries – Finland and Germany - have policies that support R&D by SMEs, in general.
- 4.2 We make no presumption in this report that defence-specific policies are more effective than policies directed at SMEs in general, or indeed, that SMEs are necessarily an appropriate focus for industrial policy. It might be the case that measures that seek to open markets – to all sizes of enterprise - in respect, for example, to international trade and public procurement – are able to promote economic welfare more effectively than SME-related policies. The case for defence-specific measures is that defence presents a highly unusual combination of circumstances – dominant customers, dominant suppliers, complex mixes of requirements and technologies – which require distinctive policy solutions.
- 4.3 Some Member States have introduced policies aimed at both information and research markets for defence-related SMEs with policies based on financial incentives and rules-based approaches. Examples include France, the Netherlands, Slovenia and the UK, where there are instances of co-financing of defence R&D and of the use of prizes. Some Member States have sought to reduce entry barriers for SMEs, by requiring Primes to introduce more open competition (e.g. France and Germany), or by requiring national defence ministries to reduce the thresholds at which Primes are obliged to advertise sub-contract requirements (e.g. the UK).
- 4.4 In order to assess the effectiveness of policies directed at defence-related SMEs, we spoke both to representatives from industry and from the national defence authorities, from across pMS. This consultation programme was carried out through a mixture of face-to-face interviews, conference calls and a workshop.

²⁴ 16 pMS replied to the survey, of which 4 (Bulgaria, Ireland, Italy and Poland) reported having no policies in place.



- 4.5 The large downstream suppliers that were consulted as part of the project were all interviewed face-to face, while a workshop bringing together representatives from trade associations from across Europe provided as broad a discussion of the issues from the perspective of the SMEs as possible. Finally, the EDA survey of pMS offered a basis for the discussions with the national authorities, largely conducted over the phone, to gather more detailed information about the policies they currently employ and their effectiveness, as well as the potential for alternative models to be effective.
- 4.6 This section considers the feedback gathered from stakeholders through this process of consultation as well as any quantitative evidence, where such data exists, to assess the impacts and effectiveness of existing policies.

SMEs' Perspective

- 4.7 In order to develop a clear picture of the issues facing innovative SMEs and their views on how effective different policies would be in increasing SME participation in R&D we engaged with as many trade associations as possible from across the region. We received feedback from a number of countries, namely the Czech Republic, Estonia, Finland, France, the Netherlands, Sweden, the United Kingdom, as well as a broader European perspective from an EU wide organisation.
- 4.8 As anticipated in Chapter 3, one of the main problems identified for innovative SMEs in defence markets is IPR ownership. Ownership of IPR and the scope for SMEs to exploit their IP is fundamental to the incentives for SMEs to engage in R&D. Companies need to be able to sell their products to more than one organisation, which is particularly challenging in the more defence-specific products because of export regulations and the secrecy required by national authorities with respect to new technology. The best opportunities for SMEs to get involved in R&D, therefore, appear to exist in fields where there is greater scope for dual use, such as security or information systems, so that they can diversify into the commercial sector.
- 4.9 Another key challenge for SMEs involved in R&D in the defence sector is the delay between the initial investment and the point at which they can earn a return on that investment, the so-called "Valley of Death". This gap is thought to be too large in defence for SMEs, and is exacerbated in certain countries, by delays in programmes, changes in the specifications etc. The importance of this problem seems to vary across pMS, however; in the UK the Supply Network policy identified this as a key problem, while in France this appears not to be considered such an important issue.
- 4.10 Communication is also a fundamental issue for SMEs in R&D. If R&T is driven solely by the top-down approach – i.e. through government contracts with specific requirements and road maps etc set out – the necessary technology base may not actually be in place to respond to the need, resulting in significant delays and cost overruns. Before the specific requirements can be defined it needs to be established that the technology exists or would work, which relies on the bottom-up approach. The bottom-up approach is not led by industry but industry must be heavily involved. Dialogue between the customer



and the industry is vital for the customer to be able to understand what stage the technology has reached.²⁵

- 4.11 In countries where the authorities do not communicate their strategy at a level at which SMEs can access, it is harder for SMEs to get involved. For example, the 2003 EC public procurement on innovation requires a lot of communication prior to the ITT being developed, which makes it very difficult for SMEs to get involved unless they are part of this process. The high level of security surrounding certain areas of defence mean that it can be especially difficult for SMEs to know what programmes or opportunities exist.
- 4.12 There are other challenges for SMEs in this area.
- (a) The threat of takeover — if SMEs are very capable, and particularly if they operate in a niche area, they are likely to be taken over by a larger company. One of the Primes' main concerns is the long-term security of supply, so they have an interest in protecting that by, for example, acquiring key suppliers.
 - (b) The existence of nationally owned research institutions — such institutions may stymie the scope for SME involvement in R&D. Traditionally the way in which research has been structured, i.e. institutionalised, has tended to make it difficult for SMEs to get involved.
 - (c) The types of contracts used - fixed price contracts also present a problem for SMEs in R&D, including the timing of the payments - the largest payment is generally withheld until towards the end of the contract life, and if the authorities do not receive what they require at the end of the contract they do not have to pay this sum. In R&D this type of contract represents an enormous risk for SMEs. There, hence, needs to be greater risk sharing in the contract type, for example through increased use of cost plus contracts.
- 4.13 The severity of these problems, however, varies not just across countries, but also across different types of SMEs, for example, there is a clear distinction between SMEs involved in R&D in equipment versus those involved in information systems. Nonetheless, policies directed in the areas identified above should help increase SME participation in R&D.

Co-financing initiatives

- 4.14 There are currently a variety of co-financing initiatives that exist in pMS that were highlighted by the trade associations as having a positive impact on R&D conducted by SMEs.

²⁵ Refer to the ASD position paper "Critical Technology Strategy for European Defence", 9 September 2008.



- 4.15 The Centre for Defence Enterprise (CDE) introduced in the UK in May 2008 offers innovative SMEs a point of contact for submitting proposals or ideas to access funding (either in full or in part). Companies can submit their proposals on any topic or in any field at any time.²⁶ In addition to this the CDE also makes specific calls for ideas on set themes. All proposals can be submitted online and there is a team based at the CDE with whom companies can discuss their ideas prior to submission. The particular advantage of the CDE for SMEs that was highlighted is the speed of turnaround; feedback is offered within two weeks of a submission.
- 4.16 Also in the UK, the Knowledge Transfer Partnership (KTP) offers all SMEs (not just for defence-related SMEs) the opportunity for 75 per cent of their R&D costs to be funded by the authorities. The programme also allows SMEs access to facilities on a temporary basis, and thus allows knowledge to be transferred from academia to industry. It is a very short-term programme which can raise the knowledge base of the SME and help with marketing themselves. The KTP provides SMEs with no knowledge to sell, “but it raises their profile”.
- 4.17 In France “Pacte PME”, run in cooperation with the Comité Richlieu and Oseo, is designed to facilitate and reinforce relationships between SMEs and large companies. To this end, an initiative offering a cooperative programme of co-financing was introduced in 2007. Under this programme, if an SME secures a client they can apply to receive one third of the funding for the R&D from the authorities, on the proviso that the remaining two thirds is funded equally by the SME themselves and their client.
- 4.18 In Finland, there is a slightly different model of co-financing, whereby it is the large companies that receive the funds for sub-contracting R&D to SMEs. This programme of support for R&D, funded by the Finnish DTI (but not by its Ministry of Defence), stipulates that funding will depend on the participation of SMEs, up to a maximum of 50 per cent, and will be limited to the degree of that participation. Thus, if SMEs accounted for 10 per cent of the funded expenditure, the large company would receive a grant of 10 per cent of the cost. In this programme, however, the Prime owns the IPR, not the sub-contractor.
- 4.19 Another co-financing initiative that was highlighted by SMEs as raising IPR or user rights issues is the EDA’s Joint Investment Programme (JIP). Under this programme (Type A programme) user rights can potentially extend to all contributing Member States. The ownership of IPR rests with the originator, however, the governments contributing to a Category A (or Category B) programme retain user rights. These user rights typically vary from “free of charge”, to “on fair and reasonable terms” or “on commercial terms”. Where user rights are very broadly extended, for example under a “free of charge approach”, the initiative is unlikely to be as effective in incentivising SMEs to get involved, unless they hold something back to then sell later and present only a less developed form of their

²⁶ The CDE process is an expansion of the Competition of Ideas concept.



innovation under the official programme. The incentives to participate will instead derive more from the ability to access restricted materials and enhance the company's profile.

- 4.20 In the Netherlands an innovation voucher for SMEs allows SMEs to 'buy' certain knowledge or apply for cooperation with established technological research institutions via vouchers. This cooperation is mostly (not always) related to the innovative development of defence-related materials.
- 4.21 However, while these were considered to offer real opportunities for innovative SMEs in defence, IPR and user rights issues were raised as a serious problem. There was a general sense that the restriction on SMEs to exploit their IPR fully, for example as a result of a lack of potential customers and limited scope to export, and the ability for the authorities to retain user rights, undermine the effectiveness of co-financing initiatives by reducing the incentives for innovative SMEs to get involved in R&D in the first place.
- 4.22 Collaborative programmes more broadly, where projects are co-financed by industry rather than simply receiving government funding, can be equally as complicated to achieve. The challenge of collaborative programmes is that the IPR is shared by all the participants, but they may bear different shares of the costs. Negotiating the terms under which the individual members are allowed to exploit the technology developed is complicated.²⁷ In addition, joint ventures are costly to establish²⁸ and there is also the concern as to what will happen to any liabilities that might arise.
- 4.23 Consequently, while co-financing programmes (both government and industry), in theory, may be useful to promote SMEs in R&D, there are a number of issues that need to be carefully considered to ensure that such initiatives actually have the desired effect.

Policies that require Primes to involve SMEs

- 4.24 On the issue of applying quotas, while we might expect SMEs to favour any initiatives requiring Primes or higher tier suppliers to sub-contract a certain proportion of the total contract value to innovative SMEs, SMEs on the whole seem fairly reluctant for such policies, though opinions did vary across countries. In particular, two concerns were raised.
- (a) The ability to implement such a policy - one view was that these are essentially "soft commitments": they can be monitored, but not enforced. In addition there may be practical difficulties in applying quotas in defence because of the security issues.

²⁷ The EC Framework Programme 7 (FP7) sets out a checklist for a Consortium Agreement for FP7 projects, which may offer some general guidance on how to manage these relationships.

²⁸ A figure of around £100,000 per partner was quoted merely to organise a joint venture.



- (b) The implications for the types of SMEs operating in the market - whatever policies are implemented, the emphasis must remain on the “survival of the fittest”- policies shouldn't ensure that all survive, only the most efficient and productive SMEs.
- 4.25 Aside from these core concerns, questions were also raised about the appropriateness of such a policy: is a rules-based policy appropriate for a behavioural problem? The potential for unexpected consequences if policies were applied asymmetrically across PMS, especially the potential for creating further distortions in the defence market, also was suggested as possibly undermining the effectiveness of such a policy tool.
- 4.26 An even more fundamental issue raised by SMEs was how to define an SME within the context of such a policy, and how to define the point at which a company is no longer in need of support - is it really as soon as they have more than 250 employees? In the USA, SMEs are defined by type of activity, in order to help to determine at what point the company no longer requires support.
- 4.27 The other side of the argument offered by SMEs was that incentives alone do not appear to be working, so rules-based policies may therefore offer a more effective alternative. However, any use of such a policy should be applied on a case-by-case basis, as in the US, rather applied in blanket fashion.

Alternative Solutions

- 4.28 One alternative solution that has appeared recently is a sort of hybrid mechanism. This model is a variation on traditional Category B type programmes²⁹; the hybrid model is effectively an attempt to introduce greater competition to the system. The one example to date is the UAV payloads project – or Innovation and Technology Partnership for Studies for Integrated Multifunction Compact Lightweight Airborne Radars and Systems (ITP SIMCLAIRS) – where there are three Primes cooperating on the project. However, in this case 50 per cent of the project is being competed. This should offer greater opportunities for SMEs to work with the Primes, though the process of selecting the contractors for the competed part of this programme still needs to be developed by the consortium and as such the impacts remain unclear.
- 4.29 Both under the standard EC procurement directive introduced in 2004 and the new defence procurement directive, R&T is exempt from the mandate for competition. R&T contracts do not have to be advertised. Even the EDA Code of Conduct specifies that R&T and cooperative programmes do not have to be advertised, competition is limited only to the calls for ideas under the general themes of the JIP. Increased competition in this area may offer another opportunity to increase SME participation.

²⁹ At the EDA level there are two mechanisms for funding, Category A (cat A) and Category B (Cat B). Category B programmes require Member States to opt in whilst Category A requires Member States to opt out.



- 4.30 Other alternative policy initiatives that were suggested as being effective included bringing Primes and SMEs together in some form of “speed dating”, where SMEs have the opportunity to present their ideas, and tax incentives to encourage Primes to sub-contract R&D to SMEs.

Conclusions

- 4.31 Overall SMEs feel that it is, in general, difficult to contract with national defence authorities. Improving their understanding of the authorities’ long-term strategy and funding plans through greater interaction with them is extremely important for increasing SME involvement. However, SMEs embedding themselves in Primes’ supply chains seemed to be generally viewed as offering the security that SMEs need in order to survive; policies that facilitate this are likely to be most effective in increasing SME participation in defence R&D, though any consideration of rules-based policies in this area must be considered carefully.
- 4.32 The limited number of potential customers for a defence-specific product means that diversification and duality - producing products/services across several supply chains, in both the civil and defence sectors – are important to incentivise SMEs in defence R&D, and for the success of co-financing arrangements.

Perspective of Large Downstream Companies

- 4.33 When considering innovative SMEs the larger companies noted that it is important to distinguish between different types of companies: those that focus purely on R&D, which tend to grow to a certain size and then stay there; and those that are entrepreneurs, who will take the product to market. In general, SMEs are thought to be better placed in the development stage of the process, and to struggle with production and actually bringing products to market. The tendency for requirements to change and for programmes to be cancelled make it hard for SMEs to get involved in investment in defence: larger companies are better placed to diversify this risk.
- 4.34 In France, a particular problem for larger companies is the age of many SMEs. The legislative environment makes it difficult to pass assets between family members, and hence, most SMEs tend to be very young and thus carry a high level of risk.
- 4.35 The overall impression from the larger companies is that the SMEs’ comparative advantage in innovation lies in their ability to react rapidly. This agility makes them more suited to meet urgent operational requirements (UOR) rather than to service traditional defence programmes, where the time horizons involved tend to be very long. In defence the time from initial research to production can be between five to ten years – this represents a long delay for most SMEs.
- 4.36 Managing relationships with SMEs is also important for the large companies, in order that the SMEs focus their efforts in the ‘right’ area. The larger companies need SMEs to provide them with specific solutions to fit with the company’s strategic objectives or existing programmes.



- 4.37 The scope for SMEs to get involved outside the context of such strategic partnerships varies depending on the type of work. The ability of larger companies to identify innovative SMEs makes this more complicated. Trade associations seem to represent a useful vehicle for large companies to identify potential suppliers. Conferences and seminars that bring together large companies and SMEs with relevant skill sets for existing or potential future work streams appear to be particularly valued. “Communities of interest”, such as the SBAC online communities that offer the members the opportunity to communicate, collaborate and network online, also offer an effective solution to identifying companies.
- 4.38 When sub-contracting to SMEs, large companies need to protect themselves from the risk of the company going bankrupt. This raises an IPR issue. Larger companies tend to protect themselves through “step in rights” or by buying the IPR, to ensure that work is not interrupted if the SME goes under.
- 4.39 IPR is also an important issue for co-financing programmes. While co-financing is always helpful to lower the costs of research, if the MoD has rights to the IPR, even when 100 per cent funded by the authorities, this will reduce the attractiveness of getting involved in R&D for SMEs – they would effectively be jobbing R&D companies.
- 4.40 In terms of policies to alter the supply chain, the key is to introduce an open acquisition framework to allow SMEs to get involved. The procurement model in certain countries tends to push the risk associated with the project onto Primes, increasing the potential transaction costs associated with out-sourcing and favouring their in-house capability. There is, therefore, a case to be made for creating an incentive to use independent innovative SMEs, but the route to the best research must be to allow the best companies to do it. The general sense from the larger companies was that any government policies that create inefficiencies in order to meet a particular public objective should be paid for by the authorities. For example, policies that require Primes to sub-contract to SMEs increase inefficiencies and the cost to the Prime. This additional cost should be funded by the authorities.
- 4.41 A less prescriptive variant of this policy would only require some form of SME involvement in projects above a certain size threshold, since, as a general rule, there are always a number of companies (including SMEs) involved; the threshold would need to be very low to actually change behaviour.

National Defence Authorities’ Perspective

- 4.42 Following on from the EDA survey of existing policies to promote R&D participation by SMEs in defence, discussions were held with a selection of pMS, primarily those with such policies in place (see the Appendix for a full explanation of existing policies in pMS).
- 4.43 There seems to be a degree of consensus in that SMEs’ involvement has been less than may be hoped for. In Portugal, for example, traditionally SMEs’ involvement in R&D



contracts has been mainly captured by the National Scientific and Technological System (SCTN), where universities and institutes have taken the lead.

- 4.44 The overall sense from the national authorities is that one of the key challenges for SMEs in defence R&D is to comprehend the activities and intentions of their respective MoDs. Without this visibility, it is difficult for SMEs to understand the future capability requirements of the MoD, and thus where to focus their efforts: it also makes it difficult for the MoD to identify useful sources of innovation. This visibility problem is exacerbated by the generally burdensome processes associated with dealing with MoDs.
- 4.45 Within this context, therefore, many of the policies that have been implemented by national defence authorities have focused on increasing communication between the MoD and innovative SMEs, simplifying processes and increasing access to financing.
- (a) Improved communication — for example, in France, the DGA introduced conferences at the start of large equipment programmes to present to innovative SMEs the various requirements for the programme and their timings, and thus the opportunities for sub-contracting (“les conférences de lancement”). The DGA also organises annual R&T conferences (“Atelier R&T”) to present to SMEs their needs in terms of R&T and give visibility over future R&T contracts and creating a specific space dedicated to SMEs (Espace PME) on their procurement site (IXARM). In the UK, the MoD’s technical experts hold a session at the monthly CDE steering group meetings to describe the future capabilities and requirements that are of interest to the MoD. In the Netherlands, the calls put out under the SBIR programme allow SMEs to understand the key themes for future capability. The “open door” policy of the national authorities allow SMEs the opportunity to interact with the MoD and gain a better understanding of their requirements, as well as making themselves more visible.
- (b) Simplifying processes and increasing transparency — in the UK the CDE offers SMEs the ability to submit applications online, uses shortened standardised contracts that are available at all times online for reviewing (even prior to submitting an application), and promises to respond to all applications within two weeks. Similarly in France the recently established “service d’achat” increases the speed of contract negotiations creating a more rapid turnaround for companies that successfully bid for projects between project award and the start of the project, while the “Espace PME” offers advice and information on the various elements of the procurement process.
- (c) Increased access to financing — in the Netherlands the recently introduced Small Business Innovation Research programme offers co-financing to companies – targeting particularly the SMEs – for the research phase of their work. In the UK the CDE also offers either full or part financing to successful candidates and in Spain the “InnoEmpresa” programme SMEs in the following industries are eligible for grants: industry; construction; tourism; businesses; and services.
- 4.46 As to the scope to encourage Primes to sub-contract R&D to SMEs, some countries already have some variant of such policies in place. France has proceeded furthest down



this path, by introducing its “Plan d’Acquisition” in 2007. This effectively dictates to Primes that have been awarded an equipment programme where the contract must be opened up to competition for sub-contractors. In Spain, the “Programa COINCIDENTE” awards higher marks to companies that are either SMEs or consortia that include SMEs when bidding for public contracts. In Finland, the DTI funds a programme of support for R&D whereby funds are awarded depending on the participation of SMEs, up to a maximum of 50 per cent of the contract value. For example, if SMEs account for 10 per cent of the expenditure, the large company receives a grant of 10 per cent of the cost. In other words, the SMEs’ input costs the Prime nothing at all. Other countries also appear to consider such policies as potentially feasible options, though the consensus was that any such policies should be applied on a case-by- case basis, rather than in a blanket fashion.

- 4.47 These approaches were not, however, welcomed by all pMS. Some pointed out that any policies involving quotas could create unexpected consequences that would undermine their effectiveness. For example, quotas might incentivise Primes to buy up SMEs, or to spin off subsidiaries. Quotas might also create perverse incentives for SMEs, discouraging them from growing in order to ensure that they remain within the qualification criteria. The question of how such policies would be enforced and what sanctions could be employed to enforce them was also raised as a possible problem.
- 4.48 Even in countries where examples of such policies exist, there have been costs. In France, for example, the contracts employed for the “Plan d’Acquisition” have had to be modified to include a bonus for Primes including SMEs in the programme, and to allow the penalty for a delay to be reduced if the delay stems from the part of the work being undertaken by an SME. Such modifications effectively transfer the cost of employing additional SMEs from the Prime to the authorities. Instead of encouraging Primes to sub-contract to SMEs through such rules-based policies, it was argued by some that it would be more effective to increase competition in the procurement process and to encourage Primes to sub-contract as efficiently as possible, in search of greater value for money.
- 4.49 Such policies also have the potential to increase costs indirectly. The unexpected consequences associated with such policies, such as companies setting up smaller subsidiaries to get around requirements as appears to have been the case to some extent in the US, also introduce inefficiencies into the market.
- 4.50 Costs must also be considered more broadly when considering any sort of policy intervention. For example, relatively small pMS without a large R&D budget are unlikely to gain substantial benefit even from more straightforward types of policies such as co-financing initiatives or time consuming conferences etc.



What does available Quantitative Evidence tell us?

4.51 Although there are a number of interesting examples of policies to promote innovative SMEs in pMS, most have been implemented only very recently.³⁰ For this reason, the data on their impact is extremely limited, and where such data does exist the period of coverage is extremely short. Because of the long time horizons in defence spending and procurement, many policies take time to “bed down”, making it difficult to interpret their impact from what little data there is.

Incentivising SME participation in co-financed R&D/R&T programmes

4.52 In the Netherlands in 2006 a Small Business Innovation Research (SBIR) programme was introduced, based on the US model.³¹ As part of this programme, the authorities publish calls for tenders on specific topics and companies respond with ideas and proposals of products to develop in the area. The first call was published in 2006 and focussed on “operating in a maritime manner under adverse weather conditions”.

4.53 The first stage involves a feasibility study of the idea; the second stage is the development phase. Only the first phase is financed under the scheme, the SME has to bear the cost of development themselves. Once the product has been developed the authorities then decide whether they want to procure it (they are under no obligation to buy it). If they do decide to purchase it, the contract (if it is worth more than €35,000) has to go out to public tender. The IPR remains with the SME but the authorities have some usage rights and as such are allowed to publish a certain amount of information regarding the research conducted. Anyone can then bid to produce the product.

4.54 Since the policy was only introduced in 2006, so far only one call has been made and the process has not yet proceeded to the procurement phase, so data is only currently available on the numbers of companies that applied and how many were awarded the grant. These figures are illustrated in the table below.

³⁰ See the Appendix for a full description of existing policies in pMS.

³¹ In the US, through the Office of Small Business Programs (OSBP), the Department of Defense (DoD) funds the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs; these provide a billion dollars each year for early-stage R&D projects in small technology companies. Funding is awarded competitively, but the process is claimed to be streamlined and user-friendly. There are three phases to the programme: In Phase 1 a firm submits an application and the agency can award the firm up to \$100,000 to “determine the scientific and technical merit and feasibility of an idea”; any firm that has been successful in being awarded a grant in Phase 1 can then apply for a Phase 2 award worth up to \$750,000 to “further develop the idea”; in Phase 3 the firm must commercialise its resulting product without any further funding.



Table 4.1: Data on Netherlands SBIR Programme – Call 1

	Total number	Number of SMEs	Proportion of SMEs
Bids	14	13	93%
Selected	4	4	100%
Contracted	3	3	100%

Source: Netherlands Ministry of Defence

- 4.55 Lessons may also be drawn from the US where the SBIR programme has been in place since 1982.³² One study by Lerner³³ of the impact of the US programme concluded that, over a decade, grant recipients grew significantly faster than matched firms did, and were more likely to attract venture financing. A related study³⁴ concluded that projects' performance was better for those technologies that are in industrial segments that attract high rates of venture capital investment. This is consistent with the idea that research results are more "appropriable" in some technologies than in others, and that is why they attract more venture capital. The lesson for co-financing R&D projects is they are more likely to be successful in technologies that are easier and cheaper to capture commercially.
- 4.56 The SBIR programme also throws light on the more general question: does government support for firms' R&D actually increase their R&D? A study of the SBIR by Wallsten³⁵ found that it did not do so: "grants crowd out firm-financed R&D spending dollar for dollar". The inference that could be drawn from this is that SBIR officials award grants to the best applications. But these are profitable projects: in the absence of the SBIR, these would be financed by the applicants. All that the SBIR is achieving is to replace private funding by public funding.
- 4.57 In contrast to Lerner, the implications of this for the European defence industry are that the greater the scope for SMEs to exploit their IPR, i.e. through dual-use technologies, the less effective such programmes as the SBIR are going to be in increasing R&D/R&T overall. Where they have a more important role at encouraging SMEs to engage in R&D/R&T is in offering financing for R&D/R&T where there is likely to be less scope to exploit the IPR, for example where the technology has a very specific defence application and thus will be purchased only by the MoD. It is worth noting, however, that the data set used in the study has a number of weaknesses when considering the implications for the

³² The definition of a SME differs in the USA compared to the EU; a company with up to 500 employees is considered a SME in the US compared to 250 in the EU. Results of any studies into the US system must, therefore, bear this in mind.

³³ Josh Lerner (1999), "The Government as Venture Capitalist: The Long-Run Impact of the SBIR Program", *Journal of Business*, Vol. 72, No. 3, July.

³⁴ Joshua S. Gans and Scott Stern (2000), "When Does Funding Research by Smaller Firms Bear Fruit?: Evidence from the SBIR Program", NBER Working Paper No. W7877, September.

³⁵ Scott J. Wallsten (2000), "The effects of government-industry R&D programs on private R&D: the case of the Small Business Innovation Research program", *RAND Journal of Economics*, Vol. 31, No. 1, Spring, p 82-100.



defence industry.³⁶ Moreover it does not address the question of whether SMEs are generally excluded from federal R&D and whether such programmes are the most cost effective way to stimulate innovative activity.

- 4.58 The real problem in assessing the effectiveness of such programmes is determining what R&D/R&T would have taken place in the absence of the funding. The official evaluation of the US programme is conducted by the U.S. General Accounting Office (GAO). The 1992 GAO report found that the DoD had a lower SBIR commercialisation rate than did other agencies. This suggests that, unlike other sectors, the SBIR programme may actually increase R&D/R&T conducted by SMEs in defence, since the money seems to be awarded to a greater extent to those projects that are not well placed to be commercialised and therefore would be less likely to take place in the absence of the public funding.
- 4.59 The EDA Joint Investment Programme (JIP) also offers co-financing for R&D, funded by contributing members. Currently, there are two segments of the JIP: Force Protection (FP) and Innovative Concepts and Emerging Technologies (ICET).
- 4.60 The JIP-FP programme, initiated by EDA in 2006, promotes R&T collaboration in technologies designed to protect EU armed forces against weaponry threats such as snipers, booby traps, or improvised bombs. It is a Category A project, which means that participation by all 26 pMS is assumed unless they decide to opt out. Currently there are 20 contributing members.³⁷ The programme has a budget of approximately €55 million.
- 4.61 To date there have been four calls for offers made. The first call issued primarily dealt with collective survivability, the second with secured tactical wireless communications and individual protection, and the third with data analysis. The fourth call project selection deals with mission planning and training. Data on the JIP-FP programme illustrate that following the first call the proportion of contracts awarded to SMEs has fallen, though the actual proportion of bids submitted by SMEs has risen slightly by the third call. This may in part reflect the differences between the themes of the calls.

³⁶ Although the data is slightly biased towards that available from the Department of Defense (DOD) and NASA, the study covers all grants awarded under the SBIR, not just those awarded in defence, and only covers a limited time frame (1990-1992). As the author himself acknowledges the grants could have an effect over a longer time horizon than covered by the data used in the study

³⁷ Austria, Belgium, Cyprus, Czech Republic, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain and Sweden.



Table 4.2: Data on JIP-FP SME involvement

	Call 1	Call 2	Call 3	Call 4
Proportion of bids submitted by SMEs	19%	17%	23%	20%
Proportion of SMEs successful (as proportion of total successful)	26%	13%	19%	23%
Proportion of SMEs successful (as a proportion of all SMEs bidding)	27%	17%	22%	17%

Source: European Defence Agency

- 4.62 The JIP-ICET, having been introduced more recently (May 2008) has only to date had one call. The proportion of SMEs that submitted bids as consortium members was 24 per cent, compared to 33 per cent from academia and 9 per cent from non government labs.³⁸
- 4.63 In the UK under the old Competition for Ideas (Col) scheme that preceded the CDE, whereby companies submit proposals for ideas and the MoD funds the ideas that win, the first contract placed, for approximately £300,000, was awarded to Plextek Ltd, to research a technology that would allow improved communications between military vehicles and convoys. The idea was that it would use a low-cost, low-power technology with little chance of intercept. Plextek is a Cambridge-based SME with approximately 100 employees. Another such contract was awarded to an Edinburgh-based company, Dreamimpact Ltd, for the I-Ball concept - a grenade-launched camera that provides 360-degree video coverage in flight.
- 4.64 It is too early for there to be definitive evidence on what tends to happen to the SMEs that have been involved in the UK's Competition of Ideas, or its successor, the CDE, when they have completed their contracts. The evidence to date, however, suggests that they follow a variety of strategies, all valid: some have developed and sold a product to MoD as a result of a Col/CDE project. Others are developing their range of products and market share, using MoD funding to develop their technical capability. Some companies see the Col/CDE funding as a means of attracting external investment.
- 4.65 One particularly interesting feature of the CDE scheme is that financing is available for up to 100 per cent of the costs associated with the R&D. To date, however, the emphasis has been on 100 per cent financing, rather than co-financing: of the 87 successful candidates, all have been 100 per cent funded. It is interesting, also, to note that the SMEs have been more successful in winning the open tenders, i.e. those proposals that are not linked to any specific themed call for ideas (see Table 4.3 below), whereas the Primes and other large companies have been more successful in winning the themed calls. This could reflect the greater ability for larger companies to understand and target the longer term capability requirements of the MoD.

³⁸ Source: European Defence Agency



Table 4.3: Breakdown of Successful Candidates by Type of Organisation

	Open Calls	Themed Calls
SMEs	60%	43%
Academia	13%	5%
Primes and large companies	27%	52%

Source: Centre for Defence Enterprise. In total 41 open calls were funded and over the six individual themed calls. 147 proposals were received, of which 46 were successful. All of these projects have been funded 100 per cent, open calls through MoD/CDE and the themed calls via the capability vision budget.

4.66 A key element to co-financing schemes is not just that they offer financial backing to the SMEs, but that the time delay between application and receipt of a grant is as short as possible and that the facility for applying is administratively as straightforward and light touch as possible. Ultimately, however, co-financing programmes are likely to be more effective for innovative SMEs engaged in R&D that has both a military and civil application, rather than defence-specific technology, where there is greater scope to exploit the innovation, unless the financing extends to 100 per cent of the cost of undertaking the R&D.

Requirements that Primes and higher tier suppliers involve SMEs

4.67 The US Department of Defense (DoD) encourages its contractors to involve small businesses. Federal Acquisition Regulation requires that other-than-small businesses submit a subcontracting plan for contracts that exceed \$550,000 (or \$1 million for construction), and offer subcontracting opportunities. Unfortunately, direct data on DoD subcontracting are unavailable for analysis: there is no centralized database for collecting it.³⁹

4.68 As discussed in the previous section offset policies also offer some insights into the potential effectiveness of such policies. While such policies are clearly effective at promoting domestic suppliers' involvement, there is a significant cost attached to this. Offsets are not the "free lunch" they appear to be; they allocate work away from least-cost suppliers, to firms in the purchasing nation. Hence, they add to costs, and the purchaser bears most of them. According to Martin and Hartley⁴⁰ the cost premium in the UK ranged from 3-60 per cent, with a typical range of 5-15 per cent. In a survey of the literature on this subject, Brauer and Dunne⁴¹ reported studies that estimated the direct costs to be 20-30 per cent for Belgium and 10-15 per cent for Finland.

³⁹ Nancy Moore, Clifford Grammich, Julie DaVanzo, Bruce Held, John Coombs, and Judith Mele (2008), "Enhancing Small-Business Opportunities in the DoD", National Defense Research Institute, RAND.

⁴⁰ Martin, S and Hartley, K (1995), "UK firms' experience and perceptions of defence offsets: survey results", Defence Economics, No. 6, p 123-139.

⁴¹ Brauer, J and Dunne, P eds (2004), "Arms Trade and Economic Development, Theory, policy and cases in arms offset", Routledge, London.



Alternative policies

- 4.69 Some data also exists on a few of the alternative policy models that are in place in various pMS.
- 4.70 Aside from the co-financing scheme outlined earlier, Pacte PME also has an initiative in place to facilitate contact between innovative SMEs and large companies – their “met” programme. This initiative was introduced in 2005. Since then, in 2006 they facilitated 28 meetings between innovative SMEs and large companies and 37 in 2007. The 100th such meeting was held in April 2008. The annual increases in these meetings would suggest that they have a positive impact for both parties involved.
- 4.71 Data from Pacte PME on the proportion of contracts awarded to SMEs also offer some indication of the effectiveness of both this initiative and the co-financing arrangement they have in place. As Table 4.4 indicates, the initiatives introduced by Pacte PME, and perhaps the mere existence of such an organisation, appear to have had a positive effect on SME participation in defence R&D.

Table 4.4: Contracts awarded to innovative SMEs participating in Pacte PME

	Value of contracts awarded to SMEs (€Million)		Proportion of contracts awarded to SMEs (%)	
	2006	2007	2006	2007
DGA (equipment)		36		0.8
DGA (R&T studies)		29		4.6
DCNS	339	258	23.8	18.2
Thales	109	706	7.2	34

Source: Pacte PME, L'Observatoire. The full data set for is not due to be released until July 2009 at the earliest.

Note: 2006 data for DCNS refers to DCN only, 2007 refers to DCNS.

- 4.72 In terms of the total value of contracts awarded to SMEs, the figure has risen to nearly €9 billion in 2008, representing almost 20 per cent of the total procurement of the large companies. This figure represents a small increase on 2006 and 2007 where the share was approximately 19 per cent. Comparing the proportions for defence and IT, as we would expect the share is higher in IT, however, a larger increase between 2006 and 2007 is apparent in defence, see Table 4.5 below.



Table 4.5: Average proportion of contracts awarded to SMEs in defence, IT and overall

Averages	2006	2007
Defence	16%	26%
IT	37%	38%

Source: Pacte PME, L'Observatoire, and Europe Economics calculations.

Note: To ensure the comparability of the data for 2006 and 2007, the averages have been calculated only for companies participating in Pacte PME in both 2006 and 2007. For defence the figure is, therefore, based on data from Thales and DCNS, and for IT the figure is based on data from Microsoft and Schlumberger.

- 4.73 Defence trade associations such as the French Naval Industry Group (GICAN), run a number of initiatives to improve access to business opportunities for innovative SMEs. For example, initiatives put in place by GICAN include:
- (a) GICAN organises meeting between Primes and SMEs that are members. These meetings (“conference fournisseurs”) follow a similar format to the meetings organised by the DGA in that the Prime presents the opportunities they have for subcontracting.⁴² The SMEs then have to take responsibility and contact the Primes directly to present any ideas or proposals they may have. They have conducted a number of these conferences to date and so far the feedback is very positive from the SMEs, some companies have even joined GICAN just to be able to attend these meetings.
 - (b) They also organise a large trade fair every two years, Euronaval. Companies from around the world attend the show and awards are presented by the Defence Minister to the three most successful SMEs, one of which is for innovation. They also offer SMEs the opportunity to meet bilaterally with domestic and foreign Primes, for free. The enthusiasm of SMEs to take advantage of such opportunities suggest that they offer some benefit, though it is not clear how effective such initiatives are in terms of actually winning sub-contracting opportunities.
- 4.74 While there are no defence-specific policies to promote innovative SMEs in Germany, there are a number of policies aimed at promoting SMEs in the economy as a whole.
- (a) The new ERP start-up fund⁴³ introduced at the start of 2006 provides equity funds for small technology-based firms together with a private investor to finance innovation projects. If the investing company goes into default the government bears part of the deficiency payment effected by out-of-court arrangement.
 - (b) In 2005 the new federal assistance programme “Innovative shipbuilding guarantees competitive jobs” entered into force. Under this programme German shipyards may

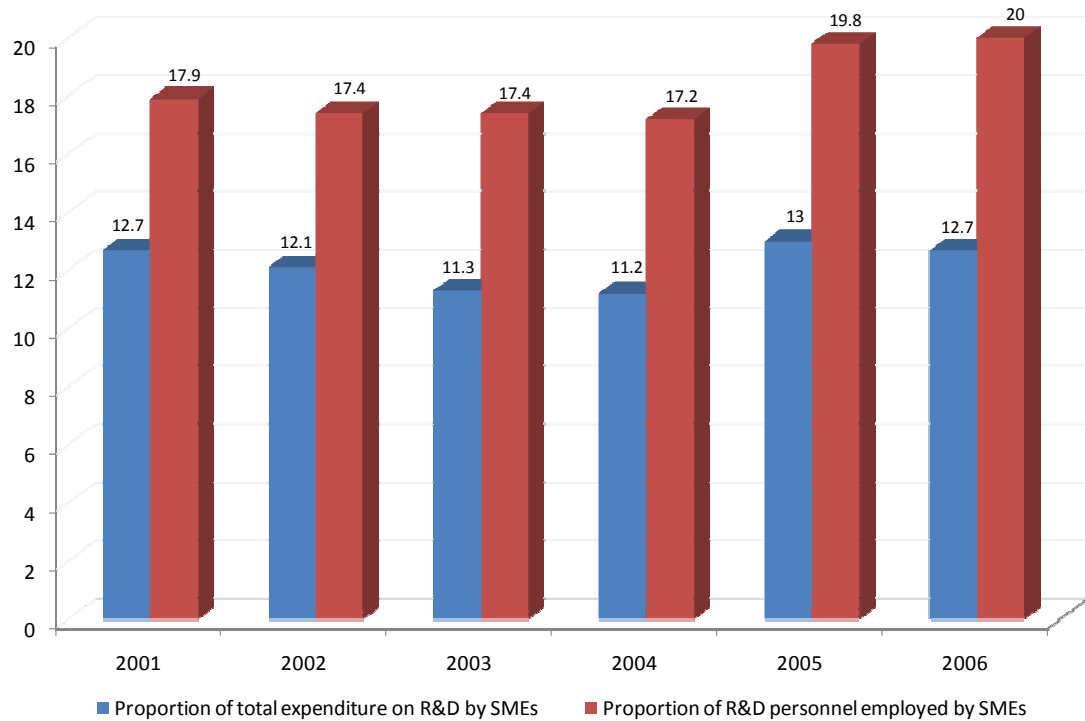
⁴² The DGA has introduced “Les conferences de lancement” for large equipment programmes. At these conferences the DGA, or, more frequently, the Prime that has been awarded the programme presents the main requirements to SMEs and specialists from the relevant industries so they are aware of the opportunities for sub-contracting.



apply for conditionally repayable grants to cover their expenses for investments, design, engineering and testing.

4.75 The Institute for SME Research collects data on the SMEs share of R&D. This data suggests that until 2005 both the share of SME spending as a proportion of total R&D and the share of R&D personnel employed by SMEs were relatively stable or declining. In 2005, however, both figures experience an increase, which is sustained in 2006 (see Figure 4.1 below). While there is nothing conclusive in this data, nor any evidence of a causal effect, it is interesting to note that this increase coincides with the implementation of the policies outlined above.

Figure 4.1: SME involvement in R&D in Germany, 2001 – 2006 (%)



Source: Institute for SME Research, Bonn.

⁴³ The successor of the “Technology Participation Programme” (BTU) which expired in 2004.



Conclusions

- 4.76 There seems to be some conflict in terms of where the comparative advantage of SMEs lies. One view is that it lies towards the research, rather than the development phase of the R&D spectrum, because SMEs lack the minimum scale needed for costly defence development facilities – costly compared to those that are required for research.
- 4.77 In contrast, the case has also been made that the opportunities for SMEs lie downstream, in the development stages, rather than at the research stages of projects. This is largely because ideas and solutions in defence need to incorporate such a wide range of knowledge, and require a wide perspective of the industry, and the ability to link concepts together. These abilities lie beyond the capacities of the typical SMEs: they are more likely to be found in universities, at the forefront of current knowledge.
- 4.78 Either view of SMEs' competitive advantage is consistent with SMEs' observed participation in defence - a valued role, but a necessarily limited one, exploiting their agility and innovation. They can contribute particularly by responding to Urgent Operational Requirements (UORs), because these require high-speed, reactive, development work.
- 4.79 In terms of policy initiatives, Member States have adopted a variety of policies along the general-to-the-specific spectrum, ranging from support for SMEs in general to support specifically for R&D by defence-related SMEs. Only three Member States appear have adopted the latter approach in a determined fashion – France, the Netherlands and the UK. These initiatives have been quite recent, so it is too early to judge whether these approaches have influenced SMEs' involvement in defence R&D.
- 4.80 IPR ownership and the delay between the initial investment by an SME to realising any return represent key challenges for SMEs in the defence industry. Consequently, fields where there is greater scope for dual use, in particular security or information systems where there is greater scope to market the product in the commercial sector, offer the most attractive opportunities for defence-related SMEs engaging in R&D. A lack of understanding about the national defence authorities' future capability requirements also seems to limit the scope for SME involvement in defence R&D.
- 4.81 Policies to increase SME participation must take these issues into consideration if they are to be effective. Evidence on the effectiveness of existing policies is, unfortunately, largely qualitative because many of the existing initiatives aimed at facilitating SME involvement in R&D in defence were implemented relatively recently. Based on the evidence that does exist, however, there seems to be a common response coming from both industry and the authorities.
- (a) Policies that offer co-financing are useful but must be targeted appropriately if they are to work. In particular, IPR issues and user rights must be considered as they will have a significant impact on the incentives acting on SMEs to invest in R&D.
 - (b) Improved communication and transparency are fundamental for SME involvement, in particular policies that allow SMEs improved access to information regarding strategic

How Effective are these Policies in Increasing SME Participation?



requirements and future capability allow them to better target their efforts and facilitate their involvement.

- (c) Procurement procedures and processes for SMEs to present their ideas and products must be simplified and made less burdensome.
- (d) Rules-based policies that oblige larger companies to sub-contract to SMEs may well have a place, but their costs need to be appreciated, identified, and borne by the authorities.



5 CONCLUSIONS AND RECOMMENDATIONS

- 5.1 This report has attempted to identify contracting policies that would raise the participation of defence-related SMEs in R&D/R&T programmes and defence equipment development projects. It began, in Chapter 2, by noting that, in statistical terms, SMEs' involvement in defence is quite modest – about one-third as large as their involvement in manufacturing as a whole. Noting that their involvement in defence is about the same as it is in another R&D-intensive industry – the pharmaceutical industry - we raised the question whether - contrary to the “romantic” view of the inventor - SMEs are, in fact, particularly competitive in R&D. It is important for policymakers to be aware of this possibility because if it is the case, then policies that seek to promote SMEs' involvement in defence are likely to be counter-productive and costly – an attempt to “push water uphill”.
- 5.2 Economists focus on market failures as a reason for government intervention in private markets, so we considered, also in Chapter 2, the types of market failure that could be relevant to R&D. A transaction costs approach indicated reasons why Primes might prefer to do their own R&D, rather than buying it from sub-contractors. There is also a problem to do with the “appropriability” of the results of R&D. Patents are not particularly effective in the types of industry that are involved in defence. Innovative companies have to rely for the protection of their knowledge on the relative complexity and demanding requirements of most defence equipment, and the security status of defence technologies.
- 5.3 We noted also that defence SMEs are denied the options that are available to their civil counterparts, to exploit the economic potential of their innovations. These theoretical observations appear to predict some aspects of defence R&D pretty well. There appears to be no place for the “jobbing” R&D company in defence. SMEs' share of defence work is quite modest, despite the alleged strengths of SMEs in R&D, and the R&D-intensive nature of defence equipment.
- 5.4 Chapter 3 applied some economic theory to candidate policies, to assess their potential, as well as their possible drawbacks. It noted that incentives, and rules-based requirements, are very different mechanisms, each with their respective advantages and disadvantages. Incentives are less certain in their effects, but pose fewer economic risks. Rules-based approaches (e.g. requiring particular levels of SME participation in defence development contracts) would have greater certainty of effect, but would pose greater economic and technical risks. Chapter 4 then considered the prospects of two types of policy - co-financing, including co-operative arrangements, and SME-content requirements.
- 5.5 By no means are all of the R&D policies that have been reviewed in this study based on a clearly identified market failure. This raises doubts as to whether such policies will improve efficiency. A clear distinction needs to be made between policies designed to address market failure and increase efficiency in the supply chain, and policies with the specific objective of increasing SME participation in R&D as an end in itself, irrespective of any associated economic benefits or costs.



- 5.6 Chapter 4 reviewed the effectiveness of the policies that have been introduced by pMS to increase SMEs' participation in defence R&D, drawing on the factual picture that we have assembled in the Appendix, and our meetings and interviews with the three sets of stakeholders – SMEs, Primes, and Ministries of Defence. There is very little evidence on which to draw at this stage, because the relevant policies have been introduced only recently. However, a number of central themes have emerged, all of which need to be taken into consideration if policies to increase SME participation are to be effective:
- (a) as predicted in Chapters 2 and 3, IPR is a key factor in R&D, and is likely to condition SMEs' responses to policies.
 - (b) The delay between the initial investment by an SME to realising any return represents a key challenge for SMEs in the defence industry.
 - (c) These two factors, together, imply that the most attractive opportunities for defence-related SMEs engaging in R&D occur when there is scope for the dual use of the technology concerned.
 - (d) Understanding the national defence authorities' future capability requirements also encourages SMEs' involvement in defence R&D.

Conclusions

- 5.7 If policymakers are determined to achieve a “statistical” impact, rules-based policies are probably their most reliable instrument. Incentives and “softer” measures, such as those directed at greater better-informed defence markets and SME-friendly procurement practices, are inherently less reliable at increasing numbers in the short term. However, because “softer” measures address some of the root causes of market failure, rather than just its symptoms, they seem likely to be more effective in improving the functioning of the market in the long term.
- 5.8 Rules-based policies that oblige larger companies to sub-contract to SMEs may, therefore, have a place, but the costs in terms of increased inefficiency must be appreciated, and borne, by the authorities. Such policies are fraught with potential pitfalls, as the French experience of the “Plan d'Acquisition” demonstrates. The terms of that scheme had to be rewritten to offer Primes a bonus for sub-contracting to SMEs and to transfer the risk of over-runs by SMEs back to the customer.
- 5.9 SME-content policies might have unintended (adverse) consequences, that would raise the cost of defence R&D – the reverse of the intended effect:
- (a) Knowing that Primes would be required to involve more SMEs, the SMEs would not need to bid as keenly for sub-contracts as they did before; and once they had been contracted, they would be less motivated to perform well.
 - (b) Whereas the long-term success of the policy depends on SMEs developing into large companies, capable of surviving without support, SMEs would be discouraged from



growing beyond the upper limit of the SME definition (a variant of the problem that besets the policy of providing tariff protection for “infant industries” – the infants never grow up).

- 5.10 In their favour, it could be argued that SME-content requirements could lead to the discovery of more innovative and less expensive defence systems. However, It seems unlikely that SME-content requirements would prompt Primes to adopt technologies that they consider less appropriate, and which would increase the technical risks. Moreover, it would make no sense for a national defence authority to over-ride the judgement of a Prime on such a matter, since it has engaged the Prime to take responsibility for developing the defence system concerned.
- 5.11 There is also the question of the effectiveness of such policies. Although rules-based policies would be expected to be more certain in their effects than would incentives, there is the possibility that Primes might seek to evade their intent by acquiring SMEs, or spinning off their own, in order to comply with such policies. In other words, the Primes might seek to comply merely by making organisational changes, rather than by changing their sub-contracting behaviour.

Recommendations

- 5.12 Our recommendations are guided by economic theory and by the feedback from industry and defence authorities. We have not limited them to “contracting policies”, as mentioned in the EDA remit, and they concern four themes:
- (a) co-financing programmes;
 - (b) information;
 - (c) procurement procedures; and
 - (d) encouraging capacity-building by defence-related Trade Associations.
- 5.13 **Co-financing programmes:** The effectiveness of co-financing programmes will depend on the scope for SMEs to exploit the technology. This will be determined both by the duality of the technology and the IPR arrangements associated with the programme. Co-financing initiatives are only likely to be effective when the products being developed also have a civil or commercial application (i.e. dual-use), which would allow the participants to exploit their IPR in the commercial sector.
- 5.14 Defence-specific R&D/R&T, where the scope to appropriate the results of the investment is limited if not non-existent, must be financed 100 per cent by national authorities. In France, where there is a clear understanding that defence-specific R&D/R&T must be 100 per cent funded by the authorities, co-financing initiatives such as RAPID, introduced in May 2009 by the Ministry of the Economy, Finance and Work and the Ministry of Defence and which provides co-financing for industrial research projects, and the COINCIDENTE programme introduced in 1985 in Spain, are only applicable to dual-use



R&D/R&T. Where the R&D/R&T is not fully funded, user rights and the potential for the SME to market their product in the commercial sector must be explicitly clarified. The use rights should vary depending on the level of funding.

- 5.15 **Information:** A theme that has emerged in this study is that the defence market poses peculiar informational challenges to its participants. These have to do with the interaction between, on the one hand, with the vast range of potentially relevant technologies, and the various possibilities for combining them; and on the other, the procurement priorities of the Ministries of Defence. It is a challenge for any organisation, even a large one, to comprehend such a picture. In this sense, there is an endemic market failure in defence: the informational overload is too great. Efficient markets depend upon information. This underlines the significance of the initiatives which certain Ministries of Defence have taken to manage and interpret this mass of information, and to share it with SMEs. In particular, the French “Atelier” and “les conférences de lancement” offer useful models, as do the CDE seminars when technical experts communicate to innovative SMEs the types of problems to which they need solutions.
- 5.16 Such policies have a cost. They require investments of administrative resources on the part of Ministries of Defence. There are also transaction costs for the market participants: how, for example, do Primes discover SMEs - domestic and foreign - with the relevant technologies, and the managerial skills that are needed to participate in defence projects?
- 5.17 **Simplified contractual arrangements and processes:** In conjunction with improved communication, simplified contractual arrangements and processes also need to be addressed if SME participation is to be facilitated. Examples are the quick turnaround promised by the CDE in the UK (where the deadline for feedback is two weeks) and RAPID in France (where the aim is for there to be no more than four months between the application for a grant and the start of work if successful). The publication in the UK by the CDE of shorter contractual terms that firms can refer to before deciding whether to engage in the first place, and the “Espace PME” in France, also offer interesting approaches. These two sets of initiatives – sharing information and simplifying procurement - address clear market failures, and we recommend their wider adoption.
- 5.18 **Encouraging capacity-building by defence-related Trade Associations:** Trade associations help defence markets to function by, for example, creating networks, disseminating information and assisting contractors to find suitable sub-contractors. Member States which involve SMEs in defence R&D tend also to have developed institutional structures which help to facilitate this process, most notably, trade associations. Such organisations are generally less well developed in defence in the Eastern European Member States.
- 5.19 Defence-related trade associations originated in a variety of ways. Some were formed by small groups of SMEs, seeking to strengthen their position by acting together (e.g. DMA). Some, such as GEBECOMA, the Belgian Aerospace Association, arose from initiatives by larger companies. Some associations have a history with Government: GICAN was created under the sponsorship of the French MoD. Although most trade associations



arose essentially as industry initiatives, in some cases with government encouragement, governments are in a position to enhance their status and vitality by using them as a means of communication and by involving them in policy. For example, the Estonian Defence Industry Union (EDIU) is underpinned by a memorandum signed between EDIU and the MoD that provides it with greater legitimacy and increases its powers to act.

Prospects for Implementing these Recommendations

5.20 We consider, briefly, the prospects for implementing these recommendations in Member States, noting some broad national differences in cultures, and institutional and industrial structures:

- (a) Sharing information is easier to achieve in countries with traditions of open government and well-established trade associations.
- (b) The costs associated with implementing these recommendations – particularly with respect to financing R&D by SMEs - are less likely to commend themselves to countries with small defence R&D budgets. Such countries are less likely to want to invest time and funds in engaging with SMEs than are France and UK, the two Member States with by far the highest defence R&D expenditures.
- (c) Differences in economic philosophies could be expected to influence Member States' adoption of SME-content requirements. For example in France there may be greater sympathy for the idea that, as newcomers, SMEs “must be protected”. But should this protection last for life? Is the distinction simply that if a SME is growing, it deserves support, and if not, not? Growth should be supported because it changes the structure of industry. In contrast, in the UK, and in Germany, with their emphasis on value for money and increasing the efficiency of the defence supply chain, there is likely to be little support for requiring - or incentivising - Primes to sub-contract R&D to SMEs.



APPENDIX: EXAMPLES OF EXISTING POLICY INITIATIVES TO PROMOTE SMES IN R&D/R&T

A.1 Prior to this study, the EDA conducted a survey of all participating Member States to identify existing policies. This Appendix sets out the policies that were reported in response to that survey. It also provides considerably more detail, based on our own research.

Belgium	
Details on existing policies	<p>The defence industry in Belgium is traditionally not very transparent, due to confidentiality issues, and not of a large scale.</p> <p>BSDI – Belgian Security & Defence Industry</p> <p>In 1989 the Belgian Minister of Defence founded a lobby group called the BDIG (Belgian Defence Industry Group). This became later the BSDI that nowadays represents an estimated amount of 85 per cent of all defence-related enterprises in Belgium. The BSDI remit is to:</p> <ul style="list-style-type: none"> • Represent the Belgian Defence sector in Belgium and abroad, to intermediate between suppliers and demand and to coordinate activities. • Inform the industry of possibilities and to support its entry into the market. • To promote the Belgian defence-related industry and its products abroad. • Advise the Government on regulations and actions that could be taken to support the sector. <p>VBO (Verbond van Belgische Ondernemingen – <i>Association of Belgian enterprises</i>)</p> <p>The website of the VBO (Verbond van Belgische Ondernemingen – <i>Association of Belgian enterprises</i>) provides information on different actions taken by the government to support Belgian SMEs on all sectors.</p> <p>KMO (SME) actieplan: The Federal government approved the ‘actieplan’ (<i>plan for action</i>) on October 17th 2008. Describing this plan, it says on the website, that it is constructed in such a way that it can support especially SMEs. Belgium has an estimated 200,000 SME employers, that offer around 1,600,000 jobs. The Government commits itself to maintaining a better relationship with SME and promise to be more precise and accurate when it comes to payments (apparently the Government was a very inconvenient client because of delayed or non-fulfilled payments). Furthermore, this summary reports that the Government sees the need to create a new ‘plan for action’ that targets especially the establishment and development of SMEs.</p>
Spain	
Details on existing policies	<p>The MoD’s “PROGRAMA COINCIDENTE” – Programme of Coincidence</p> <p>Since 1985 the Ministry of Defense (MoD) has pursued the “Programa COINCIDENTE”⁴⁴</p>

⁴⁴ Unless otherwise noted, source is http://www.mde.es/dgam/program_coincidente.htm



	<p>(Cooperación en Investigación Científica y Desarrollo en Tecnologías Estratégicas)⁴⁵, or Programme of Coincidence, whose objective is to make use of technologies developed in the civilian sphere of national research and development (R&D) applicable to defence. The programme therefore relies on the coordination between R&D programmes of the MoD and the “Plan Nacional de Investigación Científica”, or the National Plan for Scientific Research. The coordination ensures dual use of technologies and acts as a multiplier for R&D efforts. The projects are undertaken by different companies and universities, and are funded by the Ministry of Industry, Tourism and Trade and/or the Ministry of Education and Science (through the PROFIT programme). Technologies deemed useful in the defence sector are then also funded by the MoD.</p> <p>The Programme of Coincidence is open to private, not-for-profit R&D centres, registered technology centres, public research bodies, other groups or associations⁴⁶ and firms, particularly SMEs. Its primary purpose is to create a technology network providing business and technology centres of capabilities needed for continued development.</p> <p>The objective here is to maximize the capacity of these centres, as well as that of research associations, technology parks and platforms, to make it easier for SMEs especially to participate in R&D.⁴⁷</p>
Finland	
<p>Details on existing policies</p>	<p>Defence and Safety Industries Strategy, 2007, Ministry of Defence</p> <p>This strategy maps out future challenges for defence and safety industries and proposes plans of action. It recognises SMEs as a part of the industry, characterising them as being mainly high technology companies.</p> <p>The strategy identifies a need to allocate more resources for knowledge-based industries and a need for the industry to follow The Finnish Defence Forces’ strategic plans. Also recognised is the need for collaboration and strategic partnerships between the industry, The Finnish Defence Forces and the scientific research community.</p> <p>Under the title “The Importance of Research and Development”, it is stated that the gap between military and civil technologies is closing, and that this opens up opportunities for innovative SMEs that focus on a small niche area, becoming a ‘niche champion’. It is envisaged that this development will make it easier for SMEs to enter the market.</p> <p>Strategy for actions (Material Policy Strategy, 2007, Ministry of Defence)</p> <p>The strategy states that SMEs can hold their places in the market only if their goods and services are based on exceptional knowledge and they are linked into a subcontracting chain. The aim is to have the Finnish defence material industry to become an important partner for the European industry or an independent actor in small niche markets.</p> <p>The strategy recognises a need to activate the involvement of SMEs in European research and technology projects. National research and technology projects should always be encouraged to</p>

⁴⁵ Translates into “Cooperation in Scientific Research and Development in Strategic Technologies”.

⁴⁶ These include joint ventures, economic interest groups and not-for-profit sector business associations

⁴⁷ <http://www.plannacionalidi.es/plan-idi-public/mostranModelo.do?idContentValue=413&version=1&idContent=414&tipoModelo=8>



	<p>collaborate with their European partners.</p> <p>What is stressed in both strategies is that SMEs should create stronger links to the industry and to concentrate their knowledge and serve a niche market.</p> <p>Tekes (The Finnish Funding Agency for Technology and Innovation) funds R&D projects for the defence industry. Their funding is especially aimed at SMEs, universities and research centres. However, Tekes does not have a specific program through which money for defence industries is allocated.</p>
France	
<p>Details on existing policies</p>	<p>In 2007 the Defence Minister brought together industry representatives and the procurement authorities to help develop a range of initiatives to help SMEs operating in the defence sector. The “Plan PME-PMI” was the result of this interaction. It proposed a number of initiatives to help promote SMEs and to address the five core challenges:</p> <ul style="list-style-type: none"> – Improving the dissemination of information to SMEs – Facilitating direct access to DGA contracts for SMEs – Facilitating sub-contracting opportunities for SMEs – Facilitating access for SMEs to export markets – Establish a structure to direct, coordinate and monitor progress on these initiatives <p>As a consequence, a number of initiatives have been introduced since 2008 to promote SMEs involvement in defence supply chains, including in R&D.</p> <p>Co-financing policies</p> <p>There are no specific measures incentivising SMEs’ participation in defence R&D/R&T contracts in the French public procurement procedure. However in May 2009 the Ministry of the Economy, Finance and Work and the Ministry of Defence introduced “RAPID” (régime d’appui aux PME pour l’innovation duale). The objective of RAPID is not to support defence-specific R&D, rather it will provide funds for dual use industrial research projects or experimental development work with a strong technological potential. The technology must be applicable in both military and civil contexts to qualify for funding.</p> <p>The aim is for there to be no more than four months between the application for a grant and the start of work if successful. The applications will be assessed by la direction générale de la compétitivité, de l’industrie et des services (DGCIS) and the DGA. The DGA is allocating up to €10 Million to this initiative.</p> <p>The maximum financing available is 80 per cent of the costs. The actual amount awarded will depend upon:</p> <ul style="list-style-type: none"> (d) The nature of the project — industrial research would receive 50 per cent, compared to 25 per cent for experimental development; (e) The size of the company — a micro enterprise would qualify for 20 per cent, compared to 10 per cent for SMEs; and (f) Whether the project is a collaborative project or not — an additional 15 per cent of the costs are available for collaborative projects.



	<p>Policies to increase R&D sub-contracted to SMEs</p> <p>While there do not exist any mandatory requirements for Primes to sub-contract a certain proportion of public contracts to SMEs, the DGA has been setting up measures to help promote SMEs as sub-contractors of primes by:</p> <ul style="list-style-type: none"> (a) applying acquisition plans (“Plan d’Acquisition”) to certain contracts to specify, among other things: <ul style="list-style-type: none"> – the systems, sub-systems, services and R&T studies which will have to be opened to competition by the Prime, – the criteria for the Prime to select the bidders. (b) adopting new contract clauses to incentivise Primes to sub-contract to SMEs, including altering the penalties clause to allow the penalty for a delay to be reduced if the delay stems from the part of the work being undertaken by an SME and offering a bonus to Primes for sub-contracting to SMEs. <p>Aside from mandatory requirements and incentives for Primes to subcontract to SMEs, the DGA has also introduced policies to increase SME visibility with respect to Primes and their awareness of sub-contracting opportunities. To this end the DGA has introduced “Les conférences de lancement” for large equipment programmes. The format of these conferences is as follows: SMEs and specialists from the relevant industries are invited to attend presentations by the DGA, or, more frequently, the Prime that has been awarded the programme, where they set out the main requirements for the programme and timings, and thus the opportunities for sub-contracting. Two of these conferences are held each year and are linked directly to a specific equipment programme.</p> <p>Other policies to improve access for SMEs to R&D/R&T programmes</p> <p>The DGA has also implemented several measures to improve direct access to research contracts for SMEs, including:</p> <ul style="list-style-type: none"> (a) Increasing the number of small studies (worth between €300,000 and €2 million). In 2008, 50 per cent of such contracts were awarded to SMEs, equivalent to approximately €20 million. In 2009 the aim is to increase the total value of contracts awarded to SMEs to €30 million. (b) The public procurement officer can also allocate up to 15 per cent of the annual budget for SMEs, on contracts worth less than €130,000. (c) The DGA has also introduced a “service d’achat” to help address the specific needs of SMEs. The “service d’achat” increases the speed of contract negotiations creating a more rapid turnaround for companies that successfully bid for projects between project award and the start of the project. (d) The DGA also organises an R&T conference (“Atelier R&T”) once a year. The conference is not linked to a specific programme, but allows the DGA’s technical experts to present to SMEs their needs in terms of R&T and give visibility over future R&T contracts. The SMEs can approach the DGA with any ideas they have in these areas and if considered useful by the DGA, the SME may be: <ul style="list-style-type: none"> – offered a contract under the REI scheme; or – the DGA put out a tender to open competition for the capability (for which the SME can obviously bid); or – the DGA can send them to a Prime. (e) The DGA has also created a specific space dedicated to SMEs (Espace PME) on their procurement site (IXARM) and a purchasing service dedicated to SMEs has been created. Its reactivity is adapted to SMEs specific needs. (f) The DGA is also presiding over negotiations to establish a common agreement with respect to the transfer of a SMEs IPR to a Prime and the way in which any exports
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	<p>would be handled to improve the situation of innovative French SMEs.</p> <p>Since 2004, the DGA has REI (Recherche exploratoire et innovation) in place. This initiative is applies to spontaneous offers from laboratories and innovative defence SMEs. The contract value is usually limited to €300,000, but can be increased up to €500,000 in case of a very promising project involving several partners. Projects are firstly evaluated by non-DGA scientific experts and then presented to a DGA's selection board, which meets every two months. In case of selection, DGA's objective is to sign the contract within six months. When an innovative technology developed in the frame of REI is promising, the French legislation makes it possible to award, without competition, an R&T study to the SME at the origin of the innovation</p> <p>Trade association Initiatives</p> <p>Aside from the national policies, the individual professional bodies also have a variety of tools in place to help promote SMEs' involvement in R&D/R&T in France. For example, Pacte PME runs a collaborative initiative to which SMEs can apply when they have a client, and they receive one third of the financing for the project from the government, with the SME and its client also each contributing one-third of the costs. Similarly, the main defence trade associations, GICAN, GICAT, and GIFAS all provide a variety of support for their members, including conferences, advice, updates on potential opportunities etc.</p>
Germany	
<p>Details on existing policies</p>	<p>The website of the German Armed Forces & Defence (Bundeswehr) explains that the Department Ruestung (armour) is responsible for the purchase of defence-related materials. This Department is divided into two main bodies, the BWB (Bundesamt für Wehrtechnik und Beschaffung) and the ITAmtBW (Bundesamt für Informationsmanagement und Informationstechnik der Bundeswehr). The BWB focuses on the procurement of defence material and the ITAmtBW on the provision of Information Technology.</p> <p>The ITAmtBW is currently calling for enterprises to participate in a cross-disciplinary discourse for Concept Development and Experimentation purposes. There seem to be no entry requirements and everyone who considers himself suited can pass on their R&D ideas and projects. It does not specifically say anything about SMEs, for the 'Bundeswehr' wants the process to be as even-handed as possible.</p> <p>Policies to support SMEs more generally (i.e. in the economy as a whole), however, do exist in Germany.⁴⁸ Aside from a number of policies to help SMEs compete internationally with advice and support in exporting, the Federal Office of Economics and Export Control (BAFA) also has in place the following initiatives to help promote innovative SMEs in particular:</p> <ul style="list-style-type: none"> • The new ERP start-up fund – the successor of the “Technology Participation Programme” (BTU) which expired in 2004 – provides equity funds for small technology-based firms together with a private investor to finance innovation projects. If the investing company goes into default the government would bear part of the deficiency payment effected by out-of-court arrangement. BAFA sees to it that the Government's interests are safeguarded in those out-of-court arrangements. • In 2005 the new federal assistance programme “Innovative shipbuilding guarantees competitive jobs” entered into force. In accordance with the guidelines German shipyards

⁴⁸ Note that businesses with an annual turnover of less than €50 million and fewer than 500 employees are categorised as SMEs in Germany, as opposed to the EC definition which has an employee limit of 250 staff.



	<p>may apply for conditionally repayable grants to cover their expenses for investments, design, engineering and testing. These expenditures must result directly from the industrial application of innovative products and procedures in shipbuilding which are new or much better than the usual technological level and bear the risk of technical or industrial setbacks.</p>
Netherlands	
<p>Details on existing policies</p>	<p>Nationaal Technologie Project (NTP) & Commissie Defensiematerieel (CODEMA)</p> <p>A research institution or enterprise can apply for financial support at the NTP by sending in proposals. The support can cover 100 per cent of costs. The Ministry of Defence can either suggest projects, or institutions and businesses can submit their own suggestions. Criteria for financial support are innovation and relevance for the defence-related market.</p> <p>The CODEMA instrument is one via which businesses or research institutions can obtain financial support in the form of reimbursements or royalties. Ministry of Defence, Ministry of Economic Affairs and the supplier share each one-third of the costs.</p> <p>Small Business Innovation Research (SBIR)</p> <p>This instrument is set up especially for SMEs. It is constructed in such a way that the innovation capability of SMEs is strengthened. The Netherlands has expressed the wish to include SMEs more regularly in innovative procurements. In order to do this, the Dutch government is trying out the American model of the Small Business Innovation Research programme (SBIR).</p> <p>The Small Business Innovation Research programme is a programme that aims to promote innovation by SMEs. With the help of the SBIR programme, SMEs develop innovative solutions to social issues and problems. At the same time, these enterprises get a chance to create new, innovative products, processes and services.</p> <p>The SBIR programme in the Netherlands is an initiative by the Ministry of Economic Affairs cooperating with the Ministry of Agriculture, Nature and Food Quality, Ministry of Transport, Public Works and Water Management, Ministry of Defence, Ministry of Housing, Spatial Planning and the Environment, Ministry of Education, Culture and Science and the Ministry of Health, Welfare and Sport.</p> <p>Within the SBIR framework, the Ministry of Defence started off with an initial programme in 2006. The topic of this initial plan is 'operating in a <i>maritime manner</i> under adverse weather conditions'. The programme is mainly concerned with phase one and phase two of the process, which are respectively, the feasibility and the development phases.</p> <p>To make the procurement process more efficient, the Netherlands Government considers it to be useful that customer and suppliers communicate on a regular basis and work together more closely than before. To maintain a close relationship between the Ministry of Defence and the DGI the Ministry of Economic Affairs sets up theme-specific conferences in which both parties can discuss needs and possibilities. Also in other stages of the production process, the parties are given incentives to communicate in a similar manner.</p> <p>Other Instruments</p> <p>Other instruments that are used to support businesses (especially SMEs) to become more competitive and innovative are the following 'Economic Affair instruments' (EZ instrumenten):</p>



	<ul style="list-style-type: none"> • WSBO – a fiscal instrument to generate private R&D. This instrument has a budget of € 425 million per year. • Kapitaalmarktpakket – a support package set together out of a set of different programmes that support innovative SMEs, or those that are conducting R&D, by taking over a percentage of the financial risk these might face (50 per cent guarantee or more, depending on the type of work the SME does). • Innovation vouchers for SMEs – For SMEs, the requirements to work together with established technological research institutions are often very high. To remove the barriers SMEs can ‘buy’ certain knowledge or apply for cooperation with the institutions, using vouchers. This cooperation is mostly (not always) related to the innovative development of defence-related materials. • Innovatieve Prestatiecontracten (IPC) – (Innovative performance contracts): these contracts are made between a group of enterprises (per branch, sector, industry) that work on the development of one particular technological need (defence-related in particular). <p>Instruments to increase the competitiveness of enterprises focused on the international market:</p> <ul style="list-style-type: none"> • Export credit insurance – The state guarantees (via the private institution Altradius) for repayment risks for the supply of credit. The Dutch DGI makes regular use of this instrument. • Programme Starters Foreign Markets (PSB) – The government offers subsidies to SMEs that are inexperienced in exporting. <p>The Ministry of Defence and Economic Affairs assumes that working closely together with the DGI helps to strengthen the position of Dutch defence-related SMEs on an international market.</p> <p>Stichting Nederlandse Industrie voor Defensie en Veiligheid (NIDV) (<i>Foundation for the Dutch Defence Industry and Security</i>)</p> <p>The foundation NIDV functions as intermediary between the Ministry of Defence, the Parliament and the defence-related industry. The foundation tries to make sure the market functions in an optimal way, by helping small businesses with their marketing processes, providing information about upcoming projects and communicating opinions and needs. The NIDV sees itself as ‘ambassador’, ‘intermediate’, ‘centre of knowledge’, ‘stimulator’ and ‘forum’. It functions as a forum in the sense that it organises events on a regular basis that brings together demand and supply.</p>
Portugal	
<p>Details on existing policies</p>	<p>In January 2009 the national R&D Defence Strategy (EI&D) was approved. The EI&D Strategic Goals focus mainly on promoting the defence technological and industrial base (DTIB) and participation in the National Scientific and Technological System (SCTN) to sustain and develop national military defence capabilities, as well as to support the required DTIB enhancement for being part of a global logistic chain in the international defence market. In parallel with the EI&D a national Strategy for the Defence Technological and Industrial Base is under construction. In both policy instruments SMEs role has been stressed.</p>
Sweden	
<p>Details on existing policies</p>	<p>The FMV FMV, Swedish Defence Materiel Administration, is an independent, civil authority. FMV’s mandate, on behalf of the Swedish Government, is to strengthen the operational capability of Swedish Total Defence by conducting cost-effect procurement. The FMV assesses the market innovations in the</p>



	<p>perspective of the Armed Forces needs and also acts as a match-maker between small innovative companies and the established defence market.</p> <p>The FOI</p> <p>FOI is a research institute in the defence and security area. The agency is financed on a contractual basis and is responsible to the MOD. Its core business is research, method and technology development, and studies. FOI was created in 2001 through the merger of the then existing governmental agencies FOA (National Defence Research Establishment) and FFA (Aeronautical Research Institute).</p> <p>SME-D (The Swedish Association of Small and Medium Size Enterprises in Defence)</p> <p>Membership is open for independently owned high-technology companies. They define their purpose as to:</p> <ul style="list-style-type: none"> • Create the best conditions for SMEs to work within the defence and crisis management areas • Contribute towards cost-effective supply of materiel and services • Be an active accepted dialogue partner in matters of importance for the Association.
Slovenia	
<p>Details on existing policies</p>	<p>The policy project "Technology for security and peace 2006–2012 "(<i>Tehnologija za varnost in mir 2006–2012</i>) is aimed at the development of an efficient defence system for the country, the development of a system of national security, the strengthening of Slovenia's role and influence within the EU and NATO, and the development of a capacity to guarantee peace, stability and security within the international community. It determines that the maximum state aid for R&D/R&T projects conducted by enterprises is 50 per cent of eligible costs of the project for industrial research, and for experimental development 25 per cent of eligible costs.</p> <p>For medium sized enterprises, the upper level for both industrial research and experimental development can be raised by 10 percentage points, for small sized enterprises for up to 20 percentage points. Further a bonus of 15 percentage points can be given up to the highest level of state aid (80 per cent) if the project is conducted as a collaboration of at least two independent enterprises, of which none bears more than 70 per cent of the eligible costs, and of which at least one is a SME. These enterprises will have to contribute to the defence research and development projects.</p>
UK	
<p>Details on existing policies</p>	<p>Defence Technology Centres (DTC)</p> <p>There are four DTCs in the UK, providing research in a specialist area of technology aimed at benefiting the MOD's defence equipment programme. They are formal collaborations between industry and academia, partly funded by the MOD with significant contributions from the participants. Many of the DTCs fund 'open calls' for research proposals from outside the members of DTC consortium.</p> <p>Competition of Ideas</p> <p>Proposals are submitted and MoD funds the ideas that win. In the future, Competition of Ideas calls will be managed through the Centre for Defence Enterprise. £11.5 million was invested by the MOD: 467 proposals were submitted, 66 contracts were placed. Over half the proposals for the Competition of Ideas came from universities and SMEs: 18 contracts were placed with SMEs.</p> <p>Centre for Defence Enterprise (CDE)</p>



	<p>The CDE acts as a link between companies who have a new process or innovation that has a potential defence application and the MoD. Proposals can be submitted on-line. They accept proposals all year round on any subject. Successful applicants benefit by:</p> <ul style="list-style-type: none">• Proof-of-concept funding in the form of a research contract• Support from military scientists and engineers• MOD trials and testing facilities• A mentoring service ensuring a single point of contact within the MOD• A unique customer insight into both UK and non-domestic defence markets. <p>The advantages of the CDE are that feedback is quick (can be 15 days), so the company knows if efforts have been worthwhile, contracts are standardised and the CDE acts as a resource to know about one another. Possible reasons why industry had not organised this itself could be due to IPR issues, difficulties with timing, customer not receptive to it and process-related issues for customer. The CDE has too small a budget for all SMEs.</p> <p>There has apparently not been a marked increase in consortia bids to the MOD.</p> <p>The Knowledge Transfer Partnership (KTP)</p> <p>KTP gives SMEs access to facilities on a temporary basis. SMEs can get 75 per cent funding by government. The KTP is a very short-term programme which can raise SMEs' knowledge base of and help them market themselves. The KTP provides SMEs with no knowledge to sell, "but it raises their profile". Today, there are over 1,000 partnerships. Its predecessor, the Teaching Company Scheme, has been around since 1975. KTP began in around 2001.</p> <p>Grand Challenge</p> <p>In 2007, the MOD launched a challenge "to create a system with a high degree of autonomy that can detect, identify, monitor and report a range of military threats in an urban environment." Teams could apply for MOD funding to assist the development effort. The terms of any such contract are that, whilst ownership arrangements for the IPR will be vested in the contract holder, the MOD will have certain user rights to exploit the foreground IPR. 11 teams reached the final, with 6 teams funded by the MOD and 5 teams self-funded.</p> <p>Lower threshold value for advertising defence contracts</p> <p>The MOD has also reduced the threshold at which Prime Contractors are required to advertise sub-contract requirements arising from their Prime Contracts with the MOD, in the Sub-Contract Opportunities section of MOD DCB. The threshold has been reduced from £250,000 to £40,000 to align it with the reduced advertising thresholds for the MOD's tender and contract opportunities, which were introduced with effect from 30 June 2007.</p>
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