

The Establishment of Defence Science and Technology in Sri Lanka

Martin Renilson

President, Australian Division, Royal Institution of Naval Architects

ABSTRACT

It is well understood that for a modern military to be effective it needs to have access to an advanced science and technology organisation specialising in defence related activities. This includes both project based and long-term research. The balance for defence applications between the funding of project based research, and funding for long term defence research is discussed.

Many countries conduct all defence related science and technology activities within government, whereas others outsource much of this activity to the commercial sector, including universities.

Some technologies which are used by the military are advancing rapidly in the civilian sector. For many of these technologies the civilian sector can generally apply larger resources to such developments than is available from military funding. For those it may well be more appropriate for defence to maintain a watching brief on such activities, rather than to attempt to conduct its own research in these fields. This is of particular importance if the resources available to defence research activities are limited.

Other technologies are specific to military applications, or involve sensitive information, and for these it is usually necessary that the science and technology research is conducted with the specific defence applications in mind. Although such research needs to be funded, and guided, by the requirements of the military, it is not always essential that it be conducted internally in a defence laboratory. Provided adequate security can be assured, such research can be carried out by organisations external to the military, including commercial companies and universities.

Even where a particular technology is for a military application there are often considerable synergies with non-defence science and technology. These could be either software (people and know-how) or hardware (facilities and equipment) where in many cases the same expertise and facilities can be used for both military and civilian applications and it is recommended that this be applied wherever possible in the development of defence science and technology research in Sri Lanka.

Thus, two important aspects in the development of the defence science and technology capability in Sri Lanka are:

- the ability to determine what technologies are best handled in the civilian sector, and the maintenance of a watching brief on these; and
- when defence specific research is required, to determine where synergies are available, and how they can best be managed.

These aspects could well be handled by a defence orientated university such as KDU and suggestions as to how that might be done are given. Also, the benefits of much of the longer-term research being conducted by a university such as KDU are discussed.

1. INTRODUCTION

It is well understood that for a modern military to be effective it needs to have access to an advanced science and technology organisation specialising in defence related activities. This has always been important in the history of warfare, but is becoming even more so nowadays as the pace of technological advances increases, and the military makes ever greater use of advanced equipment, rather than relying on large numbers of soldiers.

A country that uses out of date military equipment will be at a major disadvantage in any conflict. The soldiers deserve to have access to state-of-the-art equipment, and if this is not provided then their lives will be at unnecessary risk, and the country is likely to lose any conflict that it is involved in.

A strong understanding of the latest developments in defence related Science & Technology (S & T) is essential to enable a country to:

- a) be a smart buyer of military equipment, both from within the country and overseas;
- b) understand the state-of-the-art in military equipment relevant to its needs, and hence determine what is and is not required for its defence needs;
- c) update, maintain, and make best use of existing equipment;
- d) train defence personnel in the best use of the equipment;
- e) encourage developments nationally that improve its military equipment; and
- f) be in a good position to liaise with similar defence related S & T organisations in other countries.

Thus, it is important to have a strong national capability in defence related S & T. Although it will require a significant resource to do this, the alternative will be very costly, both in

terms of poor acquisition and maintenance of equipment, and in the much more important consequences of having an inferior defence force.

2. RESEARCH LEVELS AND FUNDING SOURCES

Military S & T can range from that required for short term project based applications to the longer term research needed for more fundamental studies.

2.1 Emphasis on short term project based activities

There is a view that all defence research work funded by a government ought to be directly applied to future acquisition projects, and that money spend on longer term research is wasted. Those who subscribe to this view believe that it is the acquisition process which should drive the priorities, and that all funding going to defence research should be channelled through project teams that will be the direct beneficiaries of the research – *ie* current projects and those already in the acquisition pipeline.

It could be argued that this philosophy is what drove the policy in the UK in the 2000s, where the various autonomous defence research agencies were amalgamated into one larger one, which then became a Trading Fund, before eventually being privatised, and finally floated on the stock market. One result of this has been that all the research being conducted is done so at the express request of the UK MoD, who supply all the funding for every project. Much of this comes directly, or is at least strongly influenced, from project teams who are looking for answers to problems today.

Another result was that those acquiring research are not required to go to a single organisation, but are free to select from many competing companies. Whilst in the short term this appears to have many attractions, including the usual issues associated with increased efficiency caused by competition, it does mean that long term defence corporate knowledge becomes fragmented, and there is a danger that the UK's defence research capability is weakened as a result.

In addition, as the various research providers don't necessarily have long term contracts they are reluctant to invest in the necessary infrastructure, such as ranges, or large pieces of experimental kit. This was overcome (eventually) in the UK by establishing long term contracts for such activities, with key performance indicators.

A final result of this policy was that each of these competing companies has its own interests uppermost, rather than the long term interests of the UK Defence. An attempt was made to solve this problem by retaining many of the senior scientists in a Government owned organisation – the Defence Science and Technology Laboratory (Dstl).

2.2 Need for longer term research activities

In addition to the short term project support required by defence, there is also the need to conduct longer term research activities without the need for specific applications. This includes the so called "blue sky" research, which is essential to any major breakthroughs.

Longer term research is needed to understand the fundamental principles and background knowledge which is required to better utilise existing technologies. If only project based short term activities are being undertaken then it is likely that today's problems will be solved sufficiently well to "get by", but that longer term solutions will not be addressed.

Finally, longer term research is also important to maintaining the capability in a research organisation, such that it is well placed to conduct the short-term activities to support project based activities. This is a particularly important aspect for fields which are specific to defence applications. If the magnitude of the project based work reduces, for whatever reason, there is the danger that scientists working in these fields will be laid off, and the capability to service these fields will wither. If that occurs, and defence subsequently has a requirement for project based activities in these fields, then it will not be available. Such short sightedness, whilst appearing to save money in the short term, could easily lead to serious consequences for defence in due course – once it is too late. The rebuilding of a defence research capability in a field which has been allowed to be closed, can be very expensive and time consuming.

One of the difficulties with longer term research is in determining what the priorities should be.

On one hand, project managers in defence, who are well acquainted with the current in service issues, and the proposed acquisition strategy, may feel that they should be able to dictate the priorities to the scientists. However, there is the danger with this that these project managers may not be able to see "the big picture" and may be overly influenced by today's problems. They are likely to have Key Performance Indicators based on expenditure today on their projects, and are unlikely to have separate funds for longer term work, not directly related to their current projects.

On the other hand, if the scientists are left free to decide their own priorities then there is the danger that their "hobbies" will be pursued with little regard for real defence requirements. Of course, it is well known that most substantial breakthroughs, and game changing science, comes from the "blue sky" research associated with scientists pursuing their own fields with little regard for application. However, clearly defence research scientists need to be guided to work in areas of current, or future, benefit to defence. Although, within a large defence research organisation a small resource could perhaps be allocated to science-push applications, driven by the scientists, this may be a luxury that many defence research organisations can't afford.

Thus, a mechanism for determining the priorities for longer term activities needs to be developed which is a balance between:

- a) long term research to support in-service and proposed acquisitions;
- b) the gaining of fundamental understanding where relevant;
- c) a small proportion of "blue sky" research driven by scientists; and

- d) the need to maintain capability in defence research where project based work is not sufficient to maintain this.

2.3 Interaction between different levels of S & T activities

There can be a good interaction between the two levels of S & T activities, as shown in figure 2.1.

On the right hand side of the figure the interaction between the individual projects requirements and the advice being provided is shown. As can be seen, the projects place the requirements for the project based advice (and may have to pay for this). The outcomes are then provided directly to these projects, along the lines of consulting activities.

The left hand side of the figure shows the longer term research activity. As can be seen here, the projects can advise on requirements for long term research activities, although, as noted above, this should not be the exclusive way of determining what long term activities are required.

The long term activities are also used to maintain capabilities, which ensure that there is the capability to provide project based advice. The conduct of that project based advice also gives feedback into the long term research.

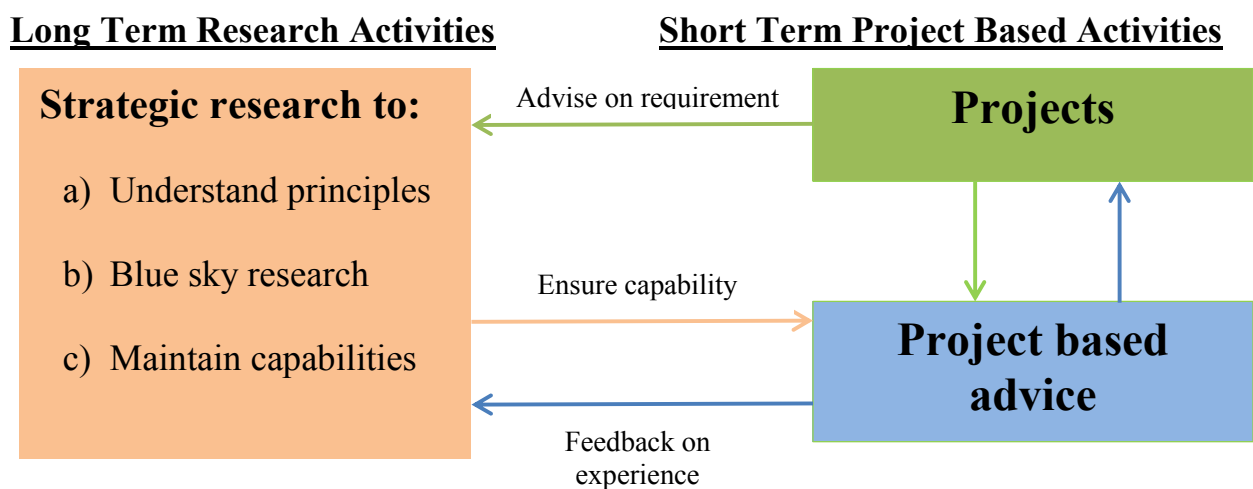


Figure 2.1 Interaction between research levels

3. WHO SHOULD CONDUCT MILITARY S & T

Many countries conduct all defence related S & T activities within government, whereas others outsource much of this activity to the commercial sector, including universities.

Many technologies are specific to military applications, or involve sensitive information, and for these it is usually necessary that the science and technology research is conducted with the specific defence applications in mind. Although such research needs to be funded, and guided, by the requirements of the military, it is not always essential that it be conducted

internally in a defence laboratory. Provided adequate security can be assured, such research can be carried out by organisations external to the military, including commercial companies and universities.

As noted above, the major UK defence government laboratory, DERA, was privatised in 2001, and subsequently became a publicly listed company, QinetiQ. The UK MoD retained very little ability to conduct research itself, other than for a small range of very sensitive technologies. Initially QinetiQ was guaranteed most of the UK MoD research work, but this was gradually tapered down. Currently, QinetiQ bids for research contacts alongside other commercial companies. Not being constrained by the public service terms and conditions has made it possible for QinetiQ to be more flexible in the way it operates, which in many cases has been an advantage. On the other hand, QinetiQ has shareholders, so the primary responsibility of the company is to these shareholders, and to ensure an adequate profit, rather than to serve the nation's national defence needs.

The need to conduct longer term defence related S & T is discussed above. In many areas it is probably very appropriate that these be conducted by universities. In general, universities are good at long term research, particularly when publication of the results is permitted. Also, defence can often get very good value for money by contracting universities to conduct long term research in fields of interest to military applications. The defence S & T organisations in countries have long term standing arrangements with particular universities for this purpose. This allows for the construction of specialist facilities within the university, and the development of research groups. A further advantage of defence sponsored research at universities is that the universities will provide a ready source of staff for the defence S & T organisation – both at PhD and graduate level. For example, the US defence has had long term partnerships with universities such as Penn State University, and Virginia Tech.

4. CIVILIAN VERSUS MILITARY S & T

Some technologies which are used by the military are advancing rapidly in the civilian sector. For many of these technologies the civilian sector can generally apply larger resources to such developments than is available from military funding.

A good example of this is battery technology. The commercial sector is making considerable developments in battery technology, and has an extremely large number of customers for advanced batteries. Thus, it can apply major resources to research activities associated with improving battery technology, and hence there is little point in any defence organisation doing much in this field.

For such technologies it may well be more appropriate for defence to maintain a watching brief on such activities, rather than to attempt to conduct its own research in these fields. This is of particular importance if the resources available to defence research activities are limited. This watching brief could be carried out directly by defence, or contracted to a third party.

Other technologies, such as those required for the safe operation of submarines for example, may not be being addressed by the commercial sector. These are fields where the relevant S & T will need to be funded by defence. However, even in these cases it is not essential that the S & T work actually be carried out by defence, provided adequate procedures are in place to ensure the long term continuity of the work, and to safeguard adequate security.

5. SYNERGIES BETWEEN MILITARY AND CIVILIAN S & T

Even where a particular technology is for a military application there are often considerable synergies with non-defence science and technology. These could be either software (people and know-how) or hardware (facilities and equipment) where in many cases the same expertise and facilities can be used for both military and civilian applications.

A good example of this is the need to be able to assess the structural integrity of naval warships. This is clearly of great importance to defence, and in the past many nations dedicated large teams to this task. However, the expertise required is similar to that required to assess the structural integrity of merchant ships. Thus, it has now been fairly common to make use of civilian naval architects who also do such work for commercial vessels. In many cases these are employed by one or other of the classification societies which have extensive programs of research into the structural integrity of ships. As a result, defence has benefited from the latest research into structural integrity of ships being carried out in the commercial sector.

In terms of the dual use of hardware, in order to predict the performance of military vessels it is necessary to make use of hydrodynamics testing facilities. However, they can also be used to predict the performance of commercial craft. Thus, unless the facility usage is so great that it can be dedicated to defence activities, it can be shared with any commercial projects. Most nations operate only one large hydrodynamics facility, and make arrangements for the use to be shared between defence and commercial projects.

In addition, universities involved in teaching subjects such as naval architecture, and those doing research in this field, also require access to hydrodynamics facilities, and in some cases they also use the same ones.

Hence, defence may not need to cover the whole cost of acquiring and running such large expensive facilities, but this can be shared with the commercial sector – provided adequate security is guaranteed when it is being used for defence purposes.

6. PARTNERSHIPS

Of course many national defence S & T organisations can't hope to cover all aspects of defence S & T themselves. As noted above, one way of doing this is to outsource some of the work to the commercial sector and/or universities.

However, an additional approach is to partner with the defence S & T organisations in like-minded nations. This also has the advantage of sharing resources, as each nation will pay for

its own activities. To engage in this process it is necessary to have something to provide to the partnership. Nations will not want to team up with countries which are not able to offer something to the partnership. Ideally, each nation should be able to provide a strength in a slightly different area, and so all those involved will benefit.

In addition, benchmarking exercises, possibly using unclassified test cases, can be conducted which are very valuable ways of ensuring that the S & T organisation is operating at the state-of-the-art. This is frequently not possible in the public domain, as the problems being addressed by defence S & T organisations are often different to those being undertaken by commercial organisations. For example, it would be difficult to find somebody to benchmark predictions of submarine performance with in the commercial domain.

Partnerships with overseas defence S & T organisations could be carried out directly by a government defence establishment, or be subcontracted by defence to a commercial organisation, or even a university. Of course, if the partnership is subcontracted it will be important for defence to retain control of this, and in many cases the overseas defence organisation will want to involve the national defence organisation in any such partnership arrangements.

7. OPTIONS FOR ESTABLISHMENT OF DEFENCE S & T IN SRI LANKA

7.1 General

As noted above, defence S & T can be done on a project by project basis, and/or on a longer term research approach.

There is also the need to determine what areas need to be specifically addressed by defence, and which fields are better left to the commercial sector, with defence only conducting a watching brief on progress.

Defence S & T can be carried out by:

- a) a national defence organisation;
- b) one or more commercial companies; or
- c) one or more universities.

Many countries make use of a combination of the above three. In some cases the mix is for historical reasons, with government laboratories having been established many years ago. The UK has attempted to break this mould, with the privatisation of its government research agency, and now places much more emphasis on the commercial sector to conduct its defence S & T activities.

In many ways Sri Lanka is fortunate in not having an existing major defence based S & T establishment. This means that the development of a capability in defence S & T can start with a relatively “clean sheet”.

On the other hand, it is assumed that Sri Lanka does not have sufficient resources to establish a major government defence related S & T organisation. Thus, the following options are considered as possible ways to establish effective defence S & T activities in Sri Lanka:

- a) Create a new defence S & T establishment within government which conducts all defence S & T for Sri Lanka;
- b) Outsource all defence S & T activities to the private sector in Sri Lanka;
- c) Make use of the existing General Sir John Kotelawala Defence University as the prime defence S & T organisation in Sri Lanka.

7.2 A new defence S & T establishment within government

The creation of a new government defence S & T establishment in Sri Lanka would at first glance seem to be the best way of generating an appropriate level of defence S & T in the country.

This will ensure that the Sri Lankan Ministry of Defence (MoD) has complete control over the S & T being conducted, and it will be relatively easy to form partnerships with overseas defence S & T organisations. In addition, there are unlikely to be any issues with security, or with continuation of expertise in relevant defence related fields. There are also a lot of advantages in having one central repository of defence S & T knowledge.

However, this is certainly likely to be an expensive approach, both in terms of the initial creation of this organisation, and in the running costs. As noted above, there are a lot of synergies with commercial S & T activities, and the creation of a government defence S & T establishment may actually make it difficult to benefit from these.

Also, a new government establishment may turn out to be much less flexible than required – particularly as priorities within defence S & T change.

7.3 Outsourcing of all defence S & T activities to the private sector

It would be possible to outsource all defence S & T activities to the private sector, requiring the various commercial organisations (including universities) to bid for each research “package”.

To do this it will still be necessary to have a small hub of experts within the Sri Lankan MoD to determine what work needs to be done, to place contracts and to review the work being done. This is shown schematically in figure 7.1.

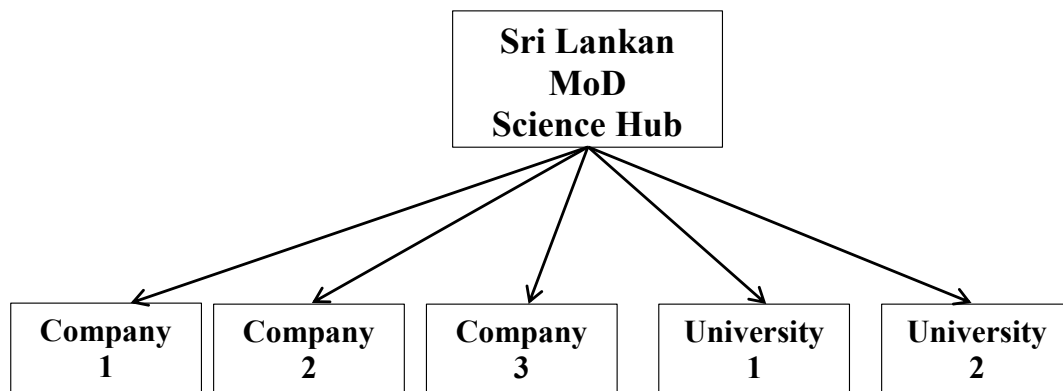


Figure 7.1 Possible outsourcing model

With this model it is important to recognise that the companies' goals are to maximise profits, rather than to operate for the good of the country. Also, the motivations of the various universities may not be for the good of the country, but to benefit the individual academics and universities involved.

On their own these are not necessarily bad things, but it does mean that the performance of the companies and universities will need to be monitored carefully by the scientists in the government S & T hub. To do this the government scientists will need to be experienced in the fields, and know what is achievable and what is not for a given budget. For research based S & T activities this is not particularly easy, as by the very nature of research things don't always turn out as expected. Because it will be important to be conducting cutting edge research it will be important that the work packages are challenging, and not always straightforward, but achievable.

When the UK privatised its defence S & T agency (DERA, which became QinetiQ) it retained a small number of scientists whose job it was to advise on the research packages and then to oversee the work being conducted by the various commercial companies. One of their tasks was to make a judgement as to whether the work being done by the commercial companies was at the appropriate level.

Initially this was done by retaining many of the senior scientific staff from DERA in a government organisation, Dstl, when it was privatised to become QinetiQ. These staff were respected by the staff in QinetiQ (often they had been leading the research groups before the split) and so the process worked quite well. However, as these experienced staff retired it became difficult for Dstl to recruit adequate replacements with the same expertise.

In the case of Sri Lanka, where it is assumed that many of these experienced scientists don't currently work for the government this may be even more of a challenge.

A further disadvantage of this model is the fragmentation of the research, and the lack of long term continuity. One company may start doing research in a field, but may lose the subsequent commercial bid for follow on work in this field. As a result many of the research packages placed were for a number of years, to attempt to retain continuity. This made the competition to win such a bid very strong, which on one hand could be seen to be of benefit, as the companies cut their prices, but on the other hand resulted in possible short cuts in the work being done. Also, the companies didn't always work together in a cooperative manner, with issues such as sharing of resources and information.

In some cases companies teamed together to bid for research work packages.

In this model, partnership with the defence S & T organisations in other countries may also be difficult. Many countries want to deal only with government agencies, and hence the formal partner will need to be the government defence S & T hub.

However, as they won't actually be conducting the work themselves, but overseeing it, it will almost certainly be necessary for them to involve the appropriate commercial company, or university, in each particular partnership. This is the process often required by the UK MoD for such partnerships. Sometimes, for part of the meetings staff of the commercial company (often QinetiQ) are not able to be present – depending on the requirements from the other partners.

Of course, if the commercial company holding a particular contract changes, then this will mean that any such partnerships will need to change. Clearly this is not so attractive to other nations, who would prefer to establish long term links with the S & T activities in Sri Lanka.

7.4 Make use of the existing General Sir John Kotelawala Defence University as the prime defence S & T organisation in Sri Lanka.

An alternative approach for Sri Lanka could be to make use of the existing General Sir John Kotelawala Defence University (KDU). It is assumed that most, if not all, of those active in defence S & T in Sri Lanka are already working there. Also, being government employees they are presumably not motivated purely by profit in the same way that a commercial company is. Thus, they are more likely to focus on the long term benefit to the nation of the work that they are doing. Academics do generally tend to have a longer term view than those in the commercial sector.

However, it is very important that the priorities and resources be allocated to the KDU by the Sri Lankan MoD. To ensure that adequate effort be allocated to long term research this should be done in a collaborative manner between the Sri Lankan MoD and KDU. It is understood that there is a very good relationship between the Sri Lankan MoD and KDU, with many senior positions at KDU being held by members of the Sri Lankan MoD.

In addition to conducting short term S & T activities for defence, staff at KDU will have an ongoing interest in longer term research, and provided there is good collaboration between

them and the Sri Lankan MoD there is the opportunity to get a good balance between short term and long term research.

The KDU is also very likely to be very well placed to provide the “watching-brief” on those commercial technologies which the Sri Lankan MoD judges are not priorities for defence resources.

However, there may be some fields where KDU is not the best source of S & T in Sri Lanka. In these cases the Sri Lankan MoD could contact a third party to conduct that work, as shown in figure 7.2. However, if this process were to be managed in this way, then the Sri Lankan MoD would need to establish a hub to place such contracts, and monitor the activities of the organisation doing this. This will have many of the disadvantages of the approach suggested in section 7.3.

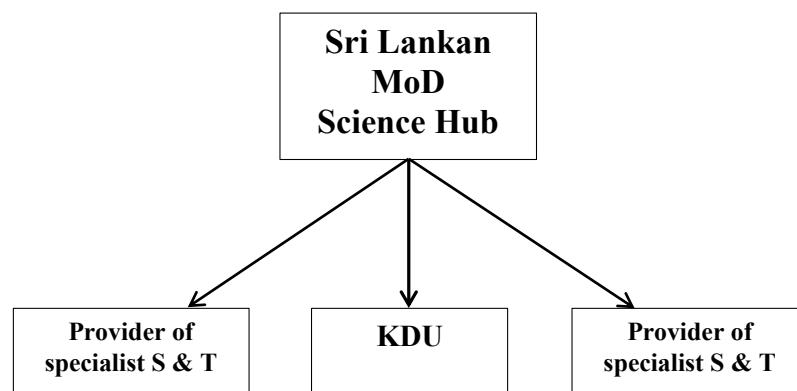


Figure 7.2 Possible involvement of KDU and specialist S & T organisations managed by the Sri Lankan MoD

Hence, an alternative procedure could be for the KDU to contract and oversee the work done by any specialist S & T provider, as shown in figure 7.3.

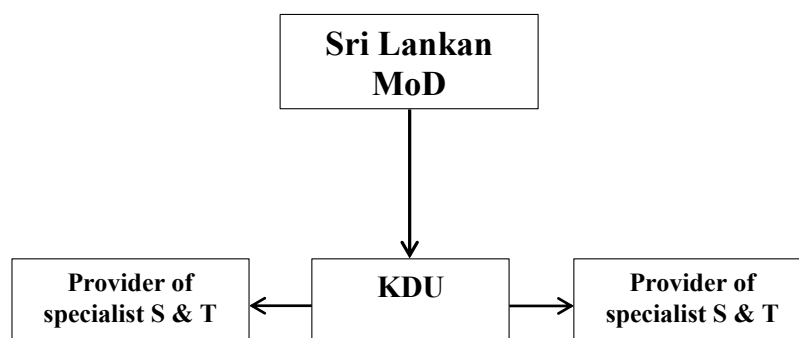


Figure 7.3 Possible involvement of KDU and specialist S & T organisations managed by the KDU

This has the advantage that the Sri Lankan MoD doesn't need to establish its own specialist hub to manage third party S & T activities. This will be done by KDU, which will already have research staff, who presumably would be better placed to manage the S & T conducted by any third party organisations than the Sri Lankan MoD.

This model works very well in Australia, where the Defence Science & Technology Group (DST) places contracts with specialist commercial companies and universities where required to obtain the best S & T available in Australia. As DST has extensive experience with S & T it is well placed to determine which organisations can best provide the required S & T expertise, and then to manage them.

DST also fosters relationships with universities and commercial companies in Australia, in order to be able to contract them to conduct S & T in specialist fields as required.

With this model KDU would be able to represent Sri Lanka in any partnership arrangements with the defence S & T organisations in other countries. Being government there should be no problems with this.

KDU would be able to provide the continuity required for long term research. It is also very well placed to understand what S & T is being conducted in the commercial sector, and hence to keep a watching brief on this for defence applications.

KDU is also well placed to benefit from dual use S & T, where its researchers can conduct both S & T for defence and for non-defence applications as required.

For KDU to take on the leading role in conducting S & T for the Sri Lankan Ministry of Defence then it is quite possible that additional funding will be required. This is extremely likely to be a much cheaper option than the creation of a new S & T organisation within the MoD.

8. RECOMMENDATIONS

It is recommended that:

- 8.1 The Sri Lankan MoD establishes a mechanism to undertake defence related Science & Technology in the country.
- 8.2 Consideration be given to each of the three following possible options for establishing defence related Science & Technology in Sri Lanka
 - a) Creation of a new defence S & T establishment within government which conducts all defence S & T for Sri Lanka;
 - b) Outsourcing all defence S & T activities to the private sector in Sri Lanka;
or
 - c) Making use of the existing General Sir John Kotelawala Defence University as the prime defence S & T organisation in Sri Lanka.

9. CONCLUDING COMMENTS

It is universally accepted that having access to the latest military science & technology is of vital importance to any nation's defence force. This is the case now, as it always has been. There are many examples in history of cases where a numerically smaller military force has triumphed over a larger one due to its superior military equipment. As the pace of technological developments increases it is certain that this is going to become even more important in the future.

Thus, it is vital that the Sri Lankan MoD establishes a mechanism to undertake defence related Science & Technology in the country.

This could be done by: establishing a new defence Science & Technology establishment within government which conducts all defence Science & Technology for Sri Lanka; by outsourcing all defence Science & Technology activities; or by a partnership with the existing General Sir John Kotelawala Defence University.

It is recommended that each of these options be considered.