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Management of the Defence Science and Technology Research Portfolio in a Dynamic Strategic Environment¹

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Abstract

Portfolio management practices are adopted by organisations to meet three major goals: maximising the value of the portfolio; achieving the right balance and mix of projects; and linking the portfolio to the business strategy. These goals are sought by both private and public sector organisations and are also applicable to organisations where a significant portion of the portfolio is dedicated to research, development and innovation. Research and development (R&D) and innovation projects are high-risk endeavours and the decision to modify, postpone or cease investment is an ongoing and dynamic process. This process becomes even more challenging where the strategic environment is subject to rapid change. This paper examines a number of practical approaches used to re-align a R&D portfolio in response to a shift in strategic direction. In a portfolio with fixed resources, this means that difficult decisions need to be made regarding the re-allocation of financial and human resources. It was observed that changes to programs and projects to meet changes in strategy and priority are more easily achieved where there is a single, clear line

¹ **Editor's Note:** This is the third paper mapping the evolution of the management of the DSTO Research Portfolio. See also:

2017: *Implementing Strategy through P3M and Benefits Management: A Case Study of the Defence Science and Technology Group.* https://www.pgcs.org.au/index.php/download_file/view/361/244/184/

2018: *Strategic management of the Defence S&T Portfolio: Are we there yet?*
https://www.pgcs.org.au/index.php/download_file/view/404/244/184/

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of decision-making and the impact is limited to a program or project. In cases where the strategic change has a broader impact across the portfolio, the decision-making process is more complex, and it is difficult to change investment from the status-quo. The approaches used have had mixed success and further work is required to develop new approaches and to effectively integrate them.

Keywords: project portfolio management, strategy, PPM, P3M.

Introduction

The Defence Science and Technology Group (DST Group), a group within the Australian Government Department of Defence, has been on a journey since 2016 to implement portfolio, program and project management (P3M) practices (Young, Vodicka & Bartholomeusz, 2017; Young, Vodicka & Bartholomeusz, 2018). Portfolio management practices are adopted by organisations to meet three major goals (Cooper, Edgett & Kleinschmidt, 1997): maximising the value of the portfolio, achieving the right balance and mix of projects and linking the portfolio to the business strategy. These goals are sought by both private and public sector organisations and are also applicable to DST where a significant portion of the portfolio is dedicated to research, development and innovation. Research and development and innovation projects are high-risk endeavours and the decision to modify, postpone or cease investment is a dynamic and ongoing process. This process becomes even more challenging where the strategic environment is subject to change.

DST introduced an investment process and P3M decision-making framework to strategically select projects and allocate resources. This approach successfully addressed the shortcomings of a largely bottom-up process that did not consistently provide clear alignment with strategy and often lacked transparency (Young, Vodicka & Bartholomeusz, 2017; Young, Vodicka and Bartholomeusz, 2018). The annual DST investment process provides a transparent decision-making mechanism to construct a portfolio of projects, which directly aligns with the strategies and goals of the organisation and its Defence stakeholders. While this approach has been largely successful, the portfolio needs to be revised and updated as new information is gathered and strategic priorities are refined and changed. Without a mechanism to capture strategic change, create new programs and projects, re-allocate resources and divest, it is difficult to maximize the benefits of investment across the portfolio.

This paper examines a number of approaches that DST used to re-align its portfolio in response to a major shift in strategic direction and to provide assurance that these changes will deliver value. In a portfolio with fixed resources, this means that decisions need to be made regarding the re-allocation of financial and human resources. DST has observed that changes to programs and projects based on changes in strategy and priority have been achievable where there is a single, clear decision-making process and the impact is limited to a single program or project. In cases where the strategic change has a broader impact across the portfolio, there is a need for a decision-making process and defined roles and responsibilities to avoid a return to the status-quo. The approaches used have individually had mixed success and further work is required to develop new approaches and to effectively integrate them. A proposed value assurance process is also discussed which intends to provide an evidence base that changes in the portfolio are achieving their intended aims.

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The Defence Science and Technology Portfolio

DST Group provides scientific advice, R&D outcomes and innovative technologies to meet Australia’s Defence and National Security challenges. It is part of the Department of Defence and is Australia’s second largest publicly funded research organisation with approximately 2,100 staff consisting mainly of scientists, engineers, information technology specialists and technicians. DST Group is organised into Major Science and Technology Capability (MSTC) areas that deliver outcomes against Defence and National Security strategies.

Research and development (R&D) and innovation projects are high-risk endeavours and the decision to modify, postpone or cease investment is an ongoing and dynamic process. This process becomes even more challenging where the strategic environment is subject to rapid change. DST Group operates in an environment of high uncertainty and rapid global technological innovation and this provides a challenge to decision-makers who need to ensure that the portfolio is strategically aligned, balanced and resourced to deliver high value outcomes. Portfolio management is a “dynamic decision process, whereby a business’s list of active new product (and R&D) is constantly updated and revised ... the portfolio decision process is characterised by uncertain and changing information, dynamic opportunities, multiple goals and strategic considerations, interdependence among projects, and multiple decision makers and locations” (Cooper, Edgett & Kleinschmidt, 1997). Portfolio management should be viewed as a holistic management system that supports faster and less bureaucratic decision-making. The decision-making process also needs to ensure that it is based on the best possible information at the time and it must be transparent to promote organisational buy-in.

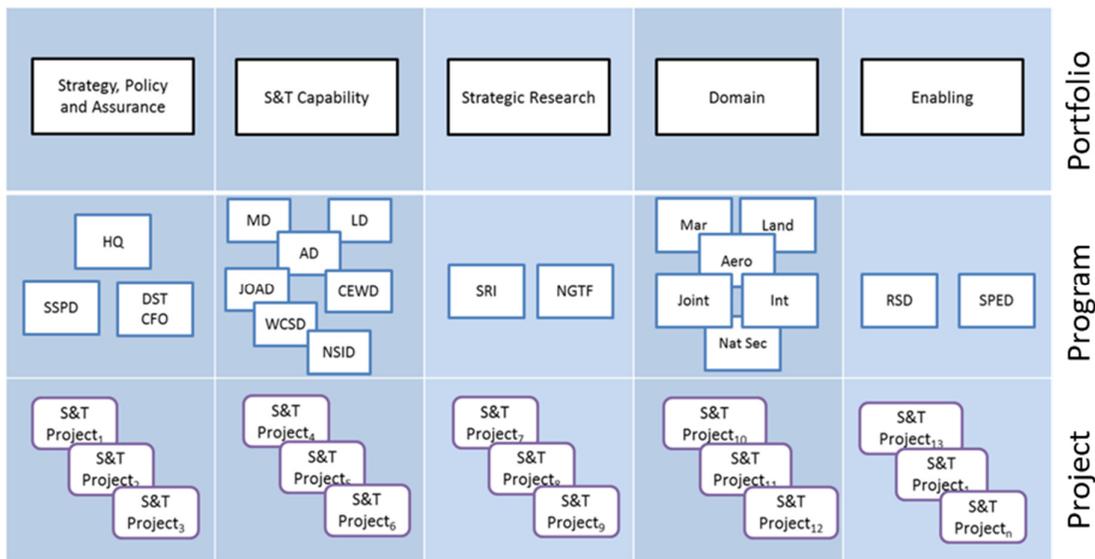


Figure 1 DST Group Portfolio, Program and Project management framework.

The DST portfolio is developed through an annual investment process that utilises a strategy-led approach to define strategic priorities (Young, Vodicka & Bartholomeusz, 2017) and ensure that investments clearly align to these priorities. The portfolio is defined and managed using a P3M construct which allows investments to be partitioned and aligned to strategy (Figure 1). DST Group utilises a number of published strategies that shape the portfolio at the program level. A whole of organisation strategy is also used to shape priorities at the portfolio level. These strategies are derived from the Defence White Paper, Defence Industry Policy Statement and Defence Planning

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Guidance. Changes in priority and demand are documented and agreed within these strategic frameworks before any significant changes to investments within the portfolio are considered. The DST Group investment process also defines the decision-making roles and responsibilities in making changes in strategy and investment prioritisation and the process is inclusive of relevant stakeholders.

Re-Balancing the Portfolio

The portfolio management process is in essence a decision-making process that enables an organisation to assure that investments provide maximum benefit to the stakeholder and effectively implement strategic objectives. Maintaining the portfolio includes continual evaluation of the components against these objectives and controlling the process of portfolio change. The need for change in the portfolio is often initiated by a change in strategy or availability of resources. In a portfolio with fixed resources, this often means that decisions need to be made regarding the re-allocation of financial and human resources to meet new strategic priorities. Without a clear decision-making process and defined roles and responsibilities, these decisions may be avoided and there also may be a strong desire to maintain the status-quo.

DST Group has utilised a number of approaches to re-balance its portfolio using its annual investment process over the period 2016 to 2019. Some of these approaches were implemented as a one-off exercise while others are being utilised at each investment cycle. Additionally, new approaches are being considered for introduction in future investment cycles. The five major portfolio-wide change processes that have been implemented or are under consideration are listed in Table 1.

Portfolio Change Process	Primary Resource Impact	Implemented?	Role and Responsibility
Allocation of a Strategic Portfolio Reserve	Finance	Yes - annually	Executive suite
Modified Zero-based budgeting	Finance	Yes – as needed	Program Managers and Stakeholders
Cross-Portfolio Prioritisation	Financial and Human Resources	Yes – as needed	Program Manager and Stakeholders
Divestment	Financial and Human Resources	No – process being developed	Executive suite
Value Assurance	Financial and Human Resources	No – process being developed	Program Office

Table 1: Portfolio-wide change processes

Allocation of a Strategic Portfolio Reserve

The DST Group annual investment process includes a provision to allocate a Strategic Portfolio Reserve. This reserve is a portion of the portfolio funding (the discretionary operating budget) that is available after staff salaries are deducted from the total budget. Over the past three years, this

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reserve has been set at about five percent of the discretionary operating budget. This reserve is set aside at the initial step and allocated in the final step of the investment process. It is typically assigned to procure or upgrade high value capital items that cannot be funded from a single project or to allow for the inclusion of new projects that could not have been funded within existing program budgets. This approach is aimed at partially addressing the issue of ‘pipeline gridlock’ (Cooper, Edgett & Kleinschmidt, 2000) which occurs when the programs are fully aligned to high-value projects and there is no resource available to allocate to something new.

The final allocation of the Strategic Reserve is conducted at the executive-board level and takes place by assessing bids received from program managers. Successful bids result in an increase in funding to the program manager. The challenge in this process is that it is almost inevitable that more bids are received than the available reserve and there is a need to ensure that the bids aligned with agreed strategic portfolio priorities. Strict prioritisation needs to be applied in this process and the resulting impact on the overall portfolio investment balance also needs to be considered.

The use of the Strategic Reserve has been partly successful. It has value in that it creates opportunities at the portfolio level that need to be considered by the executive-board level and allows for projects and initiatives to be funded that would otherwise have been turned away by program managers due to lack of financial resources. The result has been additional funding for a program or project, but it may not always result in the re-allocation of any required human resources. This approach has been more effective at addressing funding shortfalls and less on the re-allocation of staff effort.

Modified Zero-based budgeting

In 2017 concerns were raised by DST Group Executives that project and program budgets were based on long-term historical funding allocations which may no longer be relevant given changes to strategy and priorities. In 2018 a revised budgeting approach was implemented that enabled examination of the relative priority of current activities and associated costs in the context of broader Defence and DST Group strategy and priorities. The approach also allowed new activities to be funded through reallocation of funds from lower priority areas within a fixed overall funding envelope. This Zero-based budgeting (ZBB) approach aimed to realign budget to strategy.

ZBB was invented to address problems with traditional budgeting techniques. It was applied within the US government and subsequently adapted for other government and industry environments (Pyhrr,1977). Under traditional planning and budgeting processes, the focus is primarily on planned changes from the previous year’s budget or expenditure, i.e., incremental budgeting. The limitations of traditional budget processes include factors such as lack of alignment of funding to strategy, budget bids frequently exceeding funding availability, lack of flexibility to address strategic shifts in budget terms and current unaddressed inefficiencies.

When originally applied in the 1970s (Pyhrr,1977) ZBB zeroed budget lines across the entire portfolio. No one was guaranteed funding and projects and programs were redeveloped for approval based on organisational strategic priorities. This can be time consuming and disruptive, and is potentially viewed as a punitive budget process rather than part of the overall strategic management of the organisation. There is a not a strong history of success with this comprehensive level of ZBB implementation, particularly in the public sector, where “competing” activities are not assessed on profit, but rather strategic outcomes or public good objectives.

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The key issue in government organisations is more likely to be to assign priorities and identify possible savings, rather than to eliminate functions or activities. Also, staff costs are a significant proportion of total costs and staff cannot be removed or reassigned easily in short periods of time. This is particularly true for DST Group as highly skilled and experienced researchers are required and it takes time to develop these staff. For this reason, it was decided it may be unnecessarily disruptive to require a scenario of abolishing all activities (an actual zero-base) in DST Group. Instead, DST Group applied a 85% ZBB approach, which meant allocating 85% of the historical budget as the starting point. The remaining 15% of budget was held as a reserve as discussed above.

A key element for a ZBB approach is the level at which budget decisions are made. These need to be isolated for analysis and prioritisation. In DST Group the portfolio consists of about 20 programs which comprise approximately 130 individual major projects. To make the process more efficient it was decided to apply ZBB at the program level and then subsequently ask program managers to allocate their project budgets. Project Leaders were required to redevelop project plans within their program budget allocation, but were asked to highlight high priority areas that could be included if additional funding was provided.

Through the Investment Process the projects within each program were assessed and prioritised. If a project was experiencing a budget shortfall of strategic significance, the project was awarded additional funding from the Strategic Reserve. Eighteen of the projects in DST Group received additional funding. As a part of the process, each project was also assessed to determine whether their budget should be reduced, which occurred in one case. The process also identified areas of savings in enabling or supporting areas.

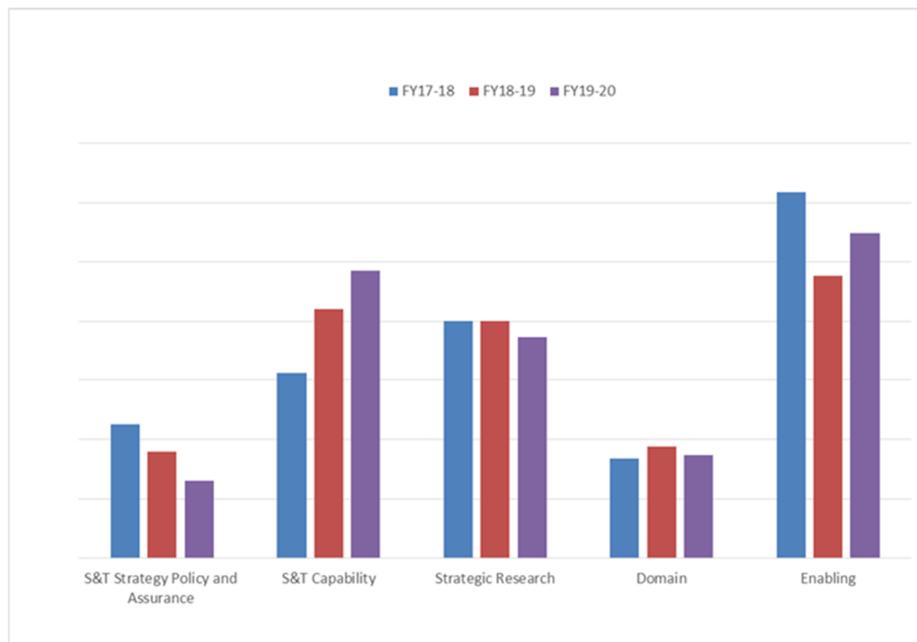


Figure 2: Operating budget distribution across portfolio. The ZBB process reallocated budget from the Strategy and Enabling streams to the S&T Capability stream to enable raise, train and sustainment of S&T technology areas.

The process reshaped the overall budget at the program and portfolio levels. At the portfolio level, additional funding was allocated to the S&T Capability Stream at the expense of DST Groups support functions (Enabling and Strategy Streams) as shown in Figure 2. Changes were also observed within

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programs. For example within the Research Services Program, budget was reallocated to areas of higher priority based on the assessment of the investment panel that included senior client and DST Group leadership team members (Figure 3).

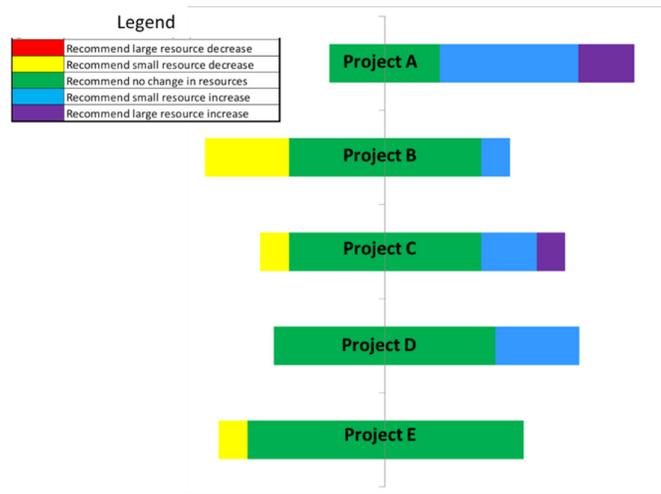


Figure 3: Investment panels made recommendations to increase or decrease Project budgets within a Program. The budgets of Project A and C were increased in this case.

The DST Group workforce constitutes the majority of the portfolio's resources, but the ZBB approach was not used to reprioritise workforce. In addition, other Defence groups and the services fund projects either through Defence's major capital acquisition program or through direct funding to DST Group. Thus while the modified ZBB was able to allocate the strategic reserve from DST Group's operating budget to areas of high priority, it did not make radical changes to the program of work as this is also shaped by workforce allocation and external funding (Young, Vodicka & Bartholomeusz, 2018).

Cross Portfolio Prioritisation

In 2018 critical science and technology capability skill sets were identified through analysis of the combination of strategic demand expressed through the investment process and through interviews with senior stakeholders. These critical skill sets were in areas where demand exceeded the current human resource capacity and therefore limited the potential outcomes from projects and programs. This capacity constraint often resulted in the same staff being allocated to multiple projects and programs which resulted in a highly fragmented staff effort. The 2019 Investment Process introduced an additional cross-portfolio prioritisation step to determine the best balance of human resources in these critical technology areas through considering: how investment is currently balanced; what are the current and future strategic demands; and what investment options are required to satisfy these and their implications. Key to delivering the cross portfolio prioritisation step are:

- a. Identifying the new strategic demands through the review of related strategic documents and tailored interviews;

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- b. Understanding the current DST Group investment allocation along with major deliverables and benefits based on program and project data;
- c. Discovering potential misalignments of the current projects to priorities, and these new strategic demands;
- d. Competing the demands across programs; and
- e. Developing options to correct any misalignments and prioritise competing demands within and across programs.

The options were developed, in consultation with Defence stakeholders and include the status quo and two scenarios: 1) re-prioritisation of investment within the portfolio; and 2) grow investment in the technology area to meet the strategic demand. Analysis of the options included identifying the implications of delaying or cancelling currently endorsed major deliverables.

This step has been successful in enabling reprioritisation of human resources to align with strategic demands. Key to delivering this was agreement by senior stakeholders that this new demand had primacy over previous work. Resources in separate projects in multiple domains were prioritised and amalgamated to meet the new strategic demand in one of the technology areas (Figure 4). Here six separate projects were amalgamated into one larger project to reduce fragmentation of staff effort. In other technology areas it was agreed by stakeholders that DST Group's resources had reached their capacity and additional resources were required to meet the new strategic demands.

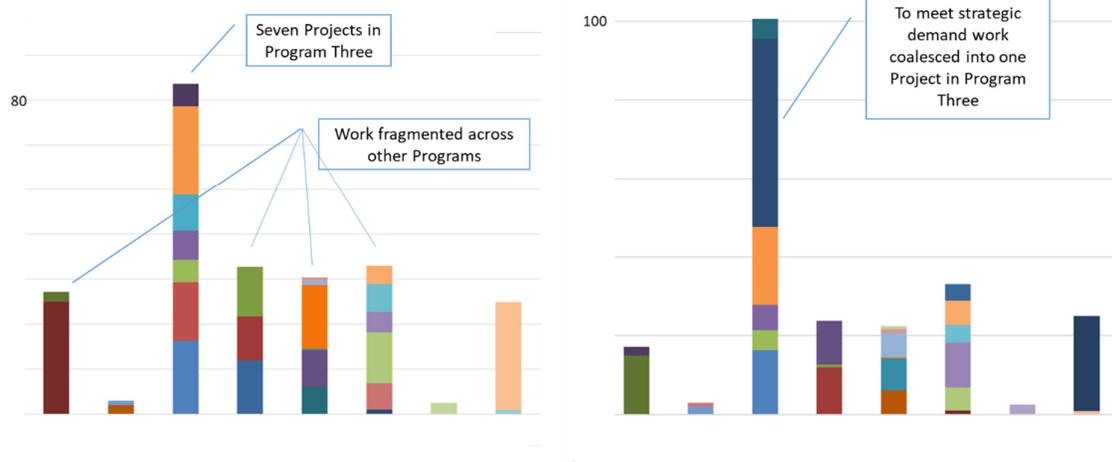


Figure 4: The cross-program prioritisation identified a fragmented program that was amalgamated to deliver a strategic effect.

Divestment

DST Group utilises Investment Logic Maps (ILM), a tool developed by the Victorian Government in the early 2000s, to provide a standard means to outline the business case for investment proposals ("Investment Management Standard Version 5", 2017). This approach is utilised in the DST Group investment reviews and is supplemented with a five-minute pitch that is provided to a stakeholder group to outline the strategic relevance, expected benefits and major deliverables for each

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candidate project. Each business case is then subject to a voting process around a small number of well-defined criteria including alignment with strategy. Business cases that score lowly in this process are subject to a deep-dive to further refine their value proposition or they may be put on hold or rejected. Ongoing projects are reviewed on an annual basis to ensure that they are aligned with priorities and are delivering value.

Major changes in strategy may require some portfolio elements to be divested to free resources to pursue higher priority strategic outcomes. DST Group is currently exploring the capability to utilise the ILM process to make a case to divest resources from low-value projects or those that are no longer strategically relevant. The divestment of resources can create major disruptions to current funding allocations and human resource allocation, and therefore requires careful consideration. The use of the ILM process to divest may provide a formal and rigorous mechanism to deal with portfolio changes. It is proposed that this divestment process will require approval at the executive-board level and be supported formally by senior level Defence stakeholders.

Value Assurance

Planning the portfolio investment has been the major focus of the DST Group investment process to date. This approach has been effective in project selection and resource allocation. The outcomes and benefits derived from these programs and projects need to be tracked to ensure that they are capable of delivering on their initial value proposition, including the realisation of their stated benefits and value. DST Group has historically used stakeholder satisfaction surveys to assess the value generated by its projects. These surveys assess the level of engagement, timeliness and quality of outputs and outcomes and is conducted with stakeholders at different levels including senior Defence leaders and lower-ranked officers. While these surveys have been a good gauge of performance of the portfolio, the surveys do not capture benefits and outcomes in a consistent manner and the surveys are more descriptive than quantitative. To provide more rigorous assurance of the portfolio, a value assurance framework (VAF) has been recently developed and is being considered for adoption in the near future.

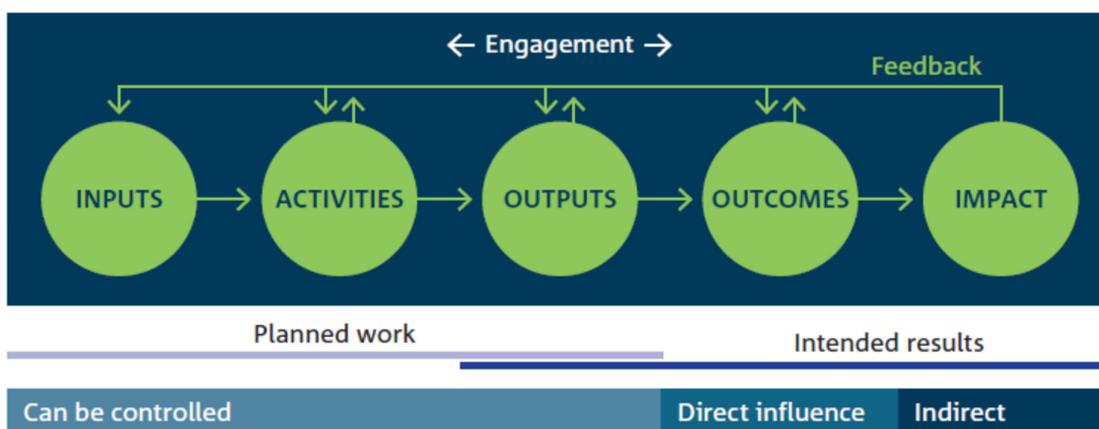


Figure 5: CSIRO Impact Framework (2015) ("CSIRO Impact Framework", 2019)

A pithy description of Value Assurance might be “the process that delivers confidence that value is and will be delivered”. It is very closely related to Benefits Realisation, defined here as “the process of identifying, executing and measuring benefits”, where the former (value assurance) is the process

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of assuring that the latter (benefits realisation) has occurred. All of this is also closely aligned with the concept of Pathways to Impact, which sets out to explicitly trace the impact delivered from a chain of inputs, activities, outputs, outcomes and benefits. DST Group has developed a modified form of the CSIRO Impact Framework (Figure 5) ("CSIRO Impact Framework", 2019) and mapped it to the P3M levels to create a minimalist description of P3M levels and associated types of delivery. The next step that is currently underway is the identification and description of the complete set of impacts, benefits, outcomes and outputs that are linked coherently and provides full coverage of the range of DST Group work.

As mentioned previously, DST Group has adopted the not uncommon approach of collecting similar functional programs into a small number of separate streams. Figure 1 shows the five streams that comprise the portfolio. As part of the VAF it may be useful to construct a value chain comprised of these streams (Figure 6). This has potential to create a natural and coherent narrative for the organisation based transparently on its portfolio.

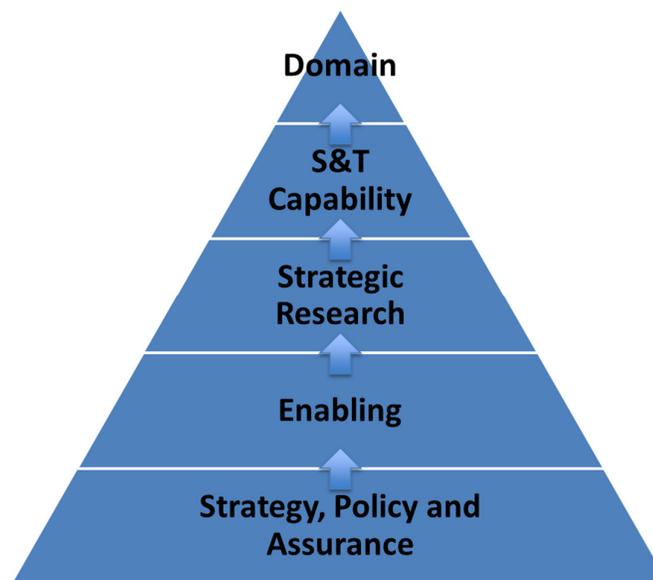


Figure 6: Portfolio value chain

The goal of the VAF is to provide a consistent means to communicate and measure the value of the portfolio and to provide assurance that strategic changes in the portfolio are reflected in future outcomes and benefits. DST Group has already laid the foundation for benefits management by adopting business cases based on ILM, which require a clear statement of expected benefits and associated key performance indicators ("Investment Management Standard Version 5", 2017). The VAF will leverage these existing tools and extend them so that value assurance can be conducted at the portfolio, program and project level in a more detailed and structured way. It is expected that the previously utilised client satisfaction surveys will be integrated with the VAF to provide both qualitative and quantitative assessments of value generated across the portfolio through feedback at the point of delivery.

Information to Support Portfolio Decision Making

DST Group has also embarked on the introduction of a new management information system (MIS) to support effective project management and to support decision-making. The new system aims to

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provide a collaboration platform for program and project managers and includes the capability to capture the initial business case, resource allocation awarded during the investment process and to track project outputs. The entire DST portfolio will be included in the system and key metadata will provide a means to aggregate elements of the portfolio and to provide views as to how they effectively align with strategic priority areas. To this end, the system implements powerful business intelligence capabilities to provide users with a view of the portfolio that is directly relevant to them. The system also provides a means to track project outcomes and benefits, which will leverage previous research to develop and introduce a benefits management framework (Young, Vodicka & Bartholomeusz, 2017).

DST Group believes that this information system will be vital in providing the evidence base for making future portfolio decisions and to implement the value assurance framework. The quality of data within the system is therefore a strong determinant of the usefulness of such a system.

Discussion

DST Group has been on a journey since 2016 to better demonstrate the alignment and value generated from its portfolio of investments. This has required the adoption of a suitable P3M framework to logically and hierarchically partition its investment decision-making process. This framework and the related investment process has provided greater transparency into the decision-making process and has allowed DST to better demonstrate the alignment of its programs and projects with Defence strategic needs. The ability for the portfolio to effectively respond to changes in strategy and investment priorities is a challenge and may often require major changes to existing programs and projects. These changes may require the movement of both financial and skilled staff resources to areas of greater priority and strategic need. DST Group has used a number of approaches to re-align its portfolio of work in response to these changes.

Management of the DST portfolio fundamentally requires the capability to effectively capture changes in priorities and strategic need on an ongoing basis and use this to inform investment in the portfolio. While the current strategy for each program is published and used to inform investment decision-making, updates and changes are constantly sought through engagement with Defence stakeholders using a team of scientific advisers. This approach ensures that the portfolio of work is driven through a top-down strategy-led approach and that any changes to current work reflect changes in high-level strategic needs and priority areas. These changes are easier to achieve where the impact is to a single program of work as the decision-making can be affected at the program level through a re-prioritisation of existing projects. In cases where the change in strategy and priority is likely to affect a number of programs within the portfolio the ability to change the balance of investment is more complex, as there is a need to move both financial and staff resources, and may also require divestment of some projects.

DST began the process of aligning its portfolio using its investment process and used a funding reserve which could be used to invest in new priority areas or major capital items. This approach had limited success as it only addressed funding and did not necessarily re-allocate staff effort in an effective way. The use of a modified zero-based budgeting approach went further to enable larger amounts of funding to be re-distributed according to priority areas and address the issue of programs being funded on a historical basis. This approach did provide a greater impact to the allocation of financial investment but again had limited impact on the direct allocation of staff resources. To address this shortfall, a cross-program prioritisation approach was utilised to address

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the allocation of staff effort. This approach did not attempt to re-allocate staff across the entire portfolio but was targeted to areas of the portfolio where Defence strategic priorities had substantially changed. This approach provided a mechanism to understand current staff allocation within the portfolio and examined options to re-allocate staff to work on programs and project of higher priority. This process is still ongoing and its effectiveness will be assessed in the future. A formal mechanism to divest in projects of lower priority is currently being examined and may adopt the same ILM format used for investment business cases.

Any changes in the portfolio need to be assessed to ensure that the outcomes are delivering value against their strategic objectives. DST has been developing a value assurance framework to assess the effectiveness of its portfolio in delivering strategic value to Defence. This is a key step as the process of re-aligning the resources within a portfolio only addresses the portfolio planning stage. The performance and outcomes from the portfolio need to be periodically assessed to ensure that value is still achievable and to capture the benefits against the original business case in a systematic manner. DST will use a new management information system to capture its current portfolio of work and the value generated.

More work is required to provide systematic and effective approaches to manage the DST portfolio, especially in times when major strategic change is experienced. DST is integrating a number of existing approaches and adding new ones to ensure that portfolio management decisions are based on a rigorous evidence base and can be effected using agreed processes.

Conclusion

This paper examined a number of practical approaches used to re-align a portfolio in response to a shift in strategic direction. In a portfolio with fixed resources, this means that difficult decisions need to be made regarding the re-allocation of financial and human resources. It was observed that changes to programs and projects to meet changes in strategy and priority are more easily achievable where there is a single, clear line of decision-making and the impact is limited to a program or project. In cases where the strategic change has a broader impact across the portfolio, the decision-making process is more complex, and it is difficult to change investment from the status-quo. The approaches used by DST needed to target both the re-allocation of financial and staff resources in order to make the portfolio management process effective. Improved approaches and decision-making tools are being considered, including a formal approach to divest from current projects. In addition, a value assurance framework and information system is being developed to demonstrate the value generated by the portfolio and its performance against original strategic requirements.

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