Performance-Based Logistics: A Potential Weapon System Support Strategy for the SAF

ABSTRACT

Performance-Based Logistics (PBL) is a weapon system support strategy to reduce Operations and Support cost through long-term contractor logistics support with payment tied to performance metrics, rather than to services and materials. Essentially, PBL leverages contractors' infrastructure, resources, expertise, supply chain management and innovation to support systems more efficiently and at lower cost. Today, PBL is widely used in the defence forces of many countries, including that of the United States, United Kingdom, Canada and Australia. As the defence industry evolves, PBL is a potential support strategy for the Singapore Armed Forces (SAF). It is therefore important to understand what PBL is and how to tailor it to maximise the benefits for the SAF.

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INTRODUCTION

The military environment is complex and dynamic. In the past, a defence force only needed to protect the nation's sovereign territory. Today, defence forces are called upon for relief and coalition operations in continents far away from home. Furthermore, their capabilities have become more integrated and lethal, with the seamless integration of new and legacy systems into one robust network. Yet, beneath such military prowess is the unseen but essential support structure that keeps each weapon system up and running. The complexity of these support tasks creates frequent unintended deviations from plans. The problem is compounded by ageing systems, which are often deployed beyond their planned useful life. Thus, it is timely to look for alternative support strategies beyond the traditional method of preventive and corrective maintenance and support.

A further support challenge is the desire for new operational capability while having to sustain present competency within tight defence budgets and manpower constraints. Singapore's defence budget has remained between 4.5% and 5.0% of the Gross Domestic Product since 2002 and is capped at 6% (Speech by Minister for Defence Teo Chee Hean at the Committee of Supply Debate, 2009). It takes good judgement and discipline to balance each year's budget between new acquisitions and sustaining existing systems. However, the more challenging issue is the decreasing number of male citizens inducted for National Service (NS), as depicted in Figure 1 (Singapore Department of Statistics, 2009).

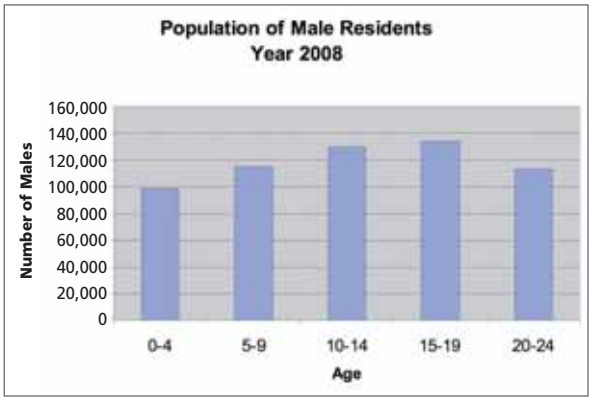

Figure 1. Availability of male citizens for NS

How then would the Singapore Armed Forces (SAF) be able to sustain its existing capability and continue to develop new capabilities under such constraints?

In his keynote address at the DSTA Suppliers' Brief in February 2006, DSTA's then Chief Executive Richard Lim stated:

> "It is clear to us in DSTA that a new menu of procurement approaches is needed to meet the challenges of defence capability development… We seek to exploit the strengths of our supplier base to provide full spectrum services taking advantage of market efficiencies from economies of scale and scope, as well as to allocate risks to the party that is best able to handle them."

Performance-Based Logistics (PBL) is one such procurement approach. It is worthwhile to study how PBL has been implemented in other defence forces, and to be aware of its pitfalls while seeking to reap its benefits for the SAF.

PBL – AN ALIGNING AND OPTIMISING STRATEGY

What is PBL?

PBL refers to "the purchase of support as an integrated, affordable, performance package designed to optimise systems readiness and meet performance goals for a weapon system through long-term support arrangements with clear lines of authority and responsibility" (Defense Acquisition University, 2005).

Impetus for PBL

Under the traditional acquisition approach, the SAF buys a system and its related parts and services, and invests the necessary capital and manpower to support its complex logistics and maintenance activities. When the system malfunctions, the faulty items are sent to the contractor, whose profitability increases as more malfunctions occur. The contractor literally earns more when the system performs below its reliability specifications. Moreover, most of a system's Life Cycle Cost occurs at the Operation and Support (O&S) phase (DSTA Life Cycle Management Manual). The intention of PBL is to leverage contractors' expertise and resources, and incentivise them to come up with innovative ways to reduce O&S costs while achieving the desired level of operational readiness.

Alignment of Goals

PBL seeks to address the undesirable status quo of traditional support structures by aligning the business goals of the contractor with the performance goals of the SAF. This is achieved by paying the contractor based on how well he fulfills performance metrics (e.g. systems availability, spares shortage) that contribute directly to the system's operational readiness.

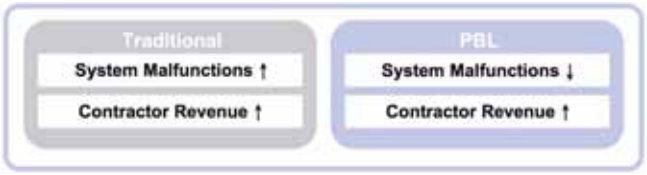

Figure 2. Alignment of goals using PBL

Comparing PBL and Traditional Acquisition

Figure 2 contrasts the traditional acquisition approach with PBL where the SAF pays the contractor according to the system's ability to achieve its specifications. The contractor's profitability function is now inversely proportional to the number of equipment malfunctions and he is incentivised to become aligned with the SAF's goal of keeping malfunctions to a minimum.

Key aspects of the traditional concept and PBL are shown in Figure 3 for comparison.

Traditional Support vs PBL Strategy

Traditional Support	PBL Strategy
Objectives The SAF buys spares and related services. Contractor is paid more as more items fail.	**Better Alignment of Objectives** The SAF buys a certain level of performance. Contractor is paid when performance is met, may be paid more for better performance.
Mission Readiness Contractor does not have direct penalties if Mission Readiness is not met.	**Enhanced Mission Readiness** Contractor has to maintain the agreed level of performance to secure bonus payment.
Reliability Improvements Contractor has no incentive to improve reliability related indicators to maximise payment.	**Reliability Improvements** With improved reliability, Contractor reduces the frequency of maintenance, which increases his profit.
Cost Fewer economies of scale possible as the SAF has widely differing systems and contracts are not not aggregated.	**Lower Cost** Contractor enjoys savings from economies of scale, better planning and design, optimisation of manpower, maintenance and storage of spares.
Resource Allocation The SAF resources have to be deployed to support all areas. This method disperses the focus and may not be the most effective.	**Better Allocation of Resources** Some resources may be provided by Contractor, freeing up SAF resources to be deployed in other critical areas.
Maintenance Footprint With more and more types of systems, maintenance footprint will only increase.	**Reduced Maintenance Footprint** The SAF can use the contractor's existing infrastructure and resources instead of duplicating them.

Figure 3. Differences between traditional support and PBL

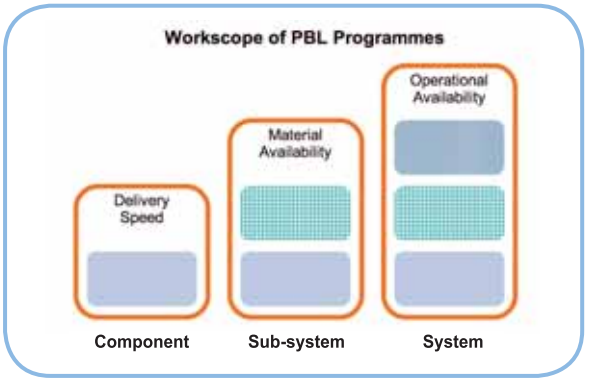

Figure 4. Levels of PBL implementation

Scope of PBL Implementation

PBL may be applied at three levels, namely: the component, sub-system and system levels as illustrated in Figure 4 (Defense Acquisition University, 2005). The level is determined by the system's size and complexity, required operational readiness and the expertise of the contractors.

Component Level

The component level is at the lower end of the spectrum, typically associated with spares and consumables. This type of PBL application is the most straightforward where the contractor leverages his supply chain process to deliver the required type and quantity of items against specific performance targets. Here, the focus is on straightforward end-to-end cost benefits achieved from engaging a contractor who is experienced in supplying the required items and keeping them operational.

Sub-system Level

The sub-system level goes beyond the supply of components and simple maintenance to one that involves the equipment performance and sustenance. Usually, the Original Equipment Manufacturer (OEM) of the equipment is the provider of the support since he is well versed with the design and consequently has control over reliability and maintainability improvements of the system. Thus, his performance will have a correspondingly larger effect on the system's performance and mission success.

System Level

The system level is at the other extreme of the spectrum where the contractor is fully responsible for the operational readiness of the entire system. A system that has a significant number of sub-systems manufactured by a single OEM will benefit the most from a PBL programme conducted at the system level. However, it is still possible to engage a prime OEM as the PBL provider is responsible for the performance of his sub-contractors.

POPULARITY OF PBL

PBL is used in many defence forces (including that of the United States, United Kingdom, Canada and Australia) under different names, to different extents and with slightly different guidelines. A summary of PBL in the US and the UK is provided in this section to highlight their subtle differences.

PBL in the United States

The US Department of Defense (DoD) mandated PBL in 2003 as the preferred product support strategy for improving weapon system readiness and reducing cost (US DoD Directive 5000.1, 2003). The DoD specified five top-level metrics for PBL programmes:

- Operational Availability
- Mission Reliability
- Cost per Unit of Usage
- Logistics Footprint
- Logistics Response Time

The Defense Acquisition University (DAU) teaches a 12-step programme to facilitate the design of product support strategies for new and existing systems. In addition to the DAU, other academic bodies are also involved. For example, the US Air Force has engaged the University of Tennessee to identify effective strategies implemented in existing PBL programmes so that they can be applied to others.

In US programmes, PBL has been applied at the system, sub-system and component levels, each with varying degrees of support from contractors. Defence programmes utilising PBL include the C-17 Transporter Aircraft (Mitchell, 2008), the F22 Fighter (Dryden, 2008), the V-22 Osprey (Matzen, 2008) and the F/A-18 Super Hornet (Heron et al, 2008). Programmes that are in the early stages are mainly financed by cost-plus contracts that gradually progress to fixed-price contracts when the programmes mature and experience with the systems increases.

PBL in the United Kingdom

The concept of Contracting for Availability (CfA)[1] by the UK Ministry of Defence was stated in the Defence Industrial Policy (2002) to involve industries in the direct support of operations. CfA was further expounded in its Defence Industrial Strategy (2005) paper. In 2009, the report 'Review of Acquisition for the Secretary of State for Defence (Oct 2009)' commissioned by the Defence Secretary, commended the Defence Equipment and Support organisation for its good work in CfA (Gray, 2009). Furthermore, it recommended a more extensive use of CfA in initial equipment acquisition to drive down defence support costs and improve equipment availability.

In the National Audit Office's report on the CfA approach for the Tornado and Harrier jets, it was noted that support costs for these jets have decreased with the CfA arrangement while meeting the availability requirement. Today, CfA is applied across the Services e.g. the Navy's Offshore Patrol Vessels (BAE Systems Surface Ships) and the Army's Rapier Missile System (Defence News, 2007).

THE ISSUES WHICH PBL AIMS TO ADDRESS

An ageing fleet will suffer from a decreasing number of available systems and frequent malfunctions. The increasing complexity of each malfunction also contributes to higher costs for the same level of operational readiness. PBL attempts to address this cost increase by better allocating resources and optimising performance per unit cost.

Optimising Allocation of Resources

In essence, PBL encourages the concept of 'each does what it does best'. Resources are directed to where they are best utilised, driving the development of each party's unique ability. Each contributor is allocated only the expenditure that will push it to the level of performance required from it. Resources saved can be used for motivating the achievement of other higher priority performance targets.

Equipment serviced by its OEM can be supported by the OEM's existing logistics system. The OEM's support cost could be more competitive than the military's in-house support costs due to the large total volume it services and its expertise in supply chain activities. By leveraging contractors' investments in expensive maintenance infrastructure and capability, the savings in capital, space and manpower can be better deployed to other critical areas.

Risks Arising from Commercialisation	Risks Particular to PBL
Ensuring Quality	Support during Military Operations
Retaining Competencies within the Services	Ability to Meet Changes in Demand
Recourse in the Event of Contractor Default	Judgement of Contractor Ability
Pricing Risk	Accurate Measures of Performance

Figure 5. Commercialisation and PBL risks

Improved and Consistent Mission Readiness

When payment is based on systems performance, there is motivation for contractors to ensure that the performance consistently meets the required levels. With a well-defined structure and transparent grading system, the contractor can be motivated to deliver the optimal level of performance, instead of under or over performing.

Reliability Improvement

Being concerned with supplying the required mission readiness, the contractor will strive to improve systems reliability as it is a key contributor to overall performance. Contractors will then be motivated to keep malfunctions to a minimum and to incorporate reliability improvements at the design stage or during upgrades.

Reduced Maintenance Footprint

PBL encourages the consolidation and development of strengths – the vertical equivalent of mergers and acquisitions. Resources will be used to their fullest potential, minimising wastage from duplication or sub-optimal use.

RISKS

Defence systems may have conditions that can make them unsuitable for PBL. These include systems that have critical Concept of Operations (CONOPS) or high security systems that do not allow any of the work to be done commercially. Basically, a system unsuited for commercialisation in terms of cost or security will not be suited for PBL. The subsequent paragraphs, summarised in Figure 5, describe the risk factors that have to be considered against the potential advantages of PBL.

CONSIDERATIONS ARISING FROM COMMERCIALISATION

Ensuring Quality

Although the contractor is primarily evaluated by performance, the way he achieves the desired outcome is also important. There must be established standards and controls in his processes to ensure consistent quality and reliable services and supplies. Assurance of quality processes is essential in PBL.

Retaining Competencies Within the Services

The ability to take over in the event of a contractor's absence is critical to ensure continual operation. However, the extent to which competency has to be retained is dependent on the long-term plan for each capability area and its impact on operational capability. Where appropriate, it is important to ensure that some overlap in support functions between the SAF and contractor exists. This is to enable the SAF to build up

its capability and take over the contractor's responsibilities seamlessly in unforeseen circumstances.

Recourse in the Event of Contractor Default

In the unfortunate event of a contractor's default or business failure, there has to be backup structures in place to minimise the impact on the system's capability. The contractor's financial health should first be checked to ensure that he has not over promised in terms of deliverables.

Alternative contractors can also be identified at the start so that they can be brought into the picture when the need arises. Where applicable and viable, a group of SAF personnel can also be assigned to work closely with the contractor so that they will be able to assume similar duties when required.

Pricing Risk

The PBL contract price is a monetary quantification of the many types of risks present in a commercialisation project. This includes the compensation to the contractor for undertaking the amount of risk over and above that in a traditional contract. Under compensation may affect the contractor's ability to deliver the required performance. In addition, the contractor may not be motivated sufficiently to take up the business. Conversely, over compensation may undercut the potential cost savings to the SAF. The fine balance in achieving a reasonable price for the PBL contract is the pricing risk that one has to manage.

Pricing risk can be lowered by ensuring regular reviews are planned within the contract for corrective price adjustments. A period of traditional commercial support may precede the PBL contract to allow both sides to gain experience and collect data.

CONSIDERATIONS ARISING FROM PBL

Support during Military Operations

In assessing if a system is suited for PBL, the CONOPS requirements and the criticality of supply and support during military operations should take utmost priority. The level of PBL application on the system may be adjusted to satisfy the CONOPS requirements. However, if the requirements cannot be adequately fulfilled, alternative sustenance approaches should be used.

Ability to Meet Changes in Demand

Using even the most sophisticated forecasting methods, it is not always possible to predict the exact demands of a system, especially if the prediction is to be valid for a long period. Hence, it is vital to select a contractor who has the ability to meet sudden changes in demand, as this can have severe effects on operational readiness and capability.

The PBL contract should also cater for periodic reviews of requirements to keep forecasted demand as current as possible. Requirements should not be based solely on historical demand. Expected demand should be forecasted and changes anticipated as far as possible.

Judgement of Contractor Ability

Contractors who are inexperienced in the conduct of PBL may submit proposals that are overly optimistic or have little buffer for changes in demand. The evaluation has to review each contractor's business proposal

carefully to be sure that what is promised is achievable without straining resources excessively.

Accurate Measures of Performance

The Key Performance Indicators (KPI) describing the system's performance should be adequate and accurate to avoid over or under payment. This should work in tandem with the constant review of quality and processes, so that signs of impending underperformance are observed and the problems corrected. In order for fair and accurate measurement, the KPI should only encompass tasks that the contractor has full control of.

CONCLUSION

PBL leverages contractors' infrastructure, resources, expertise and supply chain management to sustain systems more efficiently at lower cost. While the benefits from PBL applications are considerable, it is not a panacea for all logistics problems. Risks and constraints in military operations remain. However, there is much to gain in PBL and it should be considered as an alternative support strategy to overcome the budget constraints and decreasing manpower faced by the SAF.

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ENDNOTES

[1] The concept of Contracting for Availability is similar to PBL.

BIOGRAPHY

Teo Koon Kiat is a Principal Engineer who oversees the development of Logistics Support Analysis (LSA). He leads his team in using LSA tools to present viable options to the Services and project teams to solve complex logistics problems. Some of these solutions have been enhanced into mission planning tools. Koon Kiat received his Bachelor degree in Electrical Engineering from the University of Arizona, USA in 1994.

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