DEFENCE APPLICATIONS OF SYSTEM DYNAMICS MODELS

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Abstract. System dynamics (SD) modelling has been successfully applied in many commercial scenarios. This brief paper reports on recent successful applications of SD in strategic planning and management of defence weapon systems and in particular combat radios. The application of SD has generated shared understanding and allowed tailored logistics to be provided more cost effectively. Case studies illustrate the application of SD in defence.

INTRODUCTION

Governments around the world are keen to reduce the cost of being prepared for military action. This year has highlighted how rapidly the strategic defence environment can change when influenced by economic 'meltdown'. The key to managing defence capability is the determination of preparedness. A need has been recognised in the Australian defence environment for weapon system management that:

- minimises the risk of under or over procurement of defence assets;
- maximises the value obtained from existing defence assets; and
- balances logistic support requirements.

If the number of assets is under procured, or lacks the appropriate level of logistic support, the assets may fail to provide the capability or deterrent required thereby being of little or no defence value. If assets are over procured, or have greater than anticipated logistical cost then financial resources are trapped or excessively consumed. This paper illustrates how practical applications of system dynamics (SD) can be used to better manage defence capability.

OBJECTIVE

In this paper we consider a weapon system to be any collection of like assets which are managed as a fleet to provide some form of military capability. Within an environment of tight fiscal policy the effective utilisation of the military assets is critical to maintaining a credible defence posture. The measure of success of a SD model [1] is the maintenance of a defined capability effectively utilising the assets at various levels of effort within a force structure that is ready and able to perform military operations. This is not a static situation, but is dynamic requiring continual adjustment to maintain optimum asset utilisation. This gives rise to the concept of weapon system preparedness.

System dynamics, being concerned with the causality within complex systems, is suited to providing better control in very turbulent strategic environments.

HISTORY

During the late 1980s, logistics within the Australian defence environment started to apply commercial planning practice to its business. Strategic planning was applied to military asset management and asset support. Best-practice concepts like Program Management and Budgeting (PMB), organisational empowerment, devolution and outsourcing were adopted. Emphasis was placed on integrated logistics support and life cycle costing. However, a pre-occupation with the *inputs* and *processes* detracted from organisational understanding of the levers that controlled *outputs* such as fielded defence capability.

The challenge of the late 1990s was to adapt the classic strategic thinking processes to the new dynamic business environment of defence. To understand the fundamental dynamics of defence asset management was to provide insight into the controls needed to respond rapidly to changing defence capability demands.

SYSTEM DYNAMICS

The management of defence capability was recognised to be a process of gaining control of weapon systems and particularly defence assets. The effective utility of the weapon system is its current capability in light of acquisition cost, logistic cost and potential life expectancy. Additionally, in rapidly changing defence environments more frequent capability upgrades are needed to keep the assets at the leading edge of effectiveness.

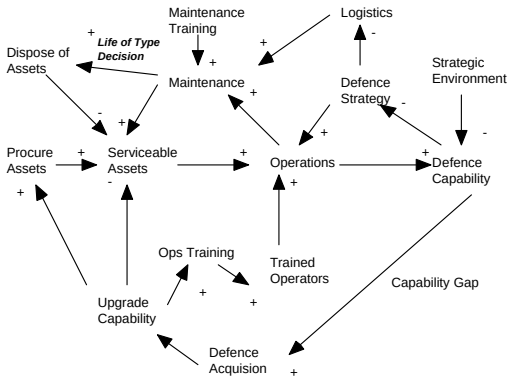

Figure 1. Causality in defence capability

The causality diagram of Figure 1 can be used to illustrate the inter-dependencies within a fleet of military assets. If an asset is under-procured or lacks adequate logistics support, it will fail to provide the required capability through operational availability. Conversely if the assets are over-procured but not utilised, then defence resources are tied up without effective benefit. If Australia is to maintain its defence capability then ongoing weapon system upgrades will be required throughout the asset life cycle. Flexibility is required within the system dynamics to adjust, in a responsive manner, to changes in operational effort, capability or logistics support.

EARLY APPLICATIONS