Asset Management and Governance – An Analysis of Fleet Management Process Issues in an Asset-Intensive Organization

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Abstract—**Efficient asset management is a key performance driver for asset-intensive organizations. Achieving high utilization and return on investment on physical assets are central corporate objectives for public and private organisations alike. Current approaches on asset management include the engineering and governance perspectives. The engineering perspective on asset management concentrates on the technical and operational dimensions of asset performance, including utilization, and operation to technical specifications. However, this perspective often ignores organisational-level factors that potentially affect asset performance. By contrast, from a governance perspective, key factors influencing asset management performance include stewardship, accountability and incentive regimes. Symmetrically, the governance view often takes the operational factors for granted. In sum, both perspectives offer valuable but incomplete insights on the management of asset performance: experience demonstrates that an exclusive focus on one or the other may lead to sub-optimal asset and organizational performance.**

In this paper, we investigate how an integrated approach to asset management can be constructed in the context of vehicle fleets. Vehicle fleets provide a suitable context to investigate these issues as they constitute significant investments, and are observable across a range of asset-intensive industries. Beginning with an analysis of how the asset management process is operated through the asset lifecycle, we identify key engineering and organizational factors influencing asset performance. The relationships between factors are analyzed to provide an integrated fleet asset management approach.

I. INTRODUCTION

ASSET-intensive organizations such as utilities, heavy engineering, mining, or transportation rely on assets that are expensive, extensive and/or complex, and have a major impact on organisational performance over extended periods [1], [2]. The efficient management of such assets is crucial to achieving high performance. From an operational perspective, high asset performance is obtained through the implementation of engineering asset management best practices [3], [4] However, engineering asset management approaches often take for granted organisational-level influences encapsulated in asset governance principles [5]. This opens up the possibility that in a given organization, engineering asset management practices and asset governance policies may not be aligned, leading to sub-optimal asset performance.

In this paper, we investigate the managerial and performance implications of asset governance policies in an asset-intensive organization, using the case of fleet vehicles in an Australian networked utility organization. Vehicle fleets provide a suitable context to investigate such issues as they constitute significant investments, and are observable across a range of asset-intensive industries.

We begin with a comparison of the engineering and governance perspectives on asset management. We then analyse the fleet services unit of a large asset-intensive transport provider from an asset governance perspective to highlight the performance implications of governance arrangements. We conclude with a summary of findings and an agenda for future research.

II. ENGINEERING AND GOVERNANCE PERSPECTIVES OF ASSET MANAGEMENT

Across the disciplines involved in asset management, there is a broad consensus to recognise asset management as the process or cycle in which assets are "put through" in order to manufacture a product or provide a service at an optimum performance level [6]-[9]. The aim of engineering asset management is to integrate the strategic planning of operations, maintenance and capital investment decision-making. The overarching goal is to increase the efficiency of assets, which comprises enhancing asset productivity, maximizing asset value through the life-cycle, and minimizing the total cost of ownership [10].

The engineering perspective to asset management can be considered from both temporal and physical dimensions. Typically, in this perspective, an engineered system is looked at through its whole lifecycle e.g. daily maintenance, weekly shutdowns, monthly larger shutdowns, and annual overhauls [11]. The engineering perspective to asset management focuses on dynamics such as technical wear, requirement specification and technological obsolescence. By performing maintenance and modifications on the system an organization can intervene in the wear out process of the asset. Engineering asset management utilizes a Life Cycle Cost (LCC) calculations to assess the value of its physical asset, which includes costs such as research & development costs,

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production & constructions costs, operation & maintenance costs, and retirement & disposal costs [5]. The maintenance process of a physical asset is a complex one, relying on feedback loops that are activated by failure reports, work requests, work orders and technical information that have to be processed smartly in order to update the maintenance program properly [12]

The engineering view usually takes for granted that there is an organization that provides the infrastructure for skilled people to deliver services [13]. Whilst such an assumption is valid in the case of fully integrated organizations, it does not fully hold for many XXIst century organizations which have outsourced a range of activities to networks of providers [14]. This dis-integration of organizations has several management implications: the focus of management is broadened from organizational boundaries to network boundaries, and the role of the asset owner emphasizes contracting, supervision and asset strategy, i.e. strategic management instead of operational management. The evolution towards dis-integrated organization and network management implies that asset managers can no longer take governance for granted.

Governance is defined as the laws, policies, and procedures that ensure organizations run in the interest of owners and resources are allocated, managed, and redeployed to maximize productivity and value [15]. Governance assists in determining appropriate management processes, organisational structures, and incentives systems to align managerial behaviour and attitudes with the interests of principals [16], and the relevant reporting and disclosures that enable proper transparency and accountability [17]. In this perspective, asset governance can be defined as a subset of organisational governance which specifies the policies and processes to acquire, utilise, maintain, and account for the assets of the organization [10]. It follows that asset governance can be viewed as a management approach for assets that takes into account asset ownership and the management of distributed systems in a competitive and deregulated market [18]-[22].

By advocating transparent and accountable asset management policies, asset governance outlines aims to define principles to manage assets effectively in distributed networks, a context where the development, stewardship and operation of assets may be open to competition [23]. Vehicle fleets provide a relevant context to investigate these issues as these assets involve substantial capital investments and may offer scope for externalization [24]. Clear definition and differentiation of roles and responsibilities of the asset owner, asset governor, and service providers for operational and maintenance activities are argued to be central to good asset governance [10]. Asset governance thus provides a framework to manage the separation of powers in asset management that characterises the management of networks [25], enabling effective asset management in a distributed system. Guidelines for the application of asset governance principles are outlined in industry standards such as the UK's Publicly Available Specification for Asset Management (PAS 55) developed by the British Standards Institution [26]-[28]. PAS 55 was initiated in 2002 to provide a standardised framework for physical asset management systems. The PAS 55 defines physical asset management as a system that requires a life-cycle view and optimal mix of capital investments, operations, maintenance, resourcing, risks, performance, and sustainability. It has been recommended to industry regulators as a framework to audit governance [29]. Key asset governance principles embodied within PAS 55 include regulatory compliance, supply business satisfaction, risk-based, data supported, continuous improvement, pragmatic, and income maximisation and generation.

A comparison of the literatures on engineering asset management and asset governance highlights areas of convergence and divergence. Proponents of both approaches advocate the implementation of systems that will maximise the performance or utilisation of assets while minimising risk factors. Both perspectives stress the importance of integrating strategic and operational decisions related to asset investments to ensure maximum return on investment. Minimising cost, or total asset life cycle cost, through careful acquisition, maintenance, and disposal policies are principles shared between engineering asset management and asset governance.

However the focus of engineering asset management is different from that of asset governance, leading to significant differences between the two perspectives. Engineering asset management refers to the operational processes specifying how asset are managed in order to maximise operational performance: how they are acquired, maintained, and disposed of. Asset governance on the other hand concentrates on the organizational principles required to design and implement effective asset management policies in terms of transparency and accountability. Each approach therefore addresses a different dimension of asset management and performance. Because asset governance is derived from the overarching organizational governance principles of the organization as a whole, it defines the managerial context in which engineering asset management is implemented. Table I summarises the characteristics of the two approaches and highlights points of convergence and divergence.

Asset governance principles are derived from two main theories of organization: agency theory and transaction cost economics (TCE). Agency theory is chiefly interested in the design of governance structures to mitigate the agency conflict arising from the possible divergence interests between shareholders (principals) and managers (agents) [16], [31]. Transaction cost economics is concerned with the governance of contractual relations in transactions between two parties [32]-[34].

TABLE I
A COMPARISON BETWEEN ASSET MANAGEMENT AND ASSET GOVERNANCE

	Engineering Asset Management	**Asset Governance**
Focus	Engineering/Mechanical/ Operational	Policy structuring, decision making process, align operations and business goals
Compliance	Technical specifications, health & safety standards	Industry regulations/rules, international standards, benchmarks
Separation of Power	Asset Manager – day to day operational matters	Asset Governor – long term strategic corporate goals
Time Frame	Long term – whole life cycle	Short term – annual reporting
Application	Operational or divisional level	Corporate core level
Competitive process/edge	Cutting edge specifications. Proactive maintenance and operational risk management	Business level strategies: procurement processes & proactive risk management
Implementation	Technical and business capabilities	Organizational change, local management personalities, organizational structure
Planning Focus	Operational and maintenance planning	Corporate goals, decision making process

Source: adapted from [5] and [30]

Agency theory focuses on ways of controlling the self-serving behavior of agents to ensure that the interests of the principals are protected. Although agency theorists explain the agency problem in terms of the relationship between owners of a firm and the managers they hire to act on their behalf, the theory can be generalized to the relationship between lower levels of management [35], [36]. Thus agency theory is relevant to the analysis of relationships between levels in a hierarchy or chain of command. The notion of opportunism and self-interest is a dominant assumption in agency theory [37]-[39]. This behavioral feature, in the presence of uncertainty, leads to conflicts arising from a divergence of goals between parties [40]-[42]. Efficient governance is achieved through the design of appropriate incentive systems and governance mechanisms that work towards aligning the interests and behavior of agents in contexts of uncertainty so they act in the interest of principals. Efficient design is achieved when agency costs are minimized [43].

Transaction cost economics (TCE) is a theory of contractual relations that focuses on efficient drawing of organizational boundaries and contractual terms to manage transactions across organizational boundaries [24], [32], [34], [44].The aim of TCE is to minimize transaction costs between and within organizations. It argues that determining factors in drawing transaction-cost efficient organizations are the specificity of the assets involved, the frequency of transaction and the indeterminacy of transaction scope: high asset specificity, high transaction frequency, high indeterminacy all provide opportunities for opportunistic behavior and therefore call for integration of the assets in a single organization (Williamson, 1975). TCE thus provides a complementary perspective to agency theory as it takes into account the nature of the assets involved –a feature pertinent to asset management.

Engineering asset management is concerned with the whole of life cycle cost of the assets, whereas the governance perspective will focus on monitoring performance in the context of a periodical reporting cycle. The two views have different, but complementary time horizons. The appropriate asset financing strategy must therefore balance the costs and benefits of whole-of-life engineering management and on-going governance. The specificity of the asset [33] is likely to be a determining factor in the choice of a financing structure that will ensure highest level of value extraction from its potential benefits [45]. In engineering asset management, an asset's specificity is commonly dictated by technical specifications, and in-house sourcing or dedicated contracting arrangements increases with the complexity of the technical specification. [46] suggest that the higher the specificity of an asset the less chance of it being sourced externally as its availability in the general market would be low. Asset specificity would indicate that the assets are not likely to be as valuable when put to another *use* or in the hands of another *user* [47], [48], therefore the investment risk increases with the specificity of assets (Williamson, 1975). Transaction intensity is another factor considered in organizing governance: the case for integrating transacting parties in the same organization increases with the frequency of transactions arising from the operation of an asset (Williamson, 1991).

Fleets of road vehicles are a particularly relevant context in which to investigate the interplay between engineering asset management and asset governance. In most asset intensive organizations, vehicle fleets comprise a mix of assets with a range of investment values and specificity: from passenger cars to dedicated logistics and maintenance vehicles fitted with highly specific equipment. However, as the vehicles are used as part of the internal operations of the organization they will tend to exhibit relatively low and predictable transaction intensity as their operation is linked to that of the other assets of the organization: vehicle utilization and maintenance can be anticipated on the basis of planned operations and experienced patterns. Thus the determination of governance for vehicle fleets hinges mainly on the specificity of the asset. In the following section, we report the preliminary findings of a study conducted at the fleet services unit of a large asset-intensive transport provider, one of Australia's largest railway operators.

III. TRANSPORT PROVIDER – FLEET SERVICES

The large asset-intensive transport provider in question is one of Australia's largest passengers, coal and freight transport providers. As a publicly owned organization, this large asset-intensive transport provider is subject to the provisions of the Transport Infrastructure Act of 1994 and the Government Owned Corporations Act of 1993. Its shareholders are represented by two Ministers – the Minister of finance and the Minister for Transport and Main Roads [49]. This large asset-intensive transport provider is governed by a Governance Management Framework (GMF001) which reflects its status and ownership as a large government owned corporation. This set of guidelines sets out principles and structures to govern the corporation. It highlights the role of a range of functional and operational units and their relationships, introducing the role of 'practice leaders' as coordinators across a range of practices considered strategic for the appropriate operation of the organization, from financial reporting to health and safety. In an apparent paradox, there are no explicit guidelines nor practice leader for asset management.

Interviews with senior managers revealed that this apparent omission was due to the assumption that operational managers were to implement autonomously asset management best practices in their business units. It was felt that the operational requirements of the business divisions –which range from the bulk transport of coal, to suburban passenger trains and interstate integrated freight- were so different that business units were better off implementing guidelines specific to their circumstances.

This presents a particular challenge for the management of the fleet of road vehicles: this fleet is centrally managed from a dedicated unit, Fleet Services, which provides services to the other business units. Through Fleet Services business groups purchase or rent vehicles, and the management of each asset is governed by a specific contractual arrangement. Each contractual arrangement specifies the acquisition procedure of the vehicle (buy or rent), vehicle specifications, arrangement of finances, maintenance responsibilities, disposal schedule of the vehicle, and length of contract. Fleet Services transact with business units on a one-on-one basis, where each contractual arrangement is tailored to the needs of the business unit.

In financial year 2004/2005 Fleet Services managed a fleet of 3323 items, of which 1996 were vehicles including passenger vehicles. light commercials, buses and trucks, and 1327 were other registered items including trailers, forklifts and tractors. The percentage breakdown of the fleet was: 55% light commercial, 14% passenger, 7% road/rail vehicles, 23% trucks, 1% bus [50]. Of these, arguably only the road/rail vehicles and some of the utility vehicles and trucks were purchased to specifications unique to the asset-intensive transport provider, whilst the majority of the vehicles were standard issue and could be valuably used by other industrial operators or private users (86% of the fleet is used for freight operations). The vehicle fleet thus comprises a mix of high specificity vehicles (e.g. road/rail vehicles for track maintenance) and low specificity vehicles (e.g. forklifts, passenger cars). Fleet Services therefore provides an ideal site to observe the interaction of engineering asset management and asset governance. Table II summarizes the principal characteristics of the management of road vehicle fleets by Fleet Services according to the key dimensions identified in the literature.

TABLE II
FLEET MANAGEMENT AT TRANSPORT PROVIDER-FLEET SERVICES UNIT

	Engineering Asset Management (EAM)	**Asset Governance (AG)**	**Comparison Notes**
Focus	Fleet provision to business groups, maintenance issues, acquisition/disposal issues	Contract with business groups, procurement and maintenance issues with external parties	EAM focus between internal fleet and business group contracts only, AG focus on all internal/external contracts
Compliance	Technical specifications, health and safety standards	Business group requirements, contract clauses (with business groups), financial reporting requirements	EAM concentrate on technical specs, AG on organizational and reporting requirements
Separation of Power	Fleet Services general manager	No asset governor or asset management practice leader	Fleet Services general manager as both asset governor and asset manager – no separation of power
Time Frame	Contract based. Total lifecycle of asset	Monthly, quarterly and annual reporting	EAM has a long-term focus, AG short-term focus
Application	Dedicated central department (Fleet Services)	Ad-hoc multiple arrangements including decentralized management in business units	EAM: dedicated department – thus "in order", a strength. AG: ad-hoc arrangements – thus needs further development, still a weakness
Competitive process/ edge	Service provision to business groups, fulfillment of technical specifications	Individual / tailored contract with business groups	-
Implemen-tation	Technical specification and maintenance support, acquisition and disposal support	Dedicated organizational structure (1 fleet services person per business contract), consumer-specific contractual arrangements	EAM: concentrated on maximizing asset life cycle AG: concentrate on the relationships and structure surrounding maximizing the asset life cycle
Planning Focus	Maintenance, acquisition and disposal, total life-cycle of asset	Driven by corporate reporting cycle	EAM: based on total life cycle of the asset AG: based on corporate reporting cycle

Source: Interviews and document analysis

The implementation of asset management at Fleet Services is driven by two sets of factors: on the one hand, engineering and technical specifications are given by experts from other units (technical specifications from the business units and

health and safety specifications from practice leader), but on the other hand each asset is governed by a specific contract, leading to a multiplicity of arrangements depending on the preferences of the client business unit. This arrangement thus maximizes the responsiveness of Fleet Services to the needs of its client business units. But this situation has been identified as a major challenge by Fleet Services: whilst the flexibility required to address the need of the business units is acknowledged, it increases the complexity of the management of the vehicle fleets, opening up the possibility that the same model of vehicle be governed by different contractual and operational arrangements depending on the client business unit. This indicates that the operational business units of the asset-intensive transport provider appear to have implemented slightly different asset management practices, thus defeating the benefits of operating a centralized management service.

Interviews with business unit managers reveal a range of understandings of the purposes and principles of asset management, each emphasizing a different aspect relevant to their local and immediate concerns. The business unit acting as practice leader for health and safety, for instance, emphasized those aspects in its understanding of asset management, at the expense of other technical, organizational, or business considerations. Business units generally emphasized their need for autonomy in governing their assets according to their business requirements, whilst acknowledging the need for increased consistency and transparency in decision making and financial reporting in relation to assets. Fleet Services highlighted the need to implement consistent processes with regards to acquisition decisions, contractual arrangements, and maintenance and disposal policies. When questioned about initiatives to reduce the complexity of fleet management and improve the performance of Fleet Services, interviewees explained that considerable efforts had been made to reduce the diversity of vehicle models in the fleet, eliminating costly small variations that were not necessary in practice: in recent years the range of types and models of vehicles business units could choose from had been reduced and this had led to improved purchasing terms due to bulk purchases. In total, the analysis of the practices of vehicle fleet management at the large asset-intensive transport provider revealed an operation dominated by technical and health and safety specifications tailored to the needs of individual business units, with only a limited commonality of practices in terms of asset governance, which made the central management of vehicle fleets relatively complex –and presumably costly.

The analysis highlights that whilst the business units in the case had paid attention to governance in terms of reporting and transparency, the quest for operational autonomy of the business units had led to adopt localized decision making criteria, and increased complexity of governance arrangements for the centralized management of the vehicle fleet. Incorporating asset specificity criteria in the decision making process offers an opportunity to reduce this complexity: transaction costs economics suggests that a uniform, standardized and centralized governance structure would be appropriate for all vehicles that exhibit low asset specificity, leading to one set of arrangements for these. By contrast, vehicles acquired to technical specifications unique to the client business units should be governed by specially tailored governance arrangements. Reorganizing the governance of vehicle fleets in this way should enable Fleet Services to reallocate some of its resources –reducing the managerial attention directed at non-specific assets- leading to increased productivity and/or higher levels of performance and service.

IV. Conclusion

In this paper we have argued that asset performance is not purely determined by engineering asset management principles, policies and practices: governance issues also matter. The implementation of appropriately designed governance principles, policies and practices has a material impact on the total organizational performance as governance is a key driver of administrative cost. The case study of Fleet Services at a large asset-intensive transport provider illustrates that paying insufficient attention to economic governance factors such as asset specificity may lead to increased organizational complexity and costs, resulting in below-potential performance.

This case study suggests that further research should be conducted on the asset performance implications of the governance arrangements implemented in asset-intensive organizations.

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