Is EAM a Corporate Level Strategy?

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Abstract. We speculate that COVID-19 will drive engineering asset owners to require governance entities such as boards of management (BoM), to elevate engineering asset management (EAM) to being a corporate level strategy and core competence. We sought to understand whether there was a fit-for-purpose conceptualization of EAM as a corporate level strategy.

Our research considered foundational Asset Management (AM) prescriptions finding that the available AM models have distinct gaps as to the roles of governance entities and of CEO’s in asset management where these are actively involved in the policy and practice of asset management. Using the Victorian Government Asset Management Accountability Framework as an example of active top-level involvement we identified a ‘bottom-up’ approach, incomplete integration with the whole organization and positioning of AM planning subsequent to strategic level planning as barriers to effective corporate level asset management strategy implementation. Responding to those findings we offer a program of future research aimed at developing fit-for-purpose strategic EAM tools to assist those BoM’s who seek to elevate EAM to a corporate level strategy.

Keywords: Asset management · Corporate strategy · Engineering asset management · Governance · Integrating strategies

1 Introduction

As the boards of governance of engineering asset-based organizations unpack the implications of COVID-19 for the survival of their organization it is highly likely that owners will have heightened expectations of their organization’s asset management competence, seeking performance above cost-effective projects, compliance and sustainability deliverables (Koronios et al. 2007). These heightened expectations upon the Boards of Management (BoM) may elevate engineering asset management (EAM) to being one of the two or three core corporate strategies, and to being a core competence (Prahalad and Hamel 1990). We adopt Beard and Dess’s (1981) conceptualization of corporate strategy as determining the scope and resource deployment of an organization’s resources to achieve corporate level objectives. The issues then for a BoM are whether there is a fit-for-purpose conceptualization of this top-down EAM, whether there are examples of this approach in practice, what might be the factors which support or hinder EAM being a corporate level strategy integrated with other corporate level strategies and, whether better performance is achieved.
Our approach to this research was to first interrogate the asset management (AM) and EAM academic literature and then explore the industry and government publications for evidence regarding a strategic and whole-of-organization perspective on optimizing the outcome from engineering assets. Two observations are necessary. Firstly, that EAM is a relatively new discipline, being formally acknowledged only 10 years ago by way of the work of Amadi-Echendu et al. (2010). Secondly, this recent emergence has been ‘bottom up’ with strategic governance factors being confronted only relatively recently in the work of Mahmood et al. (2015). This recency of both conceptual development and application of theory in practice signals a pressing need for substantial empirical research and consequent development of theory.

Because of this paucity of literature as to theory and practice we sought out an example where expectations as to the AM performance of the governance entity had been specified and where performance had been independently assessed. The Victorian Government’s Asset Management Accountability Framework (AMAF 2016) is prominent for the government’s dissatisfaction with actual asset management performance and consequent escalation of requirements as to accountability, effectiveness and efficiency, placed on the governance entity and the accountable officer. The Auditor-General of Victoria (VAGO 2019) has reported publicly as to the approach taken by governing entities in applying, and assuring compliance with, the requirements. This reporting, and expressed views as to the likely success of some of the approaches taken by the entities made the AMAF case highly suitable for our research.

Our paper has been assembled in the following four sections. The first reports the literature relevant to strategic involvement in EAM. The second reports the evidence as to practice gleaned from the Victorian Government AMAF accountability approach. The third discusses the implications of this evidence for a heightened involvement of BoM in EAM. Finally, the Conclusion section forms and justifies an agenda for future research aimed at more strategic and more effective EAM.

Our research sought to see EAM from the perspective of a Board of Management (BoM), which might reasonably ask the following questions:

1. To what extent do models conceptualize EAM as a corporate level strategy in which the BoM is actively involved?
2. What is the evidence of EAM being applied as a corporate level strategy in practice?
3. What are the factors that support or hinder EAM being an effective corporate level strategy integrated with other corporate level strategies?

2 Literature: Strategic (BoM) Involvement in EAM/AM

We first sought to understand the extent to which AM and EAM prescriptions encompass the governing entity (typically a BoM) and top management and the artefacts of their corporate level governance. We first examined the foundational ISO 55000:2014 Asset Management – Overview, principles and terminology, for such evidence and then explored the article of Mahmood et al. (2015) which lays out the component processes of six AM Capability Maturity Models and provides specific critique of the coverage (or not) of high-level management and strategic governance requirements for effective asset management.
2.1 The Standards

In this paper, ISO 55000 means the entire family of ISO 5500x standards but not including the new standard ISO 55010:2020 Asset management - Guidance on the alignment of financial and non-financial functions in asset management.

ISO 55000:2014 defines asset management as coordinated activity of an organization to realize value from assets and identifies leadership and commitment from all managerial levels as essential to successful asset management. We explored whether, within the Standards there were specifications as to: the roles of the BoM or equivalent governance entity; requirements made upon ‘top management’ i.e. the chief executive officer and second level executives; and whether EAM/AM is portrayed from the whole-of-organization, ‘top down’ perspective of a BoM.

Involvement of Governance Entity

There is no mention of the governance entity. There is no separate, specific mention of a chief executive officer or similar role that in terms of corporations law, or governance of public entities, has very specific accountabilities for an immense range of matters. The Standards are no more precise than to use the term ‘organization’ which, in 3.1.13 it defines as ‘…a group of people…’.

Governance is addressed but from the perspective of providing assurance that capability of the asset is ensured.

Top Management Involvement

Within ISO 55000:2014 S 2.4.1 specifies that an organization’s ‘…top management, employees and stakeholders should implement … (AM) … to exploit opportunities and to reduce risks to an acceptable level.’

S 2.4.2 (c) specifies as a fundamental of AM ‘Leadership and commitment from all managerial levels is essential for successfully establishing, operating and improving asset management within the organization’.

S 2.5.3.3 squarely allocates to top management responsibilities for developing AM policy, AM directives together with vision and values that guide policy and practice.

‘Top management’ is defined in S 3.1.23 of the Standard as the “person or group who directs and controls an organisation at the highest level”. It is not clear whether ‘Top Management’ is intended to include the BoM. The Asset Management – Management systems – Requirements ISO 55001:2014 prescribes in S 5.1 Leadership and commitment, prescribes actions that the ‘Top Management’ shall take which are quite operational and are the province of management and not the governing entity. It appears that the intent is for ‘Top Management to refer to the CEO and second level roles. These second level roles may be the ‘Business Leader’ role identified by The Institute of Asset Management (2008) as being the top of a hierarchy of AM roles, immediately above the ‘Head of Asset Management’.

Whole-of-Organization Approach

We applied a whole-of-organization lens in our examination of the literature, for two reasons. First the governance entity has responsibility for, and command of the resources of, the whole organization. Second, Prahalad and Hamel (1990) conceptualize core
competencies as collective learning across the whole corporation and are insistent that a core competence cannot be the result of the efforts of a specialist unit but rather are formed by efforts of the entire organization, orchestrated from the corporate level.

ISO 55000:2014 (S 2.5.2 (b)) envisages benefits to top management from the cross-functional integration and planning process inherent in an asset management system that is integrated with other organizational systems. Further, ISO 55000 observes that not all asset management activities reside within the asset management system. Rather leadership, culture, motivation and behaviour may be managed by the organization using arrangements outside the asset management system (ISO 55000:2014 S2.4.3).

However, whilst ISO 55000 makes clear the need for integration of asset management throughout the organization and its systems the Standards are either silent about the importance of the strategic asset management plan (SAMP) and planning activities relative to the key corporate artefacts, or indicate that AM planning is consequent upon those corporate level activities. Specifically, Annex B ‘Relationship between key elements of an asset management system’ employs a figure to depict the ‘feed down’ effect of ‘Stakeholder and organization context’, then ‘Organizational plans and organizational objectives’ down to ‘Asset management policy’ and SAMP with its ‘Asset management objectives’. The integration of the asset management system with the key corporate artefacts, namely the strategic plan, financial plan (budget), is depicted as asset management activities not being strategic and not the province of the governance entity.

Consideration of the overall Standards reveals a strong prescription of integration of AM planning and systems with those of the wider organization. The whole-of-organization impact of this integration is, however, diminished by AM planning and SAMP being subsequent to, and driven by earlier corporate level decisions and artefacts.

2.2 AM Capability Maturity Models

Organizations seeking to operationalize asset management policy as proposed by the Standards have increasingly used capability maturity models. These Asset Management Capability Maturity Models (AMCMM) have been used to both specify and measure the organization’s performance in each process within the domain of AM. Applying the five dimensions of EAM (Amadi-Echendu et al. 2010) Mahmood et al. (2015) interrogated 6 AMCMM’s to determine whether there were gaps in the key process areas specified in each AMCMM.

Mahmood et al. (2015) found that all models had strong asset performance measurement process areas and four started only at the asset management policy and strategy level. The remaining two models started from the perspective of organizational strategic governance (corporate governance, corporate policy and corporate strategy) and then moved on to asset management strategy. Only one model covered leadership, change management, competence management and asset management culture.

Mahmood et al. (2015: 344) concluded that a well-designed asset management maturity model must address the corporate levels of organizational management by integrating corporate planning processes with asset planning processes. The authors proposed an AMCMM in which asset planning processes are separate (in the Temporal dimension) from corporate policy, strategy and governance (in the Organizational dimension), yet reinforced the need for an AMCMM to start from the perspective of organizational
strategic governance. Such a conceptualization of AM promises benefit by way of tighter focus of organizational activities and resources, if applied in practice. However, there is no evidence as to whether this is the fact in practice, either in AM or in EAM.

3 Practice: Strategic (BoM) Involvement in EAM/AM

Having interrogated all identifiable academic literature that contemplated the matter of EAM or AM strategic governance we turned to the industry and government publications to understand whether practice reflected the tenets of the Standards and maturity models, or offered a different approach to governance of engineering asset-based organizations. The Victorian Government’s Asset Management Accountability Framework (AMAF) (AMAF 2016) is prominent for the government’s rejection of then existing standards of actual AM performance and consequent escalation of requirements as to accountability, effectiveness and efficiency, placed on the actual governance entity and the accountable officer. The Auditor-General (VAGO 2019) has reported publicly as to the approach taken by the governance entity in applying, and assuring compliance with, the requirements. The availability of the reporting by the Auditor-General was attractive because of the independence of the performance reviewer, quality assurance and challenge mechanisms in respect of facts and conclusions.

The requirements of the AMAF and the findings and conclusions of the Auditor-General are brought together in the following subsections: Strategic level AM governance requirements and the evidence as to Strategic level AM governance practice.

3.1 Strategic Level AM Governance Requirements

The AMAF was formed in 2016 by the Victorian Government which had concluded in 2013 that ‘…agencies were not taking accountability for their performance in managing their assets.’ (VAGO 2019: 18). The AMAF applies to government corporations, departments and other agencies, thus encompassing some entities that have major engineering assets. The Government sought to achieve both effective management of assets and accountability on the part of entities through a strengthened emphasis upon top management leadership and an attestation by the accountable entity as to compliance with the AMAF. This focus on the top of the organization suggested a re-conceptualization of asset management as a top-down strategic governance activity.

Entity and Accountable Officer Inclusion in AM

AMAF (2016: 10) states that ‘Without leadership and accountability… particularly from management and Accountable Officers, an organization’s asset management strategy and service delivery objectives may be ineffective’.

The AMAF Guidance (2017: 4) specifies that it is the role of Accountable Officers (Secretaries or CEO’s) to ‘…demonstrate asset management leadership’ but does not include leadership in the list of roles specified for Responsible Bodies (departmental Secretaries or Boards). The reasoning behind the Responsible Body not being required to provide asset management leadership is not explained.
Role of the Whole Organization
Management is required to ‘… drive a culture of continuous improvement in asset management.’ (AMAF 2016: 30) with the AMAF (2016: 9) prescribing that effective asset management ‘… is supported by organizational leaders who promote the principles and policies of asset management…’ making clear that such promotion of asset management is to the broader organization and is not limited to asset management professionals. The broader staff are to be informed of both the role of asset management in the organization and their contribution, role and responsibilities for asset management (AMAF 2016: 30).

AMAF Guidance (2017: 15) introduces the concept of ‘asset management thinking’ and its integration into reporting lines and operating frameworks with the objectives of reducing ‘asset management silos’ and fostering a collaborative approach across the whole of organization that balances strategic, technical and budgetary considerations. This whole-of-organization approach to asset management is conceptualized in Fig. 1: Asset management levels, provided in the AMAF Guidance (2017: 15).

![Asset management levels](image)

Importantly, this layered conceptualization allocates to the highest level, the ‘Management of the Organization’, the role of determining how AM contributes to, and achieves, organizational objectives.

3.2 Strategic Level AM Governance Practice

Entity and Accountable Officer Performance in AM
The Auditor-General (VAGO 2019: 9) found two Agencies had demonstrated better practice by:

- Active involvement of their senior leaders in AM
- Considering the criticality, risk and complexity of their assets
• Having a second level executive oversee the AMAF implementation across the whole-of-organization; and
• ‘most importantly’, being motivated to improve asset management as they understood its value to the success of service delivery.

The agencies examined by VAGO (2019: 50) were all departments and as such the accountable body is the ‘Secretary’ and good practice was for Deputy Secretaries to have specific responsibilities for each asset class.

In contrast, VAGO (2019: 36) observed that the evidence was that in three of the five agencies where the assets were complex and higher risk the corporate finance and compliance unit was responsible for driving and coordinating AMAF implementation. This task was found to be difficult for these units if the unit did not have strong support from those with asset management responsibilities or expertise.

Whole-of-Organization Approach
The Auditor-General commended an exemplar department which developed a whole-of-organization asset management plan that:

• Communicated a shared understanding about the purpose, direction and expectations for asset management across different asset classes
• Drove the department to improve capability and change practices in response to identified needs
• Highlighted the role of senior leaders in AM (VAGO 2019: 11).

The ‘whole-of-organization’ approach is established in the AMAF for the purposes of offering the option to entities (typically the larger multi-function departments) of being able to have an asset management strategy for each major asset class. AMAF (2016: 32) further specifies that the asset management strategy should be at an appropriate level to the organization’s size and functions.

However, VAGO (2019: 31–32) observed that departments ‘…without a whole-of-department asset management plan … may find it challenging to consistently achieve their asset management and service delivery objectives…’. To illustrate, VAGO (2019: 32–33) gave the example of a diverse human services organization with non-current assets of $30bn which had an asset plan for each of its asset classes. This case was described as a ‘bottom-up’ approach which missed the opportunities for understanding asset management strengths and weaknesses, improving asset management, and prioritizing and directing efforts across the department. ‘Bottom-up’ governance is where the executives reporting to the CEO are ‘independently-minded’ and have a capacity to impose strong discipline upon their CEO, providing advantage, and disadvantage to the organization (Landier and Thesmar 2005).

4 Discussion
We embarked on this research with the objective of understanding whether the EAM body of knowledge was fit for the purpose of guiding the BoM of an engineering asset-based organization that has decided to elevate EAM to the status of core corporate level
Is EAM a Corporate Level Strategy?

4.1 Current Conceptualization of EAM as a Corporate Level Strategy

EAM developed on the back of ICT inventions and innovations of the 1970’s and 80’s that were not widely implemented until the 1990’s (Hodkiewicz and Pascual 2006). Hodkiewicz and Pascual (2006) report that a number of international bodies representing their national EAM communities emerged from 2004 onwards and that these bodies have since been active in defining required bodies of knowledge, moving on from technical, to decision-making and communication skills and related soft skills. This recency of EAM led us to widen our exploration to include AM. In 2015 Mahmood et al. (2015) examined AM capability maturity models to identify gaps in the process areas specified, identifying the significant absence of consideration of corporate level management and organizational governance components of well-designed AM processes. This research concludes that AM and EAM are moving briskly from being only a function facilitated by ITC to one characterised by active involvement of those governing the organization.

An increased role of the top of the organization is explained in the theory of Mahmood et al. (2015) and demonstrated by the example of the Victorian Government AMAF (AMAF 2016). Yet, whilst the AMAF is fully consistent with ISO 55000:2014 it goes beyond the conceptualization of those Standards which are silent as to the role of the governance entity or accountable officer in AM.

In summary, the Standard, ISO 55000, does not present a conceptualization of AM (or EAM) as a corporate level strategy. Specifically, no involvement of the governance entity or BoM is described. Understanding the need for Standards to specify generalized principles, and acknowledging that the number of engineering asset-based organizations that determine a need for a strategic, corporate level approach to EAM may be a small proportion of the overall population of EAM organizations, it may be appropriate to develop a conceptualization specific to an owner (as was the Victorian Government AMAF) or to an industry e.g. energy generation, water services.

4.2 EAM as a Corporate Level Strategy in Practice

This research, with its approach of only interrogating the academic literature and industry and government publications, had found that the available evidence as to practice was limited. The Victorian Government AMAF (AMAF 2016) was chosen as a case study to inform this research because of the availability of the publicly published VAGO (2019) report as to performance that itself was the subject of quality review processes and based on a deep experience of review of asset management performance. The AMAF (2016) case study provided some assistance to this research but also has limitations as to its applicability. The case study exemplified the unequivocal requirement of the owner that there be effective AM and accountability of the governance entity and accountable officer for such AM. Further, the combination of the AMAF (2016) and VAGO (2019)
report made clear that a ‘top down’, whole-of-organization conceptualization of AM is an inherent part of the strategic, corporate level approach to AM.

However, the AMAF (2016) has limited generalizability as the governance entity had no choice as to the adoption (or not) of the AMAF and there is no clarity as to where the AM policy and strategy were positioned and integrated vis-à-vis other corporate, strategic policy and strategies. As the government entities and accountable officers were compelled to be actively involved in AM it can be assumed that there was no decision of the governance entity, say a BoM, to adopt AM as one of two or three core corporate strategies and as a core competence (Prahalad and Hamel 1990) directed to achieving organization objectives. Further, despite the attention given by the governance entity, CEO and second level executives, there was no indication that the AM policy and strategy had been elevated to being key corporate artefacts.

4.3 Barriers to EAM Being a Key Corporate Level Strategy

The approach taken in this research was not intended to develop an exhaustive list of barriers to the adoption of a corporate level (Viljoen and Dann 2000) AM strategy, but through the examination of practice inform the design of future research. The themes as to findings regarding barriers to EAM being a key corporate level strategy were, ‘bottom up’ approach to AM, AM activities not being integrated across the systems and activities of the whole organization, and positioning of AM policy and integration with corporate, strategic policies.

‘Bottom up’ Approach

A ‘bottom up’ approach to the structuring of the governance of asset management was criticised by the Victorian Auditor-General (VAGO 2019) who made clear their view that an organization without a whole-of-organization AM plan would find difficulty in achieving AM and service delivery objectives because of missed opportunities for understanding AM strengths and weaknesses, improvement of AM and prioritization of AM efforts across the whole organization.

This example, plus the Auditor-General’s according exemplar status to the entity which developed a whole-of-organization asset management plan which communicated purpose, direction and expectations across different asset classes, suggests that the Auditor-general saw benefit in a ‘top-down’, whole-of-organization approach to AM.

ISO 55000 does not convey a ‘top-down’ approach to AM. The evidence is that the Auditor-General believes that where an organization seeks to introduce a strategic, corporate level approach to AM then the practical implementation should be enacted ‘top-down’ commencing with the development of a whole-of-organization strategic corporate level AM plan.

The literature as to the ‘bottom-up’ and ‘top-down’ approach to business planning has been summarised by Babafemi (2015) who found the bottom-up approach is said to offer strategies that are consistent with customer needs and expectations but have the disadvantage of corporate business directions being substantially influenced by people who are unaware of the internal and external business environments. In contrast, Babafemi (2015) found that the literature characterised the ‘top-down’ approach as producing plans
that are truly corporate in scope but which may not meet the reality of internal capability, stakeholder credibility and cultural fit. It is thus necessary to establish whether there is evidence of a ‘top-down’ approach to AM that has increased efficiency and effectiveness, and to identify the extent to which the two approaches are applied.

**Incomplete Integration of AM with Whole Organization**

The ISO 55000 conceptualization of integration looks from the asset management system outwards to the other systems of the organization. The AMAF (2016: 30) goes further towards a whole-of-organization perspective requiring the organizational leaders to promote the principles and policies of asset management to the broader organization and specifying to each member of the broader staff their contribution, role and responsibilities for asset management. This approach is explained as ‘asset management thinking’ directed at reducing ‘asset management silos’ and fostering a collaborative approach across the whole of organization (AMAF Guidance 2017: 15).

Increased integration throughout the whole organization is held, in the Standards, the AMAF (2016) and the observations of the Auditor-General regarding the problems associated with a ‘bottom-up’ approach, to contribute to efficiency and effectiveness of AM. It would seem that: integration of systems and activities is in itself a key area of focus for organizations seeking improved AM performance; integration can be advanced by a top down approach to AM strategy, planning and implementation; and integration of systems and activities across the whole of organization is a key feature of a strategic, corporate level approach to AM.

**Integration of Corporate Level AM Strategy With Other Corporate Strategies**

The Standards present a strong prescription of integration f AM planning with that of the corporate level, but AM planning and the SAMP are depicted as being driven from above by earlier corporate level decisions and artefacts. The matter of the integration of a corporate level SAMP with the other corporate level strategies and plans is not explained in the Victorian Government example, nor in the literature. Similarly, the benefit of integration on a whole-of-organization basis assumed in the Victorian model was not quantified or otherwise established.

As such integration has not been explored by the AM and EAM literatures we turned to the literature surrounding the progressive integration of organizational sustainability with strategic management theory, seeking an indication of the scope of the task. Engert et al. (2016) identified that over a period of 25 years 118 peer reviewed articles had collectively identified factors and issues that support or hindered integration of a corporate sustainability strategy with the organization’s strategic management. Engert et al. (2016) ordered these findings into eighteen categories which they offered as a basis for managerial decisions that could be considered in order to ensure or promote success in the integration process. Engert et al. (2016) did not empirically test these areas or categories of issues.

For our EAM research some categories of issues such as risk management, economic performance and cost reduction resonate with typical EAM/AM corporate objectives suggesting that the larger body of literature regarding the integration of corporate sustainability literature can inform the design of future research into the matter of integration of EAM at the strategic, corporate level.
5 Conclusion

If EAM were to be a core corporate level strategy then a governance entity such as a BoM will need guidelines and models as to fit-for-purpose Strategic EAM policy, strategy and practice. Our research identified that the family of ISO 55000 Standards do not adequately address that need and that there are a number of barriers that must be addressed in the design and implementation of policy and practice. Some barriers were signalled rather than resolved by the exploration of the Victorian Government AMAF (AMAF 2016) confirming the need for substantial empirical research and consequent development of theory.

We identified that such empirical research might address the following:

- Where the artefacts of EAM policy, strategy, planning and activity are positioned within the hierarchy of artefacts.
- The roles of the BoM and CEO
- The positioning of EAM leadership
- The positioning of EAM related measures e.g. availability, cost.
- Whether there was a ‘top down’ approach to EAM policy, strategy, planning and activity.
- Whether there had been a chronological progression of EAM in the organization.

In addition, consideration of the report by Engert et al. (2016) as to the factors that the literature asserts supports or hinders the integration of a strategy of corporate sustainability into the strategic management of the organization has highlighted that our research must be aware of myriad factors specific to the case study organizations and industry.

We suggest that the research task will for each case study organization be substantial and that within the immense scope of EAM organizations there are diverse needs. Further, the availability of informants for interviews or surveys and the availability of internal archival records and publicly available planning artefacts suggest that public organizations might be a suitable starting point for research. Public organizations that have substantial engineering assets which dominate their core service delivery purpose, such as water systems, appear suitable.

Our research approach would be to first develop the fields of evidence we seek and investigate the viability of that information being available from water services in a specific country or countries. The research methods would be public document analysis, informant interviews, archival study, and thematic analysis utilizing NVIVO. Our objective is to develop a model and guidance as to the configuration of EAM as corporate level strategy and practice.

In doing so we will have both advanced EAM theory in respect of the role of EAM as an organizational strategy and provided to BoM’s and CEO’s tools to assist them in achieving increased performance from EAM.
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