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Strategic
management of
long-term assets

A framework for the strategic management of long-term assets (SMoLTA)

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Abstract *Managing long-term infrastructural assets, such as real estate, buildings and equipment, is becoming more topical at the strategic level. Such assets are reported to comprise 25 per cent or more of corporate assets and occupancy costs represent 40-50 per cent of net operating incomes and are often the third most expensive item (behind labour costs and IT). Managers with little experience of the strategic management of long-term assets (SMoLTA) often find this a challenging agenda. This paper reports exploratory research on how managers are addressing the SMoLTA and is drawn from the views of senior managers in 25 organisations of varying sizes from the public and private sectors. In addition, the paper uses data from research on management practices in four case companies that have excellent reputations in this field, synthesising the findings into algorithmic form. This algorithm is developed and presented as a tentative framework which aims to help facilitate managers in aligning corporate and infrastructure strategy.*

Introduction

Since the early 1980s, efficiency gain and the downward pressure on costs, as well as the challenge of improved quality in product and service delivery, has preoccupied many companies. A key response from many companies has been to instigate performance improvement programmes under a variety of themes. For example, in the early 1980s, much attention was paid to the effective introduction and exploitation of advanced shop floor technologies. This began with the introduction of robots into factory production lines, notably in the automotive industry, but rapidly spread to other forms of advanced technology such as CNC machine tooling, flexible manufacturing systems (FMSs), and, more generally, computer integrated manufacturing (CIM) (Tranfield and Smith, 1988; Bessant and Haywood, 1985; Child, 1987).

Extended implementation timescales and difficulties in fully exploiting these new technologies shifted the focus for performance improvement effort on the mid- to late-1980s on to integrated information systems (Barrar *et al.*, 1989; Waterlow and Monniott, 1986). This became a significant theme in building the "factory of the future" insofar as the prevailing wisdom at the time believed that introducing integrated information systems would provide the "nervous system" which would sustain and nourish the exploitation of advanced technologies.



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By the mid-1990s the key change theme had moved again, this time focusing on revolutionizing the social system. Having resolved many of the technological and systemic requirements, it became generally recognized that radical social reorganization was a major key to successful implementation and exploitation. As a result, total quality (TQ), just-in-time (JIT), and later business process reengineering (BPR) became fashionable techniques for driving the performance improvement agenda along with reorganization of the supply network and the consequential blurring of external organisational boundaries (Smith *et al.*, 1994).

During this whole period relatively little attention was paid to one of the most significant assets in any business portfolio, namely real estate and infrastructure. Although, from time to time, the organisation and utilization of physical space had moved into the spotlight, few academic articles or concepts had come forth to lead thinking in this area.

This research highlights how, more recently, the SMoLTA has emerged as a central concern and change theme for organisations of all kinds. The reason for management interest may have resulted from these resources moving up the list of business costs significantly, or in the public sector that privatization of public utilities has exposed for the first time the real extent of infrastructure under-funding, the impact of which is only now being realized, both in financial and human terms. Suddenly, real estate and infrastructure are being understood as assets requiring active stewardship, which should be made to work for the business in the same way as other assets. Specifically how this might be achieved, and particularly what constitutes an appropriate methodology for ensuring the alignment of corporate and infrastructure strategies has remained an open question. The aim of this article is to report exploratory research which is used to develop such a prototype methodology.

Research methodology

Survey research

Following initial exploratory work, a detailed survey was undertaken, which included both public and private sector organisations. The research participants completed a questionnaire which was distributed either by post or administered by personal or telephone interview.

The questionnaire comprised six sections and 31 questions, which focused on both process and outcome variables (see Appendix). The survey consisted of a range of different question formats. Some questions (1b, 4b, 4e, 5g, 5h, 6a) were open ended. Question 2a asked participants to rank five different types of long term assets (LTA) in terms of replacement value. Question 2d asked participants to estimate the percentage of annual LTA budget on each stage of the life cycle. Three questions (4a, 4c, 5f) asked participants to choose one option from a list of alternatives. The remaining questions (2a, 2b, 2c, 3a, 4d, 5a, 5b, 5d, 5e) covered a variety of issues using a Likert scale. Respondents were asked to rate each item in terms of importance (1 = not at all, 2 = to a small extent, 3 = somewhat, 4 = significantly or 5 = to a great extent). The

quantitative data gathered from the questionnaires was analyzed using SPSS (a statistical package for the social sciences), from which descriptive statistics were derived, with relevant means being reported in the discussion below.

Survey sample

The structured sample of respondents comprised a selection of senior and experienced managers in organisations having large infrastructure assets. In total, 25 organisations contributed to the survey. These comprised seven central government departments, three local authorities, three executive agencies, three privatised utilities, seven manufacturing companies, and two service organisations. The sample was mainly based in the UK but included responses from international managers, with about three quarters of these being based in Hong Kong, where space limitations have necessarily led to active real estate management.

Qualitative casework

Following the survey research, four in-depth case studies of experienced companies were conducted. The case study interviews concentrated on the key strategic issues facing infrastructure managers and the order in which these questions were being addressed. The case study method was used as it allows the gathering of in-depth information about a particular problem or situation (Yin, 1984; Stake, 1995). Therefore, the researcher can obtain a more detailed understanding of the specific issues involved in infrastructure asset management and codify learning from the experiences of companies.

The data gathered from interviews and the case studies were analyzed using inductive content analysis. Specifically, the researcher clustered quotes or portions of text around underlying uniformities, which became emergent themes. These emergent themes were then translated across all the studies to develop higher order categories. Common threads emerged by comparing and contrasting each quote of similar meaning and separating quotes of different meaning. This process continued until it was impossible to create a higher theme level. The survey data were also used to support the development of final themes. These themes were then ordered to develop an initial algorithm for the SMoLTA which was field tested and further developed in subsequent rounds of interviews with respondents. The final algorithm can be seen in Figure 1.

Key findings – an algorithm for the SMoLTA

The algorithm provides a framework summarizing the components of asset management and how they relate to each other. It is constructed from our empirical data and comprises interlinked but definable levels. The final algorithm divides into two sections. As with any strategic question, senior managers must satisfy themselves that the SMoLTA constitutes an appropriate concern and agenda item. Steps 1 through 4 of the algorithm address this issue directly and answer the management question “Why should

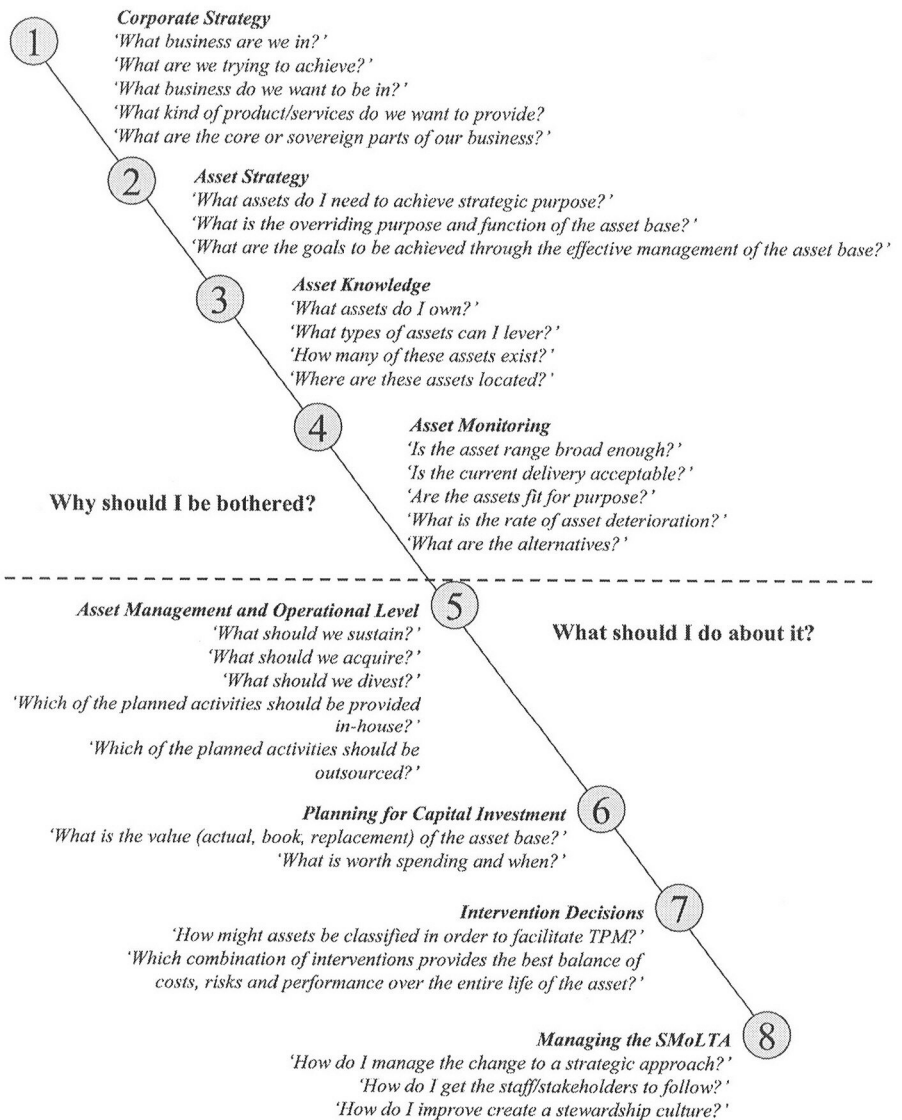


Figure 1.
 An algorithm for the strategic management of long term assets

"I be bothered"? At this strategic level, managers need to ask questions relating to high-level corporate strategy and the delivery of an asset base that can support the organisations' objectives.

Having ascertained the need for effective SMoLTA and its relationship to the delivery of corporate strategy, steps 5 through 8 address the challenge of intervention, and answer the management question "What should I do about it"? At the asset management and operational level, managers need to understand the processes, technologies and costs involved. Asset management also involves the development of a stewardship culture that nurtures the



shared understanding, motivation and trust that is needed to ensure asset and service delivery over extended timescales. In detail, our empirical data led to the following conclusions concerning the specific steps in the algorithm.

Corporate strategy

Most managements recognize that they will perform more successfully if they focus on defining a clear sense of direction for the medium/long-term. The strategy defines the overall purpose of the business and the mission to be pursued over the next time period.

Theoretically, since the mid 1990s, the debate on corporate strategy has hinged on the so-called “outside-in” and “inside-out” perspectives (Teece and Pisano, 1994; Tranfield, 1995; Marino, 1996; Tranfield and Smith, 1998; Gagnon, 1999; Eisenhardt and Martin 2000; Miller *et al.*, 2002). Briefly, these competing views reflect the extent to which strategy is driven by external factors such as markets and customer requirements (the “outside-in” or “competitive forces” perspective), or is better effected by managers deciding where their companies uniquely add value better than the competition and then finding creative ways to express these value adding processes and routines as niched products or services (the “inside-out” or “resource-based” perspective).

In reality, strategy in action usually involves a compromise between these two theoretical extremes, with companies endeavouring to meet (and occasionally exceed) market expectations within the limitations and opportunities of their resource base. A key limitation on strategy formulation and the design and implementation of strategic change and performance improvement programmes is the so-called “stickiness” of many company assets:

... resource endowments are “sticky”: over any strategically relevant time frame, firms are stuck with what they have and must live with what they lack (Teece *et al.*, 1990, p. 7).

Nowhere is this more true than in the case of real estate and infrastructure assets. Companies invest in, retain and further develop, their real estate and infrastructure base for many reasons other than tight coupling with, and direct contribution to, the realization of corporate business purposes. For example, our research suggests that managers might see real estate as a high growth asset of itself or that the high status afforded to a particular location constitutes justification for investment in its own right. “Stickiness” therefore resides not only in the intrinsic challenges of buying and selling real estate and assets, but also in the attitudes, values and culture of the management of the organisation.

Our research investigated the extent to which the management of infrastructure assets has become recognized as an essential component of an overall business strategy. About three quarters of our survey sample saw the SMoLTA as having already become accepted as a “significant” part of the overall business strategy of the organisation. This view achieved some prominence in our case study organisations, although a number of respondents

said that this tight coupling had not always been true. For example, one interviewee in the public sector noted that in the past:

... people robbed budgets to make short term political gain and this has left us with major problems. The outlook was very narrow. There was no long term planning. Instead it was about keeping your head above the parapet to see where you were going.

Particularly in the public sector, given the political dimension, long-term strategic planning was reported as having been often problematic. Given short-term electoral cycles, many local authorities reported the difficulty of members taking account of the long-term repercussions of short-term actions and decisions. As a result of the increasing significance of long term funding options such as the Private Finance Initiative (where projects often exceed 25 years), it is becoming increasingly important for politicians to think beyond their term in office. Such a view resonated with respondents in the private sector too.

The survey research highlights the key barriers to the effective SMoLTA. "Political directives" ($M = 3.44$), "increasing regulation" ($M = 3.70$), "competition" ($M = 3.70$) and the need to improve "financial performance" ($M = 3.30$) were regarded as considerable external pressures. Of the 19 key strategic drivers for change presented, respondents rated "reducing costs/improving efficiency" ($M = 4.58$), "improving service levels/responsiveness" ($M = 4.39$) and "providing better value for customers" as the most significant drivers for the SMoLTA. The research also illustrated how asset managers were reappraising the use of their LTA and in many cases this began with "establishing and focusing on the core business" ($M = 4.26$). These organizations had then considered novel and occasionally radical ways to "extract the maximum value" ($M = 4.22$) from these "sticky" resources, often producing new or improved products and services.

(1) *The key questions being addressed by infrastructure managers relating to corporate strategy are as follows:*

- "What business are we in?"
- "What are we trying to achieve?"
- "What business do we want to be in?"
- "What kind of product/services do we want to provide?"
- "What are the core or sovereign parts of our business?"

Asset strategy

Nourse and Roulac (1993) argue convincingly for the increasing importance of the proactive management of infrastructure assets as central ingredients to the realization of business purpose and the focus of strategic change initiatives. However, even within our structured sample of large infrastructure asset owners, we still found that around a quarter of organisations did not tight couple the SMoLTA with corporate strategy. In organisations such as local

government, the quest for both increased efficiencies as well as medium term mission delivery means that it has become critical to amalgamate the infrastructure strategy with other sub-strategies that exist for component elements of the organisation such as housing, environmental, and transport.

Asset knowledge

(2) *The key questions being addressed by infrastructure managers relating to asset strategy are as follows:*

- “What assets do I need to achieve strategic purpose?”
- “What is the overriding purpose and function of the asset base?”
- “What are the goals to be achieved through the effective management of the asset base?”

All organisations in our sample were infrastructure intensive, operating a range of assets. These varied from an enclosed single production plant to an organisation with over 1,000 geographically dispersed sewage works, over 40,000km of water mains and over 50,000km of sewers. Producing a comprehensive audit of both the volume and condition of the assets available to an organisation is crucial for the SMoLTA. Our survey showed that “developing better knowledge of the asset base” ($M = 4.16$) was one of the most difficult, yet important, aspects of the SMoLTA.

Asset monitoring

(3) *The key questions being addressed by infrastructure managers relating to asset management are as follows:*

- “What assets do I own?”
- “What types of assets can I lever?”
- “How many of these assets exist?”
- “Where are these assets located?”

The majority of organisations in the survey rated “assessing the life of assets” ($M = 3.24$) and “determining the physical condition of assets” ($M = 3.24$) as a critical priority. One, large international manufacturing organisation monitors every aspect of its infrastructure assets at every stage of the production process:

To make decisions you need to know what kit you have got? What condition it is in? What is happening to it? And what is the current situation? Information is power, knowledge is power.

Knowledge of the assets can be gained through asset inspection and examination routines. Technologies, such as information technology and geographical information systems, can facilitate asset inspections, condition assessments and monitoring processes. The overall goal is to produce an

integrated data, information and knowledge management system to collect appropriate data and to make it available to those who need it. However, collecting the data is just the first step. Managers need to know what information they require, why they need it and how to use it.

(4) *The key questions being addressed by infrastructure managers relating to asset monitoring are as follows:*

- “Is the asset range broad enough?”
- “Is the current delivery mode acceptable?”
- “Are the assets fit for purpose?”
- “What is the rate of asset deterioration?”
- “What are the alternatives?”

Operational approach

Once managers have sufficient knowledge of the asset base they are in a position to make intervention decisions. Interventions are the activities undertaken to ensure the condition of individual assets and require not only maintenance and replacement decisions but also the specification of timeframes detailing when these interventions need to be undertaken. Relating intervention to overall corporate strategy and business objectives is crucial and requires a “criticality” assessment specifying which are the “sovereign” assets, i.e. those central to business performance, and which must operate “failure-free” (i.e. beyond six sigma levels of performance).

Once the size of the asset base has been determined, managers need to decide how planned interventions should be provided, either in-house or outsourced. Outsourcing the SMoLTA is clearly an important strategic issue and our data reflected a sharp rising trend in terms of both the outsourcing of operations (average 21.8 per cent of assets) and maintenance (average 56.8 per cent of assets). Our respondents believed that over 80 per cent of asset maintenance would be outsourced within the next five years. For the public sector respondents alone this was close to 100 per cent. As such “developing close relationships with other organizations” ($M = 4.33$) was rated as a crucial issue in the SMoLTA and our research suggested that many of these experienced organisations were attempting to become better clients by knowing what, when and why they wanted a project undertaken by an external organisation.

Naturally, where infrastructure assets were outsourced, organisations had to work in partnership with others. The “effective management of contracts” ($M = 4.70$) and “managing partnering relations in the supply chain” ($M = 3.96$) were seen as particularly challenging issues. One organisation had adopted a prime contracting approach whereby one contractor had responsibility for the management and delivery of an entire project, including the co-ordination of subcontractors to meet the overall service specification, efficiently, economically, innovatively and on time. The client organisation was adopting

an “eyes on, hands off” approach and was using multi-disciplinary integrated project teams.

(5) *The key questions being addressed by infrastructure managers at the operational level are as follows:*

- “What should we sustain”,
- “What should we acquire?”
- “What should we divest?”
- “Which of the planned activities should be provided in-house?”
- “Which of the planned activities should be outsourced?”

Planning for capital investment

Because of the rising capital and maintenance cost of the asset and infrastructure base, the value of assets is crucial at boardroom level. The general shift towards “resource/accrual accounting” ($M = 2.83$) and budgeting, where applicable, has helped focus attention on infrastructure issues.

A strategic review of investment decisions can lead to considerable cost savings. The proportion of the budget revealed by our research which was spent on each stage of the asset life cycle, from new acquisition (23 per cent), maintenance (53 per cent), replacement (22 per cent) and taking out of service (2 per cent), demonstrated that organisations need to focus on a whole life cycle approach. In the past managers often have worked with limited budgets, attempting to maintain the asset at the minimum cost rather than investing in the infrastructure to yield maximum utility and return.

This research reinforces and has built on previous work by the Royal Academy of Engineering (Evans *et al.*, 1998) that identified the phases and key outputs of 20-year project lifecycles, specifying the typical cost profiles under each phase. This showed that total building costs often accrue to less than 3 per cent of total business operating costs, yet within the industry much of the focus of modernization and innovation has addressed cost reduction in asset delivery, often through the notion of “lean thinking”. These figures suggest the need for construction companies to ensure that both asset and service delivery is achieved seamlessly, in order that significant efficiencies can be gained, optimizing the through life operational costs and giving clients best value for money. The adoption of a “whole life approach” ($M = 4.13$), with a particular emphasis on the importance of service delivery, is providing an important strategic shift of context, which is directly impacting on the SMoLTA.

For example, the Government has advocated that:

... all procurement must be made solely on the basis of value for money in terms of whole life costs. A key part of the whole life cost assessment must address the environment and sustainability aspects of the facility (Office of Government Commerce, 2000, p. 3).

In Private Finance Initiative/Public Private Partnership environments project periods can be in excess of 25 years. Within these projects, while asset delivery

is an integral part of the lifecycle, it is service delivery where significant margins are made. Within such long-term projects, which increasingly play a vital part of the construction landscape, an overemphasis on reducing costs in the design and construction phases can be predicted to have adverse effect on service quality in the long-term.

Most owners of infrastructure assets understand that the actual productive life of aging assets is much longer than the 20 or 30 years used for whole life cycle costing, and hence the value of written down assets is inadequately represented on the balance sheet. Consequently, the asset value profiles used for whole life costing need to be critically re-examined in the light of practical experience.

(6) *The key questions being addressed by infrastructure managers relating to capital investment are as follows:*

- “What is the value (actual, book, replacement) of the asset base?”
- “What is worth spending and when?”

Intervention decisions

The maintenance and renewal of physical assets, such as buildings and structures, is extremely complex. There are two common models for thinking about maintenance and renewal decisions. First, for example in the airline industry, maintenance is usually concentrated on the best method for dealing with a single aircraft. Once this is achieved the same process can be applied to the entire fleet. A second approach, for example in the production factory, puts considerable effort into optimizing the maintenance schedule for the entire plant. However, these two models do not fit organisations that have a geographically dispersed and diverse asset base. Consequently, a classification of assets is required together with a rationale for their operational maintenance, the aim being to identify and eliminate unpredictable time consuming tasks, and develop more efficient methods for frequent repetitious work.

A solution advanced by one of our case study organisations was to adopt a process flow/job shop analysis to improve the dependability, efficiency and productivity of maintenance and renewal operations and ensure total preventative maintenance (TPM). Creating such an approach borrowed heavily from ideas developed originally in operations management (Parnaby, 1988; Bicheno, 1998). The company divided maintenance tasks into four categories: “runners” were tasks capable of being managed at 100 per cent efficiency because of their frequency, the predictability of time needed to complete them and their occurrence on a short term (sometimes daily) basis. “Repeaters” were tasks that did not occur every shift or day but were predictable in time and frequency. “Strangers” were the ad hoc tasks, occurring infrequently and unpredictably. Finally, “intruders” were the high frequency, low predictability tasks that were the most disruptive to the operation.

Making sense of the SMoLTA using these ideas proved most valuable for this large utility, which immediately saved 16 per cent of its maintenance budget by adopting this novel approach. A key senior manager argued:

Utilities are huge job shops, and embodied in the mess are routine tasks which you can take and turn into processes. You can separate the tasks that can be completed every week from those that need doing every three months. Significant cost savings have been achieved.

(7) *The key questions being addressed by infrastructure managers relating to interventions are as follows:*

- “How might your assets be classified in order to facilitate TPM?”
- “Which combination of interventions provides the best balance of costs, risks and performance over the entire life of the asset?”

Managing the SMoLTA

While asset management requires some sophisticated technical solutions, many of our companies argued that the most important element of all is the human one. The single most important organisation design element “ensuring an appropriate organisational culture” (M=4.13) was rated as the most important of organisational issues.

A measure of the increasing importance placed on the SMoLTA is the number of senior managers involved in the process. Traditionally, physical assets were managed and maintained by middle or lower management as an engineering issue. Responsibility for the SMoLTA is now commonly split between the various directors of resources/facilities, and very senior management such as general manager/managing director/chief executive. Seven of the 25 respondents (28 per cent) said that the finance director often had some degree of responsibility.

Leadership and management processes were recognized as important factors in developing shared understanding, motivation, trust and the collaboration needed to ensure the SMoLTA. While leaders need to be clear about the SMoLTA in order to achieve the desired outcomes, the top team needs to articulate agreed objectives, create shared understanding and receive feedback from all the stakeholders. Without this clarity of direction at both strategic and operational levels, there is a real risk that the lower levels of the organisation will continue to operate non-aligned asset management processes. Further, without bottom up communication of asset knowledge and new ideas it is unlikely that the SMoLTA can be achieved effectively. Despite this, the survey revealed that almost two thirds of respondents reported that good asset management practices were not being shared within their organisations and “communication within the company” (M=3.23) was rated as an important organisational issue to be addressed.

Equally, effective communication and management practices needed to extend beyond the organisation. Many infrastructure projects comprised substantial numbers of stakeholders. These included contractors, owners, clients, architects, lenders, insurers, vendors, engineers, central government,

management consultants, local government, sub-contractors, suppliers, accountants, and lawyers. Creating a partnership culture in which information is openly shared can lead to fewer surprises between partners. Resolving disputes at source has been argued to lead to fewer claims and less litigation, producing better long-term performance and enhancing team working. Successful SMoLTA therefore is underpinned not only by the need to elevate the strategic importance of the management of these assets to the boardroom, but also for managers to understand the need for shared risk, mutual commitments and the development of long-term relationships.

(8) *The key questions being addressed by infrastructure managers relating to managing the SMoLTA are as follows:*

- “How do I manage the change to a strategic approach?”
- “How do I get the staff/stakeholders to follow?”
- “How do I improve/create a stewardship culture?”

Limitations of the research and areas for further investigation

This study was exploratory in nature and as such has a number of limitations. The overall aim of the work was to develop a prototype methodology for the SMoLTA. The aim was not to provide definitive answers but to identify, codify and report an accurate interpretation of how experienced managers were addressing the SMoLTA. The algorithm which resulted comprised eight “general dimensions” and 28 key questions that were synthesised from the experiences of these managers. The algorithm does not constitute a definitive prescription of what strategies to implement. In complex organizations, there will always be local circumstances which will require crafting and bespoke interventions in practice. Instead, this exploratory research has developed a general framework that managers can use to help guide design solutions to problems in their companies and organisations. While the framework offers a “route map” of questions which have been ordered to help the practitioner align the SMoLTA with corporate strategy, practitioner judgment still remains important in this newly emergent field.

A further limitation of the study relates to sampling. In total, 25 organisations responded to the survey. While these companies were varied, more research is required to ascertain whether or not the approach to the SMoLTA varies across different sectors, or is influenced by the different characteristics of firms. Further research may also strive to link the approach to the SMoLTA with particular strategies (e.g. growth, efficiency, productivity), and also to measure whether and to what extent performance improvements are achieved through the SMoLTA.

Conclusion

The physical asset base of any organization is not only a significant item because of its capital and maintenance costs, although both are important in their own right. Real estate and infrastructure create the boundaries and



opportunities in which companies pursue their strategic objectives. They contribute significantly to the shared taken-as-given assumptions of organizational members concerning appropriate methods of communication, decision making, organization and govern behavior at work in general. In short, real estate and infrastructure are central to the creation of organizational culture. They often dominate routines and procedures, which in turn govern relationships between groups, teams and departments, yet do so in a way that is often not noticeable.

In pursuit of the twin aims of efficiency gain and mission delivery, managers are becoming increasingly aware of the need to better understand and reveal the true nature of their long-term asset base in order to promote its active management for corporate benefit. This is creating a novel theme for change management programmes previously ignored or underestimated by many management teams, and consequently much under-utilized in performance improvement programmes. Because of the novelty of this field it is helpful to have a prototype methodology to aid management thinking and guide the process. Our research has started the process of specifying such a methodology synthesized from the practices of experienced managers in this field.

(9) *Final key questions for managers:*

- “Do you have in place a tight coupling of the design and maintenance of the long term asset base of the company as part of the corporate plan?”
- “Should changing real estate and infrastructure be the theme of the next performance improvement programme?”

References

- Barrar, P., Lockett, G. and Tanner, I. (1989), “Decision processes in the design, implementation and use of CAPM systems in medium sized organisations”, Final Report to SERC/ACME directorate, grant GR/E/21278.
- Bessant, J. and Haywood, W. (1985), “The introduction of flexible manufacturing systems as an example of computer integrated manufacturing”, Brighton Polytechnic, Brighton.
- Bicheno, J. (1998), *The Lean Toolbox*, Picsie Books, Buckingham.
- Child, J. (1987), “Organisation design for advanced manufacturing technology”, in Wall, T.D., Clegg, C.W. and Kemp, N.J. (Eds), *The Human Side of Advanced Manufacturing Technology*, Wiley & Sons, London.
- Eisenhardt, K.M. and Martin, J.A. (2000), “Dynamic capabilities: what are they?”, *Strategic Management Journal*, Vol. 21, pp. 1105-21.
- Evans, R., Haste, N., Jones, A. and Haryott, R. (1998), “The long term costs of owning and using buildings”, The Royal Academy of Engineering, London, November, available at: www.raeng.org.uk/news/publications/reports/
- Gagnon, S. (1999), “Resource based competition and the new operations strategy”, *International Journal of Operations & Production Management*, Vol. 19 No. 2, pp. 125-38.
- Marino, K.E. (1996), “Developing consensus on firm competences and capabilities”, *Academy of Management Executive*, Vol. 10 No. 3, pp. 40-51.

- Miller, D., Eisenstat, R. and Foote, N. (2002), "Strategy from the inside out: building capability-creating organizations", *California Management Review*, Vol. 44 No. 3, pp. 37-54.
- Nourse, H.O. and Roulac, S.E. (1993), "Linking real estate decisions to corporate strategy", *Journal of Real Estate Research*, Vol. 8 No. 4, Fall.
- Office of Government Commerce (2000), *Guide Number 7, Whole Life Costs*, Government Construction Procurement Guidance, November, available at: www.ogc.gov.uk/index.asp?docid=1350
- Parnaby, J. (1988), "A systems approach to the implementation of JIT methodologies in Lucas Industries", *International Journal of Production Research*, Vol. 26 No. 3.
- Smith, J.S., Tranfield, D.R., Foster, M.E. and Whittle, S. (1994), "Strategies for managing the TQ agenda", *International Journal of Operations and Production Management*, Vol. 14 No. 1, pp. 75-89.
- Stake, R. (1995), *The Art Of Case Study Research*, Sage, London.
- Teece, D. and Pisano, G. (1994), "Dynamic capabilities of the firm: an introduction", *Industrial and Corporate Change*, Vol. 3, pp. 537-57.
- Teece, D., Pisano, G. and Shuen, A. (1990), "Firm capabilities, resources and the concept of strategy", Economic Analysis and Policy Working Paper EAP-38, University of California, Berkeley, CA.
- Tranfield, D.R. (1995), "Salesman, dreamer and son-of-a-bitch: QED for MDs", *Management Decision*, Vol. 33 No. 4, pp. 22-7.
- Tranfield, D.R. and Smith, J.S. (1988), "Managing rapid change", *Management Decision*, Vol. 26 No. 1, pp. 53-8.
- Tranfield, D.R. and Smith, J.S. (1998), "The strategic regeneration of manufacturing by changing routines", *International Journal of Operations & Production Management*, Vol. 18 No. 2, pp. 114-30.
- Waterlow, G. and Monniott, J.P. (1986), *A Study of the State of the Art in Computer-aided Production Management in UK Industry*, ACME Directorate, Science and Engineering Research Council, Swindon.
- Yin, R.Y. (1984), *Case Study Research*, Sage, Beverly Hills, CA.

Appendix. The survey instrument

- (1) *Challenges to good stewardship:*
 - a. How would you rate the risk to stewardship of your long-term assets (LTA)?
 - b. General comments.
- (2) *Background:*
 - a. Please estimate the rank of your organization's LTA in terms of replacement value.
 - b. For each element of your LTA please state whether the majority of operation and maintenance is undertaken in-house (IH) or is outsourced (OS).
 - c. For each element of your LTA please state how you would expect this to change in the next five years. Please circle that which will grow significantly.
 - d. Please estimate what percentage of your asset management annual budget is spent on each stage of the asset life cycle? If this is not immediately known, please provide a reference for where we might find the information.

- (3) *Drivers for change in the management of long-term assets (LTA):*
- Please indicate the extent to which the following represent drivers for your organisation at the present time:
Regulatory
Commercial
Market
Strategic
Other drivers, please specify.
- (4) *Approach to the management of long-term assets (LTA):*
- To what extent is the management of LTA an explicitly recognized part of your organization's business strategy? (Please ring)
How do you see this changing over the next five years? (Please ring)
 - Who is responsible for the management of LTA within your organisation?
 - Where the responsibility is split across the organisation, to what extent do managers effectively share best practice? (Please ring)
How is this achieved? Please tick where appropriate.
 - Here is a list of topics which have been associated with effective management of LTA. How important are they to your organisation at present?
 - In your opinion, what are the three key issues for effective management of LTA?
- (5) *Changing the management of long-term assets (LTA):*
- If your company has been involved in implementing strategic change in the management of LTA, how important were the following in supporting the change?
 - How difficult would you rate the following during a change programme?
 - Change management programmes have been argued to require monitoring and reporting against progress. If you use key performance metrics please give examples.
 - How difficult would you rate the following when outsourcing operation or maintenance of assets?
 - How difficult would you rate the following when implementing asset whole-life cycle costing?
 - How would you characterize your maintenance regime?
 - In your opinion, what are the key factors for success in the management of LTA?
 - In your opinion, what are the key difficulties encountered?
- (6) *Conclusions:*
- In your opinion what are the current "hot issues" in the management of long-term LTA?