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Building Capabilities for Infrastructure Capacity Management

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Abstract

Infrastructure capacity management is the process of ensuring optimal provision of infrastructure assets. Effectiveness in this process will enable the infrastructure asset owners and its stakeholders to receive full value on their investment. Business research has shown that an organisation can only achieve business value when it has the right capabilities. This paradigm can also be applied to infrastructure capacity management. With limited access to resources, the challenge for infrastructure organisations is to identify and develop core capabilities to enable infrastructure capacity management. This paper explores the concept of capability and identifies the core capabilities needed in infrastructure capacity management. Through a case study of the Port of Brisbane, this paper shows that infrastructure organisations must develop their intelligence gathering capability to effectively manage the capacity of their assets.

Keywords: capacity management, capability, infrastructure asset

Introduction

Infrastructure asset management has grown in importance in recent years (Too, Betts & Kumar, 2006). As owners, operators and maintainers of infrastructure assets, organisations that manage infrastructure assets assume a significant responsibility in ensuring the successful performance of the assets to meet the service needs of their customers. At the heart of asset management is the concept of continuous improvement. Infrastructure organisations should be striving to improve operations, whether from the point of customer satisfaction, increased productivity, better asset quality, better environmental performance or a host of other performance indicators. The asset manager's role embraces all of these concerns to some degree, as the physical infrastructure asset must support the organisation's activities in ways that allow the organisation to service its customers in the best possible way.

Literature in strategy suggests that to understand an organisation's performance, there is a need to focus on factors internal to the organisation in addition to the industry structure. For example, Ravichandran et al.(2005) argued that organisations that focus on its resources and capabilities can provide the appropriate theoretical lens to examine how factors internal to the organisation can be a source of competitive advantage. An organisation can only gain advantage and achieve superior performance when it has the right capabilities (Smallwood & Panowyk, 2005). The challenge therefore for most organisations is the optimal allocation of scarce resources among competing initiatives to acquire relevant capabilities.

The first step in infrastructure asset management is to consider capacity management. It is the process of identifying the direction that will contribute to the

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best utilisation of assets in the delivery of services to the customers. In so doing, compatibility between current asset portfolios and the changing operational environment surrounding the organisation needs to be ensured. To this end, the aim of this paper is to explore the capability needed for infrastructure capacity management. Through the use of the Port of Brisbane as a case study, the paper identifies the key challenges that exist in the management of capacity of infrastructure assets. It further discusses the capabilities needed for capacity management and the measures that need to be taken to acquire and develop these capabilities.

Literature Review

Improving performance

All organisations, including infrastructure organisations, must create value to justify their existence. They need to create value better than rivals can; and to contribute to the society in ways that are unique and indispensable. In other words, an organisation has to create, exploit, and sustain its competitive advantages vis-a-vis rivals and it has to do so consistently if it wants to sustain this advantage. This can only be realised either when an organisation gains an advantageous position in an industry or when it mobilises and deploys core competencies (C. K. Prahalad & Hamel, 1990; Wernerfelt, 1984) that enable it to offer superior products to customers relative to its competitors (Lado, Boyd & Hanlon, 1997).

Maintaining competitive advantage is a dynamic and never ending activity. All organisations face intense and relentless challenges, including: (1) a rapidly accelerating rate of technological change; (2) increasing customer expectations; (3) international quality and environmental standards; and (4) growing employee demand for increased autonomy. In a dynamic, fast-changing environment such as that currently experienced by infrastructure organisations, Mintzberg & Westley (2001) and Hamel (2000) pointed out that one can hardly actually plan ahead due to constant changes to the environment. Deliberate strategy to obtain strategic fit will create a tension to the organisation (Zajac, Kraatz & Bresser, 2000). This tension magnifies when environment circumstances and technology change and while the organisation still possesses the same stock of resources and capability. The organisation will not be able to sustain its competitive advantage unless new stocks of resources and capabilities are obtained.

Under this framework, an organisation's long-term survival rests on the organisation's ability to develop capabilities and innovation. Hence this perspective emphasises skill acquisition, organisational learning, and capability accumulation. Instead of matching resources with current external environment, Prahalad and Hamel (1994) suggested to leverage an organisation's resources to explore future opportunities. Development of capabilities takes time, and the process of capability development is likely to be affected by existing capabilities and an organisation's absorptive capability (Cohen & Levinthal, 1990). When organisations are unable to develop required capabilities in transforming resources into valuable services, the acquired resources are likely to become overheads rather than assets to those organisations (Amit & Schoemaker, 1993).

Capabilities must support business process

Scholars have proposed that to maintain competitive advantage, organisations should develop capabilities for improving core business processes (Hammer, 2001; Zott, 2003). DeToro and McCabe (1997) state that core processes are those processes that are strategically important to the organisation's success, and have a high impact on customer satisfaction. Core processes describe the end-to-end work that starts from the customer and ends with the customer, and is always using cross-functional activities (Hung, 2001). Specifically, from the Business Process Management perspective, the ability to improve business core processes involves the integration of business core operational processes and organisational strategic goals.

However, many scholars have acknowledged that not all business processes would be a source of competitive advantage. For example, Kaplan & Norton (2004) suggested that managers must identify and focus on the few critical internal processes that have the greatest impact on strategy and can create value to the organisations. When economic and technological complexity increase, such as those in infrastructure asset management, managers must devote more attention to definition and improvement of the few critical business processes that determine success and failure (Zehir, Acar & Tanriverdi, 2006).

There are many capabilities that can be associated with all areas of business processes. Collis (1994) warned that it may well be impossible to list the complete set of all capabilities that can be sources of superior performance because they can be found in every single activity the organisation performs, and along multiple dimensions for each activity (such as faster, more flexible, more creative...). There is no magic list of capabilities appropriate to every organisation (Ulrich & Smallwood, 2004). Ethiraj et al. (2005) argued that not all capabilities provide the same marginal contribution to performance. They further argue that if different capabilities have different costs and benefits associated with their development and acquisition, managers should pay attention to understanding these trade-offs in making investment in capability development. Organisations should therefore invest in those capabilities that can contribute best to their performance.

In addition, each industry is driven by its own demand and supply-side economics, which also change over time. One way to resolve this complexity, as suggested by Collis (1994) is to recognise that although the source of sustainable performance can be found in any one of a (very large) number of levels, valuable capabilities are dependent on the context of the industry and time. The notion that capabilities are context dependent is supported by Galunic and Rodan (1998). They suggested that capabilities developed for a specific purpose are unlikely to be used for other purposes. For example, the capabilities developed for R&D may not be appropriate for marketing of products and services (Lieberman & Montgomery, 1998). Similarly, in the context of time, Collis (1994) proposed that at any point in time in any one industry it may be possible to identify the capability that currently underpins sustainable superior performance. Under certain conditions, such as a strict regulatory regime, or non-competitive oligopolistic behaviour, the current position

may be all we need to know to understand sustainable performance. The infrastructure asset management industry before the deregulation in early 1990s might be seen as an example where sources of sustained performance have changed very little over long periods.

Hence, it is important that in identifying capabilities that are the sources of performance difference, it need to be contextually grounded (Ethiraj et al., 2005). Literature on infrastructure asset management has paid little attention to the capabilities most appropriate after the deregulation and the changing business landscape occurring over the last decade. Due to the context specificity of capabilities, this paper aims to identify capabilities specific to the context of infrastructure organisation. It examines specifically the capabilities required in the capacity management process within the infrastructure asset management context.

Capacity Management

Strategic infrastructure asset management is aimed at achieving organisational long term goals and effectiveness through dynamic alignment of the required infrastructure assets to meet changing customer needs (Too et al., 2006). This represents the optimum balance of stakeholders' aspirations, needs and requirements, and the costs over the life of the asset (Bourke *et al.*, 2005). Capacity management is identified by Too & Tay (2008) as one of the key processes that can contribute to the performance of infrastructure asset management.

The first step in infrastructure asset planning is to identify opportunities to increase both the effectiveness and value of an infrastructure asset. The asset planning process takes on the corporate strategies developed by the asset owner and considers what assets are needed to deliver these outcomes for the business. It usually begins with the understanding of the business missions, goals and needs. The impact of business trends and goals has to be evaluated and translated into a need to increase and decrease infrastructure assets. The asset planning process is fundamentally designed to consider the gap between the performance and capacity of the existing assets and those required for delivering the minimum services needed by the business in the area of growth. Wherever possible the ultimate aim should be a high utilisation of assets. It is therefore necessary to manage and negate the possibility of capacity failure (i.e. demand for infrastructure asset exceeds its capacity) or the underutilisation of any infrastructure asset (this failure represents a lack of demand for the service the infrastructure asset provides) (Maunsell & Opus, 2004). Capacity management is therefore essential to ensure that the goal of capacity matching is achieved and the right infrastructure can be planned and provided in a timely fashion to support business needs. Infrastructure assets must be utilised effectively in order to provide the maximum return on funds invested and to deliver the required level of service (IPWEA, 2006).

CASE STUDY: Port of Brisbane (PortBris)

Background

PortBris is a Government Owned Corporation responsible for the operation and management of container port. The Corporation is a publicly owned entity, but operates on a commercial basis and in a competitive environment. PortBris operates Australia's third largest container port which is positioned geographically closer to the Asia-Pacific rim than its southern competitors. PortBris services Australia's fastest growing urban region from the southeast corner of Queensland down to northern New South Wales. Trade through the port consists of a range of containerised, bulk and break-bulk cargoes. Commodities handled by the port include beef, cotton, oil, cement, grain, iron, steel, building products, silica sand, timber, woodchip, paper, wood pulp and coal.

The primary role of PortBris is to facilitate trade growth through the commercial management of an efficient and customer-focused port. PortBris essentially drives growth in trade volumes through attracting new business and facilitation of efficient and quality infrastructures. PortBris has 27 operating berths and over 7,700m of quayline at the Port of Brisbane and upriver facilities. It has six container berths (1,437m of quayline). Berths 4-6 are equipped with three conventional Panamax container gantry cranes, one Post-Panamax and two Super Post-Panamax cranes (from May 2007) and Berths 7-9 are equipped with four conventional Panamax container gantry cranes, two Post-Panamax cranes, and 23 automated straddle carriers. PortBris owns the wharves, provides a significant proportion of fixed improvements, and issues priority-use licences and leases for their operation.

Importance of Infrastructure Capacity Management

Under the Government Owned Corporations Act 1993, PortBris has an undertaking to provide access to port services and facilities on an indiscriminate basis. Under such circumstances, PortBris must continue to plan ahead to ensure the necessary infrastructure assets are available to meet the demand needed to support and facilitate trade. The importance of planning ahead is noted by the Queensland Premier's Department "It is very pleasing to see that the Port of Brisbane Corporation is so forward-thinking in planning for and delivering port infrastructure to meet the demands of South East Queensland's continued growth." (29 January 2008 News Issued by the Premier of Queensland). This is similarly echoed by the Queensland Ministry for Transport, "Port of Brisbane is well ahead of the game in planning for and delivering port infrastructure to meet the demands of South East Queensland's continued growth. The port's high rates of growth were expected to continue as investment in capital works at the port progressed to meet future demands. (John Mickel, Minister for Transport, Trade, Employment and Industrial Relations 14 November 2007).

These sentiments highlight the importance of infrastructure asset planning in port business, particularly capacity management, to ensure that the relevant infrastructure assets are available to support business needs for the future. As noted

by a manager: “managing the capacity and managing the growth are the key drivers here obviously key to the future because we don’t want any surprises, we don’t want to be caught short, and with the lead time, we really need to know 5 to 7 years out, what we exactly need to do”.

In the planning of the capacity of infrastructure assets, PortBris considers two important factors, these are, the infrastructure must be designed appropriately to meet future needs and the infrastructure is to be provided in a timely manner. These factors are echoed by a manager who noted that “the key thing is making sure what is being design is appropriate for the time and the actual asset is going to be functioning and is at great location the other fundamental problem in the industry is getting the timing right”. For example, the manager further noted “some infrastructures are excellent but they went into market too early and the market was not ready for them and they failed. Alternatively, they hit the market too late, especially the lead time required to build an infrastructure”. The importance of providing the right infrastructure at timely manner is best summed up by one manager as follow, “you don’t want to put the wrong seed in and get the wrong tree ... You don’t want to put in the wrong tree and it keep growing and get to the powerlines or wrack out your sewer line or attract some other virus etc”.

Hence, capacity management is a key process within infrastructure asset planning. To have proper operational control, the process of capacity management is essential to predict capacity under various circumstances and provide a clear picture of the risks of failure. Determining when and how the increase in demand will be met is a critical part in the development of the overall strategy and function of the asset. As noted by one informant, “the fundamental problem I see in the industry is to get the timing right. Building infrastructure too early and not getting the return or without enough certainty of what is going ahead needs to be balanced with building infrastructure too late which has happened in coal at other ports where they didn’t foresee things and got the timing wrong especially where we are when we deal with such large assets it is all about the timing and making sure what’s built is appropriate”.

Key Challenges

A major determinant of the future infrastructure needs of PortBris is trade growth. A manager noted that “the key driver is trade.....the large amount of growth is taken up by the containers as far as trade grows.....”. Trade growth will trigger the demand for infrastructure assets such as container facilities, quay line, wharf, cranes etc. This is noted by another manager who commented that “we need to base a lot on projected trade growth to make sure that the new facilities is delivered in time and that certain productivity benchmark are made over that period of time”. For example, figure 1 shows the recent history and projected future of trade growth in the container industry. If the trade now is 850,000 TEUs (Twenty-foot Equivalent Units), the projection shows that there is a need to have the necessary infrastructure assets that can support a million TEUs in place by 2009/2010.

Past and Forecast TEU Growth from 2000 to 2015



Figure 1: Forecast of TEUs Growth ((Adapted from Port of Brisbane, 2007)

Based on trade growth, PortBris has to determine not only the quantum of the infrastructure but also the type of infrastructure to be provided in terms of managing their capacity. For example, a manager noted, “when this (trade) information comes to me, we look at what current infrastructure that we have and how we can accommodate the new requirements”. To understand the type of infrastructure needed in the future, there is a need to have the knowledge of the industry and the industry trends. This is important because capacity can be increased not only through new capital investment. For example, capacity can be increased through increased utilisation of existing infrastructure assets. This view is shared by a manager who notes, “you can just add capital to a certain amount.... the other one is just knowledge of the industry such that when you are designing a district, this is integrated with that and you need a proper and logical flow”. Hence, capacity can be increased through more efficient use of existing infrastructures via design, reconfiguration and integration of infrastructure assets. This is further echoed by another manager who noted that “in port operation, it is basically materials handling and what you don’t want to have is inefficient traffic loads and directions everything should be reasonably short haul and efficient between A and B so there is an area such as an integrated logistic zone to make sure the actual physical things are pulled ... and go through one area. It is all designed to make the whole operation for everyone more efficient. That saves us building more assets... it saves us from putting in a lot more capital”.

Besides understanding the trade growth and being conversant with the operation of port business, feedback from operations related to the capacity of existing infrastructure assets is also a key trigger for capital expansion. For example, a manager noted that “once the occupancy rates reach more than 50%, it signifies that it is time to expand the wharf facilities ... based on current growth rates, we need approximately 300m of extra berth every two to three years”.

Hence, in the management of infrastructure capacity, information from trade forecasting, knowledge of the industry in terms of best practice as well as utilisation and feedback from operations in terms of capacity of existing infrastructure assets

will be fed into a forecasting and simulation model to assess the infrastructure requirements. This proposition is shared by a manager who states, “based on those forecasts, we conduct modelling to anticipate the infrastructure requirements”. The strategy adopted by PortBris is to achieve a balance between new capital investment and utilisation of existing assets in meeting the increasing demand for infrastructure assets as a result of trade growth. This is supported by another manager, “we will have an additional quay line but we expect an increase in productivity as well, because neither of them will fix it alone”.

In short, to ensure effective capacity management, there is a constant need to be aware of the changing industry trends, understand the development in the industry in terms of best practice and have regular links with operations to understand the capacity of existing infrastructure assets. Due to the constantly changing nature of such information, PortBris must ensure that they always work with the most recent and updated information. This is possible only if they are constantly connected to all the parties involved in the whole supply chain and to their essential stakeholders. By having the most updated information on trade growth, knowledge of the industry and the capacity of current infrastructure assets, PortBris is more likely to develop infrastructure assets that are timely and appropriate to support business needs for the future.

Intelligence Gathering Measures

The preceding discussion has shown that the capability essential for managing the capacity of infrastructure is the gathering of intelligence. To ensure that the right infrastructure is timely and amply provided to support their port business, PortBris is constantly gathering information through:

(1) Forums with stakeholders

The need for forums with various stakeholders is echoed by one manager who noted, ‘we make sure there are enough forums for feedback up the line. We just need to make sure that they have got all of our information’. In fact, it is noted that PortBris has met regularly with their stakeholders in a number of different forums, including:

- bi-monthly Port Landside Logistics Forums
- quarterly Port Safety and Operations Group meetings
- quarterly Port Security Committee meetings
- quarterly Law Enforcement and Security Liaison Group meetings
- annual customer forums held in Brisbane, Sydney and Melbourne
- interstate visits by our Chief Executive Office

These forums are useful for PortBris to work together with their stakeholders on how infrastructure assets can be planned to meet the changing demand. For example, the Landside Logistics Forum is used to work on projects that can improve port efficiency without actually increasing the need for new infrastructure. This is evident from the initiative by one of the customers, DP World, which introduced a new initiative to improve efficiency to avoid unnecessary container moves in the terminal, and has reduced truck turnaround times

(2) Feedback from customers and operations

PortBris also actively obtains feedback from their customers and operations to ensure that they obtain the most relevant and up-to-date information. For example, PortBris, through their Business Development section, has implemented a customer call plan, involving regular visits to various types of customers, including: port facility operators, shipping lines, cargo owners, importers and exporters, and logistics support providers, such as freight forwarders. The team incorporated the information and feedback gained from these customer visits into their strategic plans, aimed at effectively managing the future growth of the port. This approach is also echoed by a manager who noted, “we do consult our customers as part of our research ... it is always good to look at the past and it is also good to go out there because we are always out there talking to the customers”. By constantly obtaining feedback from customers, the appropriate infrastructure into the future can be planned. For example, a manager noted, “for wharf, we design based on type of ships that we expect to moor ... the shipping companies will feedback to us the type of ships they are bringing to Australia such as Generation 2 ships with 120,000 tonnes capacity ... basically we assess what the industry wants and we try to incorporate this into our planning ... we need to collect this type of information continuously”.

In addition, PortBris spends a lot of time in consultation with their customer to ensure that the appropriate infrastructure is provided. A manager noted “we don’t build anything unless we know what the user wants ... sometimes we spend up to a year with the user trying to understand their need and what they want ... it is cheaper to change the details on paper ... this is our mode of operation to spend a lot of time with the client and try to understand their needs, try to interpret what they would like to have and what type of quality they are looking at”. This is similarly echoed by another manager, “we have a lot of discussions and we develop the specifications together.... what their requirements are and what they expect from the assets”.

(3) Benchmarking against best practice

PortBris also constantly benchmarks itself against the best practices around the world to develop cutting edge infrastructure assets to support the future of port business. For example, there are ports that have achieved a higher handling intensity without expensive capital investment. This process is supported by comment from a manager who states “We have got an advantage here that we can look at other world examples; we are not being the big pioneer or cutting edge. In Hong Kong and some other places they have a higher intensity. We can look and follow and see what sort of technology is appropriate for the port down here. In one of our models, we look at ports all over the world; do some desktop research and read some correspondence and those sorts of things to see what they are doing and how they are doing it. If there is a particular issue, we will travel anywhere in the world to make sure that is the best way”.

By continually gathering up-to-date information, PortBris aims to reduce its risk exposure and uncertainty of investing the necessary infrastructure for the future. This is noted by a manager, “we will not want to invest \$100 million if there is no guarantee that it can generate a good steady income”. One way to reduce the risk and uncertainty is through continuous dialogue with stakeholders and this can

facilitate commitments from them. For example, a manager noted that “for a lot of major projects that need a wharf, we will not actually build it until they (customers) have appointed us, basically committing ourselves to doing the construction because the probability of that coming in is 30%. So 30% probability will not commit us to build a \$150 million wharf or assets. So we will wait until the probability is up and we put our case up and go through the process”. Similarly as reported in the news on 26 July 2008, PortBris managed to get commitment from one of their major customers, “One of the world’s largest marine terminal operators, DP World, today reaffirmed its commitment to Brisbane, when it signed an Agreement to Lease for a new 40-year lease at the Port of Brisbane, announcing it is looking at investing \$A250 million in the port over time in response to market demand (26 July 2008)”

Hence, it is important for PortBris to continue to gather as much relevant information as necessary so that it can continue to develop infrastructure that is sufficiently flexible to support the business into the future. A manager noted that “we are also looking at some functions of the port and seeing what is and what it is not or if a market is emerging or something else we need to make sure we stay in the cutting edge port facility business or appropriate port business”. For example, PortBris has been developing its port infrastructure to support multi trade to minimise the risk of becoming overly dependent on a very specific trade such as coal. This view is shared by a manager who notes, “If the coal stops production, we can reuse our port facilities for another trade. It is easy for us because we are multi trade port. We are fairly buffered from trade, if things slow in some areas other areas may not. So we have a mix of port services that we provide”.

The above illustrates the need for PortBris to be constantly connected to their various stakeholders. It is thus essential for PortBris to continually invest and develop their intelligence gathering capability to ensure that their capacity is always well managed to support their business operations and hence deliver value to their organisation.

Conclusion

The link between intelligence gathering capability and infrastructure capacity management is necessary for effective management of infrastructure assets. The case study described in this paper has shown the importance of this link in practice. By developing their intelligence gathering capability, the capacity management process of an organisation can ensure that core infrastructure assets are always optimally provided to support their business operation. This study has led to identification of the need for infrastructure organisations to pay more attention to develop their intelligence gathering capability. It is hoped that this account will influence other infrastructure organisations of the benefits of investing their resources in this core capability to deliver value to their organisations.

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