REGULATING EFFICIENCY INTO PORT-ORIENTED CHAIN SYSTEMS: EXPORT COAL THROUGH THE DALRYMPLE BAY TERMINAL, AUSTRALIA.

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ABSTRACT

Supply chains generally, and port-oriented chains more particularly, are not easily integrated for operational efficiency. This is not especially surprising given their complexity and the underlying power relationships by which they are structured. Nonetheless, integration which does occur may reflect efforts to re-engineer the chain; or, not unusually, it may be the result of substantial, market-based rationalization and consolidation of the industry through corporate restructuring by merger, acquisition or joint venture.

Much less common, at least in a ports/shipping context, is the attempt to induce supply chain integration and operational efficiency by direct application of regulatory power and through the intervention of a regulator into the marketplace. In April 2005 the Australian Competition and Consumer Commission (ACCC), the Australian competition regulator, intervened in the export coal chain which is oriented on the large coal handling terminal at Dalrymple Bay in Queensland. The Commission, through its *authorisation* powers, allowed the terminal operator to introduce a Queue Management System designed, *inter alia*, to reduce ship queuing at the terminal and in so doing reduce the costs of ship demurrage and its negative impacts on exports.

This paper focuses particularly, but not only, on the conceptual relationships between regulation and supply chain efficiency; and it examines the mechanisms, processes and outcomes in the Dalrymple Bay case.

Key words: Regulation; supply chain integration; supply chain efficiency; port-oriented chains; operational efficiency.

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REGULATING EFFICIENCY INTO PORT-ORIENTED CHAIN SYSTEMS: EXPORT COAL THROUGH THE DALRYMPLE BAY TERMINAL, AUSTRALIA.

1: INTRODUCTION

In April 2005 the Australian Competition and Consumer Commission (ACCC), the Australian Federal Government agency responsible for ensuring competition and efficiency in business, granted *interim authorisation* to the terminal operator of the Dalrymple Bay Coal Terminal to implement a proposed queue management system (QMS); later, in December, the Commission granted final *authorisation* for the operation of the system over the period April 2005 to 2008. The *authorisation* process recognizes that the public interest may not always be served by the operation of unconstrained competitive markets and allows the ACCC to intervene, in this case to allow the terminal to act as a monopolist, and to grant immunity from so doing under the *Trade Practices Act 1974.*

For the system operator the QMS had been conceived as a means, among other things, of reducing the shipping queue at the terminal and reducing the ship demurrage costs given the constraints of ensuring a fair and equitable allocation of system capacity. The demurrage cost was estimated, for April/May 2005, to be of the order of $2 million per day (Productivity Commission, 2005).

The intervention of the regulator into the often complex operations of a port/shipping interface and, effectively, into the port-oriented supply chain, raises questions not only about the specific impacts on the terminal involved but also about the nature of the regulatory framework and the relationships between regulation and supply chain efficiency more generally. This paper focuses on these conceptual and generic issues; but it does so in the case study context of one of the largest coal loading terminals in the world, the Dalrymple Bay Coal Terminal in Queensland, Australia.

The paper comprises three parts. The first examines the background to the regulatory decision and explores reasons why the coal supply chain focusing on the Dalrymple Bay terminal was, and was seen to be, inefficient. The second part notes that there are clear principles for chain integration and efficiency and examines the degree to which the QMS might contribute to chain efficiency. The third part suggests the improved operational efficiency of the chain; but it also identifies a need to look more carefully at the differences between operational efficiency and economic efficiency in chain systems.

2. A 'DISINTEGRATED' SUPPLY CHAIN?

Under what specific circumstances, and why, did Australia's competition authority intervene in the operations of the Dalrymple Bay terminal? What indication was there of market failure - or, more accurately, of supply chain failure or dysfunction, which suggests a 'disintegrated' rather than an integrated chain?

In this part we suggest that strong growth in coal exports over a two decade period, with exceptional demand over the last two years, certainly translated into an

intensively utilized operational and supply chain system. There is little doubt that additional infrastructure would have reduced or avoided the high levels of ship queuing and the associated costs of demurrage.

Why, then, was infrastructure not in place? And even if it were, would it have been a sufficient condition to ensure an efficient supply chain? The view in this paper is that a complex institutional environment, including the regulatory environment, as well as particular characteristics of the supply chain itself, have contributed to a difficult decision-making environment and in fact to inefficiencies in the supply chain.

2.1 Coal exports: unrelenting pressure on supply chains.

The new coal terminal constructed at Dalrymple Bay in 1983 had a nominal throughput capacity of 15 million tonnes; two decades later the capacity had been increased to about 44 million tonnes and, by 2005, to about 54 million tonnes (Flynn, 2005). Currently, a phased program is expected to establish a capacity of 67 million tonnes by 2007 and 85 million tonnes by 2008 or 2009 – an additional capacity of over 30 million tonnes over a five year period (QR Network Access, 2006).

Clearly, the pressures on infrastructure and on supply chains more generally, have been unrelenting in a global coal market showing high levels of demand particularly, but not only, from China. For the Dalrymple Bay terminal, embedded in the Goonyella coal system and its supply chain, rapid short term increases in throughput volumes in response to new contracts, together with the collapse of a reclaimer at the terminal's stockpile in February 2004, resulted in significant congestion and ship queuing at the terminal through 2004 and 2005.

Interestingly, a market perception that Australian suppliers would not be able to meet contracts, and particularly coking coal contracts, led Japanese buyers to purchase coal from US suppliers at the relatively high price of around $125 per tonne (Runnegar, 2005). These prices set something of a precedent for Australian suppliers and price rises followed. A further perception that post-2004 contract prices for coal would be higher encouraged customers to maximize tonnage throughputs in 2004 to take advantage of presumed lower contract prices – and, not surprisingly, added further to chain pressures.

By late 2004 and through 2005 vessel queues and levels of ship demurrage continued at unacceptably high levels – unacceptable to buyers and suppliers in the coal chain, to the terminal operator and, on the basis of a successful application for *authorisation*, to the Australian Competition and Consumer Commission.

In April, 2005 the Commission granted *interim authorisation* to the terminal operator to implement its proposed queue management system (QMS).

2.2 A problem regulatory framework?[i]

It may be not unreasonable to ask, despite the boom-bust characteristics of the export coal industry and with the benefit of hindsight, whether or not exceptional demand was of itself sufficient to create a severely dysfunctional supply chain? Why was there not adequate infrastructure capacity in place? Were the planning and implementation

processes seriously inadequate? And were there some characteristics of the chain itself that might be at least partly responsible? The answers are not immediately apparent; but the paper notes in this section the complexities inherent in the institutional framework and argues that they contributed to the disintegrated nature of the chain.

In 1983 The Ports Corporation of Queensland, a government owned corporation, built the Dalrymple Bay Coal Terminal as a common user facility to assist in the development of the coal resources in the Bowen Basin and, particularly, those in the Goonyella coal system. In 2001 the terminal was privatized under a long term lease first held in the name of Prime Infrastructure, a subsidiary of Babcock and Brown a major infrastructure investment firm, and subsequently in the name of Babcock and Brown Infrastructure Limited or BBI. Effectively, the terminal is owned by the Queensland government through DBCT Holdings Pty Ltd, leased to BBI(DBCT) Management Limited as the access provider and, through an operation and maintenance contract, operated on a day-by-day basis by DBCT Pty Ltd (or DBCT P/L).

The privatization of ports in Australia was, at this time, not only a relatively new deregulatory mechanism but was also only one element in an emerging national competition policy which recognized the need to ensure that markets, including the market for port services, were protected from monopoly power and were conducive to competition and efficiency. In this context, and following moves by the Coalition of Australian Governments (COAG) to align State and Federal government approaches to national competition policy the Queensland State Government, in 1997, established the Queensland Competition Authority (QCA) under its own Act and as the State regulator. In due course the Dalrymple Bay Coal Terminal was, of course, to be subject to regulation by the QCA.

The regulatory framework provided a new and rigorous decision making environment. DBCT had been created as a common user terminal; under regulation, the Ports Corporation of Queensland recognized the terminal as a natural monopoly and the QCA, under Part 5 of its Act, was required to *declare* the coal handling services of the terminal for third party access. *Declaration* gives a range of rights and obligations in relation to the negotiation of *terms and conditions of access to the declared service.* The rights and obligations are vested in the facility owner (DBCT Holdings Pty Ltd for the State Government), the access provider (BBI(DBCT) Management Pty Ltd, access seekers and access holders (coal companies). In effect, given the ownership and leasing arrangements, the access obligations are jointly held between the owner and the access provider. Further, *declaration* requires that the access provider negotiates with and provides information to access seekers and prevents the provider from hindering or preventing access; that in the case of disputes the access seeker has recourse to compulsory dispute resolution procedures; and that the owner may submit an undertaking if it is considered appropriate to do so. If settlement is not reached on price or non-price terms the QCA will be involved.

Under the leasing arrangements for the terminal a key arrangement was, and is, the Port Services Agreement which establishes the rights and responsibilities of the lessee with respect to terminal operation, management and expansion – effectively, to provide details and conditions of the access which the access provider would provide

to the access seeker. Among other things the Agreement required BBI to consult with users in the preparation of a *draft access undertaking* and to lodge the *undertaking* with the government (in fact with DBCT Holdings) by September 2002. In the event, the date of lodgement of the *undertaking* was extended to September 2003; and, because of disagreement between the lessee and users and arbitration by the QCA, a final decision was not made on the *draft access undertaking* until April 2005!

Clearly, from a privatization decision in 2001 to an initial expectation of a *draft access undertaking* in September 2002, to a further expectation in September 2003 to a final decision in April 2005 appears, prima facie, to be an unacceptably long decision making period – and, particularly, in the context of exceptionally rapid increases in throughput volumes.

The September 2003 date was important to allow time for the renegotiation of user rates for 2004 to be set in place; but disagreement between access users and the access provider on the Terminal Infrastructure Charge required that the access provider seek arbitration, in July 2003, before the Queensland Competition Authority. BBI, the access provider, insisted on a loading charge that would ensure the viability of investment for expansion and the implementation of take-or-pay contracts from terminal users – effectively a zero to low risk strategy in which capacity would be provided only if the users would underwrite development. Interestingly, this practice was in fact a legacy of the pre-privatization period when in 1999, User Service Agreements with the Port Corporation of Queensland were written on the basis of take-or-pay agreements – the terminal operator derived revenues on the basis of contracted throughput, not on the basis of actual throughput.

In any case, in July 2003, BBI (or its forerunner Prime Infrastructure) proposed to increase the loading charge from $2.08/tonne to $2.77/tonne; but terminal users proposed a charge of only $1.00/tonne – either a cynical use of industry power to ensure the involvement of the regulator or an approximation of the cost of demurrage to the coal producers or both. In December 2004 the QCA issued its draft ruling requiring a decrease, and not an increase, in the loading charge to $1.56/tonne. The access provider disagreed and suggested that capacity expansion could not go ahead on that basis. In April 2005 the QCA handed down its final decision that the charge would be $1.72/tonne. In July 2005 BBI, the access provider, agreed to proceed with capacity expansion.

There is little doubt that the long, drawn out decision making period was, and was seen to be, less than ideal; and comments from the Prime Minister, the Deputy Prime Minister, the Treasurer and later the Coalition of Australian Governments tended to reflect widely held views (Flynn, 2005; Everett and Robinson, 2006). Almost certainly, it detracted from a planned investment program; and it left no options other than operational improvements open to the day-to-day operator of the terminal – and hence the Queue Management System option. Particularly, however, it underlined an aggressively commercial approach to infrastructure development in contrast to an approach more conservatively aligned to a statutory authority, classic ‘public utility’ approach pre-privatization.

2.3 Complex leasing and ownership patterns in a constrained market place?

There is a strong prima facie case, also, for arguing that the ownership and leasing structures of the terminal, and the regulatory framework within which it is set, are strong contributory factors to supply chain dysfunction.

Figure 1 indicates some aspects of the leasing and ownership relationships and the agreements within the leasing arrangements that are relevant. Note that

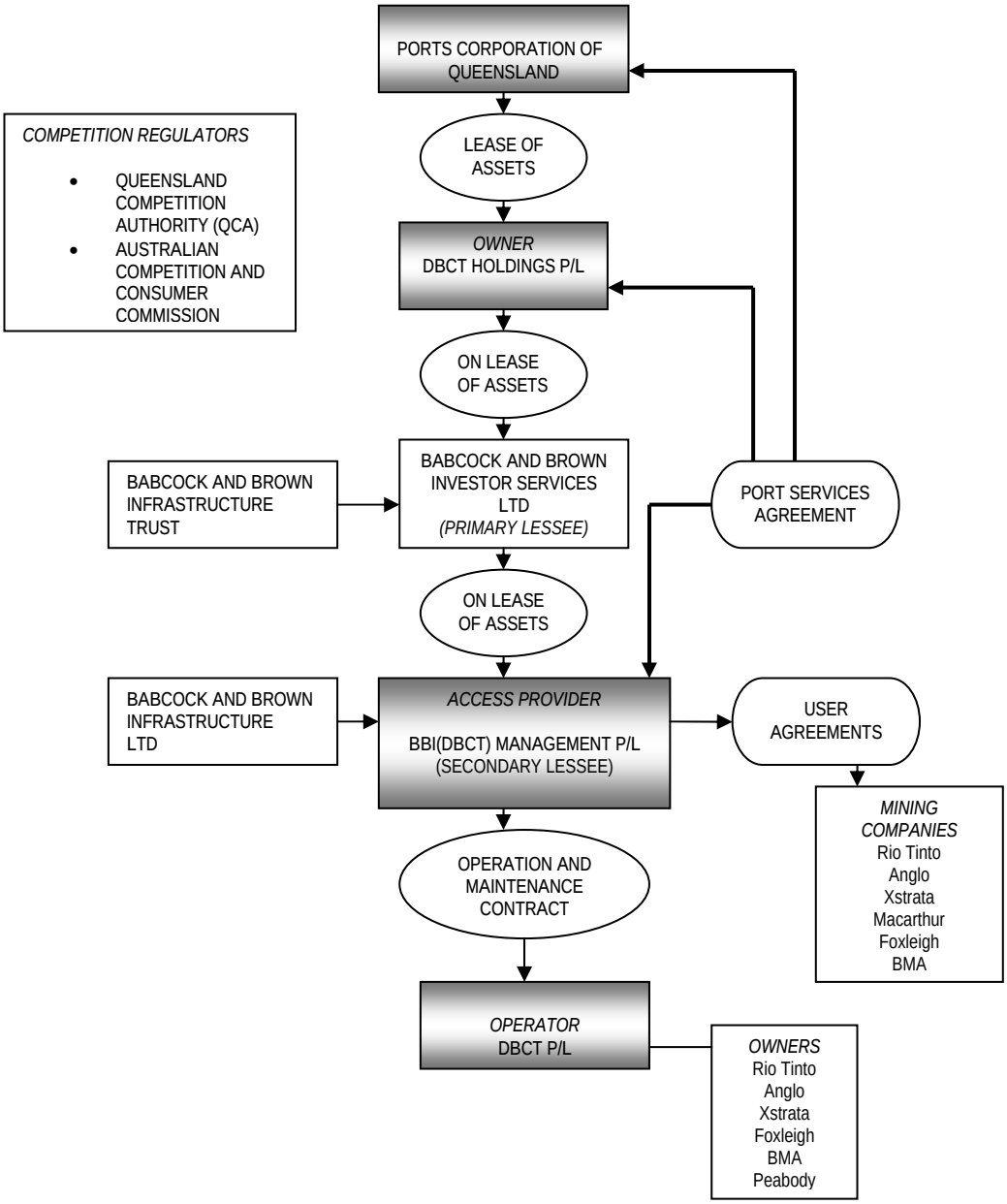
- The ownership of the terminal rests with the Ports Corporation of Queensland for the State government though the asset is leased in the name of DBCT Holdings P/L;
- The asset is further on-leased to Babcock and Brown Investor Services Limited, in turn on-leased to BBI (DBCT) Management P/L, who is in fact the asset provider; and
- The operation of the terminal is contracted to DBCT P/L – which is owned by a sub-set of the mining companies which export coal through the terminal.[ii]

Interestingly, given these ownership and leasing arrangements access obligations are in fact shared between government and the private sector lessee; and the operations are 'controlled' by the relationship between the private sector lessee and an exceptionally powerful set of mining companies. The point that suggests itself is that such relationships, rather than being integrative, might well be expected to generate conflicts of interest and, at the very least, slow decision making.

The Port Services Agreement in the leasing arrangements define the way in which the lessee will provide access to the user or access seeker, initially at least, in a *draft access undertaking* which requires consultation with the users; and the *undertaking* must be submitted to the owner of the facility (DBCT Holdings P/L, in effect the State government) and then to the regulator, the QCA, for approval. Clearly, again, the process is more likely than not to be conducive to delay.

In 2001 the terminal was privatized; notionally, the State government had transferred the responsibility for terminal expansion and investment in infrastructure to the private operator. In fact, however, the decision making environment is significantly constrained both by the leasing arrangements and by regulation. BBI is required to submit an annual plan to the facility owner; the draft undertaking must be approved by the owner; and the owner may submit an undertaking if it is considered appropriate to do so. The lessee is also likely to be under significant commercial pressures on an operational level because the operating firm DBCT P/L is owned by large and powerful mining companies – who also happen to export large volumes of coal through the terminal!

Quite apart from any judgment of whether or not the particular lease or ownership or regulatory measures are appropriate or ideal, it is apparent that they must be taken into account in any explanation of supply chain inefficiency.



Source: After Runnegar, 2005.

Figure 1: Ownership and leasing arrangements, Dalrymple Bay Coal Terminal.

2.4 Complex contractual relationships in the supply chain.

The port-oriented Goonyella coal supply chain, and the location of the terminal within it, are simply represented in Figure 2. It reflects the notion of a transactional, buy/sell supply chain as suggested by Cox et al. (1997; 2002) in classic supply chains and as applied to freight chains more generally in earlier papers (Robinson, 2002; 2003; 2006). This representation underlines the sequential pattern of dyadic linkages in the chain and the important principle that it is the chain which delivers value to the end customer; and that the revenues derived by individual players in the chain are some proportion of the total sales revenue. It is a useful framework; but it is imperative to

note that the dyadic partner (in the sense of the adjacent player in the chain) may or may not have a buy/sell relationship. If this is the case, the lack of a contractual relationship will almost certainly lessen the degree of the integration of the chain, and consequently, the efficiency of the chain.

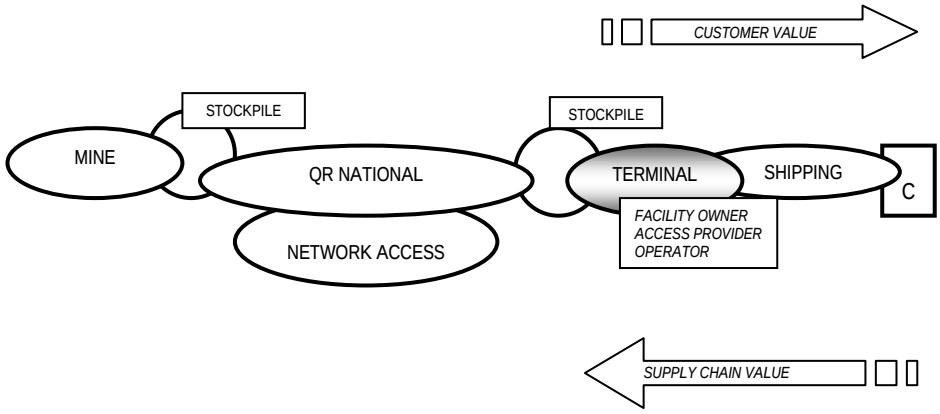


Figure 2: Supply chain logistics pathway, Dalrymple Bay.

Figure 3 shows the pattern of contractual relationships in the chain; but it also shows that the important interfaces between the rail operator and the terminal operator, on the one hand, and the terminal operator and the shipping line on the other, are managed within the framework of operating rather than contractual relationships. This is not necessarily a problem; but it has the potential to introduce unnecessary variability into the system and allow the inequitable transfer of cost inefficiencies between players[iii].

The key contract is, of course, that between the buyer and the seller (the steel plant or power station, for example, and the mining company). Note that the sale contract may specify the terms of trade under which the coal is moved and, in so doing, specify not only which player bears costs and insurance over which particular pathways but it may also underline the importance of efficiency in landside port operations. Export coal moving under *fob or free on board* Incoterms requires the seller or mining company, in this case, to bear the risks and costs of moving the coal to the terminal (and across the ship's rail); under *cif or cost, insurance, freight* terms the buyer bears risk and cost. Under *fob* terms there may be particular competitive advantage and benefit for the seller to have an efficient landside chain. The diagram notes that the customer contracts, and is contracted to, the shipping line.

The above-rail operator is under contract to the mining company, usually with rigorous performance requirements; and the rail operator pays access fees to the below-rail owner (in this case QR Network Access). The mining company is also contracted to the access provider (BBI) on the basis of a contracted tonnage to be shipped through the terminal. Interestingly, these contracts are written on a take-or-pay basis so that the mining company pays the contracted tonnage whether or not that tonnage is actually shipped. For the above-rail operator, revenues are generated on the basis of the tonnes of coal actually hauled. In effect, the access provider bears zero or low risk from tonnage fluctuations; but the rail operator is fully exposed to the risk of tonnage variations. Whether or not prices reflect these risks is, of course, an important economic efficiency as well as an operational efficiency issue.

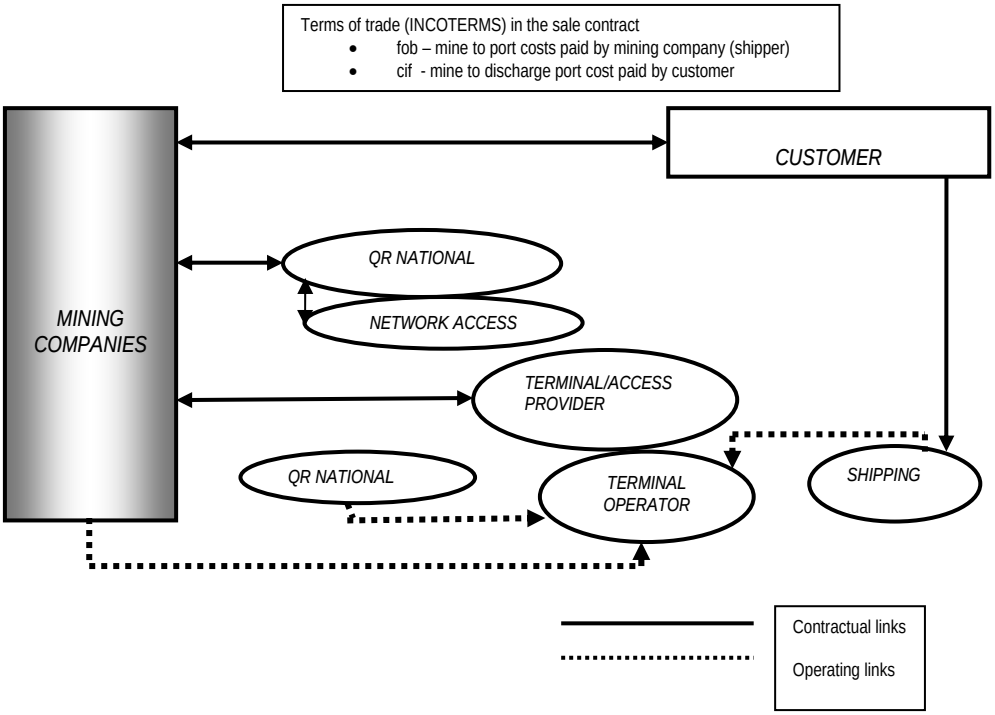


Figure 3: Contractual linkages, Dalrymple Bay coal supply chain.

2.5 Conflicting business models: underlying tensions.

Firms in supply chains are not only differentiated by a range of attributes including profitability and the appropriation of power, as Cox et al. (2002) so clearly demonstrates, but they are also differentiated by the business model which they embrace and which underlies the strategies which they adopt.

In the Goonyella chain, powerful private sector mining firms mesh with a quasi-monopoly public sector above-rail operator, a monopoly below-rail provider, and a private sector, quasi-monopoly terminal asset provider significantly constrained by lease conditions, Government ownership of the facility, operation of the facility by an industry-owned firm and a comprehensive State and Federal government regulatory framework. *In this section we suggest that the inherent differences in the business models of the players in the chain also tend to disintegrate rather than integrate the chain.*

Figure 4 is a simple summary of these aspects. The mining firms in the chain include very large multinational operators as well as smaller firms that may be national in focus; some firms are vertically integrated, others are stand alone operators and some mines are operated by a consortium of companies. A detailed analysis of company business models would reveal some considerable diversity in operating and positioning strategies; but each company will be expected to deliver acceptable levels of profit and will likely seek to deliver as much value to shareholders as possible.

BUSINESS MODEL OR PARADIGM					
MINING COMPANY	ABOVE-RAIL OPERATOR	BELOW-RAIL OPERATOR	TERMINAL	SHIPPING LINE	CUSTOMER
National firm Multinational firm Vertically integrated firm Stand-alone mining company Consortia of mining companies and/or other	Corporatised firm (Statutory State-owned Corporation – or statutory Government Owned Corporation, in Queensland)	Corporatised firm (Statutory State-owned Corporation – or statutory Government Owned Corporation, in Queensland)	FACILITY OWNER Statutory State-owned Corporation – or statutory Government Owned Corporation, in Queensland) ACCESS PROVIDER International investment bank OPERATOR Consortium of coal mining firms	International bulk carrier fleet, including national flag vessels and Flags of Convenience Operating in the charter market and particularly in the spot charter market	Steel mills Power plants Manufacturers (various) Other

Figure 4: Supply chain business models in the Dalrymple Bay chain.

The above-rail operator, QR National, is a statutory Government Owned Corporation (GOC) created under the *Government Owned Corporations Act 1993*; and as a corporatised entity reports to the Treasurer and to two shareholding ministers. Despite commercial pressures and a focus on good business practice the operator is required to deliver social obligations and outcomes socially acceptable to government. Inefficient supply chains and congested ports and terminals are neither socially nor politically acceptable and to that extent will elicit responses that will be different from those of a private sector firm. Arguably, the privatization of the terminal and the degree to which the terminal access provider and the terminal operator are willing to accept risk in expansion planning impacts not only on the rate of decision making but also on the likely outcomes. It might also be argued that a fully government controlled terminal would be in a position to upgrade more quickly to ensure both social and political goals.

The below-rail access authority, QR Network Access, is QR's access provider. It was established as a business unit within QR in 1998 and developed an Access Undertaking approved by the QCA in December 2001. The Undertaking was introduced in March 2002 and operates until June 2005. The business is 'ring fenced' for confidentiality from other businesses within QR and is responsible for managing access to QR's rail network, managing the infrastructure assets in the network and managing operations on the network. It is regulated by Queensland Transport and the Queensland Competition Authority.

It is the terminal which is locked into quite complex ownership, leasing and operational relationships, and in which considerable differences exist in the business paradigms of the players involved. The *facility owner* is DBCT Holdings P/L and effectively the Ports Corporation of Queensland (PCQ) for the State government. The Ports Corporation, like QR National, is a statutory Government Owned Corporation (GOC) set up under the *Government Owned Corporations Act 1993*. Again, the government is represented through the Treasurer and two shareholding ministers. But the Corporation is also a port authority under the *Transport Infrastructure Act, 1994* with its core business involving strategic port planning, business and infrastructure development, pilotage services and port environmental and pollution management (Ports Corporation of Queensland, 2000/2001).

The *access provider*, under long term lease is BBI(DBCT) Management P/L, as noted, or BBI and is an international investment banking group. The *terminal operator*, DBCT P/L, is a consortium of six coal companies which own and operate a number of mines in the Goonyella system (Endnote 3). For both of these private sector players profitability and value to shareholders drive the business models; and for the multinational players the relative rate of return on capital across global investments will be important.

Of all market sectors represented in the chain the international shipping market from which shipping services are drawn is almost certainly the most volatile and competitive. Freight rates on the spot charter market vary significantly, reflecting demand pressures, and particular vessel types may become scarce in the market; but customers will normally exercise choice over the type of charter party entered into, vessel type, flag of registry and rates.

It is not surprising that supply chains comprise firms with significantly different business models; but the argument here is that it is well to remember that chain integration must be achieved in the context of exceptionally powerful international and national corporate players, a valuable export product and governments both State and Federal which seek to ensure high returns. It might well be expected that the underlying tensions will be disintegrative rather than integrative in chain terms.

2.6 Chain inefficiency: a summary

In 2006 the ACCC intervened in the operation of the Dalrymple Bay Coal Terminal – and effectively, in the operation of the export coal supply chain that focused on the terminal - in an attempt to deliver efficiency. This paper has special interest in the relationship between regulation and supply chain efficiency; but in this first part of the paper our concern has been to demonstrate that a number of factors underlie the disintegrative rather than integrative structure of the supply chain which focuses on the terminal. In summary, these factors appear to be of particular importance.

- Continuing demand pressures over the last two decades have ensured the need for continuous capacity upgrades; but in the last two years pressure on the terminal was exacerbated by equipment failure, which impacted not only on loadout rates but also on stockpile capacity, as well as by unrelenting increases in demand.

- In 2001 the terminal was privatised; but this 'deregulation' required regulation against potential or actual monopoly power from the State government competition regulator (QCA) to allow third party access for users and for the access provider to consult with users for any changes in rate structures. The regulator also required *a draft access undertaking* to be completed by September 2002. In the event the *undertaking* was disputed and not accepted by the regulator until April 2005. The period represented a long period of 'paralysis' for effective decision making in respect of capacity upgrades.
- Under regulation, also, leasing and ownership arrangements gave rise to a complex terminal 'ownership' structure which required that the Ports Corporation of Queensland, a statutory Government Owned Corporation, be the owner on behalf of the State government; the long term lessee and asset provider was BBI, a large international investment banking firm; and the operator, under contract to BBI, was a consortium of six large mining firms, most of whom shipped large quantities of coal through the terminal. The arrangements were hardly conducive to integration.
- The contractual arrangements between players in the supply chain were no more conducive to an integrated chain. Particularly, there is no contractual agreement between the rail operator and the terminal operator and between the terminal and shipping operator. In both cases, the interface operations exist on the basis of operational rather than contractual agreements. This is not necessarily a problem; but it allows the possibility of unnecessary variability as well as the transfer of inefficiency costs to the other player.
- Supply chains are 'disintegrated' by 'the self-regarding efforts (of firms) …to appropriate and accumulate value' (Cox et al., 2002, p74) and firms in the Goonyella supply chain no less so. Certainly the fundamental differences in the business models of the Government Owned Corporations such as the Ports Corporation of Queensland and QR National and the private sector multinational mining companies or the international banking firm might be expected to provide underlying tensions in supply chain relationships.

Can these 'disintegrative' factors prove also to be integrative?

3. REGULATION AND THE DIMENSIONS OF SUPPLY CHAIN EFFICIENCY

Can regulation drive efficiency into supply chains? On what basis, and using what mechanisms, can it impart efficiency? Particularly, how has the ACCC's *authorization* process provided a framework for driving efficiency into one of Australia's most intensively operated coal chains oriented to the Dalrymple Bay Coal Terminal? In this part we turn our attention to the relationship between regulation and the efficiency of supply chains.

3.1 Regulation and supply chain efficiency.

The Goonyella coal chain has been conceptualized as a transactional buy/sell supply chain in which a sequence of dyadic partners operates in a logistics pathway between the mine, as the production site, and the end customer (Figure 2). The dyadic partners are, in fact, firms or agencies providing product and services and in so doing

accumulating and appropriating value (and, ideally at least, attempting to capture rents or above normal returns).

On what basis are they in the chain at all? The simple answer is that, in a competitive market place, they offer value which their rivals cannot match; in effect, they have closed the market – on the basis of having one or several *isolating mechanisms* (Cox et al., 2002, pp35-38) – which 'isolate' the firm from competition in the market. In some chains, of course, the firm or agency may be a monopolist or a quasi-monopolist or exist as a natural monopoly.

Conceptually, regulation imparts 'property rights' to scarce resources; and in so doing becomes a particularly powerful 'isolating mechanism'. As Cox notes 'One of the most important isolating mechanisms is a property right granted by the state in the form of a licence, a patent or other regulatory protection…This mechanism often operates in tandem with natural monopoly as a means of ensuring that the monopolist makes pricing and output decisions that are in line with the 'public interest' (Cox et al., 2002, p35). In return, the monopolist is given state-guaranteed protection from competition'. Further, such protection may involve either the monopoly being taken into public ownership or being privately owned and publicly controlled.

The importance of this discussion may be now evident in the context of the Dalrymple Bay terminal; *authorization* granted to the terminal lessee and the operator, under contract to the lessee, is effectively a property right and an isolating mechanism which provides regulatory protection over the three year period of the *authorization*. It has allowed the firm to close the market from competition and to implement its proposed queue management system as set out under the *authorization* process. It has, in fact, conferred on DBCT P/L the status of *de jure* channel master or brand manager in the Goonyella/ Dalrymple Bay terminal export coal supply chain.

3.2 Supply push to demand pull supply chain: the creation of a channel master.

It is important to now recognize, both conceptually and operationally, that the *architecture* of supply chains may be fundamentally different between chains. Reddy and Reddy (2001) make a useful contribution to supply chain thinking in formally recognizing a fundamental shift in the structure of chains over time and we note and apply that thinking in this context; it has immediate relevance in the case of the Dalrymple Bay supply chain (Figure 5).

The authors distinguish, usefully, between a *market economy model* of the supply chain and a *network economy model.* The *market economy model* of the chain is the well-recognized supply-push model that drives product to the customer based on forecasted market demand. The authors note that 'Technologically-enabled supply chain systems have led to tight vertical process integration and better utilization of fixed assets and working capital. Just-in-time…systems have become the symbol of tightly integrated supply chain systems' (Reddy and Reddy, 2001, p5). They further note that the chain is driven from left to right, from suppliers to end customer; and that, importantly, the brand owner or product manufacturer or channel master 'defines the processes for coordinated activity across the supply chain' (Reddy and Reddy, 2001, p9). Figure 2 suggests the structure of the chain.

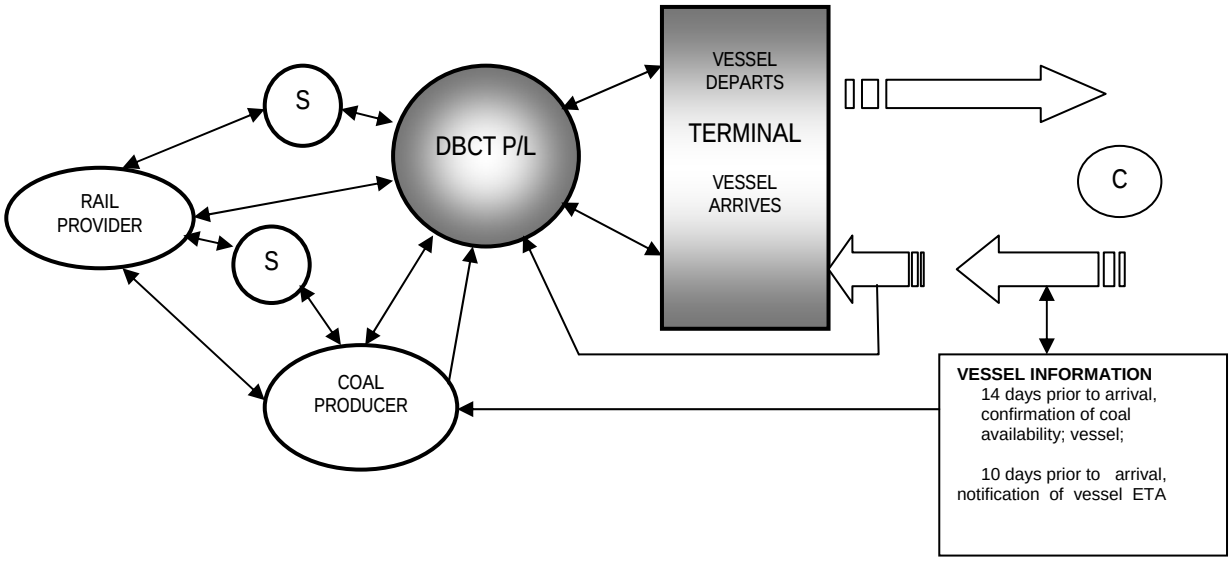


Figure 5: Demand pull, network economy supply chain model of the Dalrymple Bay coal chain.

The *network economy model*, by contrast, is a demand-pull model in which 'the firm's resources are organized to meet the unpredictable demand patterns of the customer' and has been 'fueled by information systems and accelerated by Internet technologies that have allowed disparate information systems to interact with one another' (Reddy and Reddy, 2001, p5). Effectively, the model provides exceptional competitive flexibility. Again, the brand owner coordinates the supply chain – but, in this case, only after receipt of an order from the customer and with real-time information capabilities of providing information to all players in the chain.

The pre- and post-regulation supply chains conform closely, though not precisely, to the two models. The pre-regulation supply chain represents a classic supply push chain. Coal, in fact a highly differentiated rather than a homogeneous product, is 'pushed' through the chain by numerous mining companies at varying rates; it is stockpiled either at the mine or at the terminal, blended and made available in 'parcels' of various coal types as required by the customer, for out loading to vessels which may or may not be immediately available. The mining company was the *de facto* brand manager or channel master – if, in fact, there was a channel master at all given the lack of tight contractual arrangements across key parts of the chain. It is somewhat surprising that a 'disintegrated' supply chain could deliver reasonable efficiency outcomes at any time!

The post-regulation supply chain conforms much more closely to the network economy model of Reddy and Reddy and is characterized by two critical differences. First, the chain has become a demand pull chain; it is driven by the impending, and the actual, arrival of a ship onto the berth. The availability of coal is matched to the arrival of the vessel under new and tightly controlled conditions. Second the terminal operator, DBCT P/L, has been accorded 'the right', under the new regulatory framework of authorization, to exert control over the operation of the chain – and

has become, therefore and as noted, the de jure brand manager and channel master, the integrator, in the chain (Figure 5)!

In the following sections we examine in some detail the particular mechanisms and processes involved in driving efficiency into the chain.

3.3 The Queue Management System framework[iv].

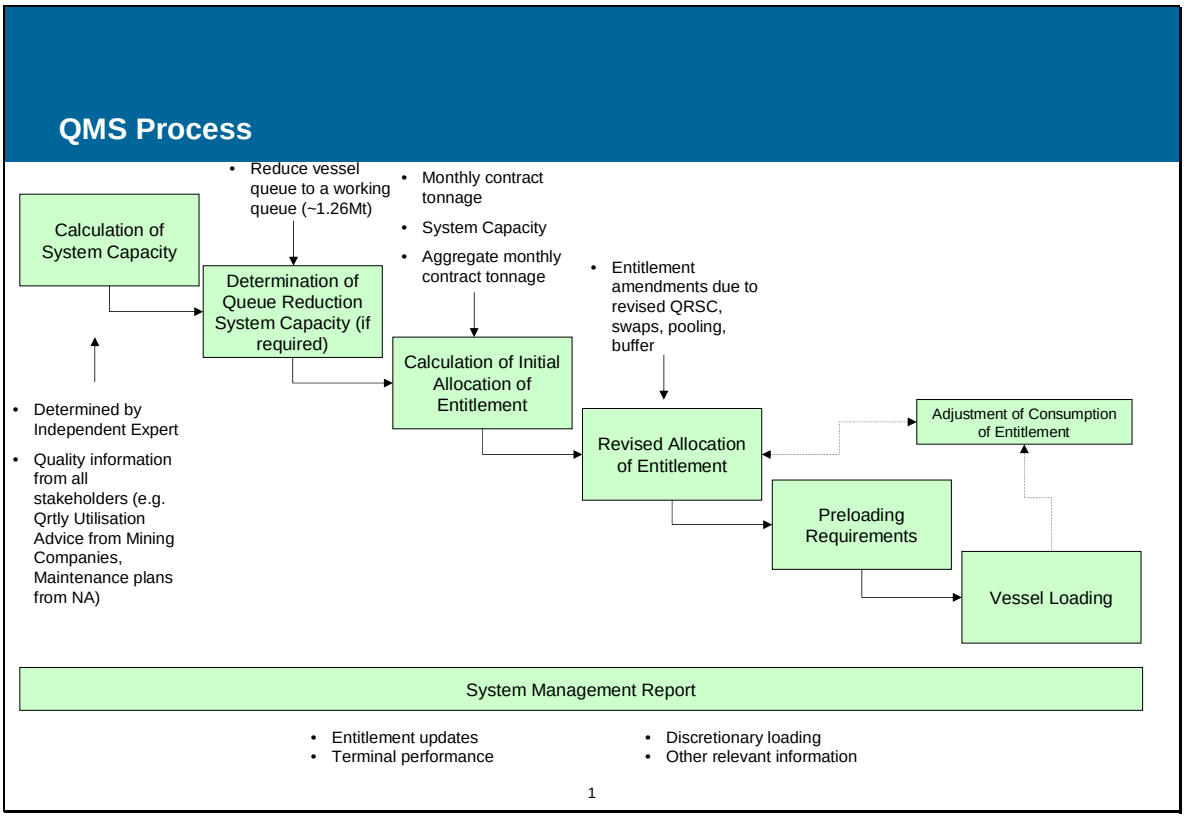
The introduction of a rigorously defined, clearly-stated set of operating procedures and rules applicable to system-wide chain operations is, of itself, a critical achievement; that the set of rules should be enforceable across all players underlines what might be regarded as a paradigm change in chain management. The essential principle involved is the minimization or removal of ad hoc variability in the system in an attempt to equate system capacity to system demand; and to do so in such a way as to ensure transparency, fairness, the maximization of system capacity and throughput and the minimization of ship demurrage and ship queuing time – and in so doing to restore and maintain the reputation of the terminal (DBCT, 2005, pp4-5).

Figure 6 is a useful overview of the QMS framework and we note briefly some of its key features.

- A central and critical feature of the QMS is a precise definition of available system capacity in any month or period of time. The task is outsourced to an independent consulting group and is based on the flow of information from chain players – contracted coal tonnages from mining companies, network availability and train pathways from QR Network Access, the under-rail access provider, rail capability from QR for example;
- Definition of the system capacity required to ensure the achievement of an acceptable level of queuing, referred to as a 'Workable Queue' (DBCT, 2005, p3);
- The calculation, on a *pro rata* basis, of the amount of coal which each supplier is entitled to ship in any period under a set of entitlement rules;
- The calculation of a revised allocation. The QMS allows companies to buy unwanted allocations and/or to exchange or pool allocations to meet pressing contractual requirements.

Effectively, these steps attempt to match available and required capacity under constraints on the length of the ship queue and the level of ship demurrage. They provide the information framework within which the key players can plan their operations. The QMS also places some limitations on operational planning – stockpiles, for example, cannot be used on a dedicated basis and all coal for any ship must be cleared from the stockpile; coal blending must be approved according to a set plan to avoid ad hoc changes; suppliers are discouraged from supplying vessels with multiple parcels of coal; and all scheduling of rail movements will be determined by the terminal operator (DBCT, 2005, pp12-13).

It is the operationalization of the chain which is of particular interest and we will look at it more closely in the following section.



Source: Courtesy DBCT P/L; Flynn 2005.

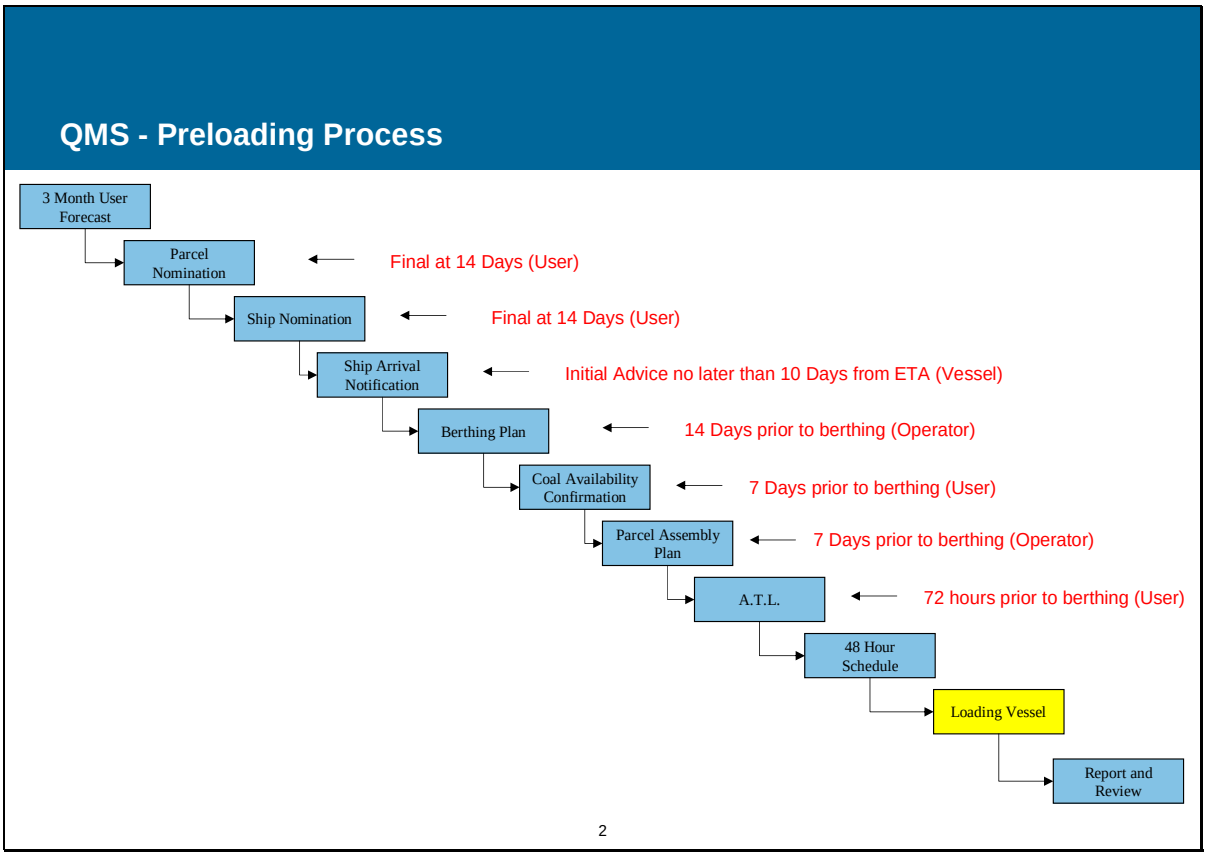
Figure 6: Overview of the Queue Management System, Dalrymple Bay Coal Terminal.

3.4 An information-driven system?

In demand driven systems, priority and privileged information about the customer and the ability to leverage control over suppliers and other members in the chain are key attributes (Weston and Robinson, 2005). Supply chains under these conditions are activated by order placement; and the channel master in the network economy model distributes this information in real time, or 'at the speed of thought' (Gates, 1999)) or in e-Business processes to chain players.

The Dalrymple Bay chain, under regulation, embraces these fundamental principles; the so-called 'pre-loading requirements' in the QMS define in detail the sequence of activities and the information requirements which drive those activities (DBCT, 2005, pp15-19); and the terminal operator is the channel master which leverages control over chain players (Figure 5).

Figure 7 provides a much simplified, but meaningful, overview of the 'pre-loading requirements' – *prima facie*, a set of activities but in fact a rigorous information framework that allows a high level of integration in the chain operations . Note the procedures involved.



Source: Courtesy of DBCT P/L; Flynn, 2005.

Figure 7: Overview of the pre-loading requirements, Dalrymple Bay Coal Terminal.

- The supplier (the coal company) must apply for coal handling services (for a specified 'parcel' of coal) a minimum of 14 days ahead of the ship's arrival; and must nominate the vessel involved.
- The vessel notifies its estimated time of arrival (ETA) no later than 10 days before its ETA.
- 14 days prior to berthing the terminal operator prepares a berthing plan.
- 7 days prior to berthing the supplier confirms the availability of coal; and the operator confirms the parcel assembly plan.
- 72 hours prior to berthing the supplier authorizes the berthing and loading of the vessel; and 48 hours prior to berthing advises of any potential impediments.
- 48 hours prior to berthing the terminal operator monitors arrangements.

Again, the key principle underlining these requirements is the removal of ad hoc variability in the system, often impacting on other players in the system.

The 'networked' information basis of the demand pull model for the Dalrymple Bay chain in Figure 5 now becomes more meaningful. The chain operation is activated a minimum of 14 days *before vessel arrival;* and the terminal operator, as the channel master and on the basis of specific information, has set in place a coordinated program that ensures that, on arrival, the ship is able to receive cargo. Failure of ships to comply with pre-loading requirements may result in the ship ceding its place in the queue to another, though it may have a later 'actual time of arrival'.

4. WHAT PRICE EFFICIENCY? A FINAL NOTE

In March 2005 there were about 50 ships anchored off the Port of Hay Point (Flynn, 2005); DBCT P/L, within the framework of the Queue Management System, operated the system in 'Queue Reduction' mode (DBCT, 2005) – effectively reducing the entitlement of coal suppliers, and hence vessel calls, by matching entitlements to *less than the actual system capacity* – through to midyear. The queue drastically reduced to 15 vessels in June, an agreed acceptable level. The operator estimated that demurrage costs, in terms of $/tonne of coal handled, had decreased over the period from approximately $10/tonne to less than $1/tonne and that the total demurrage bill had decreased by A$50 million per month. It appeared also that concerns for the public interest, expressed by the ACCC as a decrease in throughput and a decrease in the number of large vessels (and hence the possibility of higher per unit shipping costs), had not eventuated, at least in that timeframe (Flynn, 2005).

There is no doubt that the imposition of a regulatory framework on the chain – effectively changing the supply chain paradigm from an ad hoc, high variability supply push chain to a disciplined demand pull chain controlled by a *de jure,* as well as a *de facto,* channel master operating within a new and rigorously implemented information network based on agreed protocols and business rules – has provided a more stable, more effective and more efficient supply chain. Over the period also, intense efforts to investigate operational and other improvements were underway and new thinking prompted significant (and ongoing) change. Further detailed planning is currently under way[v].

Clearly, operational improvements will be, and will need to be, ongoing. But it is instructive to point out that *operational efficiency* and *economic efficiency* are different concepts; and that regulation is, after all, about driving economic efficiency into the marketplace – it is about ensuring that market power does not distort prices and, in so doing, the allocation of resources.

In asset-rich, infrastructure dependent supply chains increases in demand will be met, in the immediate short run and to the limits of capacity, by elements in the chain system with existing capacity and by modifying commercial and work practices easily changed in the short run. Assume at the limit, however, that investment in new infrastructure will be mandatory. The critical issue is who pays and the likely answer is who benefits – who is it that captures the reward, or value?

Individual chain players will capture value[vi]; how much value they capture will differ and it will differ on the basis of the *power*[vii] which the player or firm is able to exert in the chain and on the business model, and pricing strategy, which the firm adopts. Firms which enjoy considerable chain power, for example, may transfer inefficiency costs to a weaker firm which may or may not be able to capture added costs in their price. Private sector firms will seek, not unreasonably, to charge market-based prices – the mining operators, the terminal operator and asset provider; but key rail players – the below track access provider QR Network Access and the above rail operator QR National – are embedded in a statutory Government Owned Corporation in which the pricing model is required to deliver social, as well as commercial, outcomes. Clearly, the possibility of conflicting objectives is real.

Who captures the external multipliers of the chain? And how are these spin-offs factored into chain pricing and investment decisions? Certainly, the reduction in the level of ship demurrage costs is a useful index of dysfunction and of operational efficiency in an export coal supply chain; but we may need to be cautious in assuming that it is a good indicator of the wider economic efficiency that 'efficient' chains might underwrite.

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REFERENCES

Australian Competition and Consumer Commission, (1999), *Authorisations and Notifications*

Australian Competition and Consumer Commission, (2005), *Applications for authorisations lodged by Dalrymple Bay Coal Terminal Pty Ltd – interim authorisation,* April.

Australian Competition and Consumer Commission, (2005), *Applications for authorisations lodged by Dalrymple Bay Coal Terminal Pty Ltd in respect of a Queue Management System designed to address the imbalance between the demand for coal loading services at the Dalrymple Bay Coal Terminal and the capacity of the Goonyella Coal Chain,* November.

Coalition of Australian Governments, (2006), *National competition policy review,* Background Paper, February.

Cox, A., (1997), *Business Success,* Earlsgate Press, UK.

Cox, A., Ireland, P., Lonsdale,C., Sanderson, J., and Watson,G., (2002), *Supply Chains, Markets and Power,* Routledge, London.

Cox, A., Ireland, P., Lonsdale,C., Sanderson, J., and Watson,G., (2005), *Business Relationships for Competitive Advantage,* Palgrave Macmillan, Hampshire.

Dalrymple Bay Coal Terminal Pty. Ltd., (2005), *Authorisation application for the Queue Management System at Dalrymple Bay Coal Terminal,* October.

Dalrymple Bay Coal Terminal Pty. Ltd., (2005), *Queue Management System amendments to terminal regulations,* August.

Dalrymple Bay Coal Terminal Pty. Ltd., (2005), *Submission in support of the authorisation for proposed Queue Management System at Dalrymple Bay Coal Terminal,* April.

Everett, S., and Robinson, R., (2006), Supply chain inefficiencies: regulation misdirected? Forthcoming, *Public Infrastructure Bulletin,* The University of Melbourne.

Flynn, D., (2005), Research paper, Graduate Program in Bulk Freight Systems Management, University of Melbourne.
Hamel, G., (2000), *Leading the Revolution*, Harvard Business School Press, Boston.
Lines, K., (2006), Research paper, Graduate Program in Bulk Freight Systems Management, University of Melbourne.
Ports Corporation of Queensland, (2001*), Annual Report 2000/2001*, Brisbane.
Productivity Commission, (2005), *Review of National Competition Policy Reforms*, Report No 33, Canberra.
QR Network Access, (2006), *Coal Rail Infrastructure Plan (draft)*, January, Brisbane.
Reddy, R. and Reddy, S.,(2001), *Supply chains To Virtual Integration*, McGraw Hill, New York.
Robinson, R., (2002), Ports as elements in value-driven chain systems: the new paradigm, *Maritime Policy and Management*, 29, 3, 241-255.
Robinson, R., (2003), Port authorities: defining functionality within a value-driven chain paradigm, *Proceedings IAME Conference*, Busan, September, 654-674.
Robinson, R., (2006), Port-oriented landside logistics in Australian ports: a strategic framework, *Maritime Economics and Logistics*, 8,1, 40-59.
Runnegar, M., (2005), Research paper, Graduate Program in Bulk Freight Systems Management, University of Melbourne.
Weston, R.W. and Robinson, R., (2005), Value migration and profit pools in port-oriented freight systems: the implications for new patterns of efficiency, Paper presented at the IAME Conference, Limassol, June.

ENDNOTES

[i] This section draws heavily on a number of sources including Everett and Robinson, 2006; Runnegar, 2005; Flynn, 2005; Lines, 2005 and on documents listed on the ACCC website over a period of time (www.accc.gov.au).

[ii] The mines and mining companies in 2005 were as follows – Blair Athol (Rio Tinto Coal Australia P/L; Riverside (BMA Coal Operations P/L); German Creek (Anglo Coal (Capcoal Management) P/L); Oaky Creek (Xstrata Coal Queensland P/L); North Goonyella (Peabody Energy Australia Coal P/L); Burton (Peabody Energy Australia Coal P/L); Moranbah North (Anglo Coal Australia P/L; Hail Creek (Rio Tinto Coal Australia P/L; Foxleigh (Foxleigh Mining P/L); Coppabella and Moorvale (Macarthur Coal (C&M Management) P/L). A number of other new mines, including AMCI and Millennium, have take-or-pay contracts for exports later in 2006.

[iii] See also QR Network Access, 2005, Section 6 for an excellent discussion of the point.

[iv] This section draws heavily on the document Dalrymple Bay Coal Terminal (2005*), Queue Management System Amendments to Terminal Regulations* cited in the text as (DBCT, 2005).

[v] The so called Goonyella Coal Chain Improvement Project (GCCIP) was set up as an industry taskforce to identify and solve problems in the chain. Its work was, and continues to be, of considerable importance in effecting change. The QR Network Access initiative, *The Coal Rail Infrastructure Master Plan 2006*, is providing exceptional analytical insights into capacity and other issues in the Queensland coal industry.

[vi] For an excellent discussion of capacity elements in the Goonyella chain see QR Network Access, 2006, pp31-33.

[vii] The term is used in the sense in which Cox et al. (2002, p3) use the term – 'By power we mean the ability of a firm…to own and control critical assets in markets and supply chains that allow it to sustain its ability to appropriate and accumulate value for itself by constantly leveraging its customers, competitors and suppliers'. Note that critical assets may include non-physical as well as physical assets – competencies and information may be, for example, critical assets under particular circumstances.