Using Market-Based Instruments to Protect Port Hacking

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1. Outline

In his address to the 2002 Estuaries Forum, Paul Martin (2002) raised "Some radical thoughts to consider." Among them were several that relied on new kinds of property rights and possible trading in these:

- a cap-and-trade scheme for mooring, anchoring, and storing rights;
- market instruments to resist damaging use; and
- a market for management.

Before considering these in more detail, I'd like to present a broader outlook, which starts with scientific frameworks of various environmental dimensions, measurements of the state of the environment in these various dimensions, a series of target levels that are desirable to be attained in each dimension after some time, and then means for altering the behaviour of users of the estuary, or of people's activities around the estuary or in its catchment which can affect the environmental dimensions.

For example, scientific models of the propagation of sounds around the estuary (their attenuation and local concentration), together with models of the ear's sensitivity to different sound patterns and frequencies (suitably calibrated by appropriate sound expertise), will provide a framework for measuring noise along the shores of the estuary and on the water. Once target standards have been agreed (a process that must involve all parties, the noise producers and those in earshot), means of modifying the emitted sounds can be discussed. Heavier mufflers, larger buffer zones will attenuate the sounds of motors, as will quieter motors. At the limit, absence of motors would be quieter, too. Sound barriers such as trees can be more or less effective as well.

The paper proceeds by discussing possible adverse environmental impacts on estuaries in general and Port Hacking in particular (Section 2). Section 3 offers a three-way classification of ways to alter behaviour. Section 4 discusses various market-based instruments. Section 5 outlines the use of new rights in two South Australian fisheries. Section 6 outlines one possible means of reducing damage to Port Hacking through the use of market-based instruments.

2. Impacts on the Estuary and Their Causes

In general, the behaviour of some people in pursuit of profit or pleasure imposes a cost on

others, in the form of lower environmental amenity. (As David Alden 2002 discussed last year, this disamenity may be measured in dollar terms, but the techniques of cost-benefit analysis do not require all costs to be in actual dollars.) The disamenity may be immediate (as with noise) or longer term (as with habitat change or the introduction of feral species). In general, however, these costs on other parties are not passed back to those whose behaviour creates the disamenity. Users don't pay.

A generic estuary might suffer damage in one or more of the following dimensions: nutrient overload (stimulating an imbalance in the growth of plants and animals), pathogens (leading to ill-health or death of plants and animals, and of higher creatures in the food chain, such as fishers and their families), toxic chemicals (such as the classic Minamata mercury poisonings), habitat loss and degradation (such as the reduction of sea-grass beds, or the death of Bondi's Norfolk Island Pines from wind-borne detergent discharged into the ocean from the nearby sewerage plant), introduced species (such as the Zebra Mussels in Darwin Habour), alteration of natural flow regimes (such as might occur with dredging or the construction of an artificial tombolo), declines in fish and wildlife populations (from overfishing or some of the previous changes), and finally overall changes in water quality. (U.S.E.P.A. 2003)

Not all of these are relevant to Port Hacking, since the catchment supports little industry, but in the past there has been quarrying in the catchment, and inadequate sewering (or none at all) in the catchment, including the southern shore (indeed, bilge effluent is fouling the Port in places). Surveys reveal that seagrass cover has shrunk to only half of its previous area; in some parts of the Port (the Basin) there has been a significant loss of fish species. There is clear evidence of inappropriate (and in some cases illegal) foreshore development. There has been an invasion of *Caulerpa taxifolia*, which can adversely affect the ecosystem (seagrass, fish, molluscs).

If it can be agreed that these are bad outcomes, and that ameliorating them is to add not only to the sustainability of the Port for human uses but also to its current attractiveness, then the questions arise: first, what are the causes of these impacts, and, second, how can the adverse impacts be halted and reversed? Or, rather, how can we act most efficiently (or with least overall cost) and effectively (so that actions to restrain and the reverse the impacts)?

Some impacts might stem from a single, costly action, rather than continuing behaviour and actions. An example of this is the introduction of a feral species, with long-term consequences, but which could be the result of a single act of contamination. The damage may be set in train long before attempts to eliminate the species consumes vast amounts of resources.

Such once-off acts are difficult to prevent, given the opportunities, especially, but not exclusively, if they are deliberate. But the use of market mechanisms (such as taxes and fees, container return deposits, auctions, and cap-and-trade permit schemes) are more useful and appropriate for repeated schemes.

It is for others to establish the actions and behaviour that are directly implicated in the environmental disamenity and deterioration presented at last year's forum and later today. I want to discuss ways in which behaviour can be altered, with particular focus on market mechanisms, especially the creation of new rights, and new markets for trading those rights, so that participants have the correct incentives to do the right thing.

3. Altering Behaviour

3.1 A Three-Way Classification

In general, we can characterise means of altering the behaviour of others into three broad categories (Lindblom 1977): *authority*, or Command & Control (C&C), where certain behaviour is proscribed ("commanded against") with strong penalties for transgression (Helfand and Berck 2003); *exchange*, or Market-Based (MB) instruments, where in general there are opportunity costs associated with particular behaviour, which may be constant — as with taxes and fees — or increasing — as with carbon credits and other behaviour permits (Portney 2003); and *persuasion*, or Education/Persuasion (EP), where people are convinced to change their behaviour voluntarily, perhaps by education, perhaps by social sanctions.

An example of C&C is the introduction of unleaded petrol — new cars would not accept the wider nozzles of the older, leaded petrol, and the prices of the older, leaded petrol was legislated to be ever more expensive, year by year, than the newer unleaded petrol. An example of a MB instrument is this legislated price difference, which provides a small but growing incentive for drivers to save money and reduce air-borne lead by buying the new petrol (which works in older cars, and is mandated in newer cars). The best example of the EP way of altering behaviour is the change in smoking habits in Western societies in the last forty years. Yes, this has partly been due to rising taxation leading to higher prices, but society's attitudes towards smoking have been turned around, partly by the realisation of the health consequences of passive as well as active smoking.

Even if there were a clear understanding of the consequences in aggregate of individual actions around Port Hacking, as others have pointed out, there are elements of the "tragedy of the commons", where I realise that my actions might damage the environment further (to my detriment too), but I reason that, first, my actions have a small impact, far outweighed for me by the positive returns of the actions, and, two, if not I then others would act, so my sacrifice will have virtually no positive impact. As a consequence we all (well, at any rate, many of us) do the deeds, and in aggregate and over time the environment suffers, and so do we, and so may or children.

In such cases, "mutual coercion, mutually agreed on" (Hardin 1977) might be necessary. That is, if EP policies will not sufficiently change behaviour, then mutual agreement to change behaviour (by C&C means or by use of MB means) is appropriate. Figure 1 is a diagrammatic representation of the use of these three methods of altering behaviour, which can model any mix of the three. Any point inside the triangle corresponds to particular proportions of the three mechanisms, depending on the distances from the three vertices. It is possible to plot instruments for control, or even societies, on the graph, depending on their mix of the three basic mechanisms. For Port Hacking, I am arguing that we move from near the Authority node in a north-easterly direction, to a greater reliance on Exchange and Persuasion instruments.

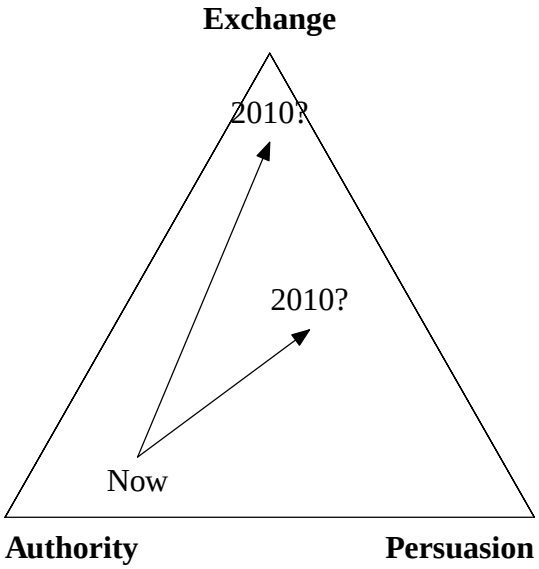

Figure 1: Three-Way Classification of Control Mechanisms

4. Exchange — Market-Based Instruments

There are two basic MB mechanisms: those that determine the price, and let the actions of the many individual decision-makers (the market) determine the quantity, and those that determine the quantity, and let the decision-makers' actions determine the price of opportunity cost. An exhaustive survey by an expert in the field of MB instruments for environmental protection is Stavins (2001), although his emphasis is on pollution, not natural resource management. An Australian survey is Bari (2002) and a recent conference is AARES (2003); see especially Bardsley (2003).

4.1 Taxes

It is often the case that users of the Port Hacking (and other) water and environs pay a fee: it might be a charge for car parking or boat launching; it might be an annual charge for a mooring. In many cases, there may be no charge. But in general these charges are low relative to the associated costs of motoring or boating, and their purpose is to recover out-of-pocket costs of the administering authority. Users are not charged sufficiently highly to alter their intensity of use of the Port's environs. If the charges included a tax component, as well as a cost-recovery component, then they might be sufficiently high to alter behaviour. Given the level of the tax, individuals would decide how frequently to launch or to park. Such "green" taxes might lead to resistance among those taxed, especially when first levied. After all, these activities were previously not heavily taxed, if at all. This once-off resistance to the tax might be reduced if the proceeds of the tax are recycled to the users (in kind, not cash), to ameliorate the environmental damage caused by the previously untaxed activities.

Note that the economist would argue that such recycling of revenues is not necessary — the taxes produce an adjustment of relative prices so that these users now face a cost commensurate with the environmental costs their activities impose, and that the price mechanism will lead to a more efficient allocation of resources (including the ability of the environment of the Port to accommodate some level of damaging activities) with the taxes than without.

4.2 Container Deposit Schemes

The container deposit (used in South Australia for soft-drink containers (see S.A.E.P.A. 2003) can be thought of as a kind of tax: the 5¢ or 20¢ certainly increases the purchase price of the drink. But it is a "tax" that can be recouped by returning the container when empty. Although 5¢ or 20¢ a container is not likely to alter individual purchasing decisions, it surely reduces littered drink containers: even if the buyer decides not to trek back to the shop for a refund, and instead litters, there is a ready army of volunteers (Scouts, etc.) who earn even 5¢ a container by collecting and returning them. The incentive for a less littered environment exists in the 5¢ deposit. If 5¢ were not enough, how about 10¢? 20¢? (Stavins 2001).

Calcott and Walls (2000) consider the costs and efficiency of container-deposit schemes, and suggest differential deposits depending whether the containers are recyclable (such as glass) or not. South Australia charges more for glass already.

4.2.1 Requirements for These Instruments

What do taxes and refund deposits require to work? First, acceptance from users, who might grumble, but who soon realise that the outcome of these MB measures are evident, even if at some cost to users, as the South Australian experience demonstrates. Second, some measurement of the levels of activity and environmental impact. This activity is self-evident with parking and launching — no pay, no service — and with refund deposits — no pay, no drink. In the case of taxes, that's where it ends, but deposit refunds require a legal obligation on shops to accept returned containers and to pay 5¢ (or whatever) per container. It might not be necessary for all shops to agree, so long as some refund centres exist nearby, but absent any obligation for the 5¢ to be refunded, littering will increase to the levels of the other states. Of course, drink manufacturers might seek to reduce the cost and inconvenience for their customers, and so increase their sales, by using drink containers which avoid the 5¢ deposit. Recent amendments to the South Australian Act reduce these possibilities.

4.3 Cap-and-Trade Permits

The second general MB framework for reducing environmental damage caused by intensity of use is the use of cap-and-trade permits. Say a factory wishes to produce some effluent in the course of its activities that will adversely impact on environment, and that by altering its intensity of operation or by investing in "cleaner" methods of operation (perhaps machines, perhaps different ways of using existing machines) it could reduce the flows of effluent. By some means (discussed below) the regulatory authority (usually the government) could allocate a permit which would allow emission of a certain amount of effluent (suitably defined) per year. If the firm wanted to produce more, it

would have to buy additional permits from firms that had excess permits. A firm might have excess permits because it had invested in new, less polluting, methods of operation, having netted out the returns from selling the now-surplus permits on the trading market. The total flows of effluent per year would be determined by the allocating authority, equal to the sum of the allowances of each permit. But individual firms would choose to produce more or less than their initial allocations. The price on the permit-trading market would reflect the aggregate excess demand for these rights to emit pollution: firms would respond to this opportunity cost of holding unused permits, by increasing or reducing their activities or by altering the methods they use to produce their products. The price is determined by the aggregate of the decisions made by the firms, here, while the quantity is determined by the regulatory authority.

For this system to work, there needs to be a legal tradeable right to pollute and a monitoring system to ensure that no firm exceeds its permitted level of emission in any period, usually a year, with sanctions to enforce compliance.

How is this different from the C&C methods? Well, decision making is decentralised, including decisions over production methods — C&C methods have notoriously mandated technology as well as levels of emission, thus eliminating any incentive for firms to seek more efficient (less costly) techniques of reducing emissions.

Keohane et al. (1997) attempt to explain four apparently inconsistent observations: “First, despite the advantages of MB policy instruments, they have been used to a minor degree, compared with conventional, C&C instruments. Second, pollution-control standards have typically been much more stringent for new than for existing sources, despite the inefficiency of this approach. Third, in the few instances in which MB instruments have been adopted, they have nearly always taken the form of grandfathered tradeable permits, rather than auctioned permits or pollution taxes, despite the advantages in some situations of these other instruments. Fourth, the political attention given to MB environmental policy instruments has increased dramatically in recent years. We search for explanations for these four apparent anomalies by drawing upon intellectual traditions from economics, political science, and law.”

Permit schemes fix the amount of emission in any period, which might be crucial in very sensitive environments. Taxes fix the per-unit cost of emissions. That is, permit schemes push the risk (of high or variable permit prices) onto the firms, while taxes push the risk (of high levels of total emissions flows) onto the environment.

4.4 New Rights

Both instruments require new rights: payment of taxes consistent with effluent flows legitimates those flows; the distributed permits entitle the bearer to produce flows of emissions legally. Both approaches decentralise decision-making. In the case of permit schemes the regulating authority determines the aggregate flow per period, and issues the appropriate number of permits, while the permit holders can decide how best to operate within the total cap of the aggregate flow per period, as described above. In the case of the taxes the firms decide the amounts of emissions to produce, and how best to operate, hopefully economising on emissions, in response to the tax: a cleaner competitor would have lower costs and so higher profits — over time such a competitor would be a formidable rival, possibly squeezing the dirtier, higher-cost firm out of the market, one

way or another.

4.5 Taxes versus Cap-and-Trade

Taxes may not be the best MB instrument to protect Port Hacking. In the absence of profit-maximizing firms, competing in a downstream market, taxes must be high enough to alter behaviour, if the environment is to bear a lower level of emissions. And this can be seen as either licensing pollution, or revenue gouging (see the recent discussions about speed cameras), or both.

On the other hand, tradeable permits are not as easily encompassed, perhaps because, as Mark Twain said, nothing is certain in life except death and taxes, but no-one has written any witty epigrams about these strange new creatures, emission permits.

For new rights to exist, they must be recognised by the law. Indeed, secure property rights is a necessary condition, I believe, for societies to effectively tackle environmental degradation: not least because, as the President of Harvard, Larry Sommers has said, "In the history of the world, no-one has ever been known to wash a rental car." Our own property gets much better treatment from us.

Indeed, if the waters of Port Hacking were owned by a private property holder, however unequal this might be, the owner would have a strong incentive to protect the seagrass beds, not to foul the waters of the Port, and so on. (But I am not saying that single ownership would be the end of all environmental issues: with sufficiently high discount rates, the future benefits from protecting the Port now — sustainability — would easily be outweighed by harvesting now, in the limit to extinction, as we see some timber resources in poor, Pacific islands being clear-felled, with virtually no prospect of replanting and regeneration; the classic example is Easter Island.)

The Anglers' Conservation Association in the U.K. was established in 1948 as a collective means of protecting its members' leased riparian fishing rights along English rivers by suing polluters. (These rights were already recognised in law.) Sturgess (2002), in a review of the book, *Saving Our Streams* (Bate 2001), points out that the Association is serious business: in 1999 alone, the ACA had 42 legal actions underway, five actions had been won or settled, and damages of £366,890 had been recovered (always used to rehabilitate the polluted rivers).

Of course, in one sense there is a single owner of Port Hacking — the people of New South Wales, through their government, thanks to the provisions of the Constitution. But this has just moved the debate down to the local level, as the political process has benefitted some users of the Port to the expense of others, in a way that is hardly sustainable.

5. Case: South Australian Fisheries

Although not for estuarine protection, an excellent example of the use of new rights to protect an environmental resource is the use of transferable fishing rights in two South Australian fisheries (Tierney 2000). The state government started the first scheme in the 1960s by setting a limit on the total number of pots used by the lobster fleet in Port Lincoln. Licences for those pots were assigned to the working fishermen, and from then on, any newcomer who wanted to set a pot in those waters had to buy a licence from

someone already in the business. In 1984 licences cost $2,000 each; in 2000 $35,000. The owners of the licences began taking the long view as soon as they saw the rising price of their licences for their lobster pots. Like any property owner, they began thinking about resale value. They have realised that the value of the licences must be protected by protecting the fishery: they pay for scientists to monitor the fishery, and they have imposed strict harvesting limits that allow the lobsters to grow into sizable adults.

A similar scheme of property rights exists for Port Lincoln tuna fishers, or, rather, tuna farmers: they still fish for their tuna in the wild, but with restrictions. Because tuna were decimated by the old open system, in the 1980s the government imposed limits on the annual catch. Now each tuna fisherman owns what is called an individual transferable quota — the right to catch a certain percentage of the yearly haul. These quotas, which can be bought or sold like stock shares, are not cheap, so fishermen have changed their strategy. No longer able to slaughter fish at will, they have looked for ways to make the most of each fish. They catch tuna in the open sea, and then pen them and feed them to improve their condition before sale.

To get to this situation in both fisheries, some knotty questions had to be answered. As Tierney puts it: “But there are, of course, a few political problems in persuading hunter-gatherers to become homesteaders. The biggest is how to divide up the range. Do you allocate the quotas and licences equally among all working fishermen or according to how many fish each has been catching? Do you calculate each one’s catch by considering the past year or the past 10 years? Do locals get first dibs on fishing rights?” Agreement was, by and large, attained, and the fish and the fishermen prosper: the incentive for the fishermen (to conserve the fishing stocks to protect the value of their licences) also leads to the protection of the fishery, which is not exhausted from over-fishing, as has happened to fisheries in the North Atlantic.

There are also distributional issues: entering the industry can be very expensive, and some people won’t be able to afford it. But it is possible to set up a quota system and still protect smalltime operators, as the lobstermen in Port Lincoln did by putting a limit on the number of pot licences that any one person can own.

6. Port Hacking

How might we harness the incentives of tradeable permits to gain the optimal protection of the Port’s environment, that is, allowing some activities that put pressure on the Port while balancing that against the need to prevent continuing environmental degradation (especially with population pressures) and to encourage sustainable use of the waterway? It would help if we had a GPS-based database of the many dimensions in which the Port and its environs could be measured, as we mentioned in Section 2. A recent study by Boyd and Wainger (2003) of Florida and Maryland wetlands provides a fine exemplar, with measurements (and maps) of 40 variables affecting the environments of the wetlands.

6.1 Rights to Foreshore Structures and Moorings

Let’s return to Paul Martin’s “radical” thoughts at the top of the paper. In a private communication (Martin 2003b), he suggests using a cap-and-trade system of rights to

limit the encroachment of foreshore structures and moorings. These structures are obtrusive and may be damaging the ecosystem of the Port. Moreover, in many cases they occupy public land at very low annual fees (see articles in the *Sydney Morning Herald* of 30 August and 28 October 2003).

What could we do? Specifically, we could, first, measure the areas and locations of all existing structures and moorings below the foreshore development line (Martin 2003a). This datum would become a cap, and rights to existing structures and moorings would be "grandfathered" to existing users, who now become owners of these transferable rights, subject to some conditions. (We would want to ensure that no moorings, for example, were posing an extreme risk to seagrass beds, especially the slow-growing *Posidonia* beds.) The cap would ensure that construction of new structure would require the dismantling of an old one, to free up the necessary permit.

For political reasons, grandfathering would be easier to perform than, say, auctioning the rights to allow existing structures (Keohane et al. 1997), but the existence of the market for such permits would highlight the opportunity cost of not relinquishing one, even if initially acquired very cheaply. Rights to any new structures (perhaps less potentially damaging to the environment through new construction methods or technologies) would be auctioned, to reflect the value of the scarce structures.

Another restriction to allay fears of a take-over by the big end of town would be to prohibit corporate ownership of such grandfathered structures and moorings, and to restrict personal ownership to one of each class (structure and mooring). It is still the case that the first generation of owners would stand to reap wind-fall profits, but alternative methods of initial allocation would face very stiff political opposition, if previous battles are anything to go by (Martin 2003a).

Such rights would not be in perpetuity. One suggestion is that they would expire after five years, when new ownership would be determined as the result of an auction, the proceeds of which could be used to ameliorate any degradation of the environment.

6.2 Other Uses of Market Instruments

These are radical thoughts. So far as I know, they are not yet being used for management of estuarine environments anywhere. Another of Paul's thoughts was to establish a "market for management", perhaps to overcome the excessive bureaucracy that is evident in the overlapping responsibilities of state and local authorities in managing Port Hacking.

One challenge here is related to the earlier proposal: to the extent that money is being bid for rights to use the environment (responsibly and sustainably, I emphasise), there is the temptation for rent-seeking to occur, and for agencies to compete for the flow on money from the purchases of the rights (every few years, as discussed above). Markets are about competition, which results in efficiency, but ideally would prefer the winning agency to be the one with the best methods of protecting the environment of Port Hacking. Money might be the preferred tender of business, but effectiveness ("Doing the right thing", in the late Peter Wilenski's words) should trump efficiency ("Doing the thing right" ditto) where the environment is concerned. The challenge remains.

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Attachment 1: Sumary of Paper

1. TOPIC

The use of market-based (MB) instruments in general, and cap-and-trade permits in particular, entail the creation and management of new rights, by legislative fiat.

2. ISSUES ADDRESSED

How to use MB instruments to help protect the environment of Port Hacking. Every MB instrument involves sacrifice and rewards; these incentives should help protect the environment, if properly structured. MB instruments do not imply unfettered competition for the use of environmental services. MB instruments are efficient, and should provide positive incentives for the protection of the environment and for the development of less damaging technologies that would allow the provision of the same level of non-environmental services at a lower level of environmental cost. By capping aggregate adverse impacts, cap-and-trade permits impose tangible, limited environmental costs, while the economic actors (the users) bear a risk (that the value of the permits will vary, depending on the demand for these rights to use the environment).

3. EXAMPLES OF THE ISSUES

Given the importance of seagrass beds to the estuarine ecology, the damage caused by anchoring and mooring must be halted if Port Hacking is to enjoy a sustainable level of environmental amenity. A related issue is that of foreshore structures: as undeveloped foreshore plots (above the high-tide mark) dwindle, there is no reason to allow further development (of jetties, etc.) below the high-tide level.

4. EXAMPLES OF CONCEPTS OR SOLUTIONS

A system of tradeable permits would cap the number of moorings and the area of foreshore structures. Anyone wanting to create a new mooring or a new structure would require a permit, which could be bought at the going market price from someone who valued the right less than its going price, so that the number and area were capped.

Attachment 2: Concepts for Consideration

1. THE ISSUES ADDRESSED

Protecting the Port Hacking environment from further degradation due to further permanent moorings or more foreshore structures.

2. THE ESSENCE OF THE SOLUTION

Cap-and-trade permits, accompanying a new right.

3. HOW IT MIGHT WORK

“Grandfathering” of exiting moorings and structures (jetties, etc.), but therefore capping the total number (or area) of these with a system of new rights, in the form of tradeable permits. Any new moorings or structures to require the elimination of existing moorings or structures, thus freeing up a permit (which would be exchanged at the going price), or the issue of a new permit by the controlling authority. New permits to be auctioned, the proceeds to be used to help administer their administration (clear identification of any new sites, subject to an environmental impact statement, oversight of amelioratiion of abandoned sites at the previous owner’s expense, monitoring to ensure any mooring or structure is accompanied by a permit). Possible use of amelioration (or performance) bonds, to ensure funds for clean-up. Restrictions on ownership of any new permits (for equity reasons, perhaps at some efficiency cost): no corporate ownership of newly issued permits? only one per individual? Limits to duration of the permit, to be auctioned when reissued, subject to these restrictions. Similar in some respects to the regulation of bathing boxes/sheds around Port Phillip Bay, but with time-limited tenure.

4. REFERENCES

See the list at the back of the paper.