REFEREED ARTICLE
Evaluation Journal of Australasia, Vol. 2 (new series), No. 1, August 2002, pp 42–50

The development and application of a non-monetary evaluation methodology for ports[1]

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Background

In May 1998, the United Kingdom Government announced a package of infrastructure, industry and human resource initiatives designed to underpin then newly concluded Belfast Agreement (Brown 1998). Central to funding a number of the infrastructure initiatives was a proposed privatisation of the Port of Belfast (Mowlam 1998) which, at that time, operated as a trust port administered by Belfast Harbour Commissioners.

This announcement followed a review which considered 'the role and status of Trust Ports in Northern Ireland with particular reference to their strategic importance to the Northern Ireland economy … [and] port operations and economic activity, accountability, constraints of statutory powers and duties, environmental constraints, financial position, performance against that of other ports and whether improvements are necessary' (Mowlam 1998). In part, this review was a response by the new Northern Ireland Assembly's Ad Hoc Committee (Port of Belfast) to the public perception that excessive profiteering might occur, and was a search for a means to protect the public interest.

As part of its submission to this review, the Belfast Harbour Commissioners (BHC) set out a number of institutional, regulatory, managerial and organisational frameworks for the Port of Belfast, including:

- a trust port (the existing structure);
- a trust port with extended powers;
- a semi-government body;
- a trade sale; and
- a public-private partnership (the recommended structure).

Following an evaluation of these options requested by the Ad Hoc Committee (1999), the government accepted the bulk of the recommendation for a public-private partnership for the Port of Belfast. This paper outlines the procedures used for that evaluation and the outcome which led to the recommendation for a public-private partnership.

Introduction

Improving the viability of ports by institutional, managerial or organisational restructuring, by deregulation, by commercialisation and/or by privatisation has been of interest to the port industry and governments alike in many parts of the world for some time (Baird 1994; Everett 1995; Hirst 1996). However, studies by the United Nations' Committee for Trade and Development, UNCTAD, have shown both that there is no such thing as a typical port and that there is no typical framework for institutional, regulatory, managerial and organisational aspects of a port (UNCTAD 1995). There are, however, variations of themes depending upon local circumstances. Consequently, there is no generally used or accepted methodology for evaluating a port.

An initial review of the present evaluation task, taking into account of the requirements to consider the institutional, regulatory, managerial and operational frameworks involved, suggested that a purely monetary economic appraisal would not have been straightforward, particularly given the non-availability of some port-specific financial information. For this reason, a methodology combining Multi-Attribute Utility Techniques (MAUT) and the UK Treasury framework (HM Treasury 1997) was specifically devised for this task.

The MAUT approach has previously been used to model and evaluate economic proposals by government, defence strategies and space developments (Zangemeister 1970), engineering (Keusch 1972), transport systems planning and airport developments (Bell, Keney & Raifa 1977), design and operational evaluation of multipurpose ships (Schmidt 1983, 1993a, 1993b), and the operation of small and medium sized ports (Schmidt & Kokkinen 1997, Schmidt et al. 1999). Insofar as is known this is the first occasion the MAUT approach has been used to model the more complex scenario of a major trading and community port.

For this evaluation, the MAUT approach was complemented by including, in the analysis, the HM Treasury analytical framework and weighting system for the derivation of a single measure of output for projects for which money is not a suitable *numeraire* (HM Treasury 1997).

This combined methodology was used to determine a numerical expression for the usefulness of the combined set of institutional, regulatory, managerial and organisational frameworks and the public interest and community utility (total utility) for each of the options suggested by the Belfast Harbour Commissioners.

In addition, given the novelty of this approach, the evaluation was extended to include a sample of port institutional, managerial and organisational restructuring and privatisation frameworks used in a number of other ports, both establishing case studies and testing the generic applicability of the appraisal method developed. The ports included in this comparative evaluation were Antwerp, Bremen, Melbourne, New South Wales (Newcastle, Lord Howe Island, Port Kembla and the Ports of Sydney), and Port Klang (Malaysia).

This combination of evaluation methodologies is transparent and enables the identification of where problems inherent in the various frameworks lie and how they could be improved. Consequently, the results of the appraisal of the options for the Port of Belfast and of the other ports were used to derive a framework for a novel and improved solution for the Port of Belfast. This improved model was then proposed to government for adoption as the form of governance for the Port of Belfast.

The port background of the appraisal methodology

This evaluation required a methodology which could be applied to distinguish between a number of options which were, to a very large extent, concerned with the ownership (control) of the port's assets and their removal from public ownership. Further, both the needs of the port community in any privatisation and the public interest concerns (including fears of the possibility of excessive profiteering) had to be respected and a solution developed to the best possible satisfaction of both interest groups. In addition, detailed financial information was either unavailable or unobtainable in the two months allowed by the New Northern Ireland Assembly for the completion of the study, so that the application of MAUT, supported by the Treasury model, appeared to offer the best way to a generic solution with a practicable application to evaluate the options whilst simultaneously safeguarding the public interest.

Improving the viability of ports by institutional, managerial or organisational restructuring, by deregulation, by commercialisation and/or by privatisation has been of interest to the port industry and governments alike in many parts of the world for some time.

Application of MAUT requires generic information, which describes as many as possible of the functions of the organisation being modelled. In this application, due to time and information availability constraints, information gathering was restricted to the institutional, regulatory, managerial and operational functions of ports and, in particular, to ports as:

- utilities providing a public service;
- managerial and organisational structures;
- regulatory bodies; and
- environmental safety and protection 'watchdogs'.

This information was gathered from the Port of Belfast and the other ports listed above. However, given the number of sources, some of this information was rather amorphous and in need of sorting, ordering and, in many cases, contextualising, for the combined data to be fully useful. This required an extensive domain knowledge of ports and of the application of multi-attribute theory, including an understanding of the relationships between entities related to port operations and management, as well as the commercial implications involved.

Using this approach the port, its institutions, management and organisational structures and assets can be categorised as a set of systems, subsystems and components which, together, provide the services the port offers to the community.

Port systems, subsystems and components act individually and in conjunction in the operation of the port. The usefulness or 'utility' of each in the overall functioning of the port can the be assessed in terms of:

- public interest;
- commercial ability/viability and development; and
- safety and environmental concerns.

Within this framework, the total service 'S' provided by a port can be described by the aggregate of the individual services provided and can be represented by a list in the form of a row vector:

$$S = (s_1, s_2, s_3, \ldots, s_j, \ldots, s_m)$$

where the individual 's_j' represents services such as pilotage, navigation and vessel traffic management services, towage, mooring, cargo handling, storage, bunkering, etc.

To provide these services, however, a port requires a number of components, or factors, including some, or all, of:

- assets, including land (territory), areas of water (aquatory), and infrastructure, suprastructure and cargo handling equipment;
- a management structure and organisation which supports and promotes commercial activities;
- regulatory powers to ensure as far as possible or, perhaps, as far as economically feasible or publicly acceptable, safe operations with respect to marine traffic, cargo handling and allied activities including environmental protection; and last but not least;
- staff and employees who are well educated and trained and who have the required specialist knowledge to provide the required service to the community.

As with the services, the total framework of a port, A, can also be described by the aggregate of the individual components (factors), a_j , and can be represented by a list in the form of a row vector:

$$A = (a_1, a_2, \ldots, a_j, \ldots, a_n)$$

In practice, however, due to interaction and hindrance, the contribution each component/factor makes to the operation of the port system, the performance attribute of the factor concerned, may be less than the ideal or maximum possible for that component/factor. The ratio between the actual and ideal performance of the j^{th} factor, then is a measure of how effectively that factor performs under the circumstances imposed by the institutional, regulatory, managerial and organisational frameworks of the port. This measure of efficiency or, better, usefulness is called the utility of the factor, and expressed as:

$$u_j = a_j/c_j$$

where:

u_j is the utility of the j^{th} factor;

a_j is the actual performance attribute of the j^{th} factor; and

c_j is the ideal performance attribute of the j^{th} factor.

Individual users and producers of port services, depending upon their needs, attach different importance (or, better, 'preference') to the services they receive and, implicitly through this, to the components of the port, which are represented by the factors 'a_j'. The aggregate importance port users and/or port managers/operators attach to each factor 'a_j' is often referred to as the 'weight' they attach to that factor (designated 'w_j'). These weights can then be used in a weighting system to derive a single measure of output for projects for which money is not a suitable numéraire (HM Treasury 1997).

It is physically impracticable to identify, measure, express and use all factors 'a_j' comprising a port system. Therefore, only those factors which have the most influence on the port's operations as a public utility were selected for inclusion in the evaluation of possible institutional, regulatory, managerial and organisational frameworks under consideration for the Port of Belfast.

In addition, the utility of each of the individual factors cannot always be readily described and expressed in monetary terms. Moreover, in a generic model, individual factors and their performance are measured in different units. There may also be factors whose performance can only be measured by their presence or absence (this is particularly applicable to the abstraction of institutional, regulatory, managerial and organisational factors) and Boolean notation may need to be included in the model to allow for these factors (i.e. 1 for 'yes', the factor is present and makes a contribution, or 0 for 'no', the factor is not present and does not make a contribution, as the case may be). In this way the generic model which may be applied to any port can be tailored to mirror the circumstances due to the institutional, regulatory, managerial and organisational frameworks which apply to a specific port, or to explore alternatives (as was done in the final part of this investigation).

Additive, multi-attribute utility theory (MAUT) applicable to this evaluation of ports[2]

For models including, say, a few dozen factors, the numerical expression of operator/user preference is not particularly difficult. However, if more factors are involved, the calculation of utility is more complex and index methods can be useful.

The preference shown by a port operator or port user for a particular system of institutional, regulatory, managerial and organisational frameworks 'A' is an expression of his or her perception of the usefulness or utility 'U' of the port in question when operating under the regime imposed by a particular set of frameworks. This perception is based upon his or her communal and/or commercial requirements. In case of a system with a multitude of components, the composite usefulness of the system would be the sum of the usefulness of the individual components.

Under specific circumstances[3], this can be represented by:

$$U(A) = u(a_1, a_2, \ldots a_j, \ldots a_n) = \sum_{j=1}^{j=n} w_j\, u_j\,(a_j) = \sum_{j=1}^{j=n} (w_j/c_j)\, a_j$$

where

$U(A)$ is the total utility of the set of components 'a_j' which comprise the frameworks of port 'A';

w_j are the weights which express user's preferences; and

u_j is the partial utility of component or factor 'a_j'.

Differentiation of this equation leads to the result:

$$\delta U = \delta u(a) = \delta \sum_{j=1}^{j=n} w_j\, u_j\,(a_j)$$

$$= \sum_{j=1}^{j=n} w_j\, \delta u_j\,(a_j) = \sum_{j=1}^{j=n} (w_j/c_j)\, \delta a_j$$

so that the change in the total utility due to changes in any attribute can be estimated by:

$$(\delta U)_j = w_j \delta u_j = (w_j/c_j)\, \delta a_j$$

The institutional, regulatory, managerial and organisational framework of each port has its own characteristics influenced by local circumstances and by the flows of ships, land vehicles and commodities through the port. It influences the port's operation, which forms a solution to a local problem and offers a service to satisfy a local demand. As such it is nothing more than a specific way in which a port service can be provided. More generally, it is an alternative as to how a port service can be provided.

This capacity to calculate the utility or usefulness of a specific set of frameworks for the ownership and management of a port's assets, operations, commercial viability and an environmental safety provides a tool for evaluating and ranking alternative frameworks for that port. For example, given a set of possible frameworks, A_i, each with an associated utility, U_i, it is possible to conclude that framework A_p is preferable to framework A_q if:

$$U_p > U_q$$

or, that the alternative frameworks are equally preferred if:

$$U_p = U_q$$

The practical application of MAUT requires the components or factors of the system under investigation to be:

- associated with expressions for user preferences; and
- arranged in a multi-dimensional hierarchy (sometimes referred to as a 'concern net').

Expressions for user preferences, which denote the usefulness or utility of components, 'a_j', as perceived by public interest, port operators and port users, can be derived by:

- the port analyst;
- a set of port operators or users in conjunction with the appropriate questionnaire. The response to the questions would need to be statistically analysed to determine a general opinion if one can be identified; or by
- individual port operators or users to specifically represent the circumstances of the port or port customer concerned.

Development of the appraisal model

During modelling, particular consideration was given to the brief provided by the Ad Hoc Committee, and the objectives of the investigation, which required the:

- development a method for non-monetary appraisal;
- evaluation of the options proposed by the Belfast Harbour Commissioners (BHC);
- identification of relevant case studies; and
- development of possible alternatives.

To be of practical, industrial use, the method of non-monetary appraisal had to take account of the functions of a port, and its institutional, regulatory, managerial and operational framework, as:

- a utility providing a public service;
- a managerial and organisational structure;
- a regulatory body; and
- an environmental safety and protection 'watchdog'.

The port as a utility

The physical infrastructure required for a port to provide a public utility (or, indeed, any utility) are port assets and land. What concerned the Ad Hoc

Committee, however, was who owns and controls these port assets and land in the best public interest, given the various institutional, regulatory, managerial and operational frameworks inherent in the options proposed by BHC and others. Both public interest and the implied management of port assets and land are related to their ownership, development and maintenance.

Port assets include:

- port infrastructure – roads, railway spurs, parking, marshalling and storage areas, aprons and quays. The land beneath the port infrastructure is a separate issue and considered under the factor of land;
- port aquastructure – the wet areas in harbour basins, manoeuvring basins, channels and fairways;
- port suprastructure (sometimes referred to as superstructure) – office buildings, terminals, sheds, warehouses, etc.;
- cargo-handling equipment – cranes, conveyors and cargo handling vehicles;
- land access to the port – the road, rail and inland waterway connections between the port boundary and the national road, rail and inland waterway networks; and
- maritime access to the port – approaches, fairways and channels connecting the shipping lanes with the port.

Land denotes the land controlled by the port, and includes:

- land for port development;
- land for industrial development, that is, activities related to manufacturing rather than port and freight transport related activities;
- land for commercial development; and
- land for nature conservation.

Again, public interest and implied management of these assets was queried through the factors of ownership, development and maintenance — who is best suited to own, develop and to maintain the asset required to provide the public utility of the port.

Port management and operation

Without appropriate management and operation, assets may be used inefficiently or inappropriately with the result that service levels, and usefulness to the community, may be wanting. The factors of Management and Organisation describe the functions which control the efficient and effective use of port infrastructure, and for convenience have been considered as including the related factors of:

- Operating as a Comprehensive Port – the port carries out all activities connected to the flows of ships, land vehicles and cargoes by itself. This does not apply to the Port of Belfast, but as the appraisal method has to be applied to other ports where the port operates comprehensively, this had to be included.
- Operating as a Landlord Port – the port can:
  - give concessions to private industry such as stevedores;
  - develop and lease complete operational facilities to terminal operators;
  - lease land (with or without infrastructure) to other entities as part of a BOOT scheme[4].
- Commercial freedom – the port has the ability to enter into joint ventures and to acquire assets, which assist the port to both diversify and expand its port-related activities. This will enable the port, and community, to establish value-adding activities and services.
- Finance and investments – the port may have or require the ability to draw on either or both public and private (commercial) sources of capital, including:
  - retained earnings;
  - Treasury appropriations, government loans, government securities; and
  - commercial sources of finance and debt – modern ports require continuous investment in expensive new assets to keep pace with advances in shipping and cargo-handling technology; Trust and some publicly owned (corporatised) ports do not necessarily have access to public sector finance and may be restricted by statute to commercial sources of finance.
- Property development – technical developments including:
  - containerisation and similar advances offering economies of scale and scope;
  - larger vessels;
  - shorter turnaround times requiring larger and more efficient cargo handling facilities;
  - 'hub' ports (fewer, larger ports acting as inter-modal exchanges with packed containers received from and dispersed to hinterland cargo depots); and
  - associated industrial parks (estates)

  require that ports acquire and develop land holdings and associated multi-modal transport access corridors.
- Vertical and horizontal integration – ports can add/gain value and contribute to general economic development by diversifying into complementary transport and logistics systems (vertical) and by joining with shipping lines and adjacent ports (either by partnering or by acquisition) to provide additional services (horizontal).
- Public interest – public interest issues can arise from a number of factors including:

- employment – ports employ labour (managerial, professional, skilled and unskilled) either directly, or indirectly through industries servicing the port or the port-related value chain; associated factors can include labour unions and professional associations, job creation, training and development;
- governance – the governance of the port can be a matter of significant public interest with factors ranging from composition of the Board (representation of business and community) to the impact of Board and operational decisions on employees (who live locally), suppliers of goods and services (both directly to the port and to other business in the port value chain[5], importers and exporters, shareholders (if any) and the general community. Ports are heavy industries and can impact significantly on surrounding amenity;
- government and/or community ownership – some countries/communities regard ports to be important assets both for strategic reasons and for the income stream (cash flow, dividends and taxation) they can produce. Various models of government involvement in otherwise commercial entities exist around the world, including: 'golden share' – the government shareholding carries voting/control rights significantly in excess of the size of the share holding; and government veto – the government retains rights to direct or veto so that certain actions can be required or prohibited even where the port would be acting in a normal commercial manner. This format is sometimes implemented to protect the whole, or sections of the community where the port is a natural monopoly;
- accountability – governments may require arrangements to ensure that the port is accountable to additional stakeholder groups beyond the normal accountability to shareholders.

Regulation, safety of navigation and environmental protection

The third and fourth functions, which need to be considered in the development of this non-monetary port appraisal methodology relate to:

- The port as a regulatory body – depending on central government, ports may have direct, indirect or delegated authority and responsibility to comply with, and enforce, international, national and local requirements for, among others things, safety of life at sea, protection of seafarers, vessel safety (survey and classification), state port control and quarantine.
- Safety of navigation – for obvious reasons, ports are required, potentially in conjunction with national and international safety regimes, to ensure the safety of navigation within, and outside of the port. This can involve the provision of services and infrastructure (either directly, or indirectly, or as a licensing or regulatory agency) including navigation aids, vessel traffic control, pilotage, towage and escort, and mooring services.
- Protection of the environment – depending on central government, ports may have direct, indirect or delegated authority and responsibility to comply with, and enforce, international, national and local requirements for protection of the environment, including laws and agreements in relation to the prevention and clean-up of pollution by oil and by other hazardous, noxious and quarantine substances.

Utilising this understanding of the factors describing a port, and using derived categorical relationships between these factors, a six-level hierarchical data structure (concern net) was developed.

The determination of factor references or weights

Central to the development of a method for the non-monetary appraisal of institutional, regulatory, managerial and organisational frameworks for ports is the identification of:

- the most appropriate form of governance for the port; and
- the form and structure of the body most suitable to manage the port assets and land so as to efficiently, economically and safely provide the services of the port, and to safeguard the public interest.

With this foremost in mind, the factors in each cluster were assigned the basic weight of 20; an arbitrary number which both offers reasonable discrimination to express the relative importance of each factor within its cluster and permits subsequent reductions and increases. The relative weight then assigned to each factor, and estimates of the actual and ideal performance attributes for those factors, was based on information supplied by port staff and researchers with domain knowledge and understanding of the port industry as well as years of experience of taking an active part in port operations and contract research into this and related subjects at both national and international level (see for example Bunce, Schmidt & Smyth 1999, Schmidt, et al. 1999).

An example of the determination of weights is included in Table 1.

Once this weighting for relative importance was established, cluster and level preferences could be computed. The computation of level preferences synthesised the non-monetary evaluation method and enabled the derivation of a single measure of output in accordance with the methodology of the HM Treasury 'Green Book' and MAUT.

TABLE 1: FIRST EXAMPLE OF THE DETERMINATION OF CLUSTER, NORMALISED CLUSTER AND LEVEL PREFERENCES

Level 1	CP	NCP	LP	Level 2	CP	NCP	LP
Port	1	1	1				
				Utility	20	0.285714	0.2857143
				Port management and operation	40	0.571429	0.5714286
				Port regulatory body	10	0.142857	0.1428571
Preference sum (cluster and level)	1	1	1		70	1.000000	1.0000000

CP – cluster preference; NCP – normalised cluster preference; LP – level preference

A single non-monetary measure of total utility: application to port operational frameworks

Once the non-monetary appraisal system was completed, it was used to evaluate each of the sets of frameworks of the ports under consideration. A single measure of output or total utility was produced for each of the test ports offering case studies and for each of the options proposed by the Belfast Harbour Commissioners. These measures of total utility could be ranked and the utility from the public interest point of view of each port under consideration could be compared. Of particular interest was the ranking of the various options proposed by the Belfast Harbour Commissioners achieved and how they compared with other port systems or options.

The outcomes of the evaluation for each of the options for the Port of Belfast proposed by the Belfast Harbour Commissioners are shown in Table 2. The outcomes of the evaluation for each of the case studies of other ports are shown in Table 3.

The analysis suggests that, of the options identified by the Belfast Harbour Commissioners, and analysed using MAUT, the proposed framework of a semi-government body appears to be the most favourable from the public interest point of view.

Looking at the numerical values of 'utility' in Tables 2 and 3, it is evident that none of the frameworks of the port considered with the exception of the semi-government body outperforms the public-private partnership (PPP) proposed by the Belfast Harbour Commissioners. It has to be noted that due to the relatively large differences between the total utilities achieved by the system and the severe shortage of time in which the evaluation had to be carried out, conducting a sensitivity analysis had to be forgone.

When applied in conjunction with the concern net, the methodology of MAUT described above becomes transparent as only the factors within the net and their individual influence on the system

TABLE 2: THE UTILITY OR USEFULNESS OF OPTIONS PROPOSED BY BHC

Options investigated and associated expressions of usefulness

Port	*Option*	*Utility* [6]
Port of Belfast	Semi-government body	0.587795
	Public-private partnership (original proposal)	**0.562725**
	Trade sale – private port	0.513513
	Trust port with extended powers	0.460743
	Trust port – status quo	0.362529

TABLE 3: UTILITIES OR USEFULNESS OF CASE STUDY PORTS

Case study ports and associated expressions of usefulness

Port	*Option*	*Utility* [6]
Port of Antwerp	Municipal port with joint venture capability	0.522987
Port of Bremen	Municipal port – Hanse model	0.433498
Port Klang	Joint venture (the Malaysian model)	0.521543
Port of Melbourne	Public sector landlord (Australia)	0.385768
New South Wales ports	Corporatised ports (Australia)	0.481937

under consideration are examined. It can be used to identify the reasons for possible deficiencies by reviewing the partial and weighted partial utilities of factors. It is also possible to use the appraisal method in reverse and to develop a set of institutional, regulatory, managerial and organisational frameworks for ports, which incorporate the best of all the options investigated, subject to suitability according to local circumstances and requirements. This was indeed done to determine an alternative form of governance for the Port of Belfast, which provides greater utility than all the options considered at that time.

Development of a possible alternative solution

The terms of reference provided by the Ad Hoc Committee included the requirement to develop an alternative solution or solutions. Based upon previous experience with successful applications of MAUT to develop alternate solutions (Schmidt 1983, 1993a), the generic net and results for the initial options were reconsidered. By exploring the dependence of the total utility on individual factors it was possible to explore alternatives, which might lead to a more favourable total utility. In fact such a possible solution was found by combining the need to safeguard public interest (the aim of the Ad Hoc Committee) and the need for commercial freedom and flexibility in financing and diversification (the aim of the BHC). The better solution identified by this process was that of a public-private corporation, operated according to commercial principles, registered and floated on the stock exchange. Table 4 indicates the MAUT assessment of total utility for such a framework.

TABLE 4: THE UTILITY OR USEFULNESS OF THE SUGGESTED PUBLIC-PRIVATE CORPORATION

Recommendation for the Port of Belfast and associated expressions of usefulness

Port	*Option*	*Utility* [6]
Port of Belfast	Public-private corporation – public limited company	0.623472

The improved solution was obtained by selecting the factors of the generic hierarchal net that showed the highest weighted partial utility. The complete analysis had to be done without making any changes to the generic net or to the preferences allocated to the factors within it, as this would change the conditions under which the analysis or evaluation took place. Only under these circumstances has the application of the reverse methodology validity and comparability the previously obtained solutions. The factors in the net, in conjunction with their weighted partial utilities, are used like building blocks and the aim is to find a combination of factors of the generic net which hopefully produce a more favourable result. In this case, an improvement of more than 10% was achieved.

The diverse nature of the entities that make up a port, its institutional, regulatory, managerial and operational frameworks, and the large number of conflicting interests (including the public interest in the port as a public utility) made a traditional economic appraisal impossible.

As a consequence the research team advised the Ad Hoc Committee that a Public Private Corporation appeared to provide a governance structure for the Port of Belfast which best met their aims and those of the Belfast Harbours Commissioners (Bunce, Schmidt & Smyth 1999).

Conclusions

The task set by the Ad Hoc Committee was to evaluate the options proposed by the Belfast Harbour Commissioners for the privatisation of this port and to provide comparisons with other ports.

The diverse nature of the entities that make up a port, its institutional, regulatory, managerial and operational frameworks, and the large number of conflicting interests (including the public interest in the port as a public utility) made a traditional economic appraisal impossible. This was particularly evident, both because the financial information which would have been needed was unavailable within the time allowed, and a because many of the entities involved in a port and its operation can neither be expressed in monetary terms nor are there comparable units in which to measure them. For this reason, and based upon the successful application of similar work applied to the modelling and evaluation of smaller ports (Schmidt Schmidt & Smyth 1999), a combination of multi-attribute utility techniques and the non-monetary appraisal method proposed by HM Treasury was used.

The results of the non-monetary appraisal, and of comparisons with similar ports in other countries, indicated that a public-private corporation (PPC) would provide the best outcome, both safeguarding the public interest in the ownership of trust port assets and in ensuring the viability of the port as a public utility. To this end it was also proposed that:

- any suggested changes should be carried out with as little disruption to the daily business of the port and particularly the port customers as possible;
- existing institutions and organisations familiar with the working of the port and with which

port customers and the public are familiar should continue should be utilised;

- the regulatory activities of the port are to be divorced from the commercial ones;
- the ownership of the port land should remain in trust with an independent statutory authority: it was suggested the Belfast Port Authority should act as a public landlord;
- a PPC would be set up, floated on the stock exchange and entrusted with the commercial operation of the port; and
- ownership of infrastructure would be divorced from ownership of land.

This PPC model for a set of institutional, regulatory, managerial and organisational frameworks was endorsed in the Report of the Ad Hoc Committee (Belfast Port) (1999) and with minor amendments has been recommended to the Secretary of State and the New Northern Ireland Assembly for adoption.

Notes

1 The Editors acknowledge the technical assistance of Dr Herbert Stock of the Flinders Institute of Public Policy and Management in the finalisation of this paper.

2 For ease of reading only a simplified summary of MAUT is presented here. Interested readers are referred to Zangemeister (1970) and/or Bunce, Schmidt, and Smyth (1999) for a more rigorous, detailed exposition [Editor].

3 These include the validity of the assumptions that:
   - the overall utility can be determined as the sum of the individual utilities;
   - each factor has an ideal value or criterion;
   - the individual factors are independent of each other; and simple relationships exist between the individual factors such that the set of factors adequately characterises the port.

4 In a BOOT scheme the lessee Buys, Owns and Operates facilities for the duration of the lease and at the expiry of the lease Transfers the facilities to the lessor against financial consideration. BOOT schemes are attractive to public sector landlords because the private sector finances and operates the infrastructure (and assumes much of the risk). Ports may, and do, participate in BOOT schemes through joint ventures [Editor].

5 The extent of, and value added by, this value chain is often surprising – see *Warehouse to wharf: efficiency of the interface between seaports and land transport,* report from the House of Representatives Standing Committee on Transport, Communications and Infrastructure (Australia), AGPS, Canberra, April 1992 [Editor].

6 The total utility of a port in a generally applicable MAUT framework is usually normalised so that the maximum possible utility is 1. However, only a selected number of factors from the generic concern net are needed to describe any one port, therefore calculated total utilities (after normalisation) are normally considerably less than 1. A calculated value around 0.5 or so is quite normal (Zangemeister 1970).

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