Ports Corporation of Queensland (PCQ)
Economic Impact Study
2006/07

A report prepared for

Ports Corporation of Queensland (PCQ)

Prepared by

econsearch

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As required by the terms of reference, this study follows the analytical framework detailed in the Bureau of Transport Economics' 2000 report, *Regional Impacts of Ports* and the previous report prepared by EconSearch, *Ports Corporation of Queensland Economic Impact Study 2001/02.*

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Abbreviations

ABS	Australian Bureau of Statistics
BTE	Bureau of Transport Economics
DBCT	Dalrymple Bay Coal Terminal
GSP	gross state product
fte	full-time equivalent
MSQ	Maritime Safety Queensland
PCQ	Ports Corporation of Queensland
QSL	Queensland Sugar Limited

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Executive Summary

Role and Impact of Ports

The operation of a port generates employment and income for the local community, as well as flow-on effects to other local industries. In addition, all levels of government receive revenue from taxes and other charges on these activities.

In recent years, there has been increased pressure across Australia to restrict the scope of port activities in response to changing perceptions (real or otherwise) about the pollution generated by ports and the contribution to congestion on main roads. Such restrictions can reduce the efficiency of a port and the competitiveness of shippers that use the port. There may also be adverse effects on local income and employment.

Port economic impact studies can contribute to a balanced assessment of the role of ports and to informed consideration of issues such as port planning (Bureau of Transport Economics 2000).

PCQ Ports

Ports Corporation of Queensland (PCQ) is a Government owned corporation charged with the responsibility of developing and managing eight trading ports, two community ports and three non-trading ports around Queensland. PCQ's ports handle bulk shipments of coal, zinc, bauxite, silica sand, sugar, molasses, woodchips, livestock and general cargo.

PCQ is one of Australia's largest port authorities in terms of tonnage throughput and revenue earned. More than half of Queensland's exports (by tonnage) pass through PCQ's ports.

The Corporation is primarily focussed on strategic issues and infrastructure development within its ports, as well as emergency response planning and protection of the environment. PCQ utilises outside service providers for stevedoring, towage and pilotage operations.

Conduct of the Study

The study of the PCQ ports was undertaken using the general framework for port impact studies developed by the Bureau of Transport Economics (2000). The study in part is an update of an earlier impact assessment which provided estimates of the economic impact of the port in 2001/02 (EconSearch 2003).

The study aimed to measure the **economic impact** of port-related activity. For the purposes of this study, port-related activity was defined as the activity undertaken by firms and organisations in moving cargo through the PCQ ports and in providing goods and services to directly facilitate the movement of cargo through the port. Port impact was measured in terms of output, value added, household income and employment (refer to the Glossary for definition of these measures).

The estimates of the **economic impact** cover the direct effects of the port and the subsequent flow-on effects to other sectors of the regional economy. A survey with responses from 30 organisations involved in PCQ ports-related activity provided the majority of the data for estimating the direct effects. An input-output table for Queensland was used to calculate the flow-on effects to other industry sectors.

Estimates of Economic Impact

Table 1 presents estimates of the economic impact of the PCQ ports, in terms of the direct and flow-on effects.

Direct effects

The direct impact of port-related activity on output, value added, household income and employment is shown in the first column of Table 1. The value of output, estimated to be $575 million, is the sum of gross business revenue of firms defined as port-related and gross expenditure by port-related government, semi-government and non-profit organisations. These are revenues generated and expenditure incurred in Queensland.

The value added from port-related activity was estimated to be $238 million. This represents approximately 0.13 per cent of Queensland's estimated gross state product for 2006/07.

Direct employment (full-time equivalents) was estimated to be 1,811 and corresponding household income was $99 million. This indicates an average gross annual income of around $55,000 for those employed in firms and organisations engaged in port-related activity.

Table 1 Economic Impact of the PCQ ports, 2006/07

Measure	*Direct effects*	*Flow-on effects*	*Total Impact*
Output ($m)	575.4	565.2	1,140.6
Value added ($m)	238.4	268.2	506.7
Household income ($m)	99.0	130.5	229.5
Employment[a]	1,811	2,557	4,368

a. Number of jobs (full-time equivalent).

Source EconSearch analysis.

Flow-on effects

The flow-on effects of port-related activity to other sectors in the Queensland economy were estimated to total over $565 million in output and $268 million in value added, more than 2,550 jobs and $130 million in corresponding household income.

Finance and business services, wholesale and retail trade and manufacturing are the three sectors where port-related activity has the largest impact. For all four measures of economic impact (output, value added, employment and income), approximately 50 per cent of the total flow-on effect occurred in these three sectors. For employment, the combined impact in these sectors was approximately 60 per cent (1,523 jobs) of the total employment flow-on from port-related activity (2,557 jobs).

Total economic impact

The PCQ ports generated a total economic impact on the Queensland economy of $1.14 billion in output in 2006/07.

Value added attributable to the operation of the port was almost $507 million. This was equivalent to approximately 0.3 per cent of gross state product in 2006/07, which provides a measure of the overall level of economic activity in Queensland.

Household income generated by the operation of the port totalled almost $230 million. Employment was estimated at around 4,368 jobs (full-time equivalent), which represented 0.2 per cent of total employment in Queensland.

There were 1,951 ship visits to the PCQ ports by commercial cargo vessels in 2006/07. The results of the analysis indicate that, on average, each ship call at the PCQ ports involved the following impact on the economy of Queensland:

- $585,000 of output;
- $260,000 of value added;
- $118,000 of household income; and
- 2.2 full-time equivalent jobs for one year.

Detailed Economic Impact Measures

Estimated economic impacts have been disaggregated to identify the relative contribution of the individual port functions and cargo types (Table 2).

Port functions

The largest impacts occurred in the *ship loading and unloading* sector, which includes bulk cargo handling facilities and terminal operation. The value of services provided by this sector was $234 million, with flow-ons to other sectors in the economy of almost than $230 million giving a total output impact of over $460 million (Table 2). The total employment impact of this sector of just under 1,900 is comprised of a direct employment component, measured at over 830, and flow-on employment in other sectors, estimated to be approximately 1,030. Associated household income, direct and flow-on, was estimated to be $97 million during 2006/07.

The *land transport* sector, which includes road and rail transport and storage, had levels of impact around two-thirds the size of the ship loading and unloading sector. Direct and flow-on employment in the land transport sector accounted for an estimated 1,260 full-time equivalent jobs, earning approximately $66 million in household income. Direct and flow-on value added was estimated at over $147 million.

The *ship operations and movement* sector includes the activities of shipping lines, ship managers, ship repairs and maintenance, bunkering and provedoring as well as towage, pilotage and shipping agents. Direct and flow-on employment in this sector accounted for an estimated 803 full-time equivalent jobs, earning over $43 million in household income. Direct and flow-on value added was estimated at just under $85 million.

Table 2 Detailed measures of the economic impact of the PCQ ports, 2006/07

Component	*Output ($m)*	*Value added ($m)*	*Household income ($m)*	*Employment no.*
Function				
Port administration	122.2	60.5	16.4	296
Ship operations	187.1	84.6	43.6	803
Ship loading/unloading	462.8	198.1	96.9	1,872
Land transport & storage	340.7	147.4	66.3	1,260
Government agencies	27.7	16.1	6.3	136
Total	*1140.6*	*506.7*	*229.5*	*4,368*
Cargo Type				
Coal	819.4	363.5	163.8	3,117
Sugar & Molasses	77.2	33.6	15.9	305
Silica	15.4	7.2	3.4	66
Bauxite	117.7	52.7	23.7	450
Lead & Zinc	71.2	31.7	14.5	276
General Cargo	39.6	17.9	8.2	155
Total	*1140.6*	*506.7*	*229.5*	*4,368*

Note Components may not sum to totals due to rounding.

Source EconSearch analysis.

The *port administration* sector provided services valued at around $67 million, with flow-ons to other sectors in the economy of $55 million (total of $122 million). Employment in the sector was measured at 48 with associated household income of $3.5 million. Flow-on employment in other sectors was estimated to be 250, earning around $12 million in household income during 2006/07.

The port-related activity of *government agencies* comprises a minor component of the total port impact.

Cargo type

Although around 57 per cent of the PCQ ports' total ship visits were *coal* ships, over 70 per cent of the ports' economic impact was related to coal: the equivalent of 1,280 people directly employed in coal-related Port activity and around 3,118 jobs when indirect effects are included.

Bauxite accounted for 18 per cent of all ship visits. The relatively low input intensive loading and unloading operations meant that this cargo group provided approximately 10 per cent of the total economic impact.

Lead and zinc accounted for around 6 per cent of ship visits. In terms of output, added, employment and household income this cargo group provided approximately 6 per cent of the total economic impact. A similar result was estimated for the *sugar and molasses* group with less than 3 per cent of ship visits and 6 to 7 per cent of the total economic impact.

General cargo (including fuel and live cattle) accounted for 13 per cent of total ship visits to the PCQ ports in 2006/07. Because these are generally smaller vessels the overall impact of this cargo group was disproportionately small. In terms of output, value added, employment and household income, the general cargo group provided around 3.5 per cent of the total economic impact.

Silica accounted for around 2 per cent of ship visits. In terms of output, value added, employment and household income this cargo group provided 1.5 per cent of the total economic impact.

Regional Ports

Estimated economic impacts were also disaggregated to identify the relative contribution of the individual ports (Table 3).

Table 3 Economic impact of the PCQ ports by regional port, 2006/07

Regional port	*Output ($m)*	*Value added ($m)*	*Household income ($m)*	*Employment no.*	*Vessels no.*
Hay Point	665.5	292.8	135.9	2,592	971
Abbot Point	154.0	70.7	27.9	525	149
Lucinda	34.4	14.9	7.1	135	20
Mourilyan	42.9	18.7	8.8	169	31
Cape Flattery	15.4	7.2	3.4	66	37
Weipa	124.4	55.8	25.2	478	443
Karumba	80.9	35.9	16.6	315	122
Thursday Island	23.2	10.6	4.6	86	178
Total	*1,140.6*	*506.7*	*229.5*	*4,368*	*1,951*

Note Components may not sum to totals due to rounding.
Source EconSearch analysis.

The coal trading ports of *Hay Point* and *Abbot Point* have by far the largest impacts of all the ports managed by PCQ. Hay Point alone accounted for around 58 per cent of the total economic impact of PCQ ports in 2006/07. Abbot Point contributed approximately 13 per cent of the total and *Weipa* accounted for around 11 per cent of the economic impact (although over 22 per cent of ship visits).

Karumba contributed around 7 per cent of the total impact and accounted for 6 per cent of total ship visits. The sugar ports of *Lucinda* and *Mourilyan* contributed 3.0 and 3.8 per cent of total impact, respectively although both accounted for little more than 1 per cent of ship visits each.

Similarly, the *Cape Flattery* impact was relatively small at around 2 per cent in terms of both impact and ship visits. *Thursday Island*, which exclusively handles small, general cargo vessels, contributed less than 2 per cent of the total impact but accounted for over 9 per cent of total vessel numbers.

Interpreting the Results

The estimates of economic impact from this type of analysis indicate the general magnitude of effects associated with the port's activities. They do not provide precise estimates, as only approximate data were available for some parts of the analysis.

The results of the study provide estimates of the impact attributable to activities required for the movement of ships and cargo through the port. They do not indicate net economic benefits, technical efficiency, competitiveness, trade facilitation effects or the contribution of port infrastructure to regional development.

1. Introduction

1.1 Background

The role of ports is to provide the point of interface between land and sea transport in the transportation of cargoes in coastal and international trade. Ports facilitate inter-state and international trade by providing important elements of the basic infrastructure and services necessary for cargo shipping and exchange.

The provision of this infrastructure and the general operation of a port generates employment and income for the local community, as well as flow-on effects to other local industries. In addition, all levels of government receive revenue from taxes and other charges on these activities.

In recent years, there has been increased pressure across Australia to restrict the scope of port activities in response to changing perceptions (real or otherwise) about the pollution generated by ports and the contribution to congestion on main roads. Such restrictions can reduce the efficiency of a port and the competitiveness of shippers that use the port. There may also be adverse effects on local income and employment.

Port economic impact studies can contribute to a balanced assessment of the role of ports and to informed consideration of issues such as port planning (Bureau of Transport Economics 2000).

1.2 Study brief

With this in mind, the Ports Corporation Queensland contracted EconSearch Pty Ltd to undertake an Economic Impact Study of the PCQ ports. Julian Morison and Lisa Rippin of EconSearch undertook the study. The study updates the previous estimates prepared by EconSearch (2003) which provided economic impacts for 2001/02. The requirements of the study were as follows:

Impact of the PCQ ports on the Queensland economy - BTE Framework

1. The study must utilise the general framework and methodology set out in Bureau of Transport Economics (2000) *Regional Impacts of Ports*, Report No. 101, BTE, Canberra.
2. The impact measures should be calculated in terms of:
    - Output;
    - Value-added;
    - Household income; and
    - Employment.
3. The impact measures should be able to be disaggregated in terms of:
    - Port function (i.e. the major activities undertaken within the port – Port administration, ship operation, cargo handling, land transport, etc.);
    - Cargo type (coal, sugar, general cargo, etc.); and
    - Regional port

1.3 Study aims

One of the key objectives of the project was to assess the direct and indirect economic impact of the movement of cargo through the PCQ ports (the economic impact). The income and expenditures of the Ports Corporation of Queensland, of firms engaged in port-related activity and of firms transporting freight to and from the port comprise the direct economic impact.

These direct impacts were used as a basis for assessing the indirect economic impacts of port-related activity. All economic impacts were measured in terms of household income, output, value added and employment.

The economic impacts were disaggregated by major port function which are listed below.

- Administration
- Ship operations
- Ship loading and unloading (including cargo services)
- Land transport and storage
- Government agencies

The economic impacts were also disaggregated by cargo type, consistent with the analysis in the previous study. These are:

- Coal
- Sugar and molasses
- Silica
- Bauxite
- Lead and zinc
- General cargo

The disaggregation of impacts by port function and cargo type, as described above, is consistent with that used in the Bureau of Transport Economics (2000) port impact framework.

The economic impacts were also disaggregated by each of the regional ports. These are:

- Hay Point
- Abbot Point
- Lucinda
- Mourilyan
- Cape Flattery
- Weipa
- Karumba
- Thursday Island

1.4 Port-related activity defined

For the purpose of measuring the impact of *port-related activity* on the economy, i.e. the economic impact of a port, it is necessary to have a clear definition of what comprises such activity.

Port-related activity is the activity undertaken by firms and organisations in moving cargo through the PCQ ports and in providing goods and services to directly facilitate the movement of cargo through the port.

Included under this definition are firms that provide various maritime services such as transport firms, stevedoring companies, bulk cargo handling facilities and shipping agents. However, users of the port are not included. For example, manufacturing firms, distributors and retailers that import and export goods through the port in the course of their business, although dependent on the port to move their cargo, are not considered to be firms directly involved in *port-related activity*[1][2].

1 Some port users are involved in cargo loading and unloading, for example, and the expenditures associated with this part of their operations are included in the analysis.

2 Activities related to commercial fishing and recreational boating are excluded from the definition.

2. The PCQ Ports

Ports Corporation of Queensland (PCQ) is a Government owned corporation charged with the responsibility of developing and managing seven trading ports, two community ports and four non-trading ports around Queensland. PCQ handles bulk shipments of coal, zinc, bauxite, silica sand, sugar, molasses, livestock and general cargo.

Ports Corporation of Queensland (PCQ) is one of Australia's largest port authorities in terms of tonnage throughput and revenue earned. More than half of Queensland's exports (by tonnage) pass through PCQ's ports. In 2006/07, PCQ recorded a 4.5 per cent increase in trade on the previous year, establishing a new record. The Port of Hay Point retained its position as the world's largest coal export port, with 86.2 million tonnes of coal exported. (PCQ 2007a).

The Corporation is primarily focussed on strategic issues and infrastructure development within its ports, as well as emergency response planning and protection of the environment. PCQ utilises outside service providers for stevedoring and towage operations.

2.1 Infrastructure, facilities and port-related activity

PCQ has responsibility for multiple port locations that handle a variety of cargoes. PCQ controls:

- Trading ports: Hay Point, Abbot Point, Lucinda, Mourilyan, Cape Flattery, Weipa, Karumba
- Community ports: Thursday Island, Quintell Beach
- Non-trading ports: Maryborough, Cooktown, St. Lawrence, Burketown.

The trading ports handle bulk export commodities, while the community ports supply neighbouring populations with essential general cargo and fuel. The non-trading ports are held for strategic purposes should a commercial need emerge. The main uses of PCQ managed ports are summarised in Table 2.1.

Table 2.1 Main uses of PCQ managed ports

Port	Port uses include
Hay Point	Coal
Abbot Point	Coal
Lucinda	Sugar
Mourilyan	Sugar, Molasses, Livestock
Cape Flattery	Silica sand
Weipa	Bauxite, Livestock, Fuel, General Cargo
Karumba	Zinc, Lead, Fuel, Livestock, General Cargo
Thursday Island	General Cargo
Quintell Beach [a]	General Cargo
Skardon River [a]	Mineral additives (kaolin)

[a] Impacts of trade through these ports are not included in this study.

Source PCQ (2007c).

As noted earlier, the firms and organisations involved in port-related activity can be grouped according to their function. These are detailed in Table 2.2. A brief explanation of each group is provided below.

(1) Administration

This function is comprised of general port management and operations. This function comprises the activities of the Ports Corporation Queensland.

(2) Ship operations

Three sub-groups make up the shipping group. The first of these relates to the activities of shipping lines and agents. The local expenditures incurred by these companies in the operation of their business comprise part of the shipping component of port-related activity.

The second sub-group relates to moving the ships into and out of the port. This includes pilotage, towage, linesmen services and mooring and unmooring.

The third sub-group includes services provided to ships while they are in the port. Firms providing these services include ship chandlers and provedores, ship repairers and oil bunkering companies.

(3) Ship loading and unloading, cargo services

This group relates to the movement of cargo on and off the ship. For containers and other general cargo, this generally involves moving the cargo across the wharf and onto (or off) some form of land-based transport (road or rail). This type of cargo movement is undertaken by stevedoring companies. Bulk cargoes (oil, chemicals, gas, etc) are generally moved through specialised facilities, sometimes owned and operated by the importing/exporting firm. Cargo services relates to customs agents, freight forwarders and fumigation services.

(4) Land transport and storage

This group comprises the activities of the railways and road transport firms in moving cargo to and from the port. Only expenditures directly related to cargo moving through the port are included in this component of port-related activity. Port related storage is also included in this category.

(5) Government agencies

This group includes cargo inspection and regulation (customs, quarantine and environmental inspections) as well as ship safety.

Table 2.2 Definition of port functions

Port industry group	*Components*
Port administration	Planning, co-ordination & promotion Land and property management Safety and emergency response Port maintenance Dredging
Ship operation, ship movement	Shipping lines Ship managers Ship repairs and maintenance [a] Bunkering Ship chandlers/provedores [b] Marine and cargo surveyors Waste disposal Shipping channels Navigation aids Ship agents Towage operators Pilots Mooring/unmooring services [c]
Ship loading/unloading, cargo services	Wharves, berths, jetties, etc. [d] Stevedoring (non-bulk) Bulk cargo loading/unloading Passenger terminals Customs agents Freight forwarders Container packing/unpacking Container parks Fumigation
Land transport and storage [e]	Road transport Rail transport Storage facilities
Government agencies	Customs Quarantine Ship safety [f]

a. Only for vessels in the port for the purpose of bringing in or taking out cargo or passengers.

b. Supply of stores and provisions to ships. Excludes supplies to commercial fishing or recreational boating sectors.

c. Includes linesmen and launch service.

d. Construction and maintenance.

e. Port-related activities only. Involves movement of cargo within the port and between the port and closest inland points (e.g. warehouses, bonded storage).

f. Australian Maritime Safety Authority.

2.2 Cargo and trade patterns

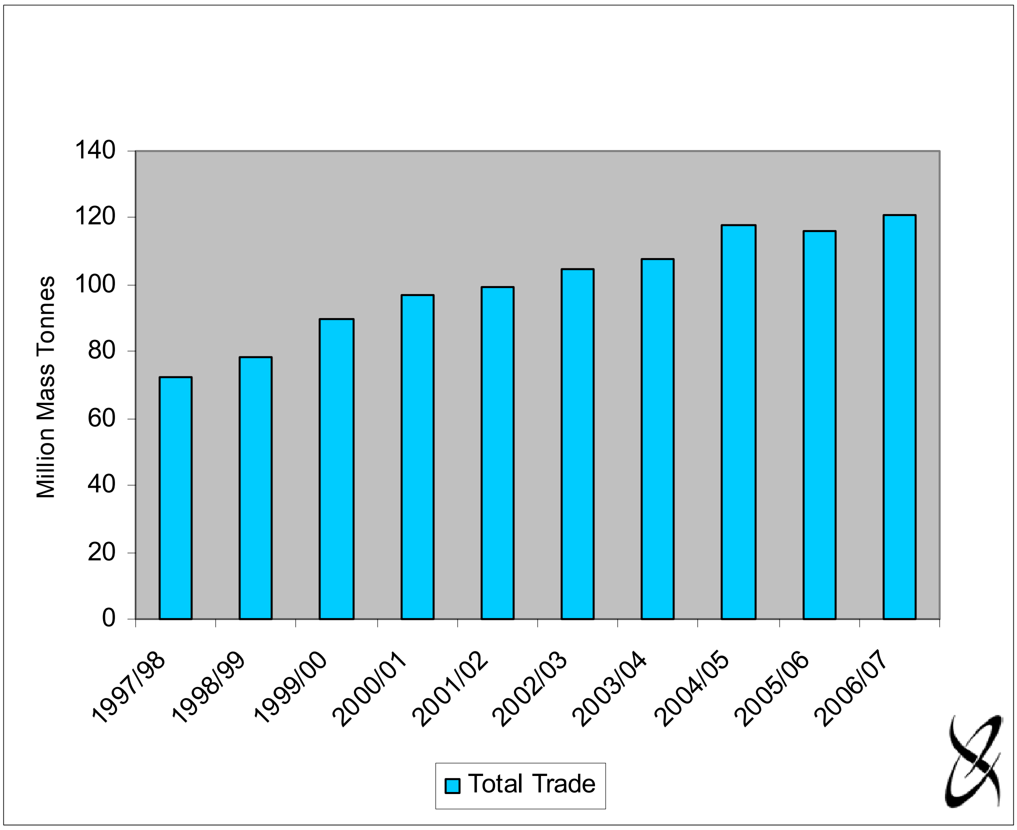
In 2006/07 total cargo moved through ports managed by PCQ grew by 4.5 per cent over the previous year (tonnage basis). For the 5 year period since the previous economic impact study (2001/02), cargo grew by 18 per cent and over the 10 years since 1997/98 it has grown by 66 per cent (Figure 2.1 and Tables 2.3 and 2.4).

The majority of cargo handled by ports managed by PCQ is exported, with the exception of Thursday Island and Karumba who import small quantities of general cargo. Exports have shown marked increases in recent years, largely as a result of increased coal exports. Imports were very small relative to exports, increasing by around 13 per cent between 2001/02 and 2006/07 but by only 17 per cent over the 10 years since 1997/98.

For the purpose of the impact analysis, cargo has been classified according to the following groups:

- Coal
- Sugar
- Silica sand
- Bauxite
- Lead
- Zinc
- General Cargo (including fuel and livestock).

Figure 2.1 Total cargo shipped through the PCQ ports, 1997/98 to 2006/07 (million mass tonnes)



Source Ports Corporation of Queensland.

Table 2.3 Cargo exported through the PCQ ports [a], 1997/98 to 2006/07 (mass tonnes)

Cargo Type	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07
Coal	58,475,901	64,184,967	73,393,882	79,940,916	82,631,010	87,464,076	89,640,895	98,352,797	93,645,128	97,380,616
Bauxite	10,812,784	11,487,346	13,093,834	13,131,877	12,663,326	12,896,549	13,665,876	15,519,910	17,927,086	19,580,335
Zinc	0	0	244,292	718,478	778,609	934,096	939,166	871,125	1,100,400	853,563
Lead	0	0	0	81,763	151,104	104,180	149,765	77,030	135,500	62,682
Silica Sands	1,744,656	1,616,553	1,667,141	1,775,391	1,633,802	1,658,200	1,816,661	1,300,672	1,395,666	1,823,550
Sugar	1,224,589	1,025,627	1,064,130	802,438	998,737	1,293,807	1,206,298	1,392,163	1,389,786	1,068,594
Molasses	125,573	138,362	125,466	74,123	77,376	87,706	88,992	97,001	93,124	94,617
Woodchips	0	0	0	0	0	0	0	0	0	4,408
Livestock (No. of head)	49,891	40,073	71,514	44,888	42,457	53,678	14,743	13,327	4,523	6,230
General Cargo	0	0	0	5,180	9,173	0	0	0	0	0
Total Cargo Exports (t)	72,383,503	78,452,855	89,588,745	96,530,166	98,943,137	104,438,614	107,507,653	117,610,698	115,686,690	120,868,365
Total Livestock (head)	49,891	40,073	71,514	44,888	42,457	53,678	14,743	13,327	4,523	6,230

a Includes coastal and overseas trade.

Source Ports Corporation of Queensland.

Table 2.4 Cargo imported through PCQ ports [a], 1997/98 to 2006/07 (mass tonnes)

Cargo Type	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07
Fuel	79,500	103,560	84,684	98,706	88,757	53,332	63,959	64,701	63,984	101,158
General Cargo	120,548	161,191	170,214	150,374	116,743	110,495	148,779	128,451	134,306	131,859
Total Cargo Imports (t)	200,048	264,751	254,898	249,080	205,500	163,827	212,738	193,152	198,290	233,017

a Includes coastal and overseas trade.

Source Ports Corporation of Queensland.

3. Methods and Data Collection

This section describes the method used to estimate the economic impact of the PCQ ports. As required in the project brief, the approach adopted for this analysis is consistent with the previous study (EconSearch 2003) and follows that described in Bureau of Transport Economics (2000). The data collection procedures are also detailed in this section, describing the survey of port-related firms and organisations, the aggregate port data compiled by the Ports Corporation of Queensland and the preparation of the Queensland input-output table for 2006/07. The concept, nature and methodology of impact measurement at the regional level are described in general terms in Appendix II.

3.1 General approach

The general approach is presented in a number of steps, although they did not always occur as discrete stages and were often carried out concurrently. They are listed in summary form and discussed in more detail below.

3.1.1 Summary of methodology

Step 1	Preparation of an input-output table.
Step 2	Definition and estimation of the economic structure of each port-related sub-sector.
Step 3	Definition of cargo sectors.
Step 4	Estimation of total port-related activity.
Step 5	Final table adjustment.
Step 6	Estimation of the economic impact of the port.

These steps are now described in more detail.

Step 1 Preparation of an input-output table for Queensland

An input-output table can be constructed largely from secondary sources, although these are almost always supplemented with some primary data. Prior to the commencement of the project an input-output table for Queensland did exist. The model was prepared by the Office of the Government Statistician (2002) and provided to EconSearch for use in this study. The model was updated to 2006/07 for the purpose of this study.

Step 2 Definition and estimation of the economic structure of each port-related sub-sector

Total port-related activity was disaggregated into five categories of port-related activity (sub-sectors), detailed in Table 2.2. In order to represent port-related activity in the input-output table for impact estimation, it was necessary to estimate the economic transactions directly attributable to each of these industry sub-sectors. In effect, this required the estimation of the cost structures of the sub-sectors and identification of that expenditure which occurred inside and outside Queensland. This expenditure corresponds to the first round of the total economic impact of each sector in the economy.

The cost structures of the industry sub-sectors were derived from a survey of port-related firms. Details of the survey are provided in Section 3.2 below.

Step 3 Definition of six cargo sectors

The five port-related sub-sectors described in Step 2 above represent the various port-related activities on a functional basis, i.e. the contribution of each of these functions to the total economic activity of the PCQ ports. These functions can be applied to the whole range of cargo types handled through the ports. It was therefore important to identify the extent to which each cargo type contributed to the activity of the ports.

For these reasons, six cargo sectors, as detailed in Section 2.2, were identified for separate representation in the impact estimation procedure. These cargo types were distinguished largely by method of handling and the location of the activity; these factors imposing different mixes of support service requirements in the ports.

Step 4 Definition of regional ports

As noted above, the five port-related sub-sectors described in Step 2 represent the various port-related activities on a functional basis. These functions can be applied to each of the regional ports that PCQ has responsibility for. It was therefore important to identify the extent to which each regional port contributed to the overall activity of the PCQ ports in aggregate.

Eight regional port sectors, as detailed in Table 2.1, were identified for separate representation in the impact estimation procedure. The regional ports were distinguished largely by cargo type and the location of the ports; these factors imposing different mixes of support service requirements in the ports.

Step 5 Estimation of total port-related activity

Total port-related activity was calculated by aggregating the estimates derived for the five sub-sectors defined in Step 2. This provided an indication of the total direct contribution of port activity to the economy of Queensland.

Step 6 Final table adjustment

The preceding steps provided the necessary basic data for the impact estimation process. Step 6 involved the insertion into the input-output table of the rows and columns developed for representation of the six port-related sectors, the five cargo groups and the eight regional ports. Adjustments were carried out to comply with certain technical requirements of the input-output technique, including the avoidance of double counting and the subtraction of these 'new' sectors from the existing sectors of the table.

Step 7 Estimation of the economic impact of the PCQ ports

The completion of Step 6 provided an input-output table with rows and columns showing the five port-related sectors, a second table showing the six cargo sectors and a third table showing the eight regional ports. These rows and columns represented the direct impact of the port sectors on the economy of Queensland. The final stage of the study involved the manipulation of the input-output table (calculation of multipliers) to produce estimates of the direct and indirect impacts of these sectors on the Queensland economy.

The results of this step are discussed in detail in Sections 4 and 5.

3.1.2 Some technical notes

It is important to note two points relating to the impact methodology. These relate to:

1. The use of 'representative years'. To preserve uniformity, data collection was directed at establishing the level of economic activity of each component of port-related sector in the same year, i.e. 2006/07. Problems associated with studies of this nature inevitably arise, namely with respect to overlapping financial years and abnormal conditions. These problems were managed by attempting to ensure that the rows and columns representing each component in the appropriate input-output tables were as faithfully representative of a normal trading year as the data allowed.
2. Double counting. Port-related activity shows a high degree of integration within the Queensland economy, with consequent high intersectoral linkages between components of the industry. Since the input-output table by its nature measures the strength of backward linkages, double counting of backward linkages can occur if the multiplier effects of linked industries are simply summed. This study has been undertaken in 'net' terms, i.e. by ensuring that double counting of impacts attributable to different components of the industry does not occur. This has been achieved by expressing the value of output of each component net of backward linkages between components of the industry.

3.2 Survey of port-related firms

3.2.1 Questionnaire

A series of succinct questionnaires were prepared for completion by firms and government agencies that undertake economic activity in, or related to, the PCQ ports. The questions were designed to elicit the scale of the respondent's port-related activity, the amounts paid by the respondent to other parties for the labour and other inputs used in such port-related work, and the amounts of revenue received from customers in payment for such work. For both payments and receipts, information was sought on how the amounts were divided between parties located within, and parties located outside, Queensland. The full questionnaires are reproduced in Appendix I.

A covering letter for the questionnaires was prepared, encouraging individual organisations to participate in the survey. It outlined the background and objectives of the study, explained why the survey was required and indicated that all survey data would be treated in confidence. The covering letter is also contained in Appendix I.

3.2.2 Organisations who received the questionnaire

The Ports Corporation of Queensland's list of clients was used as a basis for preparing a comprehensive list of key port-related firms and organisations. The final list comprised some 54 organisations (including a few government departments who provide services, such as customs inspection), and approaches were made to all of these.

PCQ provided EconSearch with a list of 54 port related entities including 43 service providers (some of which are also port users), 1 port user and 10 government agencies. To pre-empt the survey, Brad Fish, CEO of the Ports Corporation of Queensland, sent each contact on this list a letter introducing the study and asking for industry participation through the completion of a survey questionnaire.

EconSearch consultants followed up on this letter through telephone contact with the addressees. Where contact was made the consultants offered further information on the survey and forwarded the appropriate questionnaire (as designed by EconSearch) to the appropriate contact by fax, email or post. At this stage the port-related activity for the organisation was also clarified. A letter outlining EconSearch's involvement in the study was also provided to potential survey participants.

Distribution of the survey was followed by calls to provide further information, assistance in completion of surveys, issue assurance of confidentiality and reminders to ensure that surveys were returned within the collection period. During this time a series of email reminders were sent to those contacts who had provided email addresses. The survey deadline was extended to allow for an increase to the response rate. The consultants and officers from PCQ continued to follow up on surveys during this extended period by both telephone and email. During this process a Microsoft Excel spreadsheet was kept to store information on contact details for each organisation, and to record all points of contact made with the organisation.

Upon receipt of completed surveys, the information was entered into a Microsoft Excel database. Incomplete or unclear survey responses were followed up with the appropriate contact by telephone or email. Notes have been included within the database where there is any ambiguity relating to a question response.

3.2.3 Responses

Most of the eventual respondents did not did not return the questionnaire within the initial timeframe requested. As noted above, the response deadline was extended, timely reminder contact was made regularly, businesses were given the option of providing an alternative company representative to complete the survey and assurance was offered with respect to confidentiality. Eventually, with considerable assistance from PCQ officers, most firms did complete the questionnaire.

Although there is no simple statistic for "the response rate", Table 3.1 summarises the nature and extent of the various kinds of responses that were obtained in this part of the data-collection task. Of the 54 contacts provided by PCQ, EconSearch was unable to make contact with 9 of these organisations. The effective sample size was reduced to 37 as 8 other organisations indicated that their involvement in port-related activity was nil or extremely limited or they were from the same firm or organisation as others on the list. In the context of the "core sample" (i.e. the net total of firms from whom data were sought), the number of responses (19) represented 90 per cent of the total.

Table 3.1 Responses to PCQ ports industry survey

Total number of firms approached	54
- firms that could not be contacted	9
- firms found not to undertake any (significant) port-related activity in PCQ ports in 2006/07	8
Net total of firms from whom data were sought	37
Total number of responses	30
Number of firms who did not provide data	7

3.2.4 Safeguarding and processing of the questionnaires

Upon receipt, identification of the company was separated from the statistical return. The latter was coded, and the company identification stored in a separate place, to enhance the security of the storage arrangements. The returned questionnaires and the electronic data recorded from individual returns have been destroyed.

3.3 Aggregate data collected from Ports Corporation of Queensland

The survey data were complemented with information provided by the Ports Corporation of Queensland. A set of statistics was compiled from the Corporation's database for the purpose of this study. These statistics provided information on cargo tonnages and estimates of various ship and cargo costs broken down by commodity type and for individual ports. These costs included wharfage, pilotage, navigation services, ships utilities and site occupation. Data were also provided on ship numbers, on a cargo type basis.

The data related to the study period of 2006/07. Much of the information provided a useful cross-reference against data obtained from the survey.

4. Port-related Multipliers

The Queensland input-output table, modified so as to include PCQ port-related activities[3], was used to prepare the port-specific multipliers. The essence of impact measurement is the empirical measurement of the relationship between cause and effect, or between the impacting agent and the expected impact. This relationship can be expressed in terms of a multiplier.

In this study, output, income, employment and value added multipliers were used to express impacts in terms of a 'per unit of output of port-related activity'.

Each multiplier can be disaggregated into a number of components, differentiating the direct and flow-on effects of port-related activity. *Direct effects*, sometimes referred to as *initial effects*, are the stimulus for the impact analysis and correspond, in this analysis, to port-related activity. *Flow-on effects* measure the economic activity in other sectors of the economy in response to the initial stimulus. The various multiplier components are shown in Table 4.1.

Flow-on effects are divided into two components, *production-induced effects,* which are a measure of business-to-business transactions, and *consumption-induced effects*, which represent the expenditure of household income received as payments for labour used in producing the additional output. Production-induced effects can be further divided into *first-round effects* and *industrial-support effects*.

Table 4.1 Input-output multiplier components

Multiplier component	**Description**
Direct (initial) effect	The stimulus for the impact analysis – normally assumed to be a dollar change in sales to final demand
Flow-on effects:	
Production-induced effects:	
First-round effects	Refers to the purchases of inputs required from other sectors in the economy in order to produce the additional output
Industrial-support effects	Refers to second, third and subsequent-round industrial flow-on effects triggered by the purchases in the first round
Consumption-induced effects	Stem from the spending of household income received as payments for labour used in producing the additional output
Total effect	Direct effect+ flow-on effects
Type I multiplier	(Direct + production induced)/direct
Type II multiplier	(Direct + production induced + consumption induced)/direct

3 Section 3 of this report and BTE (2000, pp. 96-97) describe the process of modifying input-output tables and preparing port-specific multipliers.

Utilising the modified Queensland input-output table, which incorporated the PCQ ports sector, a range of multipliers were calculated for the various dimensions of impact analysis required in the study brief. Aggregate multipliers are shown in Tables 4.2 and 4.3. Disaggregated multipliers are provided in Appendix IV.

Multipliers are usually presented in 'per unit of output terms', as they are here. The output multiplier (Table 4.2) can be interpreted as follows: an initial $1 of output in the port sector leads to a flow-on effect in other sectors of the Queensland economy of $0.98, giving a total effect of $1.98. Each dollar of output also generates 17 cents in direct household income (i.e., wages and salaries paid to employees of port-related firms and organisations) and a further 23 cents to workers in associated industries. Similarly, each dollar of output results in 41 cents in value added in the port sector and a further 47 cents in value added in other sectors of the economy.

Employment multipliers are expressed in terms of jobs per *million* dollars of output and relate to full-time equivalent jobs. In Table 4.2, the direct effect of 3.1 jobs per million dollars of output results in 4.4 jobs in other sectors of the economy, realising a total effect of approximately 7.6 jobs per million dollars of port sector output.

Table 4.2 Multipliers for PCQ ports, 2006/07

Measure	*Direct effects*	*Flow-on effects*	*Total Impact*
Output[a]	1.00	0.98	1.98
Value added[a]	0.41	0.47	0.88
Household income[a]	0.17	0.23	0.40
Employment[b]	3.1	4.4	7.6

a. Dollar impact of $1.00 of output in port industry.

b. Number of jobs (full-time equivalent) per $million of output in port industry.

Source EconSearch analysis.

As noted earlier, multipliers were estimated not only for the port as a whole but also for the port activity disaggregated on the basis of port function (port administration, ship operations, etc.) and cargo type (containers, general cargo, etc.). These multipliers are presented in Table 4.3. Note that they are *total* multipliers, as defined in Table 4.1, and correspond to the “Total Impact” multipliers presented in Table 4.2. Multipliers estimated for the total activity at individual ports are presented in Table 4.4.

Table 4.3 Multipliers for components of PCQ ports, 2006/07

Port component	*Output* [a]	*Value added* [a]	*Household income* [a]	*Employment* [b]
Function				
Port administration	1.83	0.90	0.25	4.4
Ship operations	2.14	0.97	0.50	9.2
Ship loading/unloading	1.98	0.85	0.41	8.0
Land transport & storage	1.99	0.86	0.39	7.4
Government agencies	1.81	1.05	0.41	8.9
Total	*1.98*	*0.88*	*0.40*	*7.6*
Cargo Type				
Coal	1.98	0.88	0.40	7.5
Sugar & Molasses	1.98	0.86	0.41	7.8
Silica	1.99	0.93	0.44	8.5
Bauxite	1.99	0.89	0.40	7.6
Lead & Zinc	1.98	0.88	0.40	7.7
General Cargo	2.01	0.91	0.41	7.9
Total	*1.98*	*0.88*	*0.40*	*7.6*

a. Dollar impact of $1.00 of output in port industry.

b. Number of jobs (full-time equivalent) per $million of output in port industry.

Source EconSearch analysis.

Table 4.4 Multipliers for PCQ regional ports, 2006/07

Regional port	*Output* [a]	*Value added* [a]	*Household income* [a]	*Employment* [b]
Hay Point	1.99	0.88	0.41	7.8
Abbot Point	1.94	0.89	0.35	6.6
Lucinda	1.98	0.86	0.41	7.8
Mourilyan	1.98	0.86	0.41	7.8
Cape Flattery	1.99	0.93	0.44	8.5
Weipa	1.99	0.89	0.40	7.7
Karumba	1.99	0.88	0.41	7.8
Thursday Island	1.98	0.90	0.39	7.3
Total	*1.98*	*0.88*	*0.40*	*7.6*

a. Dollar impact of $1.00 of output in port industry.

b. Number of jobs (full-time equivalent) per $million of output in port industry.

Source EconSearch analysis.

5. Economic Impact of the PCQ Ports

This section presents estimates of the economic impact of the PCQ ports in terms of output (gross revenue/expenditure), value added (payments to primary inputs of production), household income and employment. Detailed impact measures cover the impact attributable to individual port functions, commodities and regional ports.

Although output provides a readily understandable indicator of economic activity, problems of double counting can arise when the output of a number of firms are aggregated to give an industry view. For example, if the output of the Port Corporation is added to the output of the firms that provide services to the Corporation (e.g. dredging services, pest control, etc), then the value of those services will be counted twice in the aggregate figure. A more appropriate indicator of the port's relative contribution to the State's economy is value added (payments to primary inputs of production, i.e. gross operating surplus plus wages and salaries). Value added can be directly compared to gross state product and it avoids the problem of double counting.

5.1 Overall economic impact

Table 5.1 presents estimates of the overall economic impact of the PCQ ports, incorporating the direct effects and the flow-on effects.

5.1.1 Direct effects

The ***direct impact*** of port-related activity on output, value added, household income and employment is shown in the first column of Table 5.1. The value of output, estimated to be $575 million, is the sum of gross business revenue of firms defined as port-related (or that proportion of firms' revenues attributable to port-related activity), and gross expenditure by port-related government, semi-government and non-profit organisations. These are revenues generated and expenditure incurred in Queensland.

The value added from port-related activity was estimated to be $238 million. Value added refers to the difference between the total revenue of a firm and the cost of bought-in materials, services and components. In other words, it represents payments to the primary inputs of production (labour, capital and land), and can be used to describe the contribution of an industry to gross domestic (state) product. The value added of port-related activity ($238 million) represents approximately 0.13 per cent of the Queensland's estimated gross state product for 2006/07.

Table 5.1 Economic Impact of the PCQ ports, 2006/07

Measure	*Direct effects*	*Flow-on effects*	*Total Impact*
Output ($m)	575.4	565.2	1,140.6
Value added ($m)	238.4	268.2	506.7
Household income ($m)	99.0	130.5	229.5
Employment[a]	1,811	2,557	4,368

a. Number of jobs (full-time equivalent).

Source EconSearch analysis.

Direct employment (full-time equivalents) was estimated to be 1,811, and corresponding household income was over $99 million. This indicates an average gross annual income of around $55,000 for those employed in firms and organisations engaged in port-related activity. Household income includes overtime payments and income tax, although is net of payroll tax and other related charges.

5.1.2 Flow-on effects

As described earlier, input-output multipliers can be used to estimate the ***indirect (flow-on) impact*** of PCQ port-related activity on the Queensland economy. Multipliers were used to calculate flow-on effects for each of the four economic indicators, output, value added, employment and household income. Multipliers are provided in detail in Appendix IV.

The flow-on effects of port-related activity total $565 million in output, $268 million in value added, over 2,550 jobs and $130 million in corresponding household income (Table 5.1).

Flow-on impacts from port-related activity occur in many sectors of the Queensland economy. A unique characteristic of the input-output model is the facility to calculate the size of the flow-on multiplier and the extent of the impact in each of the other sectors in the local economy. The sectoral distribution and ranking of the indirect impacts, in terms of output, value added, employment and household income, are shown in Table 5.2.

Table 5.2 Flow-on effects from the economic impact of the PCQ ports by industry sector, 2006/07

Sector [a,b]	*Output ($m)*	*Value added ($m)*	*Household income ($m)*	*Employment no.*
Finance	143.4	58.6	31.4	550
Manufacturing	97.7	28.3	17.0	312
Trade	87.6	41.6	28.2	662
TransportStorage	62.6	30.4	13.6	239
OshipDwellings	39.5	31.8	0.0	0
Utilities	23.8	14.5	3.5	53
AccmRest	20.0	9.3	5.5	136
Communications	18.0	11.8	5.0	71
CommunityServ	17.2	13.7	11.4	196
Primary	17.1	7.8	2.8	117
PersonalServ	16.6	9.7	6.2	137
Mining	8.7	4.5	1.5	10
Public Admin	6.9	3.9	3.3	46
Construction	6.0	2.5	1.0	30
Total	*565.2*	*268.2*	*130.5*	*2,557*

a. Individual sectors are ranked by output.

b. Refer to Appendix III for detailed sector definitions.

Note Components may not sum to totals due to rounding.

Source EconSearch analysis.

The ranking of sectors is determined, to a certain extent, by the labour intensity of the impacting industry (in this study, the PCQ ports sector). Generally, if the industry is labour intensive and direct purchases of goods and services by firms in the industry are relatively small, then the flow-on effects will occur predominantly in those sectors providing goods and services to households, i.e. those sectors where households spend the wages and salaries earned working in the impacting sector. It will be these sectors that are ranked highly in terms of economic impact.

To identify the nature of the linkage between the impacting sector and other sectors in the economy, a distinction is made between *consumption-induced* and *production-induced* flow-on effects in calculating sector multipliers. Consumption-induced effects are those brought about by household expenditures, while production-induced effects are generated by the direct purchases of local goods and services by firms in the impacting sector. Generally, in a relatively labour intensive sector (such as the Port sector), the consumption induced effects will be large and the production-induced effects relatively small. The port sector has traditionally been labour intensive, but with the productivity improvements of recent years and where the majority of cargo is handled in bulk, such as at the PCQ ports, the labour intensity is much less than was previously the case. For the PCQ ports sector, about 55 per cent of the output flow-ons were estimated to be consumption-induced and about 45 per cent production-induced. These proportions were similar for the value added, employment and household income flow-on effects (see Appendix IV for details).

As revealed in Table 5.2, finance and business services, wholesale and retail trade and manufacturing are the three sectors where port-related activity has the largest impact. For all four measures of economic impact (output, value added, employment and income), approximately 50 per cent of the total flow-on effect occurred in these three sectors. For employment, the combined impact in these sectors was 60 per cent (1,523 jobs) of the total employment flow-on from port-related activity (2,557 jobs).

5.1.3 Total economic impact

The PCQ ports generated a total economic impact on the Queensland economy of $1.14 billion in output in 2006/07.

Value added attributable to the operation of the port was $507 million. This was equivalent to approximately 0.3 per cent of gross state product in 2006/07, which provides a measure of the overall level of economic activity in Queensland.

Household income generated by the operation of the port totalled $230 million. Employment was estimated at around 4,360 jobs (full-time equivalent), which represented 0.2 per cent of total employment in Queensland.

There were 1,951 ship visits to the PCQ ports by commercial cargo vessels in 2006/07, an 29 per cent increase on the 1,511 vessels that visited in 2001/02. The results of the analysis on a per ship visit basis, for both 2001/02 and 2006/07, are shown in Table 5.3.

Table 5.3 Average impact per ship call for the PCQ Ports, 2001/02 & 2006/07

Indicator	2001/02		2006/07
	Nominal [a]	Real [b]	
Output	$477,000	$553,000	$585,000
Value added	$223,000	$258,000	$260,000
Household income	$93,000	$108,000	$118,000
Jobs (full-time equivalent)	2.1	2.1	2.2

[a] Estimates for 2001/02 in terms of 2001/02 dollars.

[b] Estimates for 2001/02 in terms of 2006/07 dollars.

Source: EconSearch analysis.

For the economic indicators measured in monetary terms (output, value added and household income), the change in the impact per ship visit over time will be influenced by several factors including general inflationary effects and the average volume of cargo per ship call. The 2001/02 estimates for the monetary indicators are provided in Table 5.3 in both nominal (2001/02) and real (2006/07) terms, the latter of which can be compared directly with the estimates for 2006/07. The difference in real terms between the 2001/02 and 2006/07 estimates is partly attributable to the increase in cargo per vessel[4] and partly attributable to those factors that have changed the multiplier values over the period, namely the change in local purchasing patterns and the increase in capital intensity.

For the employment impact per ship visit, which has shown a slight increase from 2.1 to 2.2, the increase in cargo per vessel was a positive influence, whereas improvements in labour productivity would have had a partially offsetting effect.

5.2 Components of the port's economic impact

Estimated economic impacts have been disaggregated to identify the relative contribution of the individual port functions, cargo types and the regional ports. The proportion for a particular component often varies according to the impact measure being used. This variation reflects differences in factors such as profitability, capital intensity, average income and labour intensity.

5.2.1 Port functions

As described in Section 2, total port-related activity was partitioned into five specific functions: port administration; ship movement; ship loading and unloading; land transport and storage; and government services. The dimensions of these sectors, in terms of output, value added, employment and household income, are detailed in Table 5.4.

[4] Average cargo per ship visit increased from 65.6kt in 2001/02 to 69.1kt in 2006/07, an increase of 5 per cent.

Table 5.4 Economic impact of the PCQ ports by port function, 2006/07

Function	*Output ($m)*	*Value added ($m)*	*Household income ($m)*	*Employment no.*
Direct Effects				
Port administration	67	34	4	48
Ship operations	88	37	20	350
Ship loading/unloading	234	89	44	837
Land transport & storage	171	69	28	498
Government agencies	15	10	3	78
Total	*575*	*238*	*99*	*1,811*
Total Impact				
Port administration	122	60	16	296
Ship operations	187	85	44	803
Ship loading/unloading	463	198	97	1,872
Land transport & storage	341	147	66	1,260
Government agencies	28	16	6	136
Total	*1,141*	*507*	*230*	*4,368*

Note Components may not sum to totals due to rounding.
Source EconSearch analysis.

Total multipliers were calculated for each of these port-related sectors and are shown in Table 4.3. Table 5.4 provides estimates of the total economic impacts calculated using these multipliers.

The *ship loading and unloading* sector, which includes bulk cargo handling facilities and terminal operation, had the highest levels of impact. Direct and flow-on employment in the ship loading and unloading sector accounted for 1,872 full-time equivalent jobs, earning approximately $97 million in household income. Direct and flow-on value added was estimated at $198 million.

The next largest impacts occurred in the *land transport and storage* sector. The value of services provided by this sector was approximately $171 million, with flow-ons to other sectors in the economy of $170 million. Direct employment in the sector was measured at almost 500 with associated household income of around $28 million. Flow-on employment in other sectors was estimated to be approximately 760, earning around $38 million in household income during 2006/07.

As noted in BTE (2001, p. 22) it is, in practice, difficult to accurately identify the components of land transport that are port-related. The general approach in port impact studies therefore focuses on land transport activities in the vicinity of the port. Port-related land transport is broadly defined as the movement of cargo between port-related facilities and the nearest warehouse, terminal, customer premises or processing plant in the local region.

Cargoes are moved by rail and road to the PCQ ports from locations many hundreds of kilometres away. It could be argued that the impact of road and rail activities should incorporate the full journey from the point of origin (e.g. stockpiles at mine sites). However, the resulting impact estimates would not be consistent with the primary purpose of a port impact study, which is to indicate the effects on the community immediately affected by the physical operation of the port. In addition, the inclusion of the full road and rail journeys would result in impact estimates for port-related rail transport that would exceed the impact of all other components of PCQ port-related activities.

The *ship operations and movement* sector includes the activities of shipping lines, ship managers, ship repairs and maintenance, bunkering and provedoring as well as towage, pilotage and shipping agents. Direct and flow-on employment in this sector accounted for an estimated 803 full-time equivalent jobs, earning approximately $44 million in household income. Direct and flow-on value added was estimated at around $85 million.

The *port administration* sector provided services valued at $67 million, with flow-ons to other sectors in the economy of around $55 million. Employment in the sector was measured at 48 with associated household income of $3.5 million. Flow-on employment in other sectors was estimated to be over 240, earning around $12 million in household income during 2006/07.

The port-related activity of *government agencies* comprises a minor component of the total port impact.

5.2.2 Cargo type

Table 5.5 shows the breakdown of direct and total impacts by the major cargo types traded in 2006/07. Details on tonnages for 2006/07 are provided in Tables 2.3 and 2.4.

Although around 57 per cent of the PCQ ports' total ship visits were *coal* ships, over 70 per cent of the ports' economic impact was related to coal: the equivalent of 1,283 people were directly employed in coal-related port activity and around 3,117 jobs when indirect effects are included.

Table 5.5 Economic impact of the PCQ ports by cargo type, 2006/07

Cargo type	*Output ($m)*	*Value added ($m)*	*Household income ($m)*	*Employment no.*
Direct Effects				
Coal	414	171	70	1,283
Sugar & Molasses	39	15	7	132
Silica	8	4	2	31
Bauxite	59	25	10	185
Lead & Zinc	36	15	6	116
General Cargo	20	8	4	65
Total	*575*	*238*	*99*	*1,811*
Total Impact				
Coal	819	364	164	3,117
Sugar & Molasses	77	34	16	305
Silica	15	7	3	66
Bauxite	118	53	24	450
Lead & Zinc	71	32	14	276
General Cargo	40	18	8	155
Total	*1,141*	*507*	*230*	*4,368*

Note Components may not sum to totals due to rounding.

Source EconSearch analysis.

Bauxite accounted for 18 per cent of all ship visits. The relatively low input intensive loading and unloading operations meant that this cargo group provided around 10 per cent of the total economic impact.

Lead and zinc accounted for around 6 per cent of ship visits. In terms of output, added, employment and household income this cargo group provided approximately 6 per cent of the total economic impact. A similar result was estimated for the *sugar and molasses* group with around 3 per cent of ship visits and 6 to 7 per cent on the total economic impact.

General cargo (including fuel and live cattle) accounted for 13 per cent of total ship visits to the PCQ ports in 2006/07. Because these are generally smaller vessels the overall impact of this cargo group was disproportionately small. In terms of output, value added, employment and household income, the general cargo group provided around 3.5 per cent of the total economic impact.

Silica accounted for around 2 per cent of ship visits. In terms of output, value added, employment and household income this cargo group provided 1.5 per cent of the total economic impact.

6. Economic Impact of the Regional Ports

6.1 Overview

Estimated economic impacts were also disaggregated to identify the relative contribution of individual ports. The direct and total impact for each port is provided in Table 6.1. More detail, on a port-by-port basis, is provided in Tables 6.2 to 6.9.

The coal trading ports of *Hay Point* and *Abbot Point* have by far the largest impacts of all the ports managed by PCQ. Hay Point alone accounted for around 58 per cent of the total economic impact of PCQ ports in 2006/07. Abbot Point contributed approximately 13 per cent of the total and *Weipa* accounted for around 11 per cent of the economic impact (although almost 23 per cent of ship visits).

Karumba contributed around 7 per cent of the total impact and accounted for 6 per cent of total ship visits. The sugar ports of *Lucinda* and *Mourilyan* contributed 3.0 and 3.8 per cent of total impact, respectively although each accounted for less 2 per cent of ship visits.

Similarly, the *Cape Flattery* impact was relatively small at around 2 per cent in terms of both impact and ship visits. *Thursday Island*, which exclusively handles small, general cargo vessels, contributed less than 2 per cent of the total impact but accounted for over 9 per cent of total vessel numbers.

Table 6.1 Economic impact of the PCQ ports by regional port, 2006/07

Regional port	*Output ($m)*	*Value added ($m)*	*Household income ($m)*	*Employment no.*
Direct Effects				
Hay Point	334.4	136.0	59.4	1,094
Abbot Point	79.5	35.3	10.8	189
Lucinda	17.3	6.8	3.1	58
Mourilyan	21.7	8.6	3.9	73
Cape Flattery	7.7	3.5	1.6	31
Weipa	62.4	26.3	10.9	198
Karumba	40.7	16.7	7.3	133
Thursday Island	11.8	5.1	1.9	34
Total	*575.4*	*238.4*	*99.0*	*1,811*
Total Impact				
Hay Point	665.5	292.8	135.9	2,592
Abbot Point	154.0	70.7	27.9	525
Lucinda	34.4	14.9	7.1	135
Mourilyan	42.9	18.7	8.8	169
Cape Flattery	15.4	7.2	3.4	66
Weipa	124.4	55.8	25.2	478
Karumba	80.9	35.9	16.6	315
Thursday Island	23.2	10.6	4.6	86
Total	*1140.6*	*506.7*	*229.5*	*4,368*

Note Components may not sum to totals due to rounding.
Source EconSearch analysis.

6.2 Hay Point

Situated about 40 kilometres south of Mackay, the Port of Hay Point is the largest coal export port in the world. It comprises two separate coal export terminals, Dalrymple Bay Coal Terminal (DBCT) leased from the State Government by Babcock & Brown Infrastructure and the BHP Billiton Mitsubishi Alliance owned and operated Hay Point Coal Terminal, which together service the mines of central Queensland. The mines are linked to the port terminals through an integrated rail-port network.

Both terminals have purpose-built, rail in-loading facilities, onshore stockpile yards and offshore wharves. The offshore wharves are serviced by conveyor systems, supported on jetties, which run out to sea and allow loading in deep water.

Maritime Safety Queensland (MSQ) provides marine pilotage services for the terminals, with most transfers to and from ships via helicopter. Each terminal has its own towage arrangements in place.

In 2006/07, total throughput for the port was 86.2 million tonnes of coal, comprising 49.9 million tonnes through DBCT and 36.4 million tonnes through Hay Point Coal Terminal.

Hay Point has by far the largest impact of all the ports managed by PCQ. Hay Point accounted for around 58 per cent of the total economic impact of PCQ ports in 2006/07. As detailed in Table 6.2, direct employment in port-related activities accounted for an estimated 1,094 full-time equivalent jobs and a further 1,500 flow-on jobs were generated by the port-related activity. The total of 2,592 full-time equivalent jobs earned an estimated $136 million in household income in 2006/07. Direct and flow-on value added was estimated at over $290 million.

Table 6.2 Economic impact of the Port of Hay Point, 2006/07

	Output ($m)	*Value added ($m)*	*Household income ($m)*	*Employment no.*
Direct	334.4	136.0	59.4	1,094
Flow-on	331.1	156.9	76.5	1,498
Total	*665.5*	*292.8*	*135.9*	*2,592*
Impact per vessel (total = 971)	0.685	0.302	0.140	2.7

Note Components may not sum to totals due to rounding.
Source EconSearch analysis.

There were 971 ship visits to the Port of Hay Point in 2006/07. The results of the analysis indicate that, on average, each ship call at the port involved the following impact on the economy of Queensland:

- $685,000 of output;
- $302,000 of value added;
- $140,000 of household income; and
- 2.7 full-time equivalent jobs for one year.

6.3 Abbot Point

The Port of Abbot Point, 25 kilometres north of Bowen, is Australia's most northerly coal port. It comprises a rail inloading facility, coal handling and stockpiling areas and a single trestle jetty and conveyor connecting to an offshore berth and shiploader 2.75 kilometres offshore.

Most of the coal supplied to Abbot Point by rail is from Newlands and Collinsville mines. In addition, small quantities of Macarthur Coal product are brought north on the coastal rail line for export. The terminal is operated by Abbot Point BulkCoal Pty Ltd, a subsidiary of Xstrata Coal Queensland Pty Ltd.

The port is serviced by two tugs which are based in Bowen and MSQ provides pilotage.

In 2006/07, total throughput for the port was 11.2 million tonnes of coal, which is slightly down on the previous year.

Abbot Point contributed approximately 13 per cent of the total economic impact of PCQ ports in 2006/07. As detailed in Table 6.3, direct employment in port-related activities accounted for an estimated 189 full-time equivalent jobs and a further 336 flow-on jobs were generated by the port-related activity. The total of 525 full-time equivalent jobs earned almost $28 million in household income in 2006/07. Direct and flow-on value added was estimated at just over $70 million.

Table 6.3 Economic impact of the Port of Abbot Point, 2006/07

	Output ($m)	*Value added ($m)*	*Household income ($m)*	*Employment no.*
Direct	79.5	35.3	10.8	189
Flow-on	74.5	35.4	17.1	336
Total	*154.0*	*70.7*	*27.9*	*525*
Impact per vessel (total = 149)	1.033	0.475	0.187	3.5

Note Components may not sum to totals due to rounding.
Source EconSearch analysis.

There were 149 ship visits to the Port of Abbot Point in 2006/07. The results of the analysis indicate that, on average, each ship call at the port involved the following impact on the economy of Queensland:

- $1,033,000 of output;
- $475,000 of value added;
- $187,000 of household income; and
- 3.5 full-time equivalent jobs for one year.

6.4 Lucinda

The Port of Lucinda, 100 kilometres north of Townsville, is dedicated to the export of raw sugar from the Ingham sugar growing district. It comprises onshore sugar handling and storage facilities and a single trestle jetty and conveyor running out to an offshore berth and shiploader.

The terminal is operated by Lucinda Bulk Sugar Terminal, a subsidiary of Queensland Sugar Limited (QSL). Supplying mills are Victoria and Macknade.

The Port of Lucinda is serviced by Switzer Australia tugs that are based in Mourilyan and pilotage is provided by MSQ.

In 2006/07, total throughput for the port was 465,607 tonnes of sugar, which was up 30.8 per cent on the previous year. A total of 9,173 tonnes of general cargo was also handled at the port.

Lucinda contributed approximately 3.0 per cent of the total economic impact of PCQ ports in 2006/07. As detailed in Table 6.4, direct employment in port-related activities accounted for an estimated 58 full-time equivalent jobs and a further 77 flow-on jobs were generated by the port-related activity. The total of 135 full-time equivalent jobs earned an estimated $7 million in household income in 2006/07. Direct and flow-on value added was estimated at almost $15 million.

Table 6.4 Economic impact of the Port of Lucinda, 2006/07

	Output ($m)	*Value added ($m)*	*Household income ($m)*	*Employment no.*
Direct	17.3	6.8	3.1	58
Flow-on	17.0	8.1	3.9	77
Total	*34.4*	*14.9*	*7.1*	*135*
Impact per vessel (total = 20)	1.718	0.747	0.354	6.8

Note Components may not sum to totals due to rounding.

Source EconSearch analysis.

There were 20 ship visits to the Port of Lucinda in 2006/07. The results of the analysis indicate that, on average, each ship call at the port involved the following impact on the economy of Queensland:

- $1,718,000 of output;
- $747,000 of value added;
- $354,000 of household income; and
- 6.8 full-time equivalent jobs for one year.

6.5 Mourilyan

The Port of Mourilyan is on the coastline 20 kilometres south of Innisfail. Its main trade is the export of raw sugar and molasses from the Innisfail, Babinda, Tully and Atherton Tablelands sugar growing districts. It comprises onshore sugar and molasses handling and storage facilities and a single sugar loader and associated wharf located with a sheltered natural harbour.

The terminal is operated by Mourilyan Bulk Sugar Terminal, a subsidiary of QSL. Mills supplying the terminal are South Johnstone, Mourilyan, Tully and Babinda.

Molasses is exported through the port by Australian Molasses Trading Pty Ltd and live cattle exports can also be accommodated.

The Port of Mourilyan is serviced by Switzer Australia tugs that are based in in the port and pilotage is provided by MSQ.

In 2006/07, throughput for the port was 468,797 tonnes of sugar and 94,617 tonnes of molasses. There was also a 4,408 tonne trial shipment of woodchip to test loading facilities. The total throughput for the port was 567,822 tonnes, a decrease from the previous year.

Mourilyan contributed approximately 3.8 per cent of the total economic impact of PCQ ports in 2006/07. As detailed in Table 6.5, direct employment in port-related activities accounted for an estimated 73 full-time equivalent jobs and a further 96 flow-on jobs were generated by the port-related activity. The total of 169 full-time equivalent jobs earned an estimated $8.8 million in household income in 2006/07. Direct and flow-on value added was estimated at over $18 million.

Table 6.5 Economic impact of the Port of Mourilyan, 2006/07

	Output ($m)	*Value added ($m)*	*Household income ($m)*	*Employment no.*
Direct	21.7	8.6	3.9	73
Flow-on	21.2	10.1	4.9	96
Total	*42.9*	*18.7*	*8.8*	*169*
Impact per vessel (total = 31)	1.383	0.602	0.285	5.5

Note Components may not sum to totals due to rounding.
Source EconSearch analysis.

There were 31 ship visits to the Port of Mourilyan in 2006/07. The results of the analysis indicate that, on average, each ship call at the port involved the following impact on the economy of Queensland:

- $1,383,000 of output;
- $602,000 of value added;
- $285,000 of household income; and
- 5.5 full-time equivalent jobs for one year.

6.6 Cape Flattery

The Port of Cape Flattery is situated more than 200 kilometres north of Cairns on the east coast of Cape York Peninsula. It is used for the export of silica sand from the Cape Flattery mine, the facility being operated by the Cape Flattery Silica Mines Pty Ltd. The company is the world's largest producer and exporter of silica sand.

There are onshore silica sand handling and stockpiling facilities, and a 500 metre, single trestle jetty and conveyor running from the mine to an offshore berth and shiploader.

There is also a general purpose wharf for the import of fuel and other supplies for the mine and for the mooring of two line boats which assist in ship berthing. No tugs are required at the port. MSQ provides pilotage services.

In 2006/07, ships visiting the Port of Cape Flattery exported 1,823,550 tonnes of silica sand, which was up 30.6 per cent on the previous year.

The Cape Flattery economic impact was estimated to be 1.5 per cent of the total PCQ ports' impact in 2006/07. As detailed in Table 6.6, direct employment in port-related activities accounted for an estimated 31 full-time equivalent jobs and a further 35 flow-on jobs were generated by the port-related activity. The total of 66 full-time equivalent jobs earned approximately $3 million in household income in 2006/07. Direct and flow-on value added was estimated at $7.2 million.

Table 6.6 Economic impact of the Port of Cape Flattery, 2006/07

	Output ($m)	*Value added ($m)*	*Household income ($m)*	*Employment no.*
Direct	7.7	3.5	1.6	31
Flow-on	7.7	3.7	1.8	35
Total	*15.4*	*7.2*	*3.4*	*66*
Impact per vessel (total = 37)	0.417	0.195	0.092	1.8

Note Components may not sum to totals due to rounding.
Source EconSearch analysis.

There were 37 ship visits to the Port of Cape Flattery in 2006/07. The results of the analysis indicate that, on average, each ship call at the port involved the following impact on the economy of Queensland:

- $417,000 of output;
- $195,000 of value added;
- $92,000 of household income; and
- 1.8 full-time equivalent jobs for one year.

6.7 Weipa

The Port of Weipa is located on the north west coast of Cape York Peninsula. The port is dedicated to the export of bauxite from the Rio Tinto Aluminium (RTA) (formerly Comalco) mine. RTA also operates the port facilities. It has onshore bauxite handling, processing and stockpiling facilities and conveyors running to Lorim Point wharf for shiploading. RTA has recently funded the refurbishment of the Lorim Point West berth and has constructed a second shiploader on this berth to increase its shiploading capacity.

There are also general purpose and fuel wharves at Weipa and, in recent years, live cattle can be exported through the port.

Tugs are operated by Weipa Tug Services Pty Ltd and MSQ provides pilotage services. PCQ maintains a shipping channel in the port through a regular maintenance dredging program.

Ships visiting the Port of Weipa in 2006/07 carried 19.6 million tonnes of bauxite, 101,158 tonnes of fuel and 31,380 tonnes of general cargo. Bauxite trade was up 9 per cent on the previous year, which had been a record. Fuel was down by 58 per cent over the previous year and general cargo was up by 75 per cent.

Weipa accounted for around 11 per cent of the total PCQ ports' economic impact (although almost 23 per cent of ship visits) in 2006/07. As detailed in Table 6.7, direct employment in port-related activities accounted for an estimated 198 full-time equivalent jobs and a further 280 flow-on jobs were generated by the port-related activity. The total of 478 full-time equivalent jobs earned around $25 million in household income in 2006/07. Direct and flow-on value added was estimated at over $55 million.

Table 6.7 Economic impact of the Port of Weipa, 2006/07

	Output ($m)	*Value added ($m)*	*Household income ($m)*	*Employment no.*
Direct	62.4	26.3	10.9	198
Flow-on	61.9	29.4	14.3	280
Total	*124.4*	*55.8*	*25.2*	*478*
Impact per vessel (total = 443)	0.281	0.126	0.057	1.1

Note Components may not sum to totals due to rounding.
Source EconSearch analysis.

There were 443 ship visits to the Port of Weipa in 2006/07. The results of the analysis indicate that, on average, each ship call at the port involved the following impact on the economy of Queensland:

- $281,000 of output;
- $126,000 of value added;
- $57,000 of household income; and
- 1.1 full-time equivalent jobs for one year.

Because of the significant number of small, general cargo vessels visiting the port, the impacts per vessel are relatively low.

6.8 Karumba

The Port of Karumba is located at the mouth of the Norman River in the south east corner of the Gulf of Carpentaria. The Zinifex Mine started exporting zinc concentrate through the port in December 1999. Zinc slurry is piped 304 kilometres to the port from the mine, dewatered and loaded onto a 5,000 tonne transfer vessel for the 40 kilometre journey to the export ships that anchor in deep water in the Gulf of Carpentaria, about 24 nautical miles off the coast.

Other facilities in the port provide for general cargo, fuel, fisheries products and the export of live cattle. Karumba is also a transhipment port for the Port of Weipa, Mornington Island and other Gulf communities, with refrigerated semi-trailers bringing goods north to Karumba for transhipment.

MSQ provides pilotage services to the port. No tugs are required at the port. PCQ provides maintenance dredging to maintain the necessary channel depth, usually about every two years.

In 2006/07, ships through the port carried 853,563 tonnes of zinc, 62,682 tonnes of lead, 6,230 head of cattle and 10,971 tonnes of general cargo. Zinc and lead were both down while live cattle trade was up considerably on the previous year.

Karumba contributed around 7 per cent of the total economic impact of PCQ ports in 2006/07 and accounted for 6 per cent of total ship visits. As detailed in Table 6.8, direct employment in port-related activities accounted for an estimated 133 full-time equivalent jobs and a further 182 flow-on jobs were generated by the port-related activity. The total of 315 full-time equivalent jobs earned an estimated $16 million in household income in 2006/07. Direct and flow-on value added was estimated at almost $36 million.

Table 6.8 Economic impact of the Port of Karumba, 2006/07

	Output ($m)	*Value added ($m)*	*Household income ($m)*	*Employment no.*
Direct	40.7	16.7	7.3	133
Flow-on	40.3	19.2	9.3	182
Total	*80.9*	*35.9*	*16.6*	*315*
Impact per vessel (total = 122)	0.663	0.294	0.136	2.6

Note Components may not sum to totals due to rounding.

Source EconSearch analysis.

There were 122 ship visits to the Port of Karumba in 2006/07. The results of the analysis indicate that, on average, each ship call at the port involved the following impact on the economy of Queensland:

- $663,000 of output;
- $294,000 of value added;
- $136,000 of household income; and
- 2.6 full-time equivalent jobs for one year.

6.9 Thursday Island

The Port of Thursday Island is a community port located in a natural harbour in the Torres Strait in the northern most part of Australia. PCQ-owned wharf facilities are established on both Thursday Island and Horn Island. The port services the needs of the two islands and also operates as a major transhipment point for the supply of essential cargoes to other islands of the Torres Strait.

The port's strategic location means that a number of government agencies, including Customs and Fisheries patrols, are based there.

In 2006/07, total throughput for the port was 82,359 tonnes of general cargo, which up 3 per cent on the previous year.

Thursday Island, which exclusively handles small, general cargo vessels, contributed approximately 2 per cent of the total impact but accounted for over 9 per cent of total vessel numbers. As detailed in Table 6.9, direct employment in port-related activities accounted for an estimated 34 full-time equivalent jobs and a further 52 flow-on jobs were generated by the port-related activity. The total of 86 full-time equivalent jobs earned $4.6 million in household income in 2006/07. Direct and flow-on value added was estimated at more than $10 million.

Table 6.9 Economic impact of the Port of Thursday Island, 2006/07

	Output ($m)	*Value added ($m)*	*Household income ($m)*	*Employment no.*
Direct	11.8	5.1	1.9	34
Flow-on	11.5	5.4	2.6	52
Total	*23.2*	*10.6*	*4.6*	*86*
Impact per vessel (total = 178)	0.131	0.059	0.026	0.5

Note Components may not sum to totals due to rounding.
Source EconSearch analysis.

There were an estimated 178 ship visits to the Port of Thursday Island in 2006/07. The results of the analysis indicate that, on average, each ship call at the port involved the following impact on the economy of Queensland:

- $131,000 of output;
- $59,000 of value added;
- $26,000 of household income; and
- 0.5 full-time equivalent jobs for one year.

Appendix I Survey Questionnaire

This appendix contains the version of the questionnaire that was sent to firms whose activities were primarily PCQ ports related. The covering letter is also included.

EconSearch Pty Ltd
214 Kensington Road
Marryatville SA 5068
Tel: 08 8431 5533
Fax: 08 8431 7710
Email: jbmorison@econsearch.com.au
Contact: Julian Morison or Lisa Rippin

CONFIDENTIAL

PORTS CORPORATION OF QUEENSLAND ECONOMIC IMPACT STUDY 2006/07 –
PORT SERVICE - PROVIDERS QUESTIONNAIRE

1. Company Information

Company Name: ______________________________

Port – Related Activities: ______________________________

(See Attachment 1 on Page 3) ______________________________

Contact Name: ______________________________

Contact Phone Number: ______________________________

2. What proportion of your firm's total PCQ related activity (as measured by revenue) is conducted in the following ports?

PCQ Port	Proportion of your firm's PCQ port-related activity (%)
Hay Point	
Abbot Point	
Lucinda	
Mourilyan	
Cape Flattery	
Weipa	
Karumba	
Thursday Island	
Quintell Beach	
Total	**100%**

3. **Staff numbers and associated costs incurred in Queensland related to activities through PCQ ports:** (average for financial year 2006/07, including working proprietors, managers, directors):

Full Time ______________

Part Time ______________ (total)

______________ (full – time equivalents)

Contractors ______________ (full – time equivalents)

Gross wages & salaries and all associated costs (super, etc.) in 2006/07 ($'000) ________

4. What other major costs, in addition to gross wages and salaries, were incurred in Queensland in 2006/07 related to activities through PCQ ports ($'000): (e.g. fuel, repairs and maintenance or contractors)

Expenditure item	($'000)

5. Please break down your PCQ port related revenue by cargo type.

Cargo Type	Revenue in 2006/07 ($'000)
Dry bulk	
General cargo	
Liquid bulk	
Other	
TOTAL	

Thank you for your time and cooperation. Please return the questionnaire to:

EconSearch Pty Ltd
214 Kensington Road
Marryatville SA 5068

or Fax: (08) 8431 7710

or jbmorison@econsearch.com.au

If you have any queries don't hesitate to contact Julian Morison or Lisa Rippin on (08) 8431 5533.

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«Salutation» «First_Name» «Last_Name»
«Title»
«Company_Name»
«Address»
«City» «State» «PostCode»

Dear «Salutation» «Last_Name»

The Economic Impact of the Ports Corporation of Queensland

The Ports Corporation of Queensland (PCQ) wrote to you earlier this month advising that we have been engaged to undertake an economic impact study of PCQ ports. This is an update of a successful, similar study undertaken by EconSearch in 2002.

As part of this study, EconSearch is conducting a survey of firms involved in port-related activities (questionnaire attached). The survey will provide information that is not available from published sources. It will enable EconSearch to estimate the direct impacts of the ports, to calculate multipliers for the estimation of flow-on effects and to prepare specific impact measures (e.g. by major cargo type).

To maintain the confidentiality of data from individual organisations, the final report will present results in aggregated forms only. All completed forms will be held by EconSearch, treated in-confidence and subsequently destroyed.

If you have any queries with regard to the project or the questionnaire, please contact one of the EconSearch team working on the project:

Julian Morison or Lisa Rippin on (08) 8431 5533.

We would be grateful if you would support the port impact study by completing the attached questionnaire and returning it to EconSearch by **XX October 2007**, via email, fax or post.

Yours sincerely,

Julian Morison
Managing Director

Appendix II Economic Impact Analysis

This study provides estimates of the economic impact of *port-related activity* on the economy of Queensland. The methodological basis for the study is input-output analysis. In this appendix the concept of economic impact, the process of impact measurement and the use of input-output models in impact measurement are briefly reviewed. The research methodology applied in this study is outlined in more specific terms in Section 3.

The input-output model is suitable for the detailed description of regional economies and for measuring the impacts of existing industries, new industries or changes in the size of industries on the regional economy. It is therefore appropriate to apply the model in estimating the impact of port-related activity on the economy of Queensland.

In the following sections the method of economic impact analysis is outlined and the structure of the input-output model and multipliers, the tools used in the estimation of economic impacts, are detailed.

Economic impact analysis

The term *impact* has no unambiguous meaning; it is used in a wide variety of contexts, and synonymously with several terms such as *results*, *incidence*, *effect*, *significance*, *contribution*, *consequence* and *importance*. It is therefore important to define clearly the concept of economic impact, and the particular use of the term applied in this study.

One of the main ends of economic research is the study of impacts, where the term refers generally to the consequences of some expected or hypothetical phenomenon, either physical or social. For example, the recent emergence of environmental impact statements reflects a desire on the part of authorities to be informed on the likely consequences of a new development, both in terms of effects on the physical environment and the socio-economic environment. An impact study is intended to isolate and identify the more significant consequences of an event or phenomenon for planning purposes.

It is necessary to distinguish between the *impacting agent*, which is the phenomenon or event under study, and the *impacts*, which are the results of the existence of, or change in, the impacting agent. Socio-economic impact studies tend to be restricted to the consequences of significant existing or new phenomena. These phenomena cause a wide variety of impacts to occur in economic, sociological, political, physical and welfare terms. For example, the activity associated with the PCQ ports has resulted in a wide variety of impacts on the regional, social and economic structure of Queensland as a whole. Apart from the economic consequences of the port, some of which are the subject of this study, virtually every facet of the state's social structure will be affected by the existence of the port.

Since this study is concerned solely with economic impact, it omits the wide variety of non-economic impacts of the industry on the region, many of which are clearly significant. The *economic* consequence of the presence of the port will be felt in many aspects of activity in Queensland, ranging from levels of regional output, income and employment, to land prices (including residential, commercial and industrial land), house and building prices, local government rates, supply and demand of labour, demand and supply of urban infrastructure and so on. Unfortunately, fully comprehensive models, including all aspects of regional economic activity, are not available and more complex econometric models with an ability to include a wide variety of economic phenomena have not been satisfactorily developed for impact analysis at a regional level in Australia.

Consistent with the BTE (2000) approach, the input-output model was considered the most appropriate for this economic impact assessment. This model is, however, limited to those aspects of impact which can be represented in the input-output model, i.e. output, income, employment and value added. The procedures used in input-output analysis are detailed in the following section.

While it is quite clear that significant economic and social impacts are associated with port-related activity, measurement of these impacts does not, *per se*, constitute an economic evaluation of the industry. Such an evaluation is possible only through a comprehensive cost-benefit analysis of the industry, which would take into account both the direct and indirect impacts of the industry as recorded in this study.

In summary, an economic impact may be defined in general terms as the measured economic effect of, or change which is attributable to, the impacting agent[5] on the economy in question.

Multipliers and impact measurement

The essence of impact measurement is the empirical measurement of the relationship between cause and effect, or between the impacting agent and the expected impact. This relationship can be expressed in two ways:

(i) on a 'per unit of impact' basis. This is normally expressed in terms of a multiplier which expresses the cause-effect relationship in empirical terms. In this study, output, income, employment and value added multipliers are used to express impacts in terms of a 'per unit of output of port-related activity'.

(ii) on an aggregate value basis. This expresses the total absolute effect, measured in terms of output, income, employment, and value added of the existence of port-related activity.

The selection of methodology for impact measurement is therefore selection of the most appropriate method of estimation of multipliers. Four general methods are available for this purpose, namely economic base multipliers, regional Keynesian multipliers, econometric models and input-output models. The consultants had access to an established methodological and research structure for the calculation of an input-output table for Queensland, and to methods of calculating multipliers from these tables. There was, therefore, a distinct advantage in the use of the input-output technique, apart from the fact that it is generally considered to be methodologically superior to the simpler techniques such as the economic base approach or the use of regional Keynesian employment multipliers. This superiority is generally considered to be attributable to the following factors (Jensen and West 1986):

(i) In terms of the incidence of impact, the economic base and the Keynesian approaches normally provide impact measurement only in

[5] The impacting agent may be an actual or potential source of economic change, or an industry which is established and operating in the economy.

aggregate terms, i.e. the total impact felt by all sectors collectively. Input-output multipliers allow the analyst to examine the manner in which the total impact is distributed among the sectors of the economy. This is a reflection of the internal linkages and interdependencies in the economy which are specified in the input-output table.

(ii) Input-output multipliers also allow the identification of the components of the multiplier; the economic base and Keynesian models do not, in their standard form, provide all of these details. The components are as follows:

(a) the **initial** effect, which is the stimulus for the impact analysis – normally assumed to be a dollar change in sales to final demand;

(b) the **first-round** effect, which refers to the purchases of inputs required from other sectors in the economy in order to produce the additional output;

(c) the **industrial-support** effect, which refers to second, third and subsequent-round industrial flow-on effects triggered by the purchases in the first round; and

(d) the **consumption-induced** effects, which stem from the spending of household income received as payments for labour used in producing the additional output.

Regional econometric models, including models of the general equilibrium family, were not available for the region or project in question, and were not considered necessary for the view of impact taken in this study.

Input-output analysis

An outline of the input-output technique can be found in any one of a number of standard texts dealing with the subject (see, for example, Hewings (1985), Midmore and Harrison-Mayfield (1996), Miller and Blair (1985), Jensen and West (1986) and West (1993, 1995, 1999). An input-output table is a simple mathematical representation of the production aspects of an economy viewed at a particular point in time. In the purely hypothetical case of no significant change in the economy from one time period to another, the table would remain relatively unchanged over that period. In reality, any economy continually experiences many types of shocks or stimuli (positive and negative) and these may be ephemeral in nature or lead to long-term structural changes in the nature of the economy. Many of these stimuli can be represented in the input-output model by appropriate adjustments to the input-output table. Some of these methods are outlined in the following section.

Methods of impact measurement using input-output analysis

The task of measuring economic impacts through the input-output model is largely one of representing the impact in the most appropriate manner in the transactions table. Once this has been completed, the analytical derivation of the impact is possible through multiplier calculation in the conventional manner.

The responsibility of the input-output analyst is to determine the nature of the impact under study, the relationship of the impacting agent with the economy in question, and to simulate this relationship as closely as possible in the transactions table of the regional economy. Some common types of impact, requiring different treatment of the input-output table, are listed below.

(a) A change in the level of output of a sector or sectors, due to changes in the level of final demand, may be traced by use of multipliers or by matrix multiplication using the table in its original form.

(b) A change in the technology or trading patterns of an existing industry would be reflected in changed column or row entries in the existing transactions table. The effects of this type of change would be measured by comparing multipliers, output levels and employment levels before and after the impact occurred.

(c) A new or existing firm or industry can be incorporated into the study in either of two ways. If the impact is regarded as of little significance, or if the firm is thought to show a cost structure (ie a column in the A matrix) similar to the average existing firm in the table, the new firm can be adequately represented by the existing sector of the table without any significant strain on the assumptions of the model. If, however, the firm or industry to be examined is considered to be of some significance, or if the requirements of the study called for a detailed study of the firm or industry *per se*, a new row and column representing that firm or industry should be prepared and incorporated into the input-output table and normal multiplier calculation carried out. Only in this manner is a detailed study of the impact of the firm or industry possible. The latter procedure was used in this study and new rows and columns were prepared for each aspect of port-related activity, as described in Chapter 3.

Limitations of input-output analysis

The input-output model, like all economic models, is not capable of a perfect or near-perfect simulation of economic reality. It is therefore important to clarify the limitations of the model. Two points are made in the context of the present study.

The first point refers to the accuracy of multiplier estimates. The results of any social or economic analysis must, by the nature of the data and the techniques of analysis used, be interpreted in a broad accuracy framework. While the mathematical operations of the technique produce results which appear to be precise, a professional assessment of accuracy in general terms is necessary. The accuracy of the estimates in this study as in other studies of this nature, should be interpreted in an 'order of magnitude' holistic framework (Jensen 1980).

The second point refers to the question of the linearity assumption of the input-output model. The notion of linearity is common to most methods of impact analysis, including most of the alternative methods discussed above. This or some other equally convenient assumption is usually necessary to achieve workable economic models. The main question is not the existence of the assumption but the extent to which it results in unacceptable inaccuracies in empirical work. In this study it was felt that since port-related activity is long-established, and clearly a 'permanent' and integrated part of the regional economy, the linearity assumption posed no problem in the estimation and interpretation of the significance of the industry in the economy of Queensland.

Appendix III Input-Output Sector Definitions

Queensland input-output table sectors	Corresponding national input-output table sectors [6]
1. Primary	0101 Sheep 0102 Grains 0103 Beef cattle 0104 Dairy cattle 0105 Pigs 0106 Poultry 0107 Other agriculture 0200 Services to agric., hunting & trapping 0300 Forestry and logging 0400 Commercial fishing
2. Mining	1100 Coal; oil and gas 1301 Iron ores 1302 Non-ferrous metal ores 1400 Other mining 1500 Services to mining
3. Manufacturing	2101 Meat & meat products 2102 Dairy products 2103 Fruit and vegetable products 2104 Oils and fats 2105 Flour & cereal foods 2106 Bakery products 2107 Confectionery 2108 Other food products 2109 Soft drinks, cordials and syrups 2110 Beer and malt 2111 Wine & spirits 2112 Tobacco products 2201 Textile fibres, yarns etc. 2202 Textile products 2203 Knitting mill products 2204 Clothing 2205 Footwear 2206 Leather & leather products 2301 Sawmill products 2302 Other wood products 2303 Pulp, paper & paperboard 2305 Paper bags and products 2401 Printing & services to printing 2402 Publishing; recorded media etc.

6 Concordance between the national input-output sectors and ANZSIC sectors can be found in Australian Bureau of Statistics (2001).

Queensland input-output table sectors	Corresponding national input-output table sectors
3. Manufacturing (cont.)	2501 Petroleum & coal products 2502 Basic chemicals 2503 Paints 2504 Pharmaceuticals etc. 2505 Soap & other detergents 2506 Cosmetic & toiletry preparations 2507 Other chemical products 2508 Rubber products 2509 Plastic products 2601 Glass & glass products 2602 Ceramic products 2603 Cement, lime and concrete slurry 2604 Plaster & other concrete products 2605 Other non-metallic mineral products 2701 Iron & steel 2702 Basic non-ferrous metals etc. 2703 Structural metal products 2704 Sheet metal products 2705 Fabricated metal products 2801 Motor vehicles & parts; other t/port equip 2802 Ships and boats 2803 Railway equipment 2804 Aircraft 2805 Photographic & scientific equipment 2806 Electronic equipment 2807 Household appliances 2808 Other electrical equipment 2809 Agricultural, mining etc. machinery 2810 Other machinery & equipment 2901 Prefabricated buildings 2902 Furniture 2903 Other manufacturing
4. Utilities	3601 Electricity 3602 Gas 3701 Water, sewerage and drainage
5. Building and construction	4101 Residential building 4102 Other construction
6. Wholesale and retail trade, etc., trade	4501 Wholesale trade 5101 Retail trade 5401 Mechanical repairs 5402 Other repairs
7. Accommodation, cafes & restaurants	5701 Accommodation, cafes & restaurants

Queensland input-output table sectors	**Corresponding national input-output table sectors**
8. Transport (excl Port)	6101 Road transport 6201 Rail, pipeline & other transport 6301 Water transport 6401 Air & space transport 6601 Services to transport; storage
9. PCQ ports	This sector is a composite of parts of a number of other sectors including 6601,6101 and 6201.
10. Communication	7101 Communication services
11. Finance, business services	7301 Banking 7302 Non-bank finance 7303 Financial asset investors 7401 Insurance 7501 Services to finance etc. 7702 Other property services 7801 Scientific research, technical and computer services 7802 Legal, accounting etc. 7803 Other business services
12. Ownership of dwellings	7701 Ownership of dwellings
13. Public administration	8101 Government administration (part) 8201 Defence
14. Community services	8601 Health services 8401 Education 8701 Community services
15. Recreation, personal services	9101 Motion picture, radio etc. 9201 Libraries, museums & the arts 9301 Sport, gambling etc. 9501 Personal Services 9601 Other services

Appendix IV Disaggregated Multipliers

Table IV.1 Disaggregated output multipliers for PCQ Ports, 2006/07

Sector[a]	*Initial*	*First*[b]	*Indust.*[b]	*Total*	*(%)*	*Consumption*[c]	*Total*	*%*
Primary	0.00	0.00	0.01	0.01	0.98	0.02	0.03	1.50
Mining	0.00	0.00	0.01	0.01	0.61	0.01	0.02	0.76
Manufacturing	0.00	0.07	0.04	0.11	7.15	0.06	0.17	8.57
Utilities	0.00	0.02	0.01	0.02	1.61	0.02	0.04	2.09
Construction	0.00	0.01	0.00	0.01	0.53	0.00	0.01	0.53
Wholesale and retail trade, etc.	0.00	0.03	0.02	0.05	3.49	0.10	0.15	7.68
Accommodation, restaurants, etc.	0.00	0.00	0.00	0.01	0.58	0.03	0.03	1.75
Transport, storage (excl port)	0.00	0.05	0.03	0.08	5.31	0.03	0.11	5.49
Port	1.00	0.00	0.00	1.00	67.35	0.00	1.00	50.45
Communication	0.00	0.01	0.01	0.02	1.09	0.02	0.03	1.58
Finance, business services	0.00	0.07	0.08	0.15	10.28	0.10	0.25	12.57
Ownership of dwellings	0.00	0.00	0.00	0.00	0.00	0.07	0.07	3.46
Public administration	0.00	0.01	0.00	0.01	0.59	0.00	0.01	0.60
Community services	0.00	0.00	0.00	0.00	0.16	0.03	0.03	1.51
Recreation, personal services	0.00	0.00	0.00	0.00	0.26	0.02	0.03	1.45
Total	1.00	0.27	0.21	1.48	100.00	0.50	1.98	100.00

a. Sector definitions are given in Appendix III.

b. First-round + industrial-support effects = production-induced effects.

c. Consumption refers to consumption-induced effects.

Note Components may not sum to totals due to rounding.

Type I Multiplier 1.48

Type II Multiplier 1.98

Source EconSearch analysis.

Table IV.2 Disaggregated value added multipliers for PCQ Ports, 2006/07

Sector [a]	*Initial*	*First* [b]	*Indust.* [b]	*Total*	*(%)*	*Consumption* [c]	*Total*	*%*
Primary	0.00	0.00	0.01	0.01	1.06	0.01	0.01	1.54
Mining	0.00	0.00	0.00	0.00	0.76	0.00	0.01	0.90
Manufacturing	0.00	0.02	0.01	0.03	4.93	0.02	0.05	5.58
Utilities	0.00	0.01	0.00	0.01	2.33	0.01	0.03	2.85
Construction	0.00	0.00	0.00	0.00	0.51	0.00	0.00	0.48
Wholesale and retail trade, etc.	0.00	0.02	0.01	0.02	3.94	0.05	0.07	8.20
Accommodation, restaurants, etc.	0.00	0.00	0.00	0.00	0.64	0.01	0.02	1.83
Transport, storage (excl port)	0.00	0.03	0.01	0.04	6.15	0.01	0.05	6.01
Port	0.41	0.00	0.00	0.41	66.49	0.00	0.41	47.06
Communication	0.00	0.01	0.01	0.01	1.70	0.01	0.02	2.32
Finance, business services	0.00	0.03	0.03	0.06	10.02	0.04	0.10	11.57
Ownership of dwellings	0.00	0.00	0.00	0.00	0.00	0.06	0.06	6.27
Public administration	0.00	0.00	0.00	0.00	0.79	0.00	0.01	0.76
Community services	0.00	0.00	0.00	0.00	0.31	0.02	0.02	2.71
Recreation, personal services	0.00	0.00	0.00	0.00	0.36	0.01	0.02	1.91
Total	0.41	0.12	0.09	0.62	100.00	0.26	0.88	100.00

a. Sector definitions are given in Appendix III.

b. First-round + industrial-support effects = production-induced effects.

c. Consumption refers to consumption-induced effects.

Note Components may not sum to totals due to rounding.

Type I Multiplier 1.50

Type II Multiplier 2.13

Source EconSearch analysis.

Table IV.3 Disaggregated income multipliers for PCQ Ports, 2006/07

Sector [a]	*Initial*	*First* [b]	*Indust.* [b]	*Total*	*(%)*	*Consumption* [c]	*Total*	*%*
Primary	0.00	0.00	0.00	0.00	0.85	0.00	0.00	1.22
Mining	0.00	0.00	0.00	0.00	0.58	0.00	0.00	0.67
Manufacturing	0.00	0.01	0.01	0.02	6.57	0.01	0.03	7.39
Utilities	0.00	0.00	0.00	0.00	1.26	0.00	0.01	1.53
Construction	0.00	0.00	0.00	0.00	0.47	0.00	0.00	0.44
Wholesale and retail trade, etc.	0.00	0.01	0.01	0.02	5.93	0.03	0.05	12.28
Accommodation, restaurants, etc.	0.00	0.00	0.00	0.00	0.85	0.01	0.01	2.40
Transport, storage (excl port)	0.00	0.01	0.01	0.02	6.12	0.01	0.02	5.94
Port	0.17	0.00	0.00	0.17	61.30	0.00	0.17	43.14
Communication	0.00	0.00	0.00	0.00	1.59	0.00	0.01	2.17
Finance, business services	0.00	0.02	0.02	0.03	11.92	0.02	0.05	13.69
Ownership of dwellings	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Public administration	0.00	0.00	0.00	0.00	1.49	0.00	0.01	1.43
Community services	0.00	0.00	0.00	0.00	0.57	0.02	0.02	4.98
Recreation, personal services	0.00	0.00	0.00	0.00	0.51	0.01	0.01	2.70
Total	0.17	0.06	0.05	0.28	100.00	0.12	0.40	100.00

a. Sector definitions are given in Appendix III.

b. First-round + industrial-support effects = production-induced effects.

c. Consumption refers to consumption-induced effects.

Note Components may not sum to totals due to rounding.

Type I Multiplier 1.63

Type II Multiplier 2.32

Source EconSearch analysis.

Table IV.4 Disaggregated employment multipliers[a] for PCQ Ports, 2006/07

Sector [b]	*Initial*	*First* [c]	*Indust.* [c]	*Total*	*(%)*	*Consumption* [d]	*Total*	*%*
Primary	0.00	0.00	0.10	0.10	1.90	0.10	0.20	2.67
Mining	0.00	0.00	0.01	0.01	0.21	0.01	0.02	0.23
Manufacturing	0.00	0.22	0.12	0.34	6.50	0.20	0.54	7.13
Utilities	0.00	0.04	0.02	0.05	1.02	0.04	0.09	1.21
Construction	0.00	0.04	0.00	0.04	0.76	0.01	0.05	0.69
Wholesale and retail trade, etc.	0.00	0.24	0.15	0.39	7.51	0.76	1.15	15.15
Accommodation, restaurants, etc.	0.00	0.03	0.03	0.06	1.13	0.18	0.24	3.10
Transport, storage (excl port)	0.00	0.20	0.10	0.30	5.79	0.11	0.42	5.48
Port	3.15	0.00	0.00	3.15	60.46	0.00	3.15	41.46
Communication	0.00	0.03	0.03	0.06	1.23	0.06	0.12	1.63
Finance, business services	0.00	0.28	0.31	0.59	11.25	0.37	0.96	12.59
Ownership of dwellings	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Public administration	0.00	0.04	0.02	0.06	1.13	0.02	0.08	1.06
Community services	0.00	0.02	0.01	0.03	0.52	0.31	0.34	4.48
Recreation, personal services	0.00	0.01	0.02	0.03	0.60	0.21	0.24	3.13
Total	3.15	1.14	0.92	5.21	100.00	2.39	7.59	100.00

a. Jobs per million dollars.

b. Sector definitions are given in Appendix III.

c. First-round + industrial-support effects = production-induced effects.

d. Consumption refers to consumption-induced effects.

Note Components may not sum to totals due to rounding.

Type I Multiplier 1.65

Type II Multiplier 2.41

Source EconSearch analysis.

Glossary

Consumption-induced effects are additional output, employment and income resulting from re-spending by households that receive income from employment in direct and indirect activities. Consumption-induced effects are sometimes referred to as "induced effects".

Direct effects are the initial round of output, employment and income generated by an economic activity.

Employment is the number of working proprietors, managers, directors and other employees, in terms of the number of full-time equivalent jobs.

Flow-on effects are the sum of the production-induced effects and the consumption-induced effects.

Gross regional product (at factor cost) is a measure of value added on a regional basis. It can be calculated using two methods. The income method calculates GRP as household income plus other value added. The expenditure method calculates GRP as household expenditure plus other final demand, that is, in total, gross regional expenditure, plus exports less imports.

Household income is wages and salaries and other payments to labour including overtime payments and income tax, but excluding payroll tax.

Input-output analysis is an accounting system of inter-industry transactions based on the notion that no industry exists in isolation.

Input-output table is a transactions table that illustrates and quantifies the purchases and sales of goods and services taking place in an economy at a given point in time. It provides a numerical picture of the size and shape of the economy and its essential features. Each item is shown as a purchase by one sector and a sale by another, thus constructing two sides of a double accounting schedule.

Multiplier is an index (ratio) indicating the overall change in the level of activity that results from an initial change in economic activity. They are an indication of the strength of the linkages between a particular sector and the rest of the regional economy. They can be used to estimate the impact of a change in that particular sector on the rest of the economy. See Table 4.1 for a description of multiplier components.

Output is gross revenue of goods and services produced by commercial organisations plus gross expenditure by government agencies.

Production-induced effects are additional output, employment and income resulting from re-spending by firms that receive income from the sale of goods and services to firms undertaking, for example, agricultural activities. Production-induced effects are sometimes referred to as "indirect effects".

Total impact is the sum of the direct effects and the flow-on effects.

Type I multiplier is calculated as (direct effects + production induced effects)/direct effects.

Type II multiplier is calculated as (direct effects + production induced effects + consumption induced effects)/direct effects.

Value added is calculated as the value of output less the cost of goods and services (including imports) used in producing the output. It represents payments to the primary inputs of production (labour, capital and land). Value added is consistent with standard measures of economic activity, such as gross domestic, state or regional product, and it provides an assessment of the net contribution to regional economic growth of a particular enterprise or activity.

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