KPMG

Potential Impact of Pandemic Influenza on the BC Economy

for the
British Columbia Ministry
of Economic Development

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KPMG LLP

AUDIT ▪ TAX ▪ ADVISORY

CONTENTS

GLOSSARY OF TERMS AND ACRONYMS

ADB	Asian Development Bank
BC	Province of British Columbia
BCCDC	British Columbia Centres for Disease Control
CAR	Clinical Attack Rate
CBO	US Congressional Budget Office
CDC	Us Centers for Disease Control and Prevention
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GPP	Gross Provincial Product
JIT	Just-in-Time (logistics and imports)
OIE	Organization for Animal Health
OTC	Over the Counter Medications (non-prescription medications)
SARS	Severe Acute Respiratory Syndrome
WB	World Bank
WHO	World Health Organization

EXECUTIVE SUMMARY

Background

Health scientists believe it is only a matter of time until an outbreak of pandemic influenza occurs. Outbreaks of pandemic influenza have occurred every ten to forty years for at least the last 500 years, and many of these pandemics have resulted in a devastating death toll and serious impact on the economy.

Pandemic influenza is a global outbreak of influenza among the human population. Pandemic influenza is different from seasonal outbreaks or "epidemics" of influenza, in that it affects the global population, and the virus is highly virulent and the human immune system has no pre-exiting immunity to it. This makes it likely that people who contract pandemic influenza will experience more serious symptoms than those caused by the normally occurring "seasonal" influenza.

However, estimating the epidemiological impact of a pandemic, should it occur, is very difficult. Therefore, policy makers are unable to plan with a high level of certainty for an outbreak and have limited, if any, ability to predict if or when a pandemic will occur. The unknown probability and impact of a pandemic imply that the expected value in economic terms is also unknown.

Due to the significant uncertainty associated with pandemic influenza, this study takes a high level approach to characterize what *could* happen, rather than what *will* happen, if and when an outbreak of pandemic influenza occurs in British Columbia.

Estimated Health Impact of Pandemic Influenza on the Population of British Columbia

An outbreak of pandemic influenza typically occurs in one or more "waves" of approximately 15 weeks in duration. The peak of a pandemic will normally occur over a 2 week period, usually during weeks 4 to 11 of the approximately 15 week duration of a pandemic wave. The US Centers for Disease Control and Prevention have developed a modeling tool that provides an estimate of the anticipated impact of pandemic influenza on a population. This modeling tool has been used in this study to help characterize the impact of an outbreak of pandemic influenza on the population of British Columbia. The model uses three clinical attack rates (15%, 25% and 35%). The clinical attack rate is a measure of the percentage of the total population that becomes clinically ill during an outbreak of pandemic influenza.

The impact of pandemic influenza on the population of British Columbia, using the range of the clinical attack rates of 15% to 35% would mean that approximately 635,000 to 1.4 million individuals could become clinically ill with pandemic influenza.

Estimates of the Economic Impact on British Columbia

As the timing, virulence and general manifestation of an outbreak of pandemic influenza are uncertain, predicting its exact economic and social costs for the province of BC is not feasible. Therefore, this study is based on a set of reasonable assumptions for the conduct of a macro-level analysis of the province-wide economic and social impact of a pandemic influenza.

The methodology employed in this study is similar to the approach followed for studies completed by the World Bank, BMO Nesbitt Burns, the Department of Finance (Canada), the US Congressional Budget Office and the Asian Development Bank, to characterize the impact of a pandemic.

An evaluation of the estimated demand and supply shocks suggests the overall, short-term single wave, direct cost impact could result in a decline in the British Columbia's GPP in the range of approximately 1.9% to 2.3%. The aggregate impact on the BC economy also considers additional factors such as the long-term effects, the impact of multiple waves of a pandemic, policy shocks and indirect (secondary costs) of bottlenecks in the economy, suggesting the total impact could result in a decline of the GPP in the range of 3.7% to 4.4%.

This decline in the provincial GPP is in line with projections made by similar studies, although these studies projected economic decline as a result of only the initial wave of the pandemic.

Study	Projection
World Bank	2.0% decline in Global GDP
US Congressional Budget Office	1.5% to 5.0% decline in US GDP
Asian Development Bank	2.5% to 6.0% decline in Asia – GDP
KPMG Study – British Columbia	1.9% to 4.4% decline in BC – GPP

The most immediate cause of economic impact is likely to be driven by a decline in consumer demand arising in part from the uncoordinated efforts of people trying to avoid infection. Sectors that are considered to have a high degree of interpersonal contact such as tourism, public transport, retail, education, accommodation and food services, and the entertainment industry, might be most vulnerable to a demand shock. Additional demand-side declines associated with a pandemic are

further decreases in international travel, due to government or self-imposed restrictions on travel to, from and within British Columbia.

However, all economic sectors will experience supply shocks, due to increased labour absenteeism caused by pandemic influenza. Sectors with critical skill sets and a shortage of back-up labour could be significantly affected.

Policy Implications

This study identified five areas where there are policy implications that should be considered in the Province's planning for a potential outbreak of pandemic influenza. These policy implications fall into the categories of:

- Health policy
- Economic policy
- Intra-governmental policy
- Inter-government policy
- Provincial Government leadership.

The findings presented in this study provide an informational basis for the BC government to commence policy making, and possibly to implement a "Provincial Epidemic Economic Response Strategy".

1. INTRODUCTION

Health scientists believe it is only a matter of time until an outbreak of pandemic influenza occurs. Outbreaks of pandemic influenza have occurred every ten to forty years for at least the last 500 years, and many of these pandemics have resulted in a devastating death toll and serious impact on the economy.

The recent outbreaks of Avian Influenza (mainly in Southeast Asia) have caused widespread concern about the status of the current threat. This H5N1strain of the influenza 'A' virus has led to unprecedented infection and mortality rates among poultry in Asia and Europe. Although it has resulted in fewer than 100 human deaths so far, it is possible that, through genetic mutation, the virus will soon acquire the capability of human transmission. However, scientists are unable to predict the probability of such an occurrence.

All influenza viruses continually undergo changes from mixing and mutation with other viruses (called 'reassortment', 'recombination'[1] or 'antigenic shift'[2]), with new strains emerging every year. As a result of a lack of human immunity to new or reassorted strains, the virus can spread quickly. If the spread of influenza leads to a pandemic, the consequences to people and economic activity can be substantial in many regions around the world. To address the potential impacts, policy-makers and health experts worldwide need to join forces in planning and preparing for such an outbreak.

Against this background, the government of British Columbia ("BC") has initiated a number of pandemic preparedness planning processes within the government. The government, through the Ministry of Economic Development, requested KPMG LLP to undertake this study, as one aspect of their overall planning process.

1.1 The Purpose of this Report

The objectives of this study are to outline the economic effects for the BC economy of a potential outbreak of pandemic influenza and to identify potential policy implications for the BC government. Although the long-term effects of a pandemic will be discussed in this study, the analysis focuses on the potential short-term impacts at a macro level for the provincial economy. The conceptual framework for the study links epidemiological assumptions to an array of economic

[1] Dr. Sherry Cooper, *Don't Fear Fear or Panic Panic* (BMO Nesbitt Burns, October 2005).
[2] Congressional Budget Office, "A Potential Influenza Pandemic: Possible Macroeconomic Effects and Policy Issues," (December 8, 2005).

variables, including demand and supply side shocks, economic bottlenecks, heath care costs and policy shocks.

Due to the high degree of uncertainty associated with pandemic influenza, this study takes a high level approach to characterize what *could* happen, rather than what *will* happen in a BC scenario. A number of assumptions underlie the evaluation. These assumptions, which are captured in the framework for the study's analysis, form the basis of the various dynamics that could occur as a result of a pandemic.

The analysis separates demand and supply activity and defines the main variables that link the pandemic to the economy. For the demand side, the main variables are: i) the requirements for interpersonal contact, ii) export dependency, and iii) seasonal patterns of activity. The variables for the supply side impacts are associated with: i) disruptions in the labour force, ii) import dependence, and iii) production processes. In this study, we have considered the *direct* impacts of the *first wave* of a pandemic in the *short*-term have for each variable, as well as the effects of additional, more uncertain and longer-term factors, such as occurrence of multiple waves, policy shocks and economic bottlenecks.

1.2 Limitations

In order to complete the required analysis, it was necessary to build upon what is know about the epidemiology of pandemic influenza and how the potential pandemic may have an impact on the population of British Columbia. This presented a significant challenge, as it did for other similar studies that have examined the economic impact of a potential outbreak of pandemic influenza. These challenges or limitations on the analysis include:

- The probability and timing of an outbreak of pandemic influenza in unknown.
- The severity to human health of a mutated strain of the H5N1 virus is uncertain.
- The epidemiology of an outbreak of pandemic influenza in unknown.
- There is limited experience in planning for a global pandemic – as the last outbreak of pandemic influenza occurred 40 years ago and since that time many factors have changed, including:
  - Patterns of global and regional mobility of people
  - Global trade patterns
  - Structure of the global economy
  - Health Care systems and technologies

It should also be noted that the prospect of an outbreak of pandemic influenza will be have a global impact. While the focus of our study is on the impact of an outbreak of pandemic influenza in British Columbia, the economy of British Columbia is part of the global economy and therefore the impact of a pandemic in other regions will impact the BC economy. Examining the potential impact of pandemic influenza in other regions was beyond the scope of this study.

Notwithstanding these limitations, our analysis produces a range of projected impacts, which, although highly uncertain, provides a reasonable understanding of the potential magnitude of a pandemic on the BC economy. As such, our findings forms an informational basis for the BC government to commence policy making and possibly to implement a "Provincial Epidemic Economic Response Strategy". In addition, it provides a context for government guidance to the private sector, in areas such as business continuity planning and risk management.

2. PANDEMIC INFLUENZA - HEALTH EFFECTS IN BC

In the late summer and early fall of 2005 there was heightened awareness of the potential for the occurrence of pandemic influenza. This was driven by a number of factors, including reports of the highly pathogenic avian influenza. This had initially surfaced in eight Southeast Asian nations (Republic of Korea, Viet Nam, Japan, Thailand, Cambodia, Lao People's Democratic Republic, Indonesia and China) between December 2003 and February 2004, but by the fall of 2005 and winter of 2006, further outbreaks in Malaysia, Russia, Kazakhstan, Mongolia, Turkey, Romania, Austria, Poland and France had also been reported.

Governments, the public, the media and the public health communities were then further alerted in October 2005 by the International Meeting of Health Ministers on "Global Pandemic Readiness", which was held in Ottawa. A subsequent meeting followed in Geneva in November 2005, on the topic of avian influenza and human pandemic influenza. This meeting was jointly convened by the World Health Organization ("WHO"), the Food and Agriculture Organization ("FAO"), the World Organization for Animal Health ("OIE") and the World Bank.

2.1 What is pandemic influenza?[3]

Pandemic influenza is a *global* outbreak of influenza among the human population. Pandemic influenza is different from a seasonal outbreak of influenza or an influenza epidemic, in that it affects the entire global population.

The Public Health Agency of Canada has noted that three types of influenza are currently referred to by the media: human influenza, avian influenza, and pandemic influenza.

2.1.1 Human influenza

Human influenza is a respiratory infection caused by the influenza virus. Strains circulate every year, making people sick. Most people will recover from influenza within a week or ten days, but some - including those over 65 and adults and children with chronic conditions, such as diabetes

[3] Information in this section was complied from the following sources: British Columbia Ministry of Health, "What is influenza pandemic?" *BC HealthFile* # 94a (November 2005), www.bchealthguide.org/healthfiles/hfile94a.stm; Public Health Agency of Canada, "Understanding Influenza" (November 1, 2005), www.phac-aspc.gc.ca/influenza/influenza-undrstnd_e.html; US Centers for Disease Control and Prevention, "Pandemic Flu – Key Facts" (October 17, 2005), www.cdc.gov/flu/pandemic; World Health Organization, "Influenza pandemic" (Revised, December 5, 2005), www.who.int/csr/disease/influenza; World Health Organization, "Avian Influenza and Human influenza pandemic" (Summary Report – meeting held in Geneva, Switzerland, November 7-9, 2005), www.who.inter/mediacentre/events/2005/avian_influenza/summary_report_nov_2005_meeting.pdf.

and cancer - are at greater risk of more severe complications, such as pneumonia. In a typical year, depending on the severity of the season, between 4,000 and 8,000 Canadians die of influenza and its complications.

2.1.2 Avian Influenza

Avian influenza, or "bird flu", is a contagious disease of animals caused by viruses that normally infect only birds and, less commonly, pigs. Avian influenza viruses are highly species-specific, but have, on rare occasions, crossed the species barrier to infect humans.

In domestic poultry, infection with avian influenza viruses causes two main forms of disease, distinguished by low and high extremes of virulence. The so-called "low pathogenic" form commonly causes only mild symptoms (e.g., a drop in egg production) and may easily go undetected. The highly pathogenic form is far more dramatic. It spreads very rapidly through poultry flocks, causes disease affecting multiple internal organs, and has a mortality rate that can approach 100%, often within 48 hours.

The current outbreaks of highly pathogenic avian influenza, which began in South-east Asia in mid-2003, are the largest and most severe on record. Never before in the history of this disease have so many countries been simultaneously affected, resulting in the loss of so many birds.

The causative agent, the H5N1 virus, has proved to be especially tenacious. Despite the death or destruction of an estimated 150 million birds, the virus is now considered endemic in many parts of Indonesia and Viet Nam and in some parts of Cambodia, China, Thailand, and possibly also the Lao People's Democratic Republic.

The H5N1 virus is also of particular concern for human health.

2.1.3 Implications of the Avian Influenza for Human Health

The widespread persistence of H5N1 in poultry populations poses a serious risk for human health, since that virus may ultimately adapt into a strain that is highly infectious for humans and spreads easily from person to person.

People are exposed to different strains of influenza many times during their lives. Even though the virus changes, their previous bouts of influenza may offer some protection against similar strains of the virus. However, three to four times each century, for unknown reasons, a radical change takes

place in the influenza virus causing a new strain to emerge, a strain for which humans have no immunity.

One way this radical change or reassortment can happen is that a person sick with a human influenza virus also becomes infected with the avian influenza virus and the two viruses re-assort or "mix." This means that the avian influenza virus acquires some of the human influenza genes, potentially creating a new subtype of the influenza A virus for which people would have no immunity. Once this adaptation occurs, it will no longer be a "bird-virus", but will then be a human influenza virus. Such a change would mark the start of a global outbreak (a pandemic).

To date, there is only limited evidence that the virus has the capability of efficient human transmission. By March 2006, the World Health Organization (WHO) had confirmed human cases of Avian Influenza in seven countries (figure 1). In almost all of these confirmed cases, the infection was caused by very close contact with sick or dead birds. It has recently been noted by the Director General of the WHO, "that there is no evidence of sustained human to human transmission of H5N1, or any other potential pandemic influenza virus at this time".[4]

Figure 1: Cumulative Number of Confirmed Human cases of avian Influenza A (H5N1) (March 10, 2006)

	2003		2004		2005		2006		Total	
Country	**Cases**	**Deaths**	**Cases**	**Deaths**	**Cases**	**Deaths**	**Cases**	**Deaths**	**Cases**	**Deaths**
Cambodia	0	0	0	0	4	4	0	0	**4**	**4**
China	0	0	0	0	8	5	7	5	**15**	**10**
Indonesia	0	0	0	0	17	11	11	10	**28**	**21**
Iraq	0	0	0	0	0	0	2	2	**2**	**2**
Thailand	0	0	17	12	5	2	0	0	**22**	**14**
Turkey	0	0	0	0	0	0	12	4	**12**	**4**
Viet Nam	3	3	29	20	61	19	0	0	**93**	**42**
Total	3	3	46	32	95	41	32	21	**176**	**97**

Source: World Health Organization, "Cumulative Number of Confirmed Human Cases of Avian Influenza A/(H5N1) Reported to WHO" (March 10, 2006), www.who.int/csr.disease.avian_influenza/country/cases_table_2006-03-10/en/index

[4] Lee Jong-Wook, Director General, World Health Organization, "Statement to Press Conference," (Nairobi, Kenya, March 9, 2006), www.who.int/dg/lee/speeches/2006/mbagathi_hospital/en/index.html.

2.1.4 Pandemic Influenza

Outbreaks of pandemic influenza have happened every ten to forty years for at least the last 500 years. There were three outbreaks of pandemic influenza the 20th century: "Spanish influenza" in 1918, "Asian influenza" in 1957, and "Hong Kong influenza" in 1968. The 1918 pandemic "killed at least 40 million people".[5] That pandemic, which was exceptional, is considered one of the deadliest disease events in human history. The 1957 and 1968 pandemics were milder, with an estimated 1 to 4 million deaths for both pandemics.[6]

Pandemic influenza has the following characteristics:

- It is readily transmissible between humans – by coughing and sneezing;
- It is highly virulent; and
- Its virus is genetically unique so that the human immune system has no pre-existing immunity to it. This makes it likely that people who contract pandemic influenza will experience more serious disease than that caused by normal influenza.

Once a fully contagious virus emerges, its global spread is considered inevitable. The pandemics of the previous century encircled the globe in six to nine months, even when international travel was not as rapid or frequent as it is today. Given the speed and volume of international air travel today, the current scientific consensus is that the virus could spread more rapidly, possibly reaching all continents in less than three months.

As most people will lack immunity to the pandemic virus, infection and illness rates are expected to be higher than during seasonal epidemics of normal influenza.

2.2 Projected Health Impact of Pandemic Influenza on the Population of British Columbia

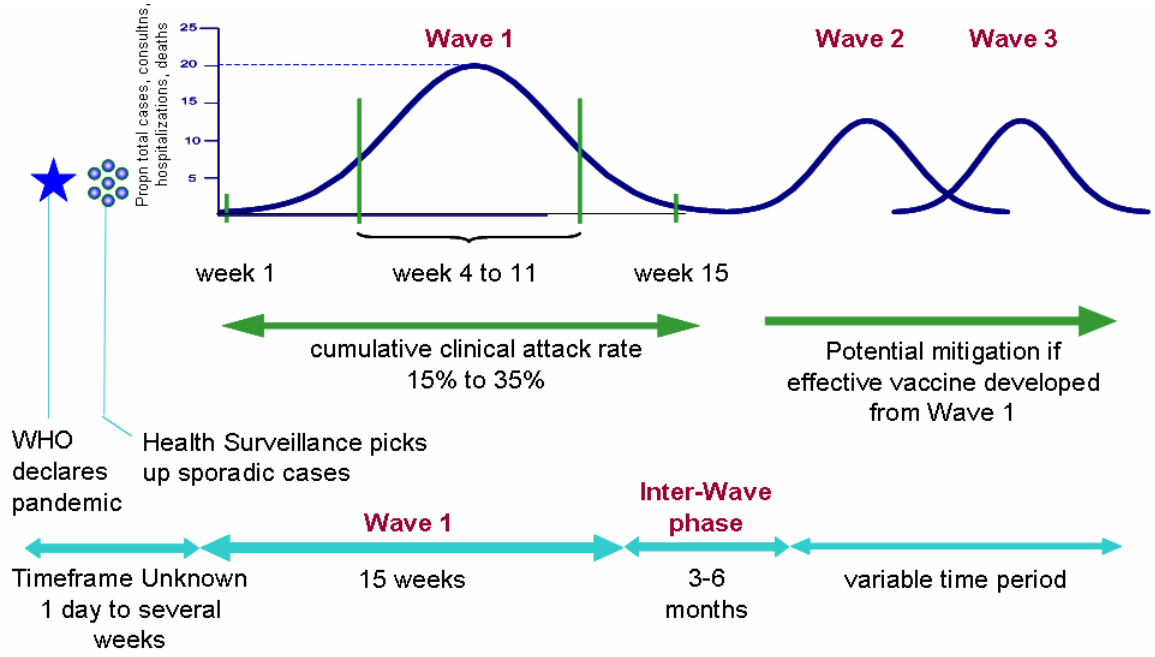
The exact nature and timing of the next outbreak of pandemic influenza in unknown, however, health authorities feel that another is inevitable.

[5] World Health Organization, "Avian influenza frequently asked questions – Why are pandemics such dreaded events?" (Revised December 5, 2005), http://www.who.int/csr/disease/avian_influenza/avian_faqs/en/print.html#vaccine
[6] Dr. Sherry Cooper, *Don't Fear Fear or Panic Panic*, (BMO Nesbitt Burns, October 2005).

2.2.1 Pandemic Influenza Curve

Pandemic influenza typically occurs in one or more "waves" of approximately 15 weeks in duration. There will be an inter-wave period of approximately 3 to 6 months prior to the second wave appearing. The peak of the pandemic wave will normally occur over a 2 week period, usually during weeks 4 to 11 of the approximately 15 week duration of the pandemic wave. This is referred to as the "pandemic curve". Figure 2 portrays the typical pandemic wave curve.

Figure 2: Typical Pandemic Influenza Curve



Source: Developed in conjunction with Dr. P. Kendall, Provincial Health Officer, BC Ministry of Health. December 2005.

It is anticipated that the initial wave of the pandemic may have the most severe impact as it is extremely unlikely that a suitable vaccine will be available at the start of the pandemic. However, the severity of a second (or third) wave may be mitigated if an effective vaccine can be developed, manufactured, distributed and administered on a population basis in sufficient quantities prior to the arrival of the second wave. The development and manufacture of an effective vaccine is dependent upon the isolation of the mutated H5N1 avian virus during the initial wave of the pandemic. Development of such a vaccine could take several months.

2.2.2 Estimates of the Impact on the Population of British Columbia

The US Centers for Disease Control and Prevention ("CDC") have developed a static modeling tool that provides an estimate of the anticipated impact on the population. The modeling tool (FluAid 2.0)[7] was designed to assist public sector planners in preparing for an outbreak of pandemic influenza by providing a range of estimates of the potential impact of the pandemic in terms of outpatient cases (to physicians and/or hospital emergency rooms), the number of cases requiring hospitalization, and mortality due to a pandemic.

The impact of an outbreak of pandemic influenza on the population of British Columbia has been modeled using a clinical attack rate (CAR) of 15% to 35%.[8] The clinical attack rate (CAR) is a measure of the percentage of the total population that becomes clinically ill during a pandemic wave. Clinically ill is defined as being unable to attend work or participate in other "regular" activities for at least 1.5 days.[9]

The model calculates these projected "impact scenarios" based on the defined clinical[10] attack rate (e.g., 15%, 25% and 35%) using the age-based population inputs (0-17 years of age, 18-64 years of age and 65+ years of age).

This is consistent with the results of other studies, one[11] of which concludes 20% - 40% of the population will be infected. The FluAid model also calculates a high-level categorization of the age-based population input into "high risk" and "non-high risk" categories.

"High risk" individuals are those who have a pre-existing medical condition (e.g., asthma, diabetes mellitus) making them more susceptible to developing medical complications from influenza. High risk does not mean that those persons are more likely to contract a case of pandemic influenza. It means that they are more likely to have an adverse health outcome, if they become ill, (e.g., outpatient visit, hospitalization) than those in the "non-high risk" category.

Figure 3 displays the categorization of the population of British Columbia for the non-high risk and high risk categories, by age group, as generated by the FluAid model.

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[7] US Centers for Disease Control and Prevention, "FluAid, On-line Calculator" (Atlanta, Georgia: 2005), http://www2a.cdc.gov/od/fluaid/

[8] The population inputs for the FluAid Model for the Province of British Columbia were provided by the BC Ministry of Health, December 2005.

[9] *BC influenza Pandemic Preparedness Plan, Annex B – Estimating Health Impacts* (BC Ministry of Health, October 2005).

[10] Also called 'infection' or 'gross' attack rate.

[11] Jefferey K. Taubenberger, "1918 Influenza: the Mother of All Pandemics" (Maryland, USA, 2005).

Figure 3: FluAid Model– Non-high Risk and High Risk Population Categorization for British Columbia (rounded)[12]

British Columbia: Population (Numbers and Distribution)[13]					
	0-17 yrs	**18-64 yrs**	**65+ yrs**	**Total**	**% of Total**
Non-high risk	799,000	2,395,000	353,000	3,547,000	84.
High risk	55,000	403,000	235,000	693,000	16.
Totals	**854,000**	**2,798,000**	**588,000**	**4,240,000**	**100**

The impact of pandemic influenza on the population of British Columbia, using the range of clinical attack rate (CAR) of 15% to 35% would mean that approximately 635,000 to 1,480,000 individuals would be clinically ill. Figure 4 presents the impact of pandemic influenza on the BC population, including the projected outpatient, hospitalization and mortality cases, as calculated using the FluAid model.

Figure 4: FluAid Model Case Projections for British Columbia (outpatients, hospitalization, and mortality) (rounded)

Projected Impact of the Population	**BC Population 4,2 million**	**CAR 15%**	**CAR 25%**	**CAR 35%**
# clinically ill		635,000	1,050,000	1,480,000
# cases - outpatient		335,000	560,000	787,000
# cases -hospitalization		7,900	13,300	18,600
# cases – mortality		1,800	3,000	4,300

Appendix 4 summarizes the detailed projected impact of pandemic influenza on the population of British Columbia using 15%, 25% and 35% clinical attack rates, by age group, as generated by the FluAid model. The data presented are for the estimated range of the number of outpatient cases, the number of cases requiring hospitalization, and the projected deaths.

The projections, using the FluAid model, have also been calculated for each of the five regional Health Regions in British Columbia and these are provided in Appendix 5.

[12] Population data provided by: BC Statistics, PEOPLE 30-QA-Nov 30, Ministry of Labour and Citizens' Services; BC Ministry of Health, Information Quality and Analytics, Knowledge Management and Technology Division

2.3 Health Sector Costs

The estimated health care costs due to an outbreak of pandemic influenza have been derived using figures for the clinical attack rate of 15% to 35% for the population of British Columbia (using the FluAid model figures). The CAR impacts on the BC population are displayed in Figure 3 (and Appendix 5 for the Regional Health Authorities in BC).

2.3.1 Direct Health Care Costs

The potential direct health care costs for both hospitalization and outpatient costs attributable to an outbreak of pandemic influenza in British Columbia are estimated to be in the range of $60 to $142 million. The derivation of this estimate is provided in Figure 5.

Figure 5: Direct Health Sector Costs

CAR 15%

Hospitalization Costs	Cost per Hospital Day (BC)[14]	Average # of Days in Hospital[15]	Cost per stay (per case)	Projected # of Hospitalization Cases	Projected Hospitalization Costs
	$660	8	$5,280	7,900	$41,712,000
Outpatient Costs	**Cost per GP Visit (BC)[16]**	**Average # of GP Visits/case[17]**	**Cost per stay case**	**Projected # of Outpatient visits**	**Projected Outpatient Costs**
	$32.50	1.7	$55.25	335,000	$18,508,750
Total (rounded)					$60,200,000

[14] Cost per hospital day in BC derived from Canadian Institute for Health Information data – Canadian MIS Hospital Financial Performance Indicators (costs per weighted caser), 2003/03 data.
[15] N. Wilson, M. Baker, P. Crampton and O. Mansoor, "The Potential Impact of the Next Influenza Pandemic on the Primary Care Medical Workforce," *Human Resources for Health*, volume 3 (2005).
[16] Cost per GP visit provided by BC Ministry of Health, Health Modernization Branch, Knowledge Management and Technology Branch. Based on 2004/05 MSP Information Resource Manual.
[17] A. Monto et al cited in a presentation given by Dr. D. Skowronski, BC Centre for Disease Control, at the Preparing for Pandemic Forum for Business, December 15, 2005.

CAR 25%

Hospitalization Costs	Cost per day (BC)	Average # of Days in Hospital	Cost per stay (per case)	Projected # of Hospitalization Cases	Projected Hospitalization Costs
	$660	8	$5,280	13,300	$70,224,000
Outpatient Costs	**Cost per GP Visit (BC)**	**Average # of GP Visits/case**	**Cost per stay case**	**Projected # of Outpatient visits**	**Projected Outpatient Costs**
	$32.50	1.7	$55.25	560,000	$30,940,000
Total (rounded)					$101,200,000

CAR 35%

Hospitalization Costs	Cost per Hospital Day (BC)	Average # of Days in Hospital	Cost per stay (per case)	Projected # of Hospitalization Cases	Projected Hospitalization Costs
	$660	8	$5,280	18,600	$98,208,000
Outpatient Costs	**Cost per GP Visit (BC)**	**Average # of GP Visits/case**	**Cost per stay case**	**Projected # of Outpatient visits**	**Projected Outpatient Costs**
	$32.50	1.7	$55.25	787,000	$43,481,750
Total (rounded)					$141,700,000

2.3.2 Associated Health Care Expenditures

Other health care costs incurred by individuals, but not borne by the publicly funded health care system, would include over the counter (OTC) "flu" medications purchased and paid for by individuals. To derive an estimate of the amount of money spent of "flu OTCs" the following assumptions have been used in this study:

- The average expenditure per person for "flu" OTC's will be $30.00, for those who purchase these medications.
- For the CAR rate of 15% (445,000), 25% (575,000) and 35% (810,000 cases), the outpatient, hospitalization and mortality cases will not have purchased "flu OTC's".
- Of the remaining portion of those in BC who become clinically ill (CAR 15% = 190,000; 25% = 475,000; and 35% = 670,000) who are not outpatient, hospitalization and mortality cases – it is assumed that 50% to 75% of those will purchase "flu OTCs".

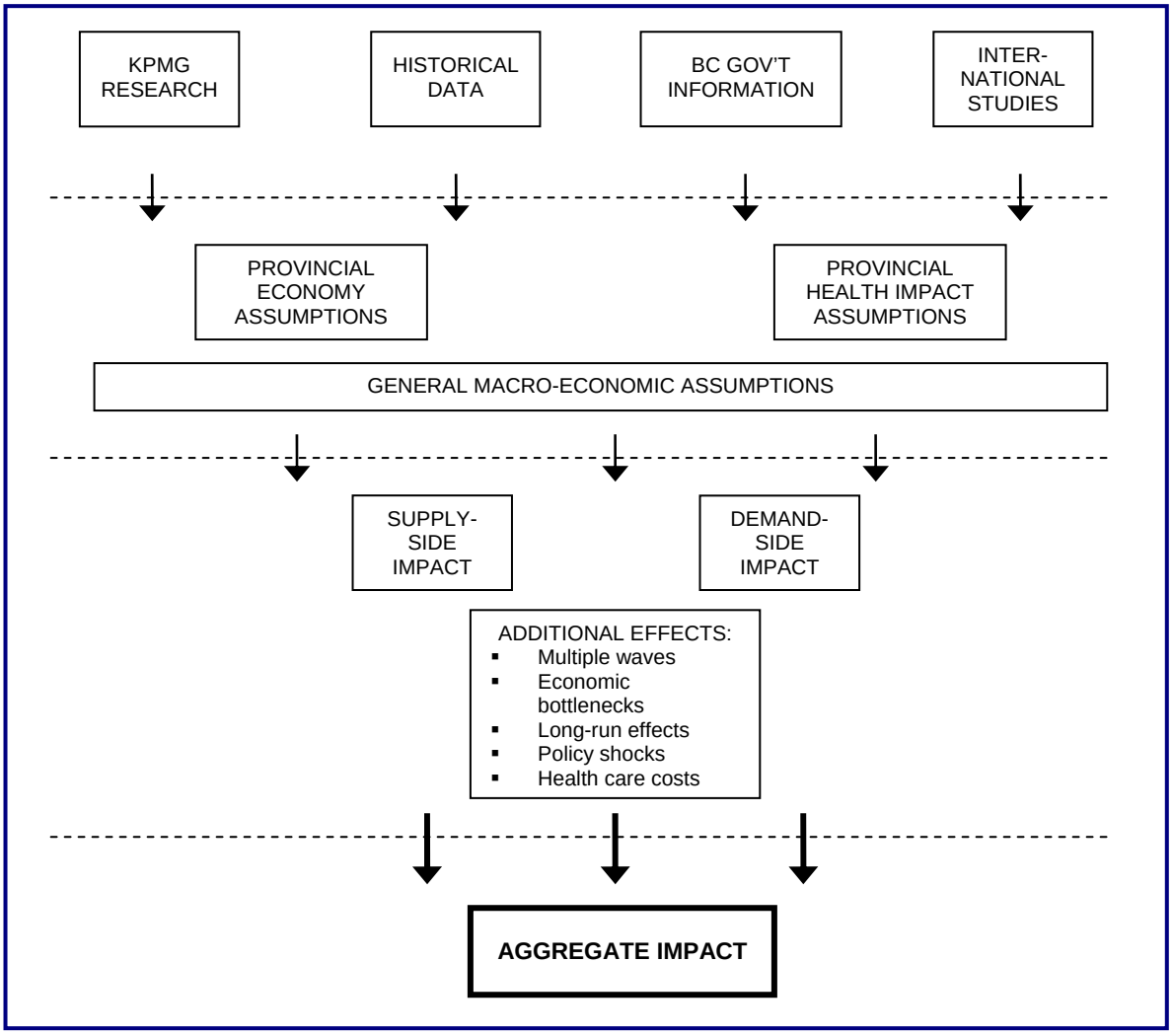
Based on these assumptions, the expenditure on "flu OTC" remedies in British Columbia is estimated to be in the range of $3 million to $15 million, as shown in Figure 6.

Figure 6: Estimated Expenditures on Over –the-Counter Medications

% of "non-outpatient, non-hospitalized, non-mortality" cases purchasing an OTC	CAR 15%	Per Capita Expenditure	Total Expenditure (rounded)	CAR 35%	Per Capita Expenditure	Total Expenditure (rounded)
50%	95,000	$30	$3 million	335,000	$30	$10 million
75%	142,500	$30	$4 million	502,500	$30	$15 million

3. ESTIMATION BASIS FOR THE ECONOMIC IMPACT IN BC

As the timing, virulence and general manifestation of a future outbreak of pandemic influenza are uncertain, predicting its exact economic and social costs for the province of BC is not feasible. What is possible, however, is the development of a conceptual framework that supports several assumptions that serve as the basis for an estimation of the province-wide economic and social impacts of a pandemic. The main components of the conceptual framework developed for this study are depicted below.



Published estimates, along with available data pertaining to historical and similar events, have been used to develop reasonable assumptions for the different elements of this analytical model.

Section 3.1 provides an overview of current studies that have been undertaken by several prominent organizations on this subject. Section 3.2 provides a description of the assumptions that support our conceptual framework. These assumptions also form the foundation of the economic indicator filter (Appendix 7) that was used to help characterize the relative impact of a pandemic by industry sector.

3.1 International Approaches to Impact Estimation

The methodology employed in our study is similar to the approach taken by several other organizations, including the World Bank, BMO Nesbitt Burns, the US Congressional Budget Office (CBO), Finance Canada and the Asian Development Bank ("ADB"), to characterize the impact of an outbreak of pandemic influenza.

The short-term impacts outlined in this paper are based on independent research and analysis. Other international studies, such as "The Potential Economic Impact of an Avian Flu Pandemic on Asia" by the Asian Development Bank (ADB) and the "Economic Impact of an Influenza Pandemic" presentation by the Canadian Department of Finance, have produced similar projections in the short run. The World Bank, for instance, predicts a 2% decline in global GDP, the CBO projects an impact between -1.5% and -5% on US GDP and the ADB estimates annual growth will be negatively impacted in the range of 2.5% to 6% in Asia.

The additional impacts of long-run economic dislocations, multiple waves, policy shocks and bottlenecks are estimated based on a disaggregation of the findings of these other studies and a review of the structure and relationships within the BC economy.

Due to the uncertainty associated with a potential outbreak of pandemic influenza, none of the existing estimation methods can capture the exact impact, particularly because it has not happened as yet – and may never happen. Highlights of some of the international approaches employed are summarized below.

3.1.1 Historical Modeling

Many studies use historical experience of previous human influenza pandemics worldwide as a basis for the expected direct impacts of infection, illness and mortality. The three pandemics that occurred in the twentieth century are most frequently referenced. Past experience has shown significant differences in both health and economic impacts. The 1918-1919 Spanish Flu outbreak, which was caused by the H1N1 strain, forms the basis for many of the 'worst case scenarios' developed. This pandemic is estimated to have killed more than 500,000 people in the US and more

than 40 million worldwide.[5] Milder pandemics, such as the H2N2 pandemic in 1957 ("Asian Pandemic") and the H3N2 pandemic in 1968 ("Hong Kong Flu"), are frequently used as a basis for so called "best case scenarios". The resulting health scenarios, combined with historical GPP impact, then form the basis for estimates of future scale and impact. Some estimates predict that 2 to 7.4 million people will die worldwide,[18] while others predict mortality exceeding 100 million.[19]

3.1.2 Similar Events

Mortality and morbidity statistics for past pandemics are not the only sources of economic and social costs during and after a pandemic. Interestingly, the most immediate impacts of a pandemic are caused by efforts of people trying to avoid contact with the virus. To get a broad idea of the psychologically induced demand, supply and policy shocks, many studies[20] refer to the scale of impact associated with SARS. This disease led to an immediate (short-run) economic loss of approximately two percent of East Asian regional GPP in the second quarter of 2003, despite the death of only about eight hundred people.[21] The Asian Development Bank ("ADB") estimated that the total (long-run) economic impact of SARS was around US$18 billion, which is 0.6% of annual GPP in East-Asia.

In some studies, economic impact is estimated based on the current economic losses resulting from the ongoing stage of the avian flu. Although this pathogenic strain has so far mainly affected the poultry population worldwide, some of the economic and social costs sustained by many nations are expected to be similar in the event of a human pandemic.

3.1.3 Modeling Tools

Many studies rely on statistical data in combination with newly developed modeling tools to predict the health, social and economic impact of a pandemic influenza. Single risk predictive models, such as the one used by the US CDC, are used to forecast illness and mortality rates of an outbreak of pandemic influenza. Similarly the Oxford Economic Forecasting ("OEF") global model has been used to estimate the new equilibrium after shocks to both demand and supply on a global basis.[22]

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[18] World Health Organization, "Avian influenza frequently asked questions – Why are pandemics such dreaded events?" (Revised December 5, 2005), http://www.who.int/csr/disease/avian_influenza/avian_faqs/en/print.html#vaccine

[19] Michael T. Osterholm, "Preparing for the Next Pandemic," *The New England Journal of Medicine* Volume 352, Number 18 (May 5, 2005): 1839-1842.

[20] Studies by Fan, 2003; Knapp et al, 2004; Lee and McKibbin, 2003.

[21] Milan Brahmbhatt, *Avian and Human Pandemic Influenza: Economic and Social Impacts*, World Bank (November 8, 2005).

[22] Erik Bloom, Vincent de Wit and Mary Jane Carangal, *ERD Policy Brief: potential economic impact of an avian flu pandemic on Asia* (San Jose, CA: Asian Development Bank, November 2005).

3.2 Assumptions

To assess the provincial impact of an outbreak of pandemic influenza, it is necessary to isolate the different dynamics that affect the economy during and after the event. For this purpose, the conceptual framework with assumptions about demand and supply variables has been formulated. The framework shows that independent economic research, backed by findings of comparable studies and historical data, forms the basis of demand and supply side assumptions for the measurement of total economic impact in British Columbia. The objective is to explain the various factors affecting economic impact, and to do so in a manner directly consistent with leading public and academic sources. The reader is cautioned, however, that while these assumptions are reasonable for illustrative purposes and to support overall understanding, they are not presented as predictions of actual impact.

The health assumptions in our study rely on estimates calculated by the US CDC's FluAid 2.0 model, using provincial age-based population data that was provided by the BC Ministry of Health. The assumptions take into account the strong possibility that an outbreak of pandemic influenza will be a reassortment of the avian strain. This results in a higher impact than in a non-'avian related'-pandemic for certain sectors (for example for agriculture).

3.2.1 General Macro-Economic Assumptions

Some of the variables that we must characterize to calculate the impact of a pandemic cannot be evaluated with a quantitative empirical approach based on factual information provided by the government or economic research. The impact of dependence of demand on seasonal cycles, for example must be based on a more qualitative judgment. For these variables, it is assumed that the impact of a pandemic on demand or supply is predominantly driven by the *importance* of the variable to the BC economy. For example, a high dependence on exports will make the economy more vulnerable to a decline in international demand. To estimate the impact of a pandemic on these variables, their importance has been carefully evaluated[23] for each individual sector[24] in BC and averaged to obtain the aggregate impact of the variable on the BC economy.

Importance is classified as low, medium or high based on best judgment. In order to determine relative impact magnitudes, these characterizations (L, M and H) have been set to correspond to the following assumptions about economic impact:[25]

[23] Both subjective judgement of the authors and opinion of representatives of certain industries have been consulted for this evaluation. Appendix 6 provides a summary of the industry interviews conducted.
[24] The filter in Appendix 7 provides an overview of the assumed importance by sector
[25] This approach assumes a direct translation of the importance of a variable to the impact of a pandemic on this variable. As such, it does not take into consideration that the impact of an influenza pandemic on these variables may be greater for

- Low importance is assumed to lead to an average 0.2% negative sectoral impact of a pandemic on annual GPP.
- Medium importance is assumed to lead to an average 0.5% negative sectoral impact of a pandemic on annual GPP.
- High importance is assumed to lead to an average 0.8% negative sectoral impact of a pandemic on annual GPP.

These assumptions are modeled on the impacts of previous similar events and other economic impact studies associated with pandemic influenza.

Due to the uncertainty about the dimensions of the pandemic, insufficient information exists to predict long-term consequences for the BC economy. The analysis, therefore, focuses on the short-term impact, defined as 'the impact that will occur within one year from the onset of the pandemic'. (For the purpose of simplification the pandemic is assumed to come in one single wave, shortly after January 1st - see section 3.2.2.)

Although this study is focused predominantly on the short-term impact of a pandemic, some consideration is given to the longer-run consequences, such as the impact of damaged investor confidence and the delayed effects of policy shocks. These long-term notions are, however, merely intended to provide some direction for future consideration.

In addition to the distinction between longer-term and short-term impacts, the evaluation is based predominantly on the direct impacts related to a pandemic. Direct impact is defined as the changes in demand or supply for a particular sector, directly related to the absence of employees or customers. Indirect (secondary) impacts, defined as the change in demand or supply due to reduced demand or shortages in another sector, are considered to a lesser extent. Both exogenous and endogenous sources of impact are included in this assumption.

Implicit in the evaluation is the likelihood that some sectors will be more significantly affected than others and the likelihood that some companies in certain sectors will benefit from the pandemic.

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some sectors than for others. Nor does it allow for a greater impact on select variables. For example: the variables 'seasonality' and 'enterprises that bring people together' are both of 'medium' level importance to successively the forestry sector and the information & culture sector. This leads to a 'medium level' (0.5%) impact of an influenza pandemic on each sector, despite the fact that the degree of required social contact is thought to affect demand more than any of the other variables impacting demand.

3.2.2 Health Specific Assumptions

Health impact in BC is calculated based on the FluAid 2.0 model designed by the US-CDC[26]. This model is a Monte Carlo mathematical simulation model with predefined probability rates based on death and illness rates reported in earlier pandemics. It calculates the number of additional deaths, hospitalizations, and illness requiring medical consultation that is attributable to pandemic influenza (see section 2.2). It does not take into account any public health interventions to control disease spread such as quarantine, or access to and use of an appropriate vaccine. The basic health related assumptions of this impact evaluation are as follows:

- The pandemic will occur in several waves of approximately fifteen weeks in duration, each peaking for about two weeks between week four and week eleven. As the impact of the initial wave is assumed to be the most significant, all calculations and estimates in this document apply only to this first wave; the impact of subsequent waves is calculated as a percentage of the first wave. (See section 4.5)
- Clinical attack and absenteeism is assumed to be normally distributed. The assumed clinical attack rate is between 15% and 35% with a risk rating based on age and pre-existing medical conditions. 84% of the population is considered to be in the non-high risk category, while 16% is considered as high risk. The majority of the affected population will fall within the higher and lower age groups, as it is assumed that these age-groups, plus people with a pre-existing medical condition will have weaker immune systems, thus making them more vulnerable to the infection.
- The virus will run its course within twelve months of the same calendar year and will reach all continents of the world in less than three months from the onset of the outbreak. It is also assumed the pandemic will likely occur between the late fall and early spring seasons. For purposes of this analysis, it is assumed that it will strike shortly after January 1st. The incubation period (interval between infection and onset of symptoms) is approximately 2 days. Some people will become infected without developing clinically significant symptoms. Asymptomatic or minimally symptomatic individuals are capable of transmitting infection and developing immunity to subsequent infection themselves. Development of the vaccine against the virus will take several months, after the virus has been isolated.

[26] Details of the FluAid model software and a comprehensive list of the underlying assumptions can be obtained from the US-CDC.

3.2.3 Supply Specific Assumptions

Implicit in the supply side estimation is the assumption that the pandemic will run its course within 12 months over calendar year, despite the fact that it is possible that the event might cover two calendar years.

The employed workforce of BC counts 2.1 million people. [27] Average productivity measured on a value-added basis in BC for the entire workforce is $31.40 per hour. [28]

It is assumed that the impact on supply in BC can be captured by an estimation of the aggregate effect of a pandemic on the following variables:

- Labour disruptions due to absenteeism.
- Dependence on imports.
- Dependence on Just-in-Time productions and logistics ("JIT").

The impact of absenteeism can be evaluated with a calculation and the impact of the other variables must be estimated based on subjective judgment. The assumptions underlying these variables are set out below.

Absenteeism

It is assumed that the absenteeism rate of the employed workforce will equal the clinical attack rate of the population.[29] However, several factors could increase or decrease absenteeism relative to the CAR. However, due to the lack of reliable data, it is assumed these effects cancel each other out in this estimation. Therefore, the assumed absenteeism rate for the aggregate economy includes all employees that do not report to work due to illness, care of sick family members, fear of infection and public health interventions.

The absenteeism *rate* is 15%, 25% or 35%, depending on the scenario used and represents the total number of people that will be absent over the course of the pandemic wave.

[27] BC Statistics, Ministry of Labour and Citizens' Services, www.bcstats.gov.bc.ca/data/1ss/1fs/1fsall.pdf
[28] BC Statistics, "Probing the Productivity Puzzle" (October 14, 2005).
[29] As per the suggestion of the Public Health Agency of Canada, Dr. T. Tam (February 15, 2006).

The estimated average number of days off work due to pandemic influenza is 5.25 days or 1.05 weeks.[30] Assuming a work week of 37.5 hours, this translates into an average duration of absenteeism of 39.4 hours due to the pandemic over and above regular absenteeism.

Although this study does not provide estimates for the supply-side impact on individual sectors, the following assumption is implicit in the absenteeism calculation: while the required number of people per one million dollars of output varies for every sector, it is assumed that the sectoral level of labour intensity will not cause disproportionate losses for certain sectors. The only cases where disproportionate losses could occur include:

- Sectors with critical skill sets where replacement in the short term is not possible (e.g., air traffic controllers); and
- Sectors with higher levels of social contact required (e.g., tourism and entertainment sectors).

Dependence on Just-in-Time Logistics and Imports

A higher dependence on just-in-time logistics (delivery of inputs, manufacturing and shipment of outputs) is assumed to increase the negative impact on GPP as a result of production process problems.[31] In addition, a higher dependence on imports for input materials is expected to increase negative effects due to the direct impact of the susceptibility to logistical problems with shipping and cargo systems, and the indirect impact of material shortages in other countries.

It is assumed that the impact of these variables on BC supply is predominantly driven by their importance to the BC economy. Based on the judgment of the authors and discussions with several members of industry, the importance of these variables has been assessed for each individual sector.[32] This analysis takes into consideration the relative dependence of each sector, on each factor affecting susceptibility to pandemic influenza impact. The results of this assessment as follows:

[30] A.P. Smith et al cited in a presentation given by Dr. D. Skowronski, BC Centre for Disease Control, at the Preparing for Pandemic Forum for Business, December 15, 2005.
[31] Only supply chain costs originating in the sector itself (direct costs) are included in this estimate. Indirect costs are considered to add to overall supply-side impact. The impact of indirect costs is considered in section 4.4 of this document.
[32] The filter in Appendix 7 provides an overview of the assumed importance by sector.

Industry Sector	Importance of Just-in-Time Production Processes	Import Dependency	% of GPP
Crop and Animal Production	L	L	0.9%
Forestry & Logging	M / H	L	2.7%
Fishing, Hunting and Trapping	L	L	0.1%
Support Activities for Agriculture & Forestry	L	M	0.4%
Mining, Oil & Gas Extraction	M / H	M	2.9%
Utilities	M	M	1.8%
Construction	L	L	5.9%
Manufacturing	M / H	M / H	11.9%
Wholesale Trade	L	H	5.2%
Retail Trade	L / M	H	6.0%
Transportation & Warehousing	M / H	L / M / H	6.4%
Information and Culture	L	L	4.2%
Finance, Insurance and Real Estate	L	L	22.3%
Professional, Scientific & Technical Services	L	L	8.6%
Administrative & other Services	L	L	
Educational Services	L	L	4.7%
Health Care & Social Assistance	L	L	6.6%
Arts, Entertainment & Recreation	L	M	1.1%
Accommodation and Food Services	L	M	3.1%
Other services (Except Public Administration)	L	L	Part of professional scientific and other services
Non-profit Institutions serving households	L	L	
Government Sector	L	L	5.2%

This assessment suggests an approximately equal level of "L" (low) and "M" (medium) importance was assigned across the economy for both JIT processes and import dependency. As result, these factors are considered to have a low to medium impact on the supply-side of the BC economy.

3.2.4 Demand Specific Assumptions

For the purpose of our analysis, it is assumed that the impact on demand in BC can be captured by an estimation of the aggregate effect of a pandemic on the following variables:

- Required degree of social interaction.
- Dependence on exports.
- Influence of the time of year (particular season).

Required Degree of Social Contact

Consumer confidence is one of the main drivers of demand in the economy. Fear and panic ignited by an outbreak of pandemic influenza are assumed to influence consumer confidence, causing significant changes in consumption and social patterns immediately following the onset. Enterprises that bring people together, such as public transport, the entertainment industry and hospitality, could be avoided out of fear of becoming infected with the virus. As a result, a higher score on this variable indicates a greater expected impact on provincial GPP as a result of an pandemic. In addition, a greater dependence on cross-jurisdictional travel is expected to increase the economic impact of an outbreak of pandemic influenza. Implicit here is the assumption that no inter-sectoral reallocation of demand takes place.

Export Dependency

A higher dependence on exports is assumed to cause a greater decline in GPP as a result of an outbreak of pandemic influenza. This is predominantly due to the direct impact of the susceptibility to public trade and travel prohibitions,[33] and the indirect impact of economic downturns in other countries.

Seasonality

It is assumed that higher dependence on economic activity during the winter (or holiday) season for annual profitability will increase the negative impact of a pandemic.

It is assumed that the impact of these three variables on BC demand is predominantly driven by their importance to the BC economy. Based on the judgment of the authors and discussions with

[33] Local and global advisory and prohibitions could cause logistical disruptions to the global shipping and cargo systems, in addition to a significant reduction in tourism and business travel.

industry representatives, the importance of these variables has been assessed for each individual sector[34] as follows:

Industry Sector	Export Dependency	Enterprises that Bring People Together	Seasonality	% of GPP
Crop and Animal Production	L	L	L	0.9%
Forestry & Logging	L	L	M	2.7%
Fishing, Hunting and Trapping	L	L	M	0.1%
Support Activities for Agriculture & Forestry	L	L	L	0.4%
Mining, Oil & Gas Extraction	H	L	L	2.9%
Utilities	M	L	L	1.8%
Construction	L	L	L	5.9%
Manufacturing	H	L / M	L	11.9%
Wholesale Trade	L	L	L	5.2%
Retail Trade	L	H	L	6.0%
Transportation & Warehousing	L / M / H	L / M	L	6.4%
Information and Culture	L	M	L	4.2%
Finance, Insurance and Real Estate	L	L	L	22.3%
Professional, Scientific & Technical Services	L	M	L	8.6%
Administrative & other Services	L	M	L	
Educational Services	L	H	M	4.7%
Health Care & Social Assistance	L	H	L	6.6%
Arts, Entertainment & Recreation	L	H	L	1.1%
Accommodation and Food Services	L	H	L	3.1%
Other services (Except Public Administration)	L	M	L	Part of professional scientific & technical services
Non-profit Institutions serving households	L	M	L	
Government Sector	L	L	L	5.2%

[34] The filter in Appendix 7 provides an overview of the assumed importance by sector.

In summary, with allowances for individual sectors, the importance of exports is considered low, required social contact is considered medium, and dependence on the winter-holiday season is considered low, for the purpose of estimating the impact on the demand-side of the BC economy.

Implicit in the demand assumptions is the idea that certain strong initial and weaker final reactions will cancel each other out. For example: although the average required social contact in the BC economy is considered only "medium', the economic impact of the effect of a pandemic on this variable could be greatly exacerbated during the first weeks of a pandemic. This would cause more than the assumed corresponding 0.5%[35] decline in GPP. This effect would be somewhat mitigated if such overreaction of the market is short-lived. Indeed, historical evidence shows that populations quickly adapt to catastrophes such as natural disasters and terrorist attacks, bringing economic activity back to regular levels in relatively short order.

3.2.5 Factors of Uncertainty

Despite the fact that these assumptions create a good basis for drawing qualitative and quantitative conclusions about the impact of pandemic influenza in BC, it needs to be emphasized that the potential consequences are based on a subjective interpretation of the assumptions, not on a scientific or empirical inference. It is important to remember that the assumptions themselves are, in fact, ambiguous. As a cautionary note, some of the aspects adding to a possible over- or under-statement of the impact that need to be considered are:

- There is a possibility of adverse distributional effects for certain commodities in certain countries (for example for poultry in Vietnam).
- The economy today could be more vulnerable than stipulated in the assumptions due to increased travel and tourism and increased dependence on global trade. Just-in-time inventory management and increased global vertical specialization could make production more vulnerable to supply chain disruptions. On the other hand, decreased vulnerability could result from modern phenomena such as tele-working, provisions for sick-leave and absence[36] and implementation of international level public health interventions such as surveillance systems, use of antiviral prophylaxis and improved medical treatment
- It is not known when and where the human influenza will break out. Nor is it known how dangerous the influenza strain will be to human health. If it is accompanied by a so called

[35] See macro economic assumptions in paragraph 3.2.1.
[36] Department of Finance, Canada, *The economic impact of an influenza pandemic* (December 14, 2005).

'cytokine storm,[37] for example, mortality can be focused quite disproportionately among the working population (20 – 40 year olds). This could shift BC's demographics and cause more serious employed workforce disruptions leading to more serious supply side impacts.

- A limitation of the FluAid model is that its upper incidence rate for clinical illness is 35%, when higher rates (such as 50%) are plausible.

[37] A cytokine storm refers to the phenomenon of enormous lung and other organ damage from an overproduction of the regulatory protein cytokine by the immune system. People with strong immune systems produce the most cytokine. As a result, the majority of fatalities will be among the working population. (BMO Nesbitt Burns, 2005)

4. ECONOMIC IMPACT IN BC OF PANDEMIC INFLUENZA

The assumptions in Section 3 form the foundation of this high level study outlining the macro-economic impact of an outbreak of pandemic influenza. The outputs of the FluAid model have been used to characterize the expected BC health impact of a pandemic (section 2.2.2, Figure 3).

In combination with a number of overall economic and sector-specific assumptions, the health impact can be translated into the possible direct, short-term, supply- and demand-side effects on the economy (sections 4.2). To discuss longer term impacts, a macro-level picture of the aggregate effect on the BC economy is presented in section 4.3, including consideration of a number of mitigating and aggravating factors and additional effects to the economy. Section 4.4 presents a number of sector-specific issues.

4.1 Health Impact on the Population

An outbreak of pandemic influenza in BC, with clinical attack rate (CAR) of 15% to 35% could result in approximately 635,000 to 1,480,000 individuals becoming clinically ill, with 335,000 to 787,000 person requiring outpatient attention, 7,900 to 18,600 hospital cases, and between 1,800 and 4,300 deaths (see figure 3, section 2.2.2).

4.2 Aggregate Short-term, Single Wave, Direct Impact on the BC Economy

4.2.1 Macro Level Supply Shock

Given the assumptions outlined in section 3.2, an outbreak of pandemic influenza could result in an average absenteeism of 15%, 25% or 35% among the employed workforce during its fifteen week course. Given a total BC employed workforce of 2.1 million,[52] this means between 315,000 and 735,000 members will be absent at some point during the pandemic, following a normal statistical distribution (figure 7). The following formula has been used to calculate absenteeism:

Total number of employed people **x** absenteeism rate = Pandemic absenteeism

Figure 7: Potential Absenteeism – BC Workforce

CAR	BC employed workforce	Resulting absenteeism
15%	2,100,000	315,000
25%	2,100,000	525,000
35%	2,100,000	735,000

To calculate the supply side effect of the pandemic, the assumptions about the absenteeism rate, average productivity measured in valued-added terms, and the average period of absence must be combined with the total workforce in BC. The following formula results:

Total number of persons absent due to pandemic **x** (Average period of absence x Average productivity per employee) = Loss in GPP as a result of the pandemic

Thus the total loss of output (GPP) in BC as a result of pandemic related absenteeism would be $390 million to $909 million for the year in which it occurs (figure 8). This represents about a 0.3% - 0.7% short term impact on the economy.

Figure 8: Short-term Impact on GPP (BC) due to Absenteeism

Absenteeism	Resulting GDP loss @ 39.4 hours per $31.40 productivity[38]
315,000	$390 million (or 0.3% of GPP)
525,000	$650 million (or 0.5% of GPP)
735,000	$909 million (or 0.7% of GPP)

The decline in GPP from the supply shocks related to disruption in production processes (dependence on JIT) and dependence on imports must be added to this impact to obtain the total direct, short-term, supply shock. Interviews with representatives of various industries confirmed **that both these variables are of low to medium importance** on average for the supply-side of BC's economy, corresponding to 0.35%[39] decline in GPP per variable. Combining the ratings for these variables results in an estimated 0.7% decline in GPP results in a **total short-term, direct supply shock** of **1.0% - 1.4%** (figure 9).

[38] BC Statistics, "Probing the Productivity Puzzle" (October 14, 2005).
[39] (Low (0.2%) + Medium (0.5%) = 0.7%) / 2 = 0.35%

Figure 9: Total Short-term Direct Supply Shock

CAR	GDP loss from absenteeism	GDP loss from JIT + import dependence	Total short-term, single wave direct supply shock
15%	0.3%	0.7%	1.0%
25%	0.5%	0.7%	1.2%
35%	0.7%	0.7%	1.4%

Note: This estimate does not include long-term effects, the impact of indirect effects, or consequences of multiple waves of influenza associated with a pandemic. The impact of these factors as a result of an outbreak of pandemic influenza is captured in an estimation of the aggregate impact on the BC economy, as outlined in section 4.4.

4.2.2 Macro Level Demand Shock

The economic performance of individual sectors in BC (see appendix 1), in combination with the assumptions about the demand-side effects (see section 3.2) allow for a rough estimate of the decline in BC's demand as a result of an outbreak of pandemic influenza. The assumptions are based on the judgment of the authors and on opinions of industry representatives.[40]

The demand related assumptions consider the average **importance of exports as low**, the average required **level of social contact as medium** and the average **importance of seasonality as low** for the BC economy, corresponding to, respectively, a **0.2%, 0.5% and 0.2%** decline in GPP. To obtain the total direct short-term, demand shock, the corresponding assumed impacts on GPP, as outlined in section 3.2 have been aggregated, bringing the **total direct short-term, demand shock** to **0.9%** (figure 10).

Figure 10: Total Short-term, Direct-cost Related Demand Shock

Loss from decline in exports	Loss from psychological effects of perceived social contact	Loss from seasonal impact	Total short-term, single wave direct Demand shock
0.2%	0.5%	0.2%	0.9%

Note: This estimate does not include long-term effects, impact of indirect impacts in the economy or consequences of multiple waves of influenza associated with a pandemic. The impact of these

[40] A synopsis of the industry interviews is included in Appendix 6.

factors could be severe enough to trigger recessionary effects in the economy, although might be mediated by social and economic policies such as employment insurance, direct transfers to individuals or businesses, or sectoral economic support. However, estimating the impact of recessionary pressures and ameliorating factors are outside the scope of the current analysis.

4.2.3 Aggregate Short-term, Single Wave, Direct Impact on the BC Economy

So far, our study has presented the short-run, direct impacts of a single wave of pandemic influenza to the economy of BC. A summation of these estimated demand and supply shocks suggests that an approximate **1.9% - 2.3%** direct decline in provincial GPP can be expected as a result of the first pandemic wave in the short run (first year after the pandemic) (see figure 11).

Figure 11: Aggregate Short-term, Single wave, Direct Impact on the BC Economy

CAR	Total short-term, single wave direct Supply shock	Total short-term, single wave direct Demand shock	Aggregate short –term, single wave direct GPP loss
15%	1.0%	0.9%	1.9%
25%	1.2%	0.9%	2.1%
35%	1.4%	0.9%	2.3%

The most immediate effects of this 1.9% - 2.3% loss will include the curtailing of non-acute health care and a decline in other demand arising from the uncoordinated efforts of people trying to avoid infection with the virus. Sectors that are considered to call for a high amount of interpersonal contact, such as tourism, public transport, retail, education, accommodation and food services and the entertainment industry will likely suffer a large demand shock from this psychological effect. Additional demand-side declines associated with a pandemic might be further decreases in international travel, due to government or self-imposed restrictions on travel to, from and within BC. These declines could dent consumer confidence, leading to further negative impact on demand in BC. It is reasonable to suggest that stock markets will show an initial decline, but with a short-term rebound, as during the SARS outbreak.

The supply shock in BC would predominantly depend on the spike in absenteeism. Disruption of production processes, possibly including broken supply chains, and dependence on imports would add to this negative effect on the economy. If the virus is in fact a strain of the avian influenza, the poultry sector would be hit especially hard. As millions of birds in BC will have to be culled, the production and consumption of eggs and poultry could decrease significantly, affecting not only the agricultural sector, but also the fast-food and manufacturing industries.

4.3 Aggregate Total Impact on the BC Economy

As outlined in the assumptions underlying this analysis, the impacts considered so far include *only* the direct short-run impact associated with the first wave of a pandemic. They do not, for example, consider the reallocation of demand. For a comprehensive final projection, a number of additional, potentially mitigating or aggravating aspects have to be factored into the evaluation. These include, by way of example, the long-run effects, the effects of multiple waves, policy shocks and indirect (secondary) costs of bottlenecks in the economy.

The following considerations will help shape the overall aggregate macro-level impact of pandemic influenza on the economy. The result can be expressed as a range, emphasizing the uncertainties inherent in the projections.

4.3.1 Multiple waves

To facilitate modeling of the short-run shocks to demand and supply in BC, only the effects of the first wave of the pandemic are included in the 1.9% - 2.3% impact estimate. Although it is commonly expected that the impact of the first wave will be the most significant, consecutive waves could contribute to the decline in economic performance in BC. We assume the impact of each of two additional waves to be 20% of that of the first wave on the BC economy, amounting to a possible additional impact of approximately **0.8% - 0.9%**[41] on GPP (Figure 12).

Figure 12: Additional Impact of a Second and Third Pandemic Wave

CAR	Additional impact of 2 more pandemic waves in BC
15%	0.8%
25%	0.8%
35%	0.9%

4.3.2 Economic Bottlenecks

The estimate of 1.9% - 2.3% does not consider secondary impacts. For example, delays in the transportation industry could lead to a broken supply chain in the manufacturing sector, causing

[41] 1.9% x (0.2 + 0.2) = 0.74% at CAR 15%; 2.1% x (0.2 + 0.2) = 0.84% at CAR 25% ; 2.3% x (0.2 + 0.2) = 0.92% at CAR 35%

major impacts on immediate and longer term outputs. The following sectors are especially likely to form a bottleneck in the BC economy:

- Transportation & Warehousing
- Mining, Oil & Gas
- Governmental Services

In addition, the following industries in BC also have the ability to negatively impact other sectors in the economy, albeit to a lesser extent:

- Finance, Insurance & Real Estate
- Construction
- Health Care & Social Assistance
- Forestry & Logging

For the purpose of this estimation, we have assumed the total impact of secondary effects could aggravate supply- and demand-side impacts on the BC economy by approximately 30%, leading to a possible additional impact of up **to 0.6% - 0.7%**[42] decline in output in the year that the pandemic occurs (figure 13).

Figure 13: Additional Impact of Economic Bottlenecks

CAR	Additional impact of economic bottlenecks
15%	0.6%
25%	0.6%
35%	0.7%

4.3.3 Policy shocks

Finally, the economic and social costs of prevention and mitigation policies *themselves* should be factored into the estimate for a comprehensive overview of the impact of pandemic influenza. Although the findings in this study suggest that substantial benefits can be gained from government involvement in this issue, both disease prevention and control strategies and government compensation for industry losses can place a burden on the fiscal budget. As more analysis is

[42] 1.9% x 0.3 = 0.57% at CAR 15%; 2.1% x 0.3 = 0.63% at CAR 25% ; 2.3% x 0.3 = 0.69% at CAR 35%

necessary to help frame these costs and benefits, the impact of potential policy shocks is not taken into account in this study.

4.3.4 Health care costs

Health care costs associated with a pandemic are not included in the estimated short-run impact estimate of 1.9% to 2.3%. Using the figures produced by the FluAid model, direct[43] health care costs for hospitalization and outpatient care in BC attributable to an outbreak of pandemic influenza are estimated to be between $60 and $142 million. In addition, indirect[44] health care costs could amount to $2.8 million in the event of a 15% CAR, or as high as $15 million with a 35% CAR. In summary the pandemic could lead to health care costs in the range of $63 million and $156 million for the year in which the pandemic occurs. This cost should be seen as an additional cost to the economy, however, not directly as a decline on GDP. This is due to the fact that part of this expenditure represents an increase in economic activity in the health and pharmaceutical sector , and demands on the tax-funded health care system has redistributive effects in the economy, although not a direct impact on GPP.

4.3.5 Long-run effects

It is noted that in the current economy, an array of aspects could have additional aggravating or mitigating effects on the impact in BC of a pandemic. The continuity of income and capital in today's markets could, for example, lessen the aggregate impact of a pandemic, not to mention the strength of the financial system in BC. Long-term negative effects of a pandemic could also be expected and these are outlined below.

These indirect impacts also form the basis of the longer lasting impact of a pandemic on the BC economy. Although this analysis has so far focused on the first year following the initial outbreak, pandemic influenza could have a significant impact on both human and physical capital, which could shift international demand and supply levels. In addition, the duration of the psychological impact is difficult to predict, which makes the declines in demand uncertain. For example, a pandemic could lower investor confidence, causing a long-lasting reduction of demand. Business closures as a result of this would in turn aggravate losses in future employment and investment in BC. For the purpose of this evaluation, it is assumed that a longer-term impact of up to 0.5% of GPP may be felt in the province over the 1-2 years following the year in which the pandemic took

[43] Health care costs borne by the publicly funded health care system.
[44] Health care costs incurred by individuals.

place. Although some experts[45] suggest its possibility, the impact of a worldwide recession is not included in this estimate.

As a result, over a period of one to two years following the year of the pandemic, small, lingering negative impacts of perhaps 0.5% could be experienced as markets and economies slowly regain their equilibrium. However, this impact could be greater if investor confidence is seriously harmed.

4.3.6 Aggregate Total Impact

Combining the significant impact of the short-term effects on the BC economy leads to an additional potential impact of 1.83% - 2.11%[46] reduction in output for the BC economy, for an overall impact of approximately **3.7% - 4.4 %** (figure 14).

Figure 14: Total Short-term Impact

CAR	Aggregate short – term, single wave direct GPP loss	Additional impact of 2 more pandemic waves	Additional impact of economic bottlenecks (indirect costs)	Additional long-term impact	Aggregate Total GPP loss
15%	1.9%	0.8%	0.6%	0.5%	3.7%
25%	2.1%	0.8%	0.6%	0.5%	4.1%
35%	2.3%	0.9%	0.7%	0.5%	4.4%

As these additional factors add to impact, as well as to the uncertainty, the aggregate on total GPP is best considered in terms of a range, in which 1.9% forms the lower end of the range and 4.4%, which forms the top end of the range.

Changes in short-term assumptions will have the effect of a shift to this range, keeping the relative gap constant. Applying different values for the additional factors will have the effect of widening or contracting the range. Due to the uncertainties associated with a potential outbreak of pandemic influenza, this range indicates what *could* happen, rather than what *will* happen in a BC pandemic influenza scenario.

[45] Erik Bloom, Vincent de Wit and Mary Jane Carangal, *ERD Policy Brief: potential economic impact of an avian flu pandemic on Asia* (San Jose, CA: Asian Development Bank, November 2005).
[46] 0.76% - 0.92% for additional waves + 0.57% – 0.69% for bottleneck issues + 0.5% for long-term effects = 1.83% - 2.11%

4.4 Sector Specific Impact

Although our study does not outline the impact of a pandemic on the individual sectors of the BC economy, our research has drawn attention to several interesting sector-specific points that are worth highlighting.

4.4.1 Agriculture

The Crop and Animal Production sector includes the poultry industry, which will be significantly affected if the pandemic virus originates from an anti-genetic shift of avian influenza. The drastic measures usually required to limit the virus' damage (e.g. culling), could lead to a hugely disproportional impact in this entire sector, despite the fact that many of the economic indicators for this sector are of relatively low importance to output (see Economic Impact Indicator Filter in Appendix 7). It has been suggested that a pandemic could cut output by 50% in the first year following the event, with lead time of up to five years to rebuild the poultry industry.[47]

Aside from the sector's vulnerability to policy measures, labour intensity is another short-term variable that could lead to complications. Labour absenteeism could have costly consequences due to the low level of labour redundancy (many farmers are single proprietors, whose business would almost grind to a halt if they fall seriously ill.) In addition, the sector could become a bottleneck to other industries, due to freezer space congestion caused from temporary poultry storage, as subject to government restrictions.

4.4.2 Forestry & Logging

Most of the production of the BC forestry and logging sector is intended for the BC manufacturing industry (sawmills, pulp and paper mills, log home manufacturers, etc.). Thus, the impact on the demand-side of the economy is not expected to be significant. In addition, historical events have shown that there is enough production elasticity in the industry, to prevent disproportional impact on the supply-side in the short term. The psychological effects of the pandemic could lead to delayed spending in the construction industry, affecting the demand for solid wood exports in BC over the medium to long term.

[47] Interview with Ray Nickel, President, BC Poultry Association.

4.4.3 Mining, Oil & Gas, Support Activities for Oil, Gas & Mining

For the mining industries in BC, the impact of an outbreak of pandemic influenza would likely be greatest shortly *after* the event, as opposed to during the pandemic. While demand may drop in the short term, mining activity could continue, with stockpiles growing slightly. Of more significant concern is the impact of decreased production of rubber. The mining industry is reliant on large quantities of rubber for specialized tires and has already had problems in sourcing product. Disruptions to the economies of rubber-producing countries may exacerbate this situation.

4.4.4 Manufacturing

Susceptibility in the manufacturing industries in BC could be high, medium or low, depending on the product manufactured and the markets to which they are destined. Manufacturing industries could be affected if:

- They are heavily reliant on imported inputs to their manufacturing processes;
- They rely heavily on the transportation sector; and
- Their markets are in areas of the world that may be hit harder by the pandemic than Canada (e.g., Southeast Asia).

4.4.5 Transportation & Warehousing

Because transportation industries are interconnected to almost all other sectors in BC, this sector could form a bottleneck in the BC economy in the event of a pandemic. Travel and trade restrictions could shut much of this sector down, with devastating impact to the rest of the economy. Short-run disruptions in logistics will impact the supply-side of the economy, while decreased activity at the ports and the airports in BC will impact the demand-side.

4.4.6 Education

This sector would likely be significantly impacted in the short-term, as a large number of sick and healthy students will be kept at home by concerned parents. This demand-side impact would be amplified by the low labour intensity in the sector: one absent teacher could force an entire class of children to miss school, particularly if substitute teachers are not available. The outcome could also result in a significant child-care crisis.

4.4.7 Tourism, Accommodation & Food Services, Arts, Recreation & Entertainment

The analysis suggests that sectors that require a high level of social contact will be the most severely affected. Tourism and all leisure and luxury service industries in BC fall into this category.

The tourism industry encompasses several sectors of the economy (accommodation and food services, recreation and entertainment, retail and transportation); hence, estimating specific Tourism impacts is difficult. Given the high level of personal interaction in the industry, the significant likelihood of travel advisories and the psychological effect, the Tourism industry could be significantly affected. Recent events such as 9/11, the invasion of Iraq and SARS have all had marked impacts on tourism. For example, during the SARS crisis, Cathay Pacific cancelled all its flights into Vancouver for an extended period (and hence laid-off many of their Vancouver-based staff). International tourism would most likely be the most impacted, though the tourism industry could be disproportionately affected across the board.

2010 Olympic and Paralympic Winter Games

The hosting of the 2010 Olympic and Paralympic Winter Games in Vancouver and Whistler will place the global media spotlight on BC between 2006 and 2010. The potential impact of an outbreak of pandemic influenza on the 2010 Games is an issue for both the pre-2010 period and for the Games themselves.

During the pre-2010 period, pandemic influenza has the potential to impact construction schedules for the Games facilities and related major transportation infrastructure projects.

Should there be an outbreak of pandemic influenza during the 2010 Games period (late 2009 to spring 2010) the impact on the Games themselves could be significant, particularly with respect to attendance, on the tourism sector in British Columbia, and potentially on the logistics required to stage the Games, as a result of worker and volunteer absenteeism.

The Vancouver Organizing Committee for the 2010 Olympic and Paralympic Winter Games (VANOC) is currently developing its business continuity plans for an outbreak of pandemic influenza. This issue is also is a point of discussion by VANOC with the International (IOC), Canadian Olympic Committees (COC) and the Games' major sponsors.

5. POLICY IMPLICATIONS

In outlining the economic effects for the BC economy of a potential pandemic a number of potential policy implications for the provincial government have been identified. Our study provides an initial basis for discussing the policy implications that BC government officials will be facing as they consider options in preparing for, and possibly having to respond to, an outbreak of pandemic influenza.

In this study, the identification and analysis of policy issues is limited. The information provided in our study does add to the information at decision-makers' disposal. However, further discussion and analysis of the impact of the findings is required before policy responses can be fully developed. This will be particularly challenging, in the absence of comprehensive data on the epidemiological, health and economic impacts of influenza impact. Indeed, there are a number of general conditions that make policy response particularly challenging:

- The probability of an outbreak of pandemic influenza is unknown. Policy makers are thus unable to plan with a defined level of certainty for an outbreak and have limited, if any, ability to predict if or when a pandemic will occur;
- Estimating the epidemiological impact of a pandemic, should it occur, is very difficult. The best estimates currently available rest on static epidemiological models which, while suitable for indicative analysis, do not consider the dynamic nature with which multiple factors will affect the actual epidemiology of an outbreak;
- The unknown probability and impact of a pandemic implies that the expected value in economic terms is also unknown. Policy makers therefore run a very real risk that whatever their response, it is unlikely to match the conditions of an actual outbreak. Moreover, it is not possible to predict whether policy responses will 'over' or 'under' plan, although adherence to precautionary principles might suggest that 'over' planning is prudent; and
- Policy makers have limited experience in dealing with either the planning for, or response to, a pandemic that might have a dramatic impact on health and economic conditions should it occur. The last significant global pandemic occurred almost 40 years ago, and effectively all important factors that will determine impact have changed: health care systems, modern transportation systems, global trade patterns, and the structure of the economy. Policy knowledge is thus very limited, adding to the uncertainty facing decisions-makers.

With these general constraints in mind, five policy areas appear to be especially important for consideration of an outbreak of pandemic influenza in British Columbia. These policy areas and the related implications are points for consideration as outlined below, and no recommendations about

specific policy responses are made. Indeed, this study is not in a position to recommend any such policy action. However, the analysis conducted in this study does suggest that perhaps the most important overall policy recommendation is that information needs to be continually updated and explored, given the (strong) relative uncertainty facing policy makers.

5.1 Implications for Health Policy

The implications of a pandemic on health policy may be the most straightforward to define, although this does not necessarily make them easy to deal with. From an impact perspective, a pandemic is likely to affect health policy along a number of dimensions, including:

- There is significant pressure on epidemiologists to understand and communicate the real level of risk facing the public. This pressure is felt both in terms of creating advanced models of epidemiological impact (e.g., dynamic vs. static modeling), as well as monitoring the status of the virus on a global basis in both poultry and human populations;
- Demand for health-care services could rise dramatically should a pandemic occur. Such demand may include that placed on emergency health services, public health systems, family physicians, community-based clinics, and health regulators such as public health officials that may institute quarantine and vaccinations programs/policies, or require specific interventions to control disease spread (including in agricultural sectors through poultry culls for example);
- There is an inherent trade-off that requires careful consideration of policies/programs aimed at preventive intervention or preparation (e.g., vaccination), balanced against reactive interventions (e.g., treatment). This challenge may be exacerbated if the root cause of pandemic influenza was a strain for which current vaccinations and/or treatments were ineffective;
- Health care professionals may be at particularly high-risk of infection in the event of a pandemic outbreak, and there may be 'labour supply' effects in the health care systems at the same time demand for services is increasing; and
- Fiscal pressures placed on the health care system will be borne primarily by the government and taxpayers.

5.2 Implications for Economic Policy

The implications of pandemic influenza on economic policy are complex, due primarily to the fact that economic policy has multiple dimensions and multiple policy actors, and at the same time the ability to influence economic performance through policy influence is relatively muted (especially

in the short term). From an impact perspective, a pandemic is likely to affect economic policy in a number of ways, including:

- There is almost certainly going to be a negative economic impact on the BC economy if an outbreak of pandemic influenza occurs in the manner considered in this study. This impact will be felt differentially across industry sectors, as identified herein. From a policy perspective, such impact identifies a number of specific concerns for economic actors, including:
  - The importance of business continuity planning for all economic actors, and particularly those in 'high risk' sectors of the economy. Factors such as risk identification and valuation, risk management procedures, alternative supplier markets, alternative customer markets, and so on, will need to be considered in such plans;
  - The possibility that severe economic impacts may force some businesses to close, either temporarily or permanently; and
  - The possibility that individuals will lose wages and/or jobs, either temporarily or permanently.
- In the event of an outbreak of pandemic influenza, there is almost certainly going to be a call for the government to intervene to help businesses and individuals deal with economic impacts. The implications for policy makers are numerous, and include issues such as:
  - Balancing prevention (e.g., business continuity planning support) versus reactionary support (e.g., employment support, loan/insurance support, etc.);
  - Supporting appropriate resolution mechanisms in the face of possible large-scale labour or management absenteeism that is atypical, or is not protected by current collective agreements, labour legislation, and business legislation; and
  - Considering specific policies aimed at supporting negatively impacted businesses and individuals.

5.3 Implications for Intra-governmental Policy

The implications of a pandemic on intra-governmental policy are likely to be significant, as all government ministries (and public employees) might be affected. From an impact perspective, a number of factors will be important, including:

- The Government is likely to face significant pressure from a number of communities, and will need to respond in a coordinated, coherent manner. This is particularly important to address issues such as:

  - Public risk communication;
  - Health issues;
  - Security issues;
  - Peace and order issues; and
  - Emergency management.

- Planning for a pandemic should address a number of issues including:
  - Preparation of specific plans (akin to business continuity plans) for each ministry, and for the government as a whole;
  - Identification of the 'order of precedence' for decision-making along all possibly affected organizations, including ministries, crown corporations, and other public bodies; and
  - Identification of clear and coherent points of contact and communication for ministries and the government as a whole.
- There are likely to be significant fiscal pressures placed on the government in the event of pandemic outbreak. Such pressures might be both short-term in nature (e.g., health care costs, security costs), and long-term in nature (e.g., business recovery support, employment recovery support). In addition, planning itself will have fiscal implications that need to be accounted for, with resources needing to be allocated; and
- Public pressure on government to appropriately respond to a pandemic will be high, and public reaction itself will be affected by the government's response. The government has a significant responsibility to allay public fears, and this role is likely to have a direct impact on the overall economic effects of a pandemic.

5.4 Implications for Inter-governmental Policy

The implications of a pandemic on inter-governmental policy are significant, and many of the policy pressures that will affect actual impact of the pandemic have an inter-governmental dimension to them. There are thus many issues to consider, and these can be conceived in terms of provincial-municipal, provincial-federal, and provincial-international issues:

- Provincial-Municipal issues will focus primarily on:
  - Cooperative responses to the possibility of pandemic in both a preventative and reactive context;

  - Education issues such as closure of schools, provincial examinations, linkages to universities (entrance requirements/timing);
  - Transit/transportation issues; and
  - Support for municipalities in the event of undo fiscal pressure for municipal services (e.g., police, utilities, fire services).

- Provincial-Federal issues will focus primarily on those issues involving federal or shared jurisdiction, including:
  - Cooperative responses to the possibility of pandemic in both a preventive and reactive context;
  - Regulatory issues such as public safety and security, food inspection, animal health, human health;
  - Travel advisories;
  - Border security;
  - Inter-provincial trade (including movement of persons, goods and services - (including temporary interprovincial licensure of health care workers);
  - Federally regulated transportation (e.g., shipping, aviation);
  - Fiscal issues involving provincial-federal relations; and
  - Any federal policy responses with a potential impact on the province.
- Provincial-International issues will focus primarily on global trade, and transportation issues, including:
  - Cooperative responses to the possibility of pandemic in both a preventative and reactive context (including temporary cross-boarder licensure of health care workers);
  - Unique policy issues involved with the movement of goods and persons between global areas encountering pandemic outbreaks; and
  - Specific trade issues involving BC goods and services, including issues associated with closing/opening borders.

5.5 Implications on Provincial Government Leadership

A consistent theme expressed through the industry sector discussions (see Appendix 5) was the need for government to provide leadership with respect to the educating the industry and business

sectors, as well as the general population on the realistic impact in British Columbia of pandemic influenza. The specific leadership roles identified included:

- The provision of coherent and reliable information on a timely basis, on the potential of a pandemic occurring, as well as on the anticipated impact of pandemic influenza on British Columbia.
- The provision of a reliable "picture" of pandemic influenza is regarded as critical in assisting BC industries and businesses in preparing for a pandemic.

  Note: At the present time, it is not clear to industry where they can obtain factual information on the potential of a pandemic in British Columbia.
- Ongoing communication/dialogue between Government and BC industry and business (perhaps through the industry and business associations and organized labour) with respect to a potential pandemic.
- The provision of guidelines to all BC industries and businesses on influenza inflection mitigation measures to help prevent and control the spread of the infection.
- The provision of guidelines and information to BC industries and businesses that would assist them in the development of their business continuity planning.

6. CONCLUSION

The timing, virulence and general manifestation of a possible occurrence of pandemic influenza are uncertain. Therefore predicting its exact economic and social costs for British Columbia is not feasible. However, based on a set of reasonable assumptions, the KPMG study has provided a macro analysis of the province-wide economic and social impact of pandemic influenza. The purpose of providing this high level approach is to characterize what *could* happen, rather than what *will* happen, as a result of the effects of pandemic influenza in British Columbia.

Our study addresses the economic impact of a potential occurrence of pandemic influenza from what is believed to be a unique perspective to that currently available in literature and published sources. The analysis is consistent with prior examinations in that it accounts for aggregate level demand shocks and supply-side impacts, driven by epidemiological models. However, our study also disaggregates the potential impact of a potential pandemic by analyzing expected sectoral differences. As a result, policy makers, business leaders, industry associations, and individuals are better equipped to understand the potential impact of a pandemic within British Columbia – and thereby, hopefully, make better decisions about preparation and response.

6.1 Methodology

The majority of current analyses – notably the studies by the World Bank, the Asian Development Bank, the US Congressional Budget Office, and the Canadian Department of Finance – make macro-level assumptions about supply- and demand-side impacts. In each case, the goal of those studies was to quantify the potential degree of impact at an aggregated, economy-wide level. The objective of these studies was to identify the overall magnitude of potential impact, and to communicate the importance of a potential pandemic influenza outbreak at a global, regional or country level.

Our study is informed by these approaches, and in particular applies a common methodology to estimate potential supply-side impacts through epidemiological analysis. Additionally, this study has accepted the importance of macro-level factors that are likely to affect demand-side shocks: These factors include:

- Reduction in consumer demand,
- Potential disruptions in trade flows , and
- Psychological effects of pandemic outbreak.

Our study also disaggregates the impact on both the supply and demand sides, in a sectoral analysis that attributes potential impact on the basis of factors that, while sometimes mentioned in other studies, are not analyzed directly. These factors include:

- Labour intensity,
- Just-in-time production processes,
- Import dependency,
- Export dependency,
- Required degree of social contact,
- Seasonality,
- Potential economic bottlenecks, and
- Multiple waves.

6.2 Economic Impact

The estimated impact of a potential pandemic on the economy of British Columbia could result in a decline in the provincial GPP of 1.9% to 4.4%. This potential impact is projected as a result of the multiple waves of the pandemic. This decline in the provincial GPP is similar to projections of similar studies, although the other studies projected the decline as a result of the initial wave of the pandemic, as opposed to multiple waves.

Study	Projection
World Bank	2.0% decline in Global GDP
US Congressional Budget Office	1.5% to 5.0% decline in US GDP
Asian Development Bank	2.5% to 6.0% decline in Asia – GDP
KPMG Study – British Columbia	1.9% to 4.4% decline in BC - GPP

6.3 Industry Sectors

It is clear from the review of the British Columbia economy, together with an examination of the factors noted, and interviews with representatives of industry associations that several sectors of the B.C. economy could be more significantly affected than that of the economy as a whole. These sectors and the rationale for why they may be more significantly affected are as follows:

6.3.1 Tourism

The tourism industry is not defined as a specific sector of the economy, rather it encompasses portions of the economic sectors that are identified in this Study – Accommodation and Food Services, Arts, Entertainment and Recreation, Retail and Transportation. Past experience with SARS, the start of the recent Gulf War, and the terrorist attacks in September 2001, has demonstrated that the demand for tourism is very elastic with respect to the public's perceptions of safety. In addition, travel advisories, such as issued by the World Health Organization, can have a significant negative effect on travel. The tourism industry (and associated sectors of economy) is likely to be the most affected portion of the provincial economy should an outbreak of pandemic influenza occur.

6.3.2 Manufacturing

The manufacturing sector is likely to be disproportionately affected for a number of reasons including:

- **Just in time production processes.** In recent years, it has been important for firms to minimize their inventory and keep their costs down. As a result, the manufacturing sector now relies heavily on "just-in-time" delivery of materials and components. Hence, this sector will be at risk is the supply chain is disrupted, due to the impact of a pandemic.
- **Export dependency**. Exports are important for the forest industries where a significant volume of production is headed for overseas markets. See the comments below as they pertain to the transportation sector.
- **Import dependency.** Imports are important for assemblers of products such as computers where many of the component parts come from off-shore producers. Imports are susceptible to the impact of an outbreak of pandemic influenza, both at their point of origin (and manufacture), as well as within British Columbia, should there be a slowdown in BC ports due to increased absenteeism as a result on the impact of a pandemic on the BC workforce.

6.3.3 Transportation and Warehousing

This sector covers many aspects of the supply chain that manufacturers, importer and exporters rely upon for the delivery of their inputs and outputs. A disruption to the workforce in any one of the numerous links in this supply chain would have a cascading effect. For example, if ships' pilots become sick and are absent from work, the following scenario could play out:

- Ships would not be able to berth at the marine terminals or would not be able to leave a marine terminal once loaded.
- Marine terminals would become clogged with product and would have to cancel further deliveries.
- Rail yards would become plugged with goods destined for the docks and trains would sit idle.
- Trucks would be idled due to lack of business.
- Shippers would have difficulty finding railcars to load, resulting in the build-up of inventories and potentially the need to curtail production.

The same type of scenario could occur if grain inspectors, air traffic controllers, airport firefighters, customs agents or other similar critical jobs were not filled due to absenteeism.

6.3.4 Educational services

Schools (elementary, secondary, colleges, universities, trade and other) could have significant problems due to staff (instructional and support) shortages, potential local health advisories, or students and staff staying away due to the fear of coming into contact with infectious individuals.

6.4 Policy Implications

The importance of this approach used in this Study, is that it allows for the creation of more meaningful information for use by all individuals interested in impact of a potential outbreak of pandemic influenza in British Columbia. Indeed, as part of this Study, sectoral representatives and individual business leaders were interviewed as a means to inform and verify the findings. Although the findings rest on assumptions that cannot be validated empirically, they are still reasonable for intended objectives – namely to support policy makers.

Support for policy makers is provided in two important ways. First, the constraints on knowledge – that are almost exclusively a function of absence of specific scientific information on how, where and when a pandemic will occur (if at all) – are made clear. These constraints offer the only sure recommendation to policy makers: invest in creation of additional information on how pandemic influenza may impact countries and economies on a domestic and international basis.

Beyond this, the second implication of our study research is that while certain sectors of the economy might be affected by a pandemic differentially, all sectors *would be affected*. The pressure on policy makers is, therefore, to secure appropriate preventative and reactive strategies in a number

of important policy fields, including health, economic development, intra- and inter-governmental affairs, and government-business relations. In fact, the BC Government has begun a process of planning such strategies by striking an Inter-Ministry Committee; it is hoped our study will support this exercise.

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3. BC Tourism: www.tourism.bc.ca
4. Guide to BC Economy and Labour Market: www.guidetobceconomy.org
5. Health Canada: www.hc-sc.gc.ca
6. Invest BC: investbc.com/overview.htm
7. Pandemic Flu: www.pandemicflu.gov
8. Public Health Agency of Canada: www.phac-aspc.gc.ca/influenza
9. Statistics Canada: http://www.statcan.ca/start.html
10. US Centers for Disease Control and Prevention: www.cdc.gov/flu/pandemic
11. World Health Organization: www.who.int/csr/disease/influenza

Interviews/Personal Conversations:

1. Discussions with Lillian Halin, BC Statistics, December 2005
2. Discussions with Don McRae, BC Statistics, December 2005
3. Discussions with Dan Schrier, BC Statistics, December 2005
4. Interview with Ray Nickel, BC Poultry Association, 01-24-2006
5. Interview with Mary Mahon Jones, COTA; Walt Judas, Tourism Vancouver; John Hansen, North West Cruise Ship Association, 01-25-2006
6. Interview with Paul Landry, BC Trucking Association, 01-24-2006
7. Interview with Ron Caldwell, BC Mining Association, 01-31-2006
8. Interview with Werner Knittel, Canadian Manufacturers and Exporters Association, 01-26-2006
9. Interview with Council of Forest Industries, 01-23-2006
10. Interview with Fraser River Port Authority, 01-31-2006
11. Interview with Barrett Fisher, Tourism Whistler, 01-26-2006
12. Interview with Dr. Jack Taunton, VANOC, 01-30-2006

13. Interview with Lori Lindahl et al, Vancouver Port Authority, 01-30-2006
14. Interview with Tony Gugliotta, Craig Richmond and Jennifer Kooren, 01-20-2006
15. Interview with Phil Grewar, Risk Management Branch, BC Provincial Treasury

APPENDIX 1: CHARACTERIZATION OF THE BC ECONOMY

To analyze both direct and indirect impacts on BC's economy, an understanding of the characteristics of the BC economy from both a province-wide and an industry sector perspective is required. This section contains a high level overview of the BC economy from the perspective of a potential pandemic from both these perspectives. Direct (or 'primary') costs are defined as sector costs directly related to the decrease in productivity or customer demand in that sector. Indirect (or 'secondary') costs are defined as losses in one sector as a result of losses in another sector of the economy.

All findings presented in this section are based on the latest available data. It should be noted that the underlying data covered in this document are based on a variety of sources, not all of which are mutually consistent in their representation of GPP, output and export numbers, etc. In general, figures are presented in 1997 constant dollars on a national accounts basis, unless otherwise indicated.[48] It should also be noted that classification of industry categories may vary based on source, and those reported herein do not necessarily match the 2002 NAICS classification of the BC Economy; important variances are identified in the analysis.

A.1 General Characteristics of the BC Economy

BC's economy was originally founded on natural resource extraction and processing industries, but has seen extensive growth in the service sector and a number of manufacturing industries in the larger urban centers of the province. This diversification was the result of a more liberal continental trading environment (under NAFTA), the low Canadian exchange rate and a rapidly expanding domestic market and labour pool that have developed over the last 15 years

Although the services sector now generates the majority of BC's GPP, the province is still heavily dependent on natural resource industries. For example, taking inter-industry linkages into account, the resources sector accounts for at least one quarter of the jobs in BC.

Forest-based industries form the most important segment of the resource industries, with virtually every community in the province relying on this sector to some degree. Of all manufacturing industries in BC, wood industries rank first, followed closely by the paper and allied industries. These two industries combined account for almost one half of all manufacturing in BC. Agriculture

[48] Note: figures are reported in the 1997 constant dollars, to maintain consistency with source data. Because we present analysis on a (sub) sector basis, standard CPI inflators are not directly relevant, due to sectoral variances in prices that would not be captured in standard CPI inflators. For general applicability, however, one (1) 1997 dollar equates to $1.19 2005 dollars (source: Bank of Canada – http://www.bankcanada.ca).

is very diverse, ranging from cattle ranching, dairy, poultry and fruit orchards, to wine grapes. Most of the agricultural activity is located in the southern regions of the province, primarily in the Okanagan and the Kootenays. Fishing is mostly predominant in northern BC, around Prince Rupert, and the north of Vancouver Island. The fish canning industry is concentrated mainly around Vancouver, Richmond and Prince Rupert.

Mining is another important resource industry for BC. Coal mining occurs predominantly in the East Kootenay Region; oil and gas extraction in the Peace River and Northern Rockies Regions. Copper is by far the most important metal mined in BC. Metal smelting and refining is an important activity for some communities, particularly for Trail and Kitimat.

Tourism accounts for over 4% of BC's GPP with the Lower Mainland and the Vancouver Island-Coast Regions accounting for more than half of travel expenditures.

A.2 Current Performance

The following is an overview of the main economic indicators for BC. Information and statistics presented are based on 2004 data and tied to 1997 dollars where applicable, unless otherwise indicated.

A.2.1 Output measures

- GPP in BC: $126,857 million[49]
- Average productivity: approximately $31.40 of GPP per employee hour worked [50]

A.2.2 Employment

- BC employment growth[51]: 3.5%
- BC labour force[52]: 2.2 million
- BC employed labour force[52]: 2,1 million
- BC unemployment rate[52]: 7.2%

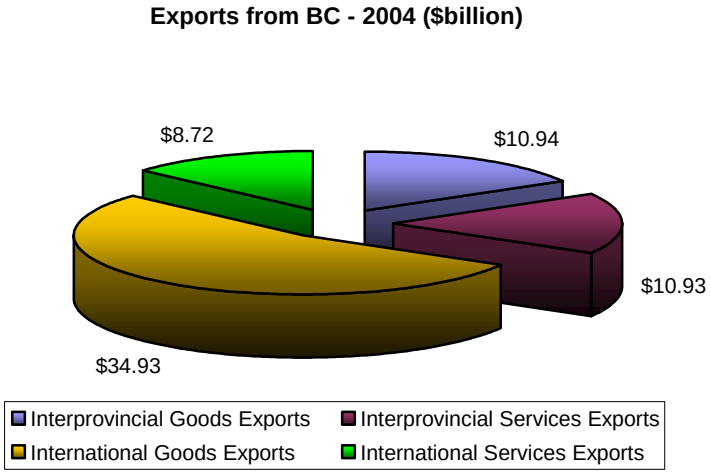
[49] BC Statistics, Nov 2005
[50] BC Statistics, "Probing the Productivity Puzzle", October 14th 2005
[51] BC Statistics, August 2005
[52] *BCStatistics*, January 25, 2006 revisions

A.2.3 Exports

Lumber, pulp, minerals, coal and natural gas make up BC's main export products. In addition, machinery and equipment, agri-food and fish products are significant export goods in BC. The major international export markets are United States (approx 64%), Japan (approx 12%) and China, Hong Kong and Taiwan (approx 8%). (See Appendix 1 for a comprehensive list of international exports)

Figure A.1[53] shows the distribution of export activity between BC and other provinces of Canada and between BC and other countries. The trade flows presented applies to the year 2004, expressed in 1997 dollars. The export data below are based on the national accounts/GPP information; while the sector specific numbers presented later in this chapter are on a customs (declared value) basis.

Figure A.1: Exports from BC – 2004



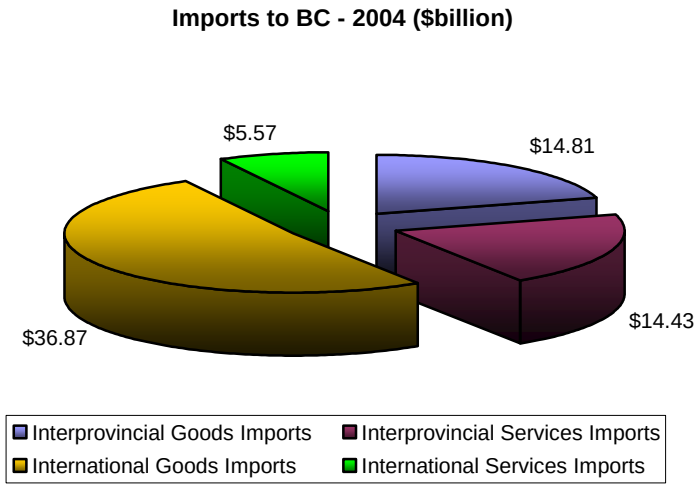
Small and medium sized exporters tend to be concentrated in service producing industries (45% of all small/medium exporters), compared with large exporters, which are largely concentrated in the manufacturing sector (60% of all large exporters).

[53] Based on data obtained from BC Statistics

A.2.4 Imports

Figure A.2[54] shows the distribution of import activity between BC and other provinces of Canada and between BC and other countries. The trade flows presented applies to the year 2004, expressed in 1997 dollars. The import data below are based on the national accounts/GPP information; while the sector specific numbers presented later in this chapter are on a customs (declared value) basis.

Figure A.2: Imports to BC – 2004



A.2.5 Trade Intensity

The BC economy is highly dependent on trade, as illustrated above. This dependency is evident in the following calculation of trade intensity. Trade intensity in BC can be calculated as follows: $65,350 million (Total Exports[55]) / $126,857 million (Total GPP[56]) = 52%.

A.3 Medium Term Outlook

In addition to the expanding service sector, BC's current economic environment is characterized by the increasing importance of trade and commerce, a stronger Canadian dollar and intensified foreign competition in the key export industries (e.g., lumber, pulp and paper, call centers, tourism).

[54] Based on data obtained from BC Statistics
[55] Data from BC Statistics presenting 2004 total exports expressed in 1997 constant dollars.
[56] Sum of sector output numbers presented in chapter 3.

In 2004, the BC economy posted strong growth, outpacing total Canadian GDP growth. According to the Business Council of British Columbia, the medium term (until 2010) outlook for BC shows a continuation of job-gains and rising spending levels. The following drivers of these positive BC trends can be characterized as follows:

- More competitive business climate and rising business investment
- Major transportation and other construction projects
- Stronger population growth (inter-provincial migration)
- Housing construction should remain at a high level
- Expanding energy industry, revival of mining
- Recovery of technology sector and development of more diversified economic base
- Strong growth in China and other Asia-Pacific markets (a market for BC's goods/services and source of business for the gateway)
- 2010 Olympics, expanded convention centre, resorts

In the long term (post 2010), skill shortages are expected for some industries and escalating health care budgets could pose significant fiscal challenges for the BC government.

A.4 Interdependencies

Changes in the output of any given industry sector will affect the output of many other industries in BC. The impact will vary by sector and can be significant, although the impacts are usually concentrated in a small number of sub-sectors.

The following describes the major interdependencies among the broad categories of industry in BC.

A.4.1 Trade/All other (sub) sectors

As a small open economy, BC depends heavily on trade with other countries and provinces. Last year exports of goods and services accounted for 52% of GPP in BC. Most industries are affected by the developments in the trade sector, most significantly the natural resource sectors, transportation and tourism. Due to the twofold and mutual impact between trade and transportation, and the magnitude of the interdependency between trade and tourism, these interdependencies are discussed separately

A.4.2 Trade/Transportation

BC's trade depends heavily on the Province's transportation infrastructure. The transportation sector functions as a gateway for trade, as well as a source of export earnings. Transportation is a source of export earnings because it represents a significant portion of the delivered cost of many export commodities. Therefore, the transportation sector is critical to the growth of the wider BC economy.

A.4.3 Transportation/All other (sub) sectors

All goods available in BC depend on some form of transportation to reach the end-user (consumer). As such, transportation forms a crucial component of all production processes in BC.

A.4.4 Tourism/Transportation

Approximately 22 million tourists visit BC each year for an overnight stay[57], spending more than $9.5 billion dollars in the province. As the transportation sector plays a key role in the travel of tourists to and throughout BC, large dependencies exist between these two sectors. The Business Council of British Columbia reports that upwards of 40% of tourist expenditures are for transportation and related services.

A.4.5 Tourism/Other (sub) sectors

Of the approximate $9.5 billion in tourism expenditures in 2004, about 60% pertained to accommodation, food, retail, recreation and entertainment. Tourism is thus very important to those sectors of the economy.

A.4.6 Public Sector/Other (sub) sectors

All changes in economic variables have an impact on government fiscal plans. The government fiscal plans, in turn, affect provincial economic performance in current and subsequent years. Therefore, an outbreak of pandemic influenza can pose a risk to the economy both directly (through changes in economic variables and consequent reduction in tax, royalty and other fee revenue), and indirectly (through budgetary pressure from public expenditure on health care).

[57] *British Columbia 2004 Tourism Performance Preliminary Estimate*, Tourism British Columbia. www.tourism.bc.ca.

A.5 BC Economy by Sector

This section of the report provides an overview of the BC economy by sector. All numbers are based on 2004 related data. GPP per sector is based on information from BC Statistics using NAICS aggregations[58]. Output is based on application of the direct GPP/Output multiplier from the Input-Output model[59]. These numbers were then checked against information from the Cansim 2.0 database[60] for reasonableness. Dollars shown represent GPP at basic prices in 1997 dollars, unless stated otherwise.

The employment figures represent the number of people (not jobs) employed per sector, as presented by BC Statistics, February 2005. Labour intensity is calculated by dividing sectoral economic output by the number of persons employed. It is therefore not congruent with the data presented in the Input/Output Model.

Information related to BC exports and trade intensity is not presented in this section, due to the following factors.

- Export data was calculated based on a customs clearance numbers, while GPP and output are presented on a national account basis.
- Export data is available only in current dollars, not 1997 dollars.
- Export data is available for commodities, not sectors of the BC economy. Fish exports for example are made up of the raw, harvested fish included in the sectors 'Fishing, Hunting and Trapping' and 'Agriculture' and processing activities and materials in the sector 'Food Manufacturing'.

There is no data available related to an allocation of the total amount of export dollars to each of these sectors. Appendix 2 contains a summary of export data for the different commodities.

Figures A.3 to A.7 provide a summary of sectoral output, Gross Provincial Product (GPP) and labour intensity for each economic sector of the BC economy. All of these figures present the sectors in rank order by GPP.

[58] Due to the fact that this information was obtained from a different source than the one used in previous sections of this document, the sum of all sectors' GPP in this section does not exactly match the total GPP as outlined in section 2.2.1. For the purpose of impact estimation, the total provincial GPP of $126,857 will be used in all calculations.
[59] Gary Horne, British Columbia "Provincial Economic Multipliers and How to Use Them", October 2005, BC Statistics, Ministry of Labor and Citizen's Services.
[60] Statistics Canada: www.statscan.ca

As indicated in figure A.3, Manufacturing (primarily wood products, pulp and paper) and the Finance, Insurance and Real Estate sectors are the largest contributors to the provincial economy, accounting for close to 40% of total economic output.

Figure A.3: Industry Output – 2004

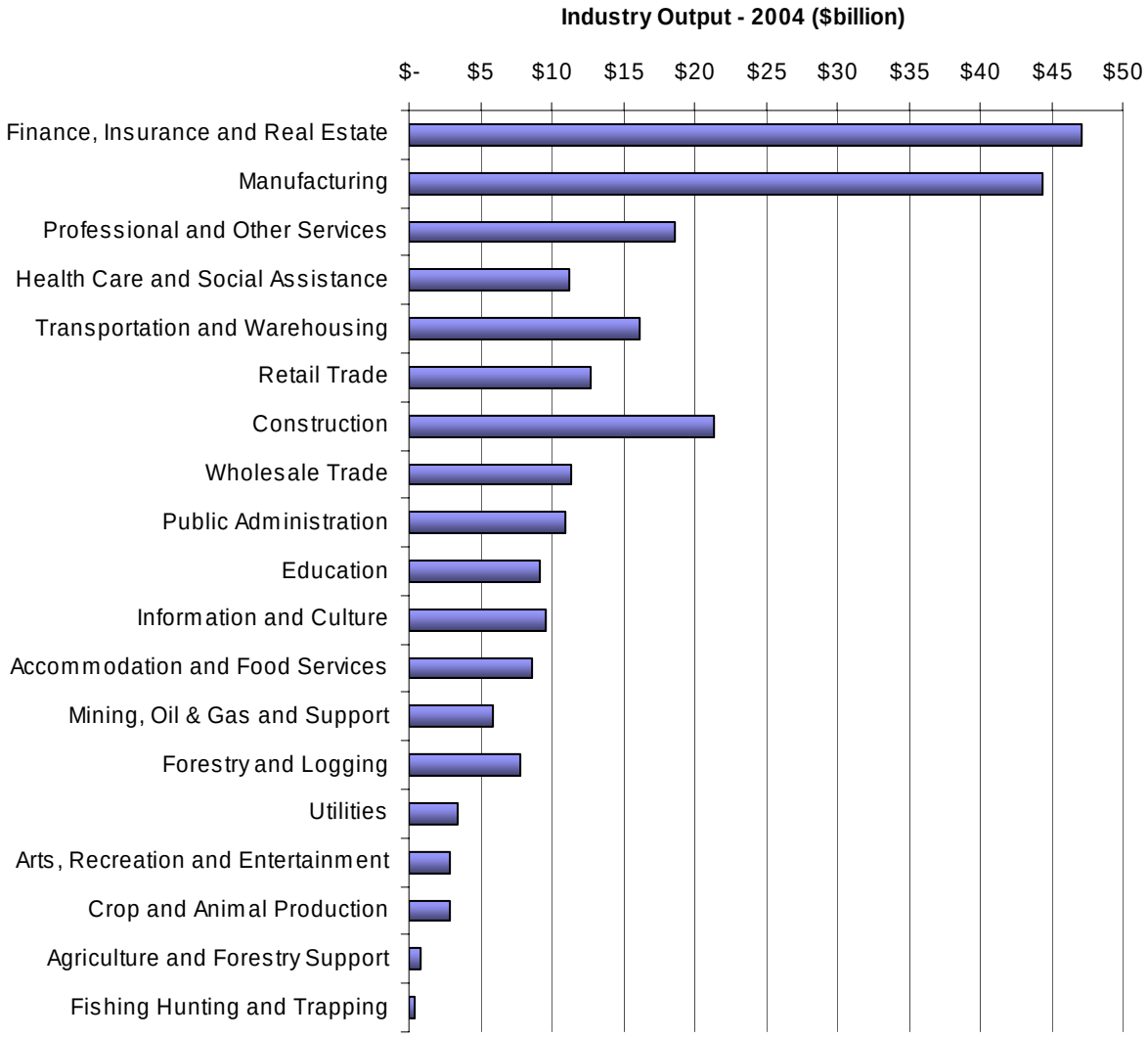


Figure A.4 illustrates the relative value in terms of contribution to GPP of each sector. As illustrated, the Finance, Insurance and Real Estate sector is by far the largest contributor to GPP.

Manufacturing is also important, although this sector relies on inputs from other sectors of the economy (e.g., transportation, forestry and logging, etc.) to a greater extent.

As illustrated in figure A.5, the manufacturing, construction, crop and animal production and fishing, hunting and trapping sectors of the BC economy have the most significant linkages to other sectors of the economy as evidenced by their low ratios of GPP to economic output. As a result, these sectors are more likely to suffer from economic bottleneck issues during a pandemic (e.g., if railroads cannot operate, even the reduced level of manufacturing output will be unable to move to market).

Figure A.4: Gross Provincial Product – 2004

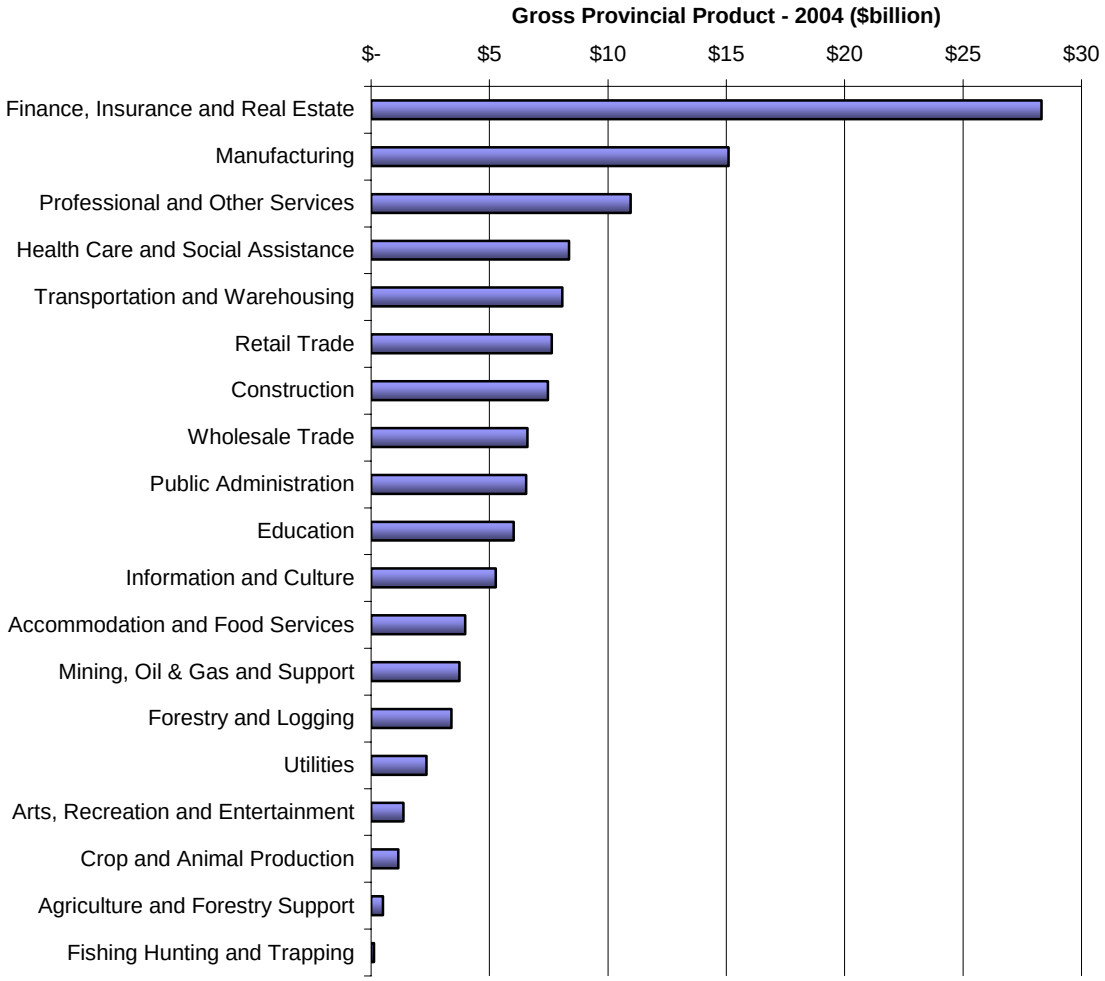
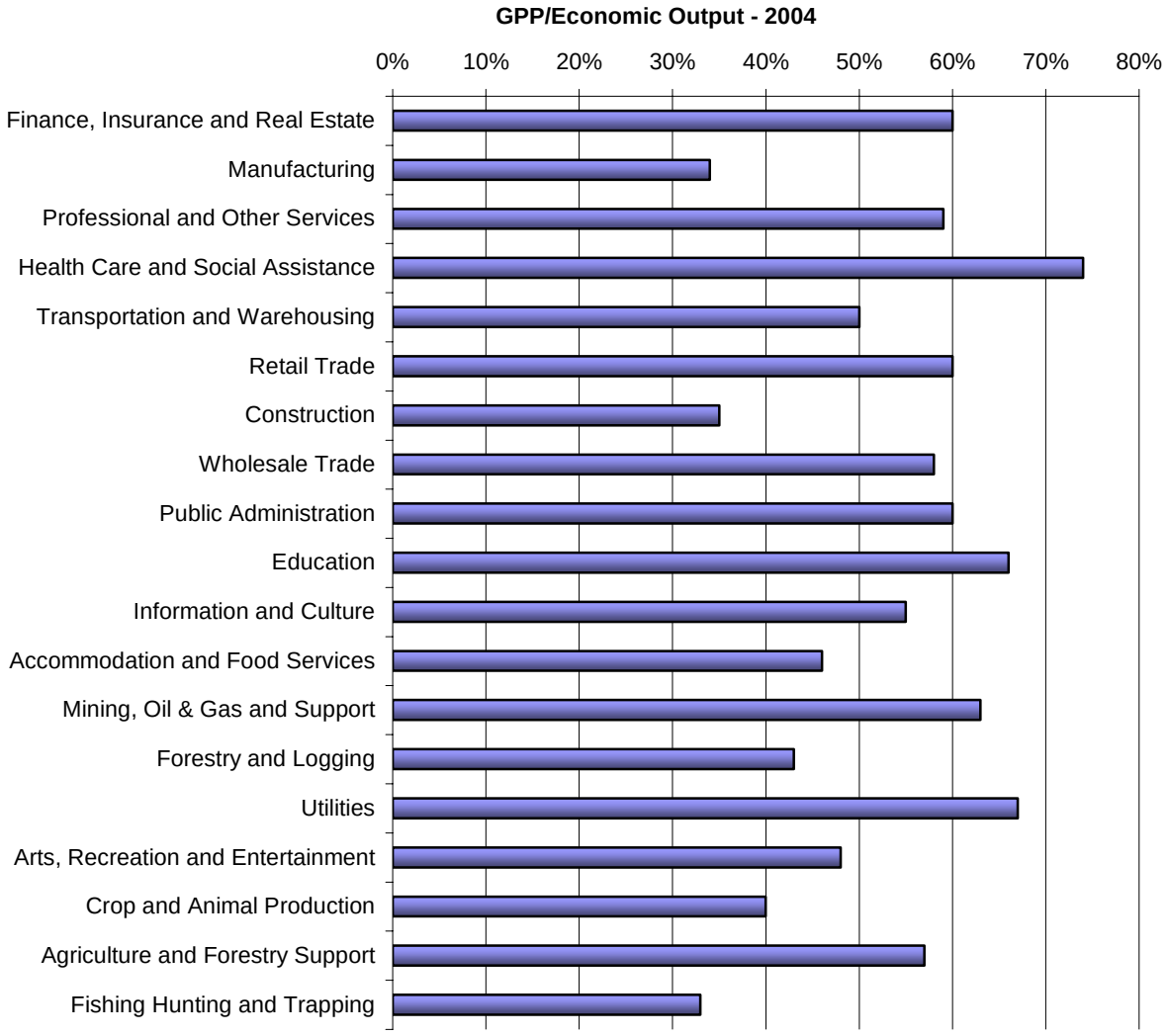


Figure A.5: GPP/Economic Output – 2004



Figures A.6 and A.7 illustrate total employment and labour intensity by sector of the BC economy. While some previous studies have suggested that labour intensive industries may be more affected than other industries, it is not clear that this will be the result. If a sector's major production input is labour, there is a potential for reduced output, but consideration has to be given to a number of other factors such as:

- Required skills and training – if this is low, replacement of absent workers may be easily accomplished from the pool of under- or unemployed workers.

- Full versus part-time employment – a sector with a significant proportion of part-time employees (e.g., retail) may be able to more easily shift workload.
- Critical employees – some sectors have subsets of critical employees (e.g., air traffic controllers) who, if not able to work, may cause significantly disproportionate impacts on those sectors.
- Level of person-to-person contact – while professional and other services are highly labour intensive, the level of person-to-person contact may be significantly lower than the education sector, for example. The impact of a pandemic could thus be significantly different.

Figure A. 6: Sectoral Employment – 2004

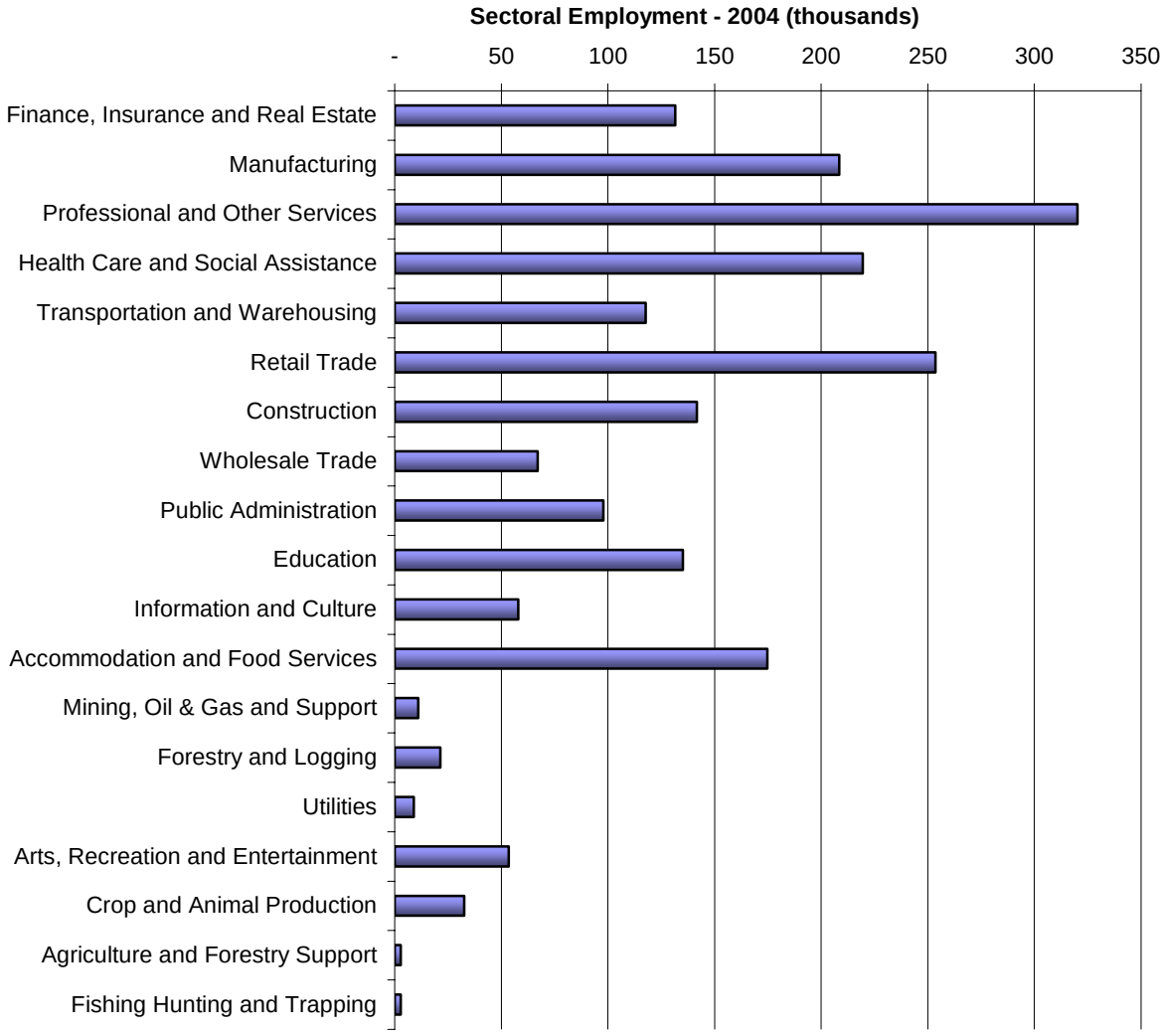
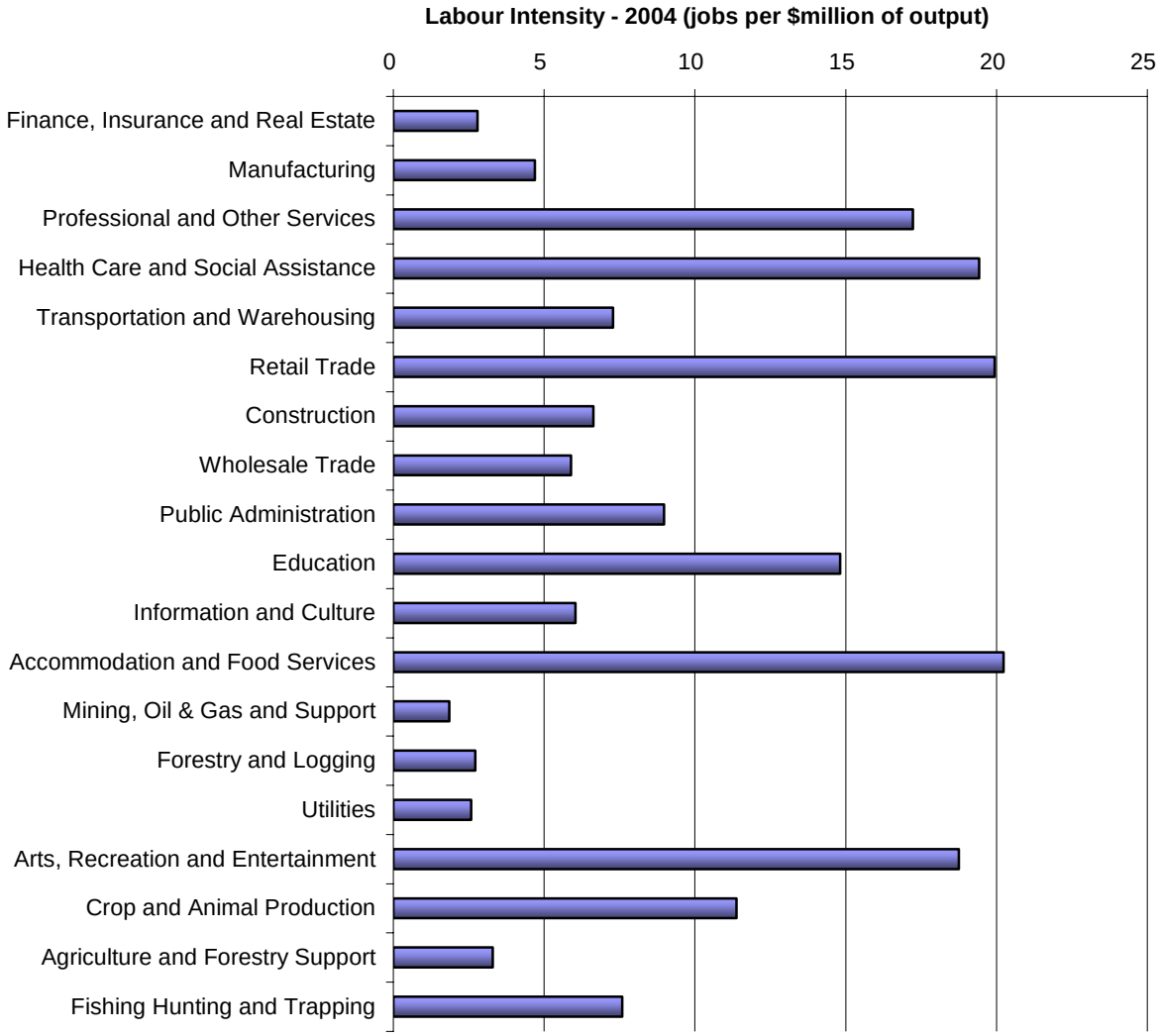


Figure A.7: Labour Intensity – 2004



APPENDIX 2: BC INTERNATIONAL EXPORTS BY COUNTRY[61]

Relative BC Total Exports	2004
United States (US)	64.709328%
Japan	11.915125%
China	4.065791%
Korea, South	2.888220%
Taiwan (Taipei)	1.539855%
Italy (includes Vatican City State)	1.426019%
Germany	1.337682%
United Kingdom (U.K.)	1.202725%
Hong Kong	1.048736%
Netherlands	1.021340%
Australia	0.738354%
Belgium	0.681408%
Mexico	0.625534%
France (incl. Monaco, French Antilles)	0.608917%
Indonesia (includes East Timor)	0.553053%
Brazil	0.484896%
India	0.462679%
Thailand	0.411163%
Philippines	0.404354%
Turkey	0.302264%
New Zealand	0.285320%
Spain	0.192670%
Malaysia	0.189997%
Chile	0.189496%
Greece	0.154192%
Singapore	0.134433%
Venezuela	0.133597%
Egypt	0.129163%
Switzerland	0.126534%

[61] Source: Statistics Canada and the US Census Bureau (US Department of Commerce).

Relative BC Total Exports	2004
South Africa	0.103023%
Colombia	0.094879%
Sweden	0.094001%
United Arab Emirates	0.089067%
Pakistan	0.088322%
Guatemala	0.088193%
Russia	0.081581%
El Salvador	0.079027%
Iran	0.076944%
Saudi Arabia	0.075457%
Israel	0.074979%
Finland	0.074707%
Ireland	0.064755%
Ecuador	0.053217%
Norway	0.051458%
Bulgaria	0.050211%
Peru	0.046009%
Costa Rica	0.037586%
Kuwait	0.033910%
Austria	0.033538%
Nepal	0.032144%
Vietnam	0.031709%
Portugal	0.030989%
Korea, North	0.026731%
Poland	0.024762%
Denmark	0.023329%
Czech Republic	0.021442%
Argentina	0.020718%
Cuba	0.020584%
Iceland	0.018167%
Panama	0.017854%
Bangladesh	0.016800%
French Polynesia	0.016635%
Ukraine	0.016553%

Relative BC Total Exports	2004
Lithuania	0.016395%
Nigeria	0.016349%
Sri Lanka	0.012080%
Romania	0.011474%
Mongolia	0.011419%
Jamaica	0.011026%
Bermuda	0.010990%
Guam (US)	0.010972%
Hungary	0.010353%
Tanzania	0.009124%
Ghana	0.008808%
Dominican Republic	0.008389%
Yemen	0.008068%
Azerbaijan	0.007974%
Kazakhstan	0.006433%
Brunei Darussalam	0.006412%
Macau (Macao)	0.006010%
Algeria	0.005956%
Greenland	0.005448%
American Samoa	0.005439%
Nicaragua	0.004968%
Luxembourg	0.004820%
Bahrain	0.004436%
Yugoslavia - Serbia and Montenegro	0.004425%
Senegal	0.004113%
Tunisia	0.003834%
Qatar	0.003785%
Honduras	0.003752%
Morocco	0.003365%
Croatia	0.003289%
Kenya	0.003271%
Bahamas	0.003256%
Haiti	0.003255%
Slovenia	0.003205%

Relative BC Total Exports	2004
Benin	0.003199%
Jordan	0.003197%
Fiji	0.003169%
Georgia	0.003153%
Malta	0.002973%
St.Pierre-Miquelon	0.002851%
Angola	0.002715%
Slovakia	0.002619%
Uruguay	0.002581%
Sudan	0.002549%
Papua New Guinea	0.002452%
Cyprus	0.002430%
Afghanistan	0.002333%
Zimbabwe	0.002244%
Bolivia	0.002117%
Libya	0.002059%
Cameroon	0.002029%
Lebanon	0.002004%
Gabon	0.001959%
Syria	0.001921%
Guinea	0.001617%
Côte-D'Ivoire (Ivory Coast)	0.001465%
Congo (former Zaire)	0.001436%
Antigua and Barbuda	0.001429%
Trinidad and Tobago	0.001316%
Estonia	0.001315%
Oman (Muscat)	0.001287%
Barbados	0.001279%
US Minor Outlying Islands	0.001173%
Belarus (Byelorussia)	0.001151%
Uganda	0.001049%
Latvia	0.000973%
Mali	0.000877%
Guyana	0.000874%

Relative BC Total Exports	2004
Mozambique	0.000873%
Cayman Islands	0.000862%
Macedonia	0.000855%
Zambia (Zambi)	0.000745%
British Virgin Islands	0.000730%
Namibia	0.000723%
Surinam	0.000720%
Cocos (Keeling) Islands	0.000700%
Sierra Leone	0.000690%
Mauritius	0.000661%
Congo (Brazzaville)	0.000628%
Samoa (Western)	0.000609%
Aruba Island	0.000597%
New Caledonia	0.000539%
Faeroe Islands	0.000403%
Uzbekistan	0.000395%
Albania	0.000372%
Cambodia (Kampuchea)	0.000345%
Netherlands Antilles	0.000337%
St.Vincent-Grenadines	0.000289%
Madagascar	0.000285%
Swaziland	0.000280%
Belize	0.000277%
Christmas Island	0.000269%
Seychelles	0.000236%
Armenia	0.000226%
St. Kitts-Nevis	0.000224%
Ethiopia	0.000218%
Togo	0.000217%
Tajikistan	0.000215%
Eritrea	0.000198%
Moldova	0.000191%
Paraguay	0.000182%
Grenada	0.000168%

Relative BC Total Exports	2004
Saint Lucia	0.000165%
Solomon Islands	0.000163%
Kyrgyzstan	0.000156%
Maldives	0.000153%
Equatorial Guinea	0.000153%
Turks and Caicos Islands	0.000144%
Tonga	0.000133%
Bosnia-Hercegovina	0.000125%
Dominica	0.000115%
Malawi	0.000098%
Vanuatu (New Hebrides)	0.000088%
Botswana	0.000068%
Liberia	0.000048%
Cook Islands	0.000046%
Guinea-Bissau	0.000045%
Djibouti	0.000043%
Iraq	0.000042%
Pitcairn Island	0.000037%
Burkina Faso	0.000029%
Falkland Islands	0.000026%
Rwanda	0.000021%
Gibraltar	0.000010%
Chad	0.000010%
Turkmenistan	0.000006%
Anguilla	0.000006%
French Southern Territories	0.000000%
Andorra	0.000000%
Central African Republic	0.000000%
TOTAL (ALL COUNTRIES)	**100%**

APPENDIX 3: BC INTERNATIONAL EXPORTS BY COMMODITY[62]

The following data represent the international export numbers for 2004 per commodity on a current dollar, customs cleared basis.

COMMODITY	2004 ($,000,000)
Wood Products	**10,062**
Lumber	6,895
Cedar Shakes and Shingles	240
Plywood and Veneer	487
Other Panel Products	889
Selected Value Added Wood Products	952
Other	599
Pulp and Paper Products	**4,954**
Pulp	2,972
Newsprint	609
Paper, Paperboard – exc. Newsprint	1,225
Other	147
Agriculture and Food Other than Fish	**1,501**
Fruit and Nuts	182
Vegetables	298
Other	1,021
Fish Products	**974**
Whole Fish exc. Salmon	189
Whole Salmon	288
Salmon Fillets	99

[62] BC Statistics. http://www.bcstats.gov.bc.ca

COMMODITY	2004 ($,000,000)
Other	398
Metallic Mineral Products	**2,097**
Copper Ores and Concentrates	583
Molybdenum Ores and Concentrates	3321
Unwrought Aluminum	599
Unwrought Zinc	376
Other	209
Energy Products	**4,516**
Natural Gas	2,496
Coal	1,573
Electricity	290
Other	157
Machinery and Equipment	**3,137**
Motor Vehicles and Parts	372
Electrical/Electronic/Communications	614
Other	2,151
Plastics and Articles of Plastic	**523**
Apparel and Accessories	**158**
All Other Commodities	**3,056**
GRAND TOTAL	30,978

APPENDIX 4: PROJECTED HEALTH IMPACT ON THE BC POPULATION (TOTAL)

OUTPATIENT VISITS (NUMBER OF CASES) – British Columbia						
Clinical attack rates				**Distribution by age group (% of total): Most likely**		
	15%	**25%**	**35%**		**% High Risk**	**% Total**
0-18 yrs most likely	75,732	126,220	176,708	**0-18 yrs**	2	22
19-64 yrs most likely	215,835	359,726	503,616	**19-64 yrs**	9	64
65+ yrs most likely	45,653	76,088	106,523	**64+ yrs**	6	14
TOTAL: Most likely	337,220	562,034	786,847	**Totals**	17	100

HOSPITALIZATION (NUMBER OF CASES) – British Columbia						
Clinical attack rates				**Distribution by age group (% of total): Most likely**		
	15%	**25%**	**35%**		**% High Risk**	**% Total**
0-17 yrs most likely	239	399	558	**0-17 yrs**	1	3
18-64 yrs most likely	5,170	8,617	12,064	**18-64 yrs**	10	65
65+ yrs most likely	2,571	4,285	5,999	**65+ yrs**	20	32
TOTAL: Most likely	7,980	13,301	18,621	**Totals**	31	100

DEATHS (NUMBER OF CASES) – British Columbia						
Clinical attack rates				**Distribution by age group (% of total): Most likely**		
	15%	**25%**	**35%**		**% High Risk**	**%Total**
0-17 yrs most likely	13	22	31	**0-17 yrs**	0	0
18-64 years most likely	875	1,459	2,042	**18-64 yrs**	41	48
65+ yrs most likely	964	1,607	2,250	**65+ yrs**	42	52
TOTAL: Most likely	1,852	3,088	4,323	**Totals**	83	100

APPENDIX 5: PROJECTED HEALTH IMPACT ON THE BC POPULATION (BY HEALTH AUTHORITY)

Interior Health Authority

POPULATION (NUMBERS AND DISTRIBUTION) - Interior Health Authority					
	0-17 yrs	**18-64 yrs**	**65+ yrs**	**Total**	**% Total**
Non-high risk	130,818	384,806	72,881	588,505	82.79
High risk	8,944	64,733	48,586	122,263	17.2
Totals	139,762	449,539	121,467	710,768	100

OUTPATIENT VISITS (NUMBER OF CASES) - Interior Health Authority						
Clinical attack rates				**Distribution by age group (% of total): Most likely**		
	15%	**25%**	**35%**		**% High Risk**	**% Total**
0-17 yrs most likely	12,399	20,665	28,931	**0-17 yrs**	2	22
18-64 yrs most likely	34,686	57,810	80,933	**18-64 yrs**	8	61
65+ yrs most likely	9,429	15,715	22,001	**64+ yrs**	7	17
TOTAL: Most likely	56,514	94,190	131,865	**Totals**	17	100

HOSPITALIZATION (NUMBER OF CASES) - Interior Health Authority						
Clinical attack rates				**Distribution by age group (% of total): Most likely**		
	15%	**25%**	**35%**		**% High Risk**	**% Total**
0-78 yrs most likely	39	65	91	**0-17 yrs**	1	3
18-64 yrs most likely	831	1,385	1,939	**18-64 yrs**	9	59
65+ yrs most likely	531	885	1,239	**65+ yrs**	23	38
TOTAL: Most likely	1,401	2,335	3,269	**Totals**	33	100

MORTALITY (NUMBER OF CASES) - Interior Health Authority						
Clinical attack rates				**Distribution by age group (% of total): Most likely**		
	15%	**25%**	**35%**		**% High Risk**	**%Total**
0-17 yrs most likely	2	4	5	**0-17 yrs**	0	1
18-64 years most likely	141	234	328	**18-64 yrs**	36	41
65+ yrs most likely	199	332	465	**65+ yrs**	47	58
TOTAL: Most likely	342	570	798	**Totals**	83	100

Fraser Health Authority

POPULATION (NUMBERS AND DISTRIBUTION) - Fraser Health Authority					
	0-17yrs	**18-64 yrs**	**65+ yrs**	**Total**	**% Total**
Non-high risk	301,325	815,852	111,137	1,228,314	84.11
High risk	20,603	137,246	74,090	231,939	15.88
Totals	321,928	953,098	185,227	1,460,253	100

OUTPATIENT VISITS (NUMBER OF CASES) - Fraser Health Authority						
Clinical attack rates				**Distribution by age group (% of total): Most likely**		
	15%	**25%**	**35%**		**% High Risk**	**% Total**
0-17 yrs most likely	28,560	47,600	66,640	**0-17 yrs**	3	25
18-64 yrs most likely	73,540	122,566	171,592	**18-64 yrs**	8	63
65+ yrs most likely	14,378	23,964	33,549	**64+ yrs**	5	12
TOTAL: Most likely	116,478	194,130	271,781	**Totals**	16	100

HOSPITALIZATION (NUMBER OF CASES) - Fraser Health Authority						
Clinical attack rates				**Distribution by age group (% of total): Most likely**		
	15%	**25%**	**35%**		**% High Risk**	**% Total**
0-17 yrs most likely	90	150	210	**0-17 yrs**	1	3
18-64 yrs most likely	1,762	2,936	4,111	**18-64 yrs**	10	66
65+ yrs most likely	810	1,350	1,889	**65+ yrs**	19	30
TOTAL: Most likely	2,662	4,436	6,210	**Totals**	30	99

MORTALITY (NUMBER OF CASES) - Fraser Health Authority						
Clinical attack rates				**Distribution by age group (% of total): Most likely**		
	15%	**25%**	**35%**		**% High Risk**	**%Total**
0-17 yrs most likely	5	8	12	**0-17 yrs**	0	1
18-64 years most likely	298	497	696	**18-64 yrs**	43	49
65+ yrs most likely	304	506	709	**65+ yrs**	40	50
TOTAL: Most likely	607	1,011	1,417	**Totals**	83	100

Vancouver Coastal Health Authority

POPULATION (NUMBERS AND DISTRIBUTION) - Vancouver Coastal Health Authority					
	0-17 yrs	**18-64 yrs**	**65+ yrs**	**Total**	**% Total**
Non-high risk	167,454	626,771	80,183	874,408	83.69
High risk	11,449	105,438	53,455	170,342	16.3
Totals	178,903	732,209	133,638	1,044,750	100

OUTPATIENT VISITS (NUMBER OF CASES) - Vancouver Coastal Health Authority						
Clinical attack rates				**Distribution by age group (% of total): Most likely**		
	15%	**25%**	**35%**		**% High Risk**	**% Total**
0-18 yrs most likely	15,872	26,453	37,034	**0-18 yrs**	2	19
19-64 yrs most likely	56,496	94,160	131,824	**19-64 yrs**	9	68
65+ yrs most likely	10,374	17,289	24,205	**64+ yrs**	5	13
TOTAL: Most likely	82,742	137,902	193,063	**Totals**	16	100

HOSPITALIZATION (NUMBER OF CASES) - Vancouver Coastal Health Authority						
Clinical attack rates				**Distribution by age group (% of total): Most likely**		
	15%	**25%**	**35%**		**% High Risk**	**% Total**
0-17 yrs most likely	50	84	117	**0-17 yrs**	1	3
18-64 yrs most likely	1,353	2,256	3,158	**18-64 yrs**	10	68
65+ yrs most likely	584	974	1,363	**65+ yrs**	18	29
TOTAL: Most likely	1,987	3,314	4,638	**Totals**	29	100

MORTALITY (NUMBER OF CASES) - Vancouver Coastal Health Authority						
Clinical attack rates				**Distribution by age group (% of total): Most likely**		
	15%	**25%**	**35%**		**% High Risk**	**%Total**
0-17 yrs most likely	3	5	7	**0-17 yrs**	0	1
18-64 years most likely	229	382	535	**18-64 yrs**	44	51
65+ yrs most likely	219	365	511	**65+ yrs**	39	49
TOTAL: Most likely	451	752	1,053	**Totals**	83	101

Northern Health Authority

POPULATION (NUMBERS AND DISTRIBUTION) – Northern Health Authority					
	0-18 yrs	**19-64 yrs**	**65+ yrs**	**Total**	**% Total**
Non-high risk	73,654	173,213	15,803	262,670	85.45
High risk	5,036	29,138	10,534	44,708	14.54
Totals	78,690	202,351	26,337	307,378	100

OUTPATIENT VISITS (NUMBER OF CASES) – Northern Health Authority						
Clinical attack rates				**Distribution by age group (% of total): Most likely**		
	15%	**25%**	**35%**		**% High Risk**	**% Total**
0-18 yrs most likely	6,981	11,635	16,289	**0-18 yrs**	3	28
19-64 yrs most likely	15,613	26,022	36,431	**19-64 yrs**	8	63
65+ yrs most likely	2,044	3,407	4,770	**64+ yrs**	4	8
TOTAL: Most likely	24,638	41,064	57,490	**Totals**	15	99

HOSPITALIZATION (NUMBER OF CASES) – Northern Health Authority						
Clinical attack rates				**Distribution by age group (% of total): Most likely**		
	15%	**25%**	**35%**		**% High Risk**	**% Total**
0-18 yrs most likely	22	37	51	**0-18 yrs**	1	4
19-64 yrs most likely	374	623	873	**19-64 yrs**	11	73
65+ yrs most likely	115	192	269	**65+ yrs**	14	23
TOTAL: Most likely	511	852	1,193	**Totals**	26	100

MORTALITY (NUMBER OF CASES) – Northern Health Authority						
Clinical attack rates				**Distribution by age group (% of total): Most likely**		
	15%	**25%**	**35%**		**% High Risk**	**%Total**
0-18 yrs most likely	1	2	3	**0-18 yrs**	0	1
19-64 years most likely	63	106	148	**19-64 yrs**	52	59
65+ yrs most likely	43	72	101	**65+ yrs**	33	40
TOTAL: Most likely	107	180	252	**Totals**	85	100

Vancouver Island Health Authority

POPULATION (NUMBERS AND DISTRIBUTION) – Vancouver Island Health Authority					
	0-18 yrs	**19-64 yrs**	**65+ yrs**	**Total**	**% Total**
Non-high risk	125,764	393,849	72,870	592,483	82.75
High risk	8,599	66,254	48,579	123,432	17.24
Totals	134,363	460,103	121,449	715,915	100

OUTPATIENT VISITS (NUMBER OF CASES) – Vancouver Island Health Authority						
Clinical attack rates				**Distribution by age group (% of total): Most likely**		
	15%	**25%**	**35%**		**% High Risk**	**% Total**
0-18 yrs most likely	11,920	19,867	27,814	**0-18 yrs**	2	21
19-64 yrs most likely	35,501	59,168	82,835	**19-64 yrs**	8	62
65+ yrs most likely	9,427	15,712	21,997	**64+ yrs**	7	17
TOTAL: Most likely	56,848	94,747	132,646	**Totals**	17	100

HOSPITALIZATION (NUMBER OF CASES) – Vancouver Island Health Authority						
Clinical attack rates				**Distribution by age group (% of total): Most likely**		
	15%	**25%**	**35%**		**% High Risk**	**% Total**
0-18 yrs most likely	38	63	88	**0-18 yrs**	1	3
19-64 yrs most likely	850	1,417	1,984	**19-64 yrs**	9	60
65+ yrs most likely	531	885	1,239	**65+ yrs**	23	37
TOTAL: Most likely	1,419	2,365	3,311	**Totals**	33	100

MORTALITY (NUMBER OF CASES) – Vancouver Island Health Authority						
Clinical attack rates				**Distribution by age group (% of total): Most likely**		
	15%	**25%**	**35%**		**% High Risk**	**%Total**
0-18 yrs most likely	2	4	5	**0-18 yrs**	0	1
19-64 years most likely	144	240	336	**19-64 yrs**	36	42
65+ yrs most likely	199	332	465	**65+ yrs**	47	58
TOTAL: Most likely	345	576	806	**Totals**	83	101

APPENDIX 6: SYNOPSIS OF INDUSTRY INTERVIEWS

BC Poultry Association

Participants:

Ray Nickel – President, BC Poultry Association

Kirsten van Loo – KPMG

Discussion Points:

The interview focused on the poultry industry as part of the Crop and Animal Production sector. Specific information applies only to the poultry industry, unless otherwise stated.

- BCPA feels that labour intensity is indeed "M", due to the fact that lots of farmers are single proprietors whose business will almost come to lay still if they are off sick.
- BCPA agrees with the all other ratings KPMG generated, but feels the rating for the following indicators should be changed as follows:
  - Export Dependency should be "M/L" not "L" as about 15% of poultry is considered less desirable in North America (darker meat parts of poultry) and an export market is needed for this.
  - Just-in-Time-Production-Process could be "M" instead of "L" on the manufacturing side of poultry production, since poultry needs to be delivered fresh for further processing.
  - Potential Economic Bottleneck could be "M/L" not "L" due to the fact that if animals cannot be moved due to restrictions, they would need to be cold stored – this could clog up the freezer space in BC, potentially affecting other industries. (Happened during the 2004 crisis)
- BCPA expects a hugely disproportional impact on the poultry industry compared to the BC economy (3-5%) in case the pandemic influenza is a strand of the avian influenza. The Lower Fraser Valley industry alone represents a billion dollars before further processing. Most products also stay within the province of BC. This entire industry would be temporarily shut down, as entire bird flocks would have to be destroyed. Build back times of up to 18 months are expected, with lead times of business returning to normal levels would be in the 5 year range due to consumer confidence issues, international bans etc. In the first year following the pandemic, the economic impact is expected to exceed 50% of industry output.

- An interesting point raised by Ray Nickel was his opinion that the government does not have a proper compensation plan in place for farmers, which would add to the negative financial impact of a pandemic in the industry. The lack of a plan may lead to a lack of cooperation of the poultry farmers. Without certainty of compensation for having to destroy all their birds, they may be less than willing to obey government orders, which could lead to expensive compliance enforcement. It could also lead to further spreading of the virus, which will cause further economic impacts.
- An Emergency Response Plan and an Industry Framework Plan are in place (and an Avian Flu Plan is under construction) in case of avian flu in BC, however, these focus on the handling and prevention of sick/dead birds and NOT on the human factors. The human effects and results of these related to pandemic influenza(Avian strand or not) are seen as a secondary priority. The Canadian Food Inspection Agency (CFIA) drives the destruction efforts.
- In terms of government support of this issue, BCPA is of the opinion that the government is probably doing more damage than good to the industry by providing extensive information to consumers and the general public. (Again, the focus of this comment is the animals and not so much the human side of a pandemic.)

Tourism Vancouver, NW Cruise Ship Association, Council of Tourism Associations

Participants:

Mary Mahon Jones – Chief Executive Officer, COTA

Walt Judas – Director, Marketing Communications Tourism Vancouver

John Hansen – President North West Cruise Ship Association

Paul Levelton – KPMG

Kirsten van Loo – KPMG

Discussion Points:

- The interview focused separately on the tourism industry in BC in general, on the cruise ship industry in BC and on conference activity in BC. Representatives of all three organizations participated to help form a picture of the impact on the following sectors:
  - Retail Trade
  - Arts, Entertainment and Recreation

- Accommodation & Food Services

The following picture was composed during the interview:

Industry Sector	Labour Intensity	Export Dependency	Import Dependency	Susceptibility to Local/Global Advisory/ Prohibition	Enterprises that Bring People Together	Just-in-Time Production Process	Seasonality	Potential Economic Bottleneck
Cruise Ship Industry	**H**	**H**	**M**	**H**	**H**	**H**	**L**	**L**
Conventions Industry	**M/H**	**L**	**L**	**H**	**H**	**H**	**L**	**L**
Tourism BC	**H**	**H**	**L**	**H**	**H**	**H**	**M**	**L**

Cruise ship industry:

- Peak tourism months are in the summer season.
- 15% of tourists are domestic, 70% are American and the remaining 15% is from all other parts of the world.
- Cruise ships would avoid docking and loading in Vancouver/BC altogether if there was a pandemic.
- Not able to put a number to general economic impact on cruise ship industry as it is uncertain how hard the industry will be hit.

Convention industry:

- The peak convention months are June, July, August and September.
- Most convention tourists are from other Canadian provinces (H), but in terms of international convention tourists the Export Dependency is low (L).
- Convention industry could be hard hit (about 600.000 fewer visitors per annum in first year). This is due to the fact that it is easy for consumers of convention industry to just reallocate their dollars to other parts of the world. It is important for convention locations to be safe, and so long as the city they are in is somewhat appealing, it is not that important to the consumers where that is in the world. As a result of this attitude, conventions will probably be one of the first tourism related activities to see a downturn in revenue.
- It could take 6 months to 3 years to recover from a pandemic attack in this respect. So the potential of economic impact is significant and long term.

BC Tourism industry:

- Labour intensity would be highest in the hospitality component of the tourism sector.
- The Japanese especially are a rather fickle folk when it comes to traveling – any hint of trouble in a country and they skip it for a number of years as a travel destination.
- Peak tourism months are both summer and winter.
- The state/city in Canada where the pandemic will be first diagnosed as such, will probably be seen as the gateway to the pandemic.
- Fear of the flu seems to outweigh fear of terrorism – figures for BC revenues of the last 5 years tell this story.
- Inter-industry bottlenecks are M/H (if hotels cannot take people, they will return home and not use recreational facilities), while on an inter-sectoral level, the tourism industry probably does not form a bottleneck to other industries
- Aside from in the cruise industry, participants felt that most tourism operators probably do not have any contingency plans in place to deal with a pandemic when it hits. Amongst tourism leaders there may be some awareness; however, this likely does not stretch beyond general public levels. Some of the large international hotel chain might have this addressed in a business continuity plan, if in place.

  Cruise ship industry operators have a very high level of awareness, and due to the nature of their business, most of them follow the industry standards to have plans in place for prevention, education and fast response. The cruise line association is responsible for coordination of the guidelines and standards for these plans.
- A role for the government should concentrate on keeping media coverage objective and away from fear mongering. The government should look after objective information dissemination and make sure that it comes from a central point, so that all messages are consistent. The government can assist with fast identification of the pandemic as such and example response plans for the industry operators. The government will hopefully facilitate efficient communication efforts within industries and amongst the public.

BC Trucking Association

Participants:

Paul Landry –President and CEO, BC Trucking Association

Paul Levelton – KPMG

Kirsten van Loo – KPMG

Discussion Points:

The interview focused on the trucking industry as part of the Transportation & Warehousing sector. Specific information applies only to the trucking industry.

- BCTA feels that labour intensity should not be "M", but rather "H" for the entire trucking industry, due to a tight labour market. This would not be true for the "local trucking" part (5%) of the industry – for which oversupply of labour is present.
- BCTA agrees with the export and import dependency ratings KPMG generated, but feels the rating for the following indicators should be changed as follows:
  - Susceptibility to Advisory/Prohibition should be "L" not "M"
  - Enterprises That Bring People Together should be "L" not "M"
  - Just-in-Time-Production-Process should be "M/H" not "L"
  - Potential Economic Bottleneck should be "M/H" not "H" as production will likely go down as well so not as much to ship = not as much to hold up.
- BCTA does not expect any disproportional impact on the trucking sector as a whole compared to the BC economy: 3-5% is a good measure.
- An outbreak of pandemic influenza has not been raised as an issue in the association. BCTA is not aware of any BCPs for individual companies and nothing is in place for the industry as a whole. The industry tends to react to things after they get affected, rather than plan ahead.
- In terms of government support of this issue, BCTA is of the opinion that the government can help by providing good and to-the-point information (not a 30 page report, but for example a column in a newsletter). As businesses may not be taking a pandemic seriously enough at this point, anything to gain awareness is welcome. No scare mongering, but rather an objective dissemination of information is required.

BC Mining Association

Participants:

Ron Caldwell – VP Health, Safety and Disability Management

Kirsten van Loo – KPMG

Discussion Points:

- The following points were discussed during the interview:

Industry Sector	Labour Intensity	Export Dependency	Import Dependency	Susceptibility to Local/Global Advisory/ Prohibition	Enterprises that Bring People Together	Just-in-Time Production Process	Seasonality	Potential Economic Bottleneck
Mining sector	**L/M**	**H**	**M**	**L**	**L**	**M/H**	**L**	**M/H**

  - Labour Intensity is L/M: some of the highly skilled workers can be done without for a while, but if many of the other employees would be absent, there could be an impact on productivity.
  - Import Dependency: Rubber from the Middle East would have an impact if it cannot be imported because the mines make extensive use of tires, which are produced in Canada with imported raw materials. The impact would be greatest AFTER the pandemic, as there are stockpiles of tires/rubber available in BC.
  - Enterprises that Bring People Together is L: Employees not likely to self-quarantine. Mines are well ventilated these days.
  - Potential Economic Bottleneck is M/H: if an entire mine has to close down due to absenteeism, tires would not be purchased, just like iron milling balls (from foundries). The support industries would be affected.
  - If an entire mine is closed down, it is possible that an entire community has to shift focus, since the workers are usually day-labourers without a contract.
- Awareness levels in the mining industry are said to be akin those of earthquakes. A pandemic is not currently perceived to be a realistic threat in BC; so businesses have been focusing on other priorities.
- Ron Caldwell feels that government involvement in such matters as pandemic response and preparation could by nature cause panic amongst the public. So other than coordinate vaccine administration, less government involvement is preferable.

Canadian Manufacturers and Exporters

Participants:

Werner Knittel – Vice President, BC Division, CME

Kirsten van Loo – KPMG

Discussion Points:

- The following points were discussed during the interview:

Industry Sector	Labour Intensity	Export Dependency	Import Dependency	Susceptibility to Local/Global Advisory/ Prohibition	Enterprises that Bring People Together	Just-in-Time Production Process	Seasonality	Potential Economic Bottleneck
Manufacturing	**H**	**H**	**M / H**	**L / M / H**	**L / M**	**M / H**	**L**	**L**

  - 80% of BC manufactured goods go to the US.
  - Labour Intensity low, but if some of the higher skilled workers are absent, the production process at many plants would slow down.
  - Import Dependency: M/H, not L, due to the fact that a lot of inputs in the system come from the US.
  - Susceptibility to Advisory and Prohibition is L, M or H depending on the product manufactured and depending on the type of ban/advisory that is issued. (A ban at the US border could mean total shut down of the Canadian economy.)
  - Enterprises that bring people together would be rated at L/M, due to the fact that factories are a place where people congregate and many workers take public transport to work.
  - JIT Process can be rated H in some (automotive, aerospace, high end electronics and specialty goods) and M/H in most other manufacturers due to the fact that most manufacturers these days carry as little inventory as possible: inventory is one of the largest costs in production process, so many companies are dependent on an uninterrupted flow of supplies to the plants.
  - Potential Bottleneck: although a large ripple effect can be expected in the long run, no immediate bottleneck potential was identified during the interview.
- The manufacturing sector in BC will likely be proportionally affected by a pandemic in comparison to the BC economy as a whole. Long term effects are not unlikely.
- According to Werner Knittel, the awareness in the manufacturing industry in BC is probably comparable to the public's awareness of the matter. Most companies know about it, but prefer to focus on more pressing issues for their companies. The pandemic is seen as possible,

however, not probable and certainly not current. Maybe the large, international conglomerates will have something mentioned in their BCPs, if they even have one, but otherwise, Werner does not expect the manufacturers in BC to have any plans in place.

- A role for the government would be to properly address the health side. To be prepared in terms of infrastructure, communication and prevention in the province.

Council of Forest Industries

Participants:

Gary Crooks – Vice President, Southern Operations

Doug Routledge – Vice President, Northern Operations

Paul Levelton – KPMG

Kirsten van Loo – KPMG

Discussion Points:

- COFI agrees with most ratings for Forestry & Logging on the KPMG economic filter, with the exception of the ratings for Labour Intensity and Just in Time Production Process – They feel that Labour Intensity should be rated as "H" due to the fact that it does not take many absentees to shut down a logging site; and JIT should be rated as "H" also. (240.000 employees - $18 billion output)
- COFI agrees with the ratings for the forestry related part of the Manufacturing sector on the KPMG economic filter.
- The significant export countries are developed nations (mainly the US and Japan). COFI does not expect a large impact on forestry related economic activity from the supply side in the event of an outbreak of pandemic influenza. There seems to be enough elasticity in the ability to produce finished product as required. However, the demand side is more likely to be affected – this would be in housing construction: psychological factors (delayed spending) could affect the demand for solid wood products. (The disproportion of this effect would be within 1% from the general estimate: 4% instead of 3% for example.)
- It is mostly environmental and regulatory events that affect demand however – forest fires can create a run on the market for example. But not even currency crises have affected demand very much in recent years, so no large/disproportionate effects are expected.

- According COFI, there is little awareness of the potential impact of pandemic influenza n the industry. COFI's priorities have been with trade barrier issues.
- In terms of government support of this issue, COFI is of the opinion that the government can help build a picture of the potential impact on the industry to prepare companies for such an event. In addition it would be good if the government could reassure that they are prepared for the health effects (vaccines, care facilities, etc.). The government can help with education and avoidance of fear and panic through strong leadership.

Fraser River Port Authority

Participants:

Captain Allan Domaas – President and CEO

Kirsten van Loo – KPMG

Discussion Points:

- The following points were discussed during the interview:

Industry Sector	Labour Intensity	Export Dependency	Import Dependency	Susceptibility to Local/Global Advisory/ Prohibition	Enterprises that Bring People Together	Just-in-Time Production Process	Seasonality	Potential Economic Bottleneck
Ports	L	H	H	L/M	L	M	L	H

  - Labour Intensity is L: some of the crane operators and long shore men are not so much highly skilled as highly experienced. This makes them very efficient and brings down their damage rate. Missing them would affect the ports. Coast pilots can be considered critical in the port industry. There are only a handful of them and they are highly skilled so even missing a few of them would have a great impact.
  - Enterprises that Bring People Together is L: Employees not likely to self-quarantine.
  - Just-In-Time Production Process is M, not H like VPA said, due to the fact that logistics practices are changing to minimize threats to the production process from links in the chain malfunctioning. (interesting point)
- Awareness levels are very low. Mr. Domaas mentioned he felt a bit jaded after the Y2K uproar.

- Mr. Domaas feels the government's role is to assess if the pandemic is a real threat to the economy as opposed to a concern about a threat. They can encourage cross-training and other enhancement of best practices and they need to prepare the health side (vaccines etc.).

  Possibly, the government could prepare guidance plans as to which shipments have priority.

Tourism Whistler

Participants:

Barrett Fisher – President, Tourism Whistler

Kirsten van Loo – KPMG

Discussion Points:

- The interview focused specifically on the tourism industry in Whistler to help form a picture of the impact on the following sectors, as defined in the indicator filter and the characterization study:
  - Retail Trade
  - Arts, Entertainment and Recreation
  - Accommodation & Food Services
- The following picture was composed during the interview:

Industry Sector	Labour Intensity	Export Dependency	Import Dependency	Susceptibility to Local/Global Advisory/ Prohibition	Enterprises that Bring People Together	Just-in-Time Production Process	Seasonality	Potential Economic Bottleneck
Tourism Whistler	H	H	L	H	H	H	H	L

  - The tourism picture in Whistler at present looks as follows: 35% of visitors from Canada, 35% from the US, 10% from the UK, 4-5% from Japan, 4-5% from Australia, 2-3% from Germany, 1% from Mexico and the remainder from Europe.
  - The Japanese and Germans stand out as a fickle folk when it comes to traveling – see COTA interview. The UK travelers are the opposite: they do not seem to be affected by current events as much as other nations.

  - In terms of Import Dependency, international imports are probably rather low, however inter-provincial import dependency is high.
  - In terms of susceptibility to Advisories and Prohibitions, any bans on traveling to BC or Whistler, in particular, will seriously affect the tourism industry, with residual effects of up to 2 years.
  - Inter-industry bottlenecks are M/H (if hotels cannot take people, they will return home and not use recreational facilities), while on an inter-sectoral level, the tourism industry probably does not form a bottleneck to other industries

- Tourism in Whistler will likely be more heavily impacted by a pandemic than other parts of the economy. Health issues are becoming more and more important to travelers and the public in general and the flu season is in winter, which is also Whistler's peak season for tourism.
- Barrett Fisher suspects that there is limited or no awareness present in the Whistler tourism industry of the necessity of having contingency plans in place in case of a pandemic. Priorities lay elsewhere for most industry operators.
- The government can assist by ensuring influenza prevention plans are developed and support plans are available to help react quickly to an outbreak. The media, however, will be the biggest challenge to prevent large impact on the Whistler/BC tourist economy.

VANOC

Participants:

Dr. Jack Taunton, Chief Medical Officer, VANOC

Wayne Dauphinee, Exec. Director, Emergency Management Branch, MoH

Joel Finlay – KPMG

Discussion Points:

- The following points were discussed during the interview:

Industry Sector	Labour Intensity	Export Dependency	Import Dependency	Susceptibility to Local/Global Advisory/ Prohibition	Enterprises that Bring People Together	Just-in-Time Production Process	Seasonality	Potential Economic Bottleneck
VANOC – Pre-2010	H	L	L	H	M	H	L	L
VANOC – 2010 Games	H	L	L	H	H	H	H	L

- The discussion dealing with the 2010 Games breaks logically into two categories (a) Pre- 2010 and the 2010 Games themselves (January to March, 2010).

Pre-2010 Games

- VANOC is primarily concerned with the impact of the potential outbreak of pandemic influenza during the period (2006-2009) as it pertains to:
  - Delays of construction of 2010 venues and related projects (RAV Line, Sea to Sky Highway etc.)
  - VANOC workforce (and volunteers for pre-2010 "test events") as it pertains to key planning milestones (impact of worker absenteeism)

    Note: VANOC staff will grow to 1,600 by 2010 plus up to 25,000 volunteers.

2010 Games (January to March 2010)

- Impact on Pandemic could be devastating in terms of impact on:
  - Tourism – attendance at Games (ticket revenue) – Major Impact
  - Games logistics – food and beverage suppliers and preparers – impact of labour absenteeism, supplies due to supply chain issues
  - Security – labour absenteeism
  - Transportation - impact on YVR infrastructure and major carriers of Pandemic
  - Sponsors - loss of marketing opportunities

  - capability to provide services promised (due to both labour absenteeism and or supply problems)

- Sport competition – athletes (and officials) not able to compete due to Influenza
- Media – coverage is compromised due to Pandemic
- Health services – Games Health Services is sub-par – as required physicians nurses and other health professional are needed to provide services to general population

VANOC – Level of Awareness (Pandemic Influenza)

- The issue is high on the VANOC Executive Agenda
- VANOC is currently linked with the COC - re: Pandemic planning for the 2006 and 2008 Games
- Issue is also on the VANOC-IOC agenda
- At this stage (Jan. 2006) – VANOC has not yet fully developed a strategic Business Continuity Plan - but they will be doing so.
- However, VANOC (Jack Taunton) does have protocols for a full range of "disasters" - which they are reviewing with the IOC in February 2006
- Initial discussions have also been initiated with IOC and VANOC major sponsors – as to their "business continuity plans"

Recommendations/Needs from the BC Government

- Raising the level of general awareness among the general public (basic mitigation/public health strategies – to control the spread of influenza).
- Provision of reliable, accurate and timely information to the business and industry communities, media and the general public (reduce fear scenarios)
- Establishment of a reliable surveillance system (and necessary communications and information sharing links)
- A plan – which clearly articulates the roles/responsibilities of a) physicians, b) hospitals, c) community clinics, d) public health (provincial and HAs) - concerning how things are to be handled during a Pandemic ("disaster mode")
- A clear indication as to the process that will be followed regarding the policy decisions to business and industry – re: any potential compensation due to closures/ cancellations etc.

- Assurance to VANOC – that should the Pandemic occur during the 2010 Games period (January to March 2010) – that VANOC's health services (Health profe4ssionss, ambulances, laboratory services, etc.) requirements will be met - BUT – not at the expense of the provision of health services to the general public.
- VANOC be provided with sufficient doses of Tamiflu for their staff, the IOC Family and athletes (and their support staff)

Vancouver Port Authority

Participants:

Lori Lindahl – VP Corporate Service

Graham Kee – Security & Risk Management

Christine Dioszeghy – HR

Yvette Myers – Harbour Master

Joel Finlay – KPMG

Kirsten van Loo – KPMG

Discussion Points:

- The following points were discussed during the interview:

Industry Sector	Labour Intensity	Export Dependency	Import Dependency	Susceptibility to Local/Global Advisory/ Prohibition	Enterprises that Bring People Together	Just-in-Time Production Process	Seasonality	Potential Economic Bottleneck
Port Community	**H**	**H**	**H**	**L/M**	**L/M**	**H**	**L**	**H**

  - Labour Intensity is H due to fact that, if some of the higher skilled workers (such as longshoremen, ships' pilots and tug operators) are absent, a replacement crew would have to be organized. These workers will likely not be as efficient and effective, which will cause delays (e.g., longshoremen) –or would not be available at all (pilots and tug operators).
  - Susceptibility to Advisory and Prohibition is L/M: cruise ship industry would be shut down

  - Enterprises that bring people together would be rated at L/M, due to the fact that workers are recruited trough a hiring hall, which brings lots of people together every day.
  - JIT Process can be rated H: especially the shipping of fuel can create serious problems if delayed. (For instance: around Christmas the Second Narrows bridge in Vancouver was shut down for 3 days due to fog – this caused such serious heating problems on Vancouver Island, that emergency measures had to be taken.)
  - Although cruise ships would be affected strongly if the pandemic hit during the spring season, and container activity increases in the fall, seasonality can generally be rated as L in the port community.

- The transportation sector in BC, of which the ports are a part, will likely be much more strongly affected by a pandemic than the economy on average in BC.(and the Port needs to be thought of as part of the larger Canada – wide transportation infrastructure)
- The VPA has been working with the Ministry of Health (Federal) to coordinate integration of health related plans into the organization's emergency response plan. There are currently protocols in place. The workforce awareness levels remain low however.
- Workforce awareness is regarded as "sensitive" – as "too much attention" to the potential pandemic may result in the media portraying the VPA as actively working on pandemic prevention, (which, for example, could adversely impact the cruise ship industry).
- A role for the government would be to inform the public and the companies in the industries properly. In addition, it would be very useful to have a solid communication plan in place for information dissemination within the industry (e.g., Transport sector – how do the port, trucking, rail and air lines sectors coordinate and sequence their messages?).
- Need for clear, reliable and accurate information from Government (VPA doesn't want to get their information via the "Oprah Winfrey show") for both the industry and their workforce.
- Port needs guidance (a "checklist") from government to fully develop their Business Continuity Plans for the Pandemic (no Business Continuity Plan in place at this stage)

Vancouver International Airport Authority

Participants:

Tony Gugliotta – V.P. Finance

Craig Richmond – V.P. Operations

Jennifer Kooren – Manager Planning

Paul Levelton – KPMG

Discussion Points:

- YVR agrees with the ratings on KPMG economic filter, with the exception of the rating for labour intensity – They feel that this should be rated as "H" due to the numerous critical skills required (e.g., air traffic controllers, fire fighters and pilots). The lack of these individuals could shut the airport down.
- Previous economic disruptions have had a significant impact on the airport:
  - It took 4 years to recover from 9/11. The 9/11 incident resulted in a drop in traffic in the following year of 10%.
  - SARS resulted in a 50% drop in Asian traffic for a period of 3 months
- Airport traffic is 50% domestic, 25% US and 25% overseas
- Airport is planning for a potential drop of 65% to 75% in overall traffic levels during a pandemic. They are more concerned about having to lay off staff than how to deal with the staff that is absent due to illness. During SARS for example, Cathay laid-off most of their Vancouver staff and shut down all flights to Asia from Vancouver.
- There is a potential that the airport may have to close for safety/regulatory reasons (e.g., lack of air traffic controllers or fire fighters) for short periods of time
- YVR believes that the residual impact of a pandemic could be like 9/11 (i.e., it will take several years to recover)
- Pandemic will affect cargo and other airport operations just as much as passenger service.
- Planning:
  - YVR is working on a plan to deal with the long term financial and short term operational impacts of a potential pandemic. The airport needs to be able to survive the financial impact of the pandemic.
  - YVR is working with Health Canada and BC Centre for Disease Control on operational issues
  - Will be going to other airport stakeholders to bring them into the overall planning
- Key issues for government to deal with:

- **The Fear Factor** – Need clear, consistent messaging about the pandemic about what works and what does not work - The goal is to prevent people from needlessly walking off the job. This should be the role of the Provincial Health Officer and his federal counterpart
- **Visibility of Government Action** – The government needs to be seen to be doing something. This will instill confidence in the public and the labour force, even if those actions will only have minimal beneficial impact.
- **Education** – The government needs to educate the industry and public about the pandemic, preventative measures and other key matters. The message should be consistent between the federal and provincial governments (this was not the case during SARS, particularly regarding the effectiveness of masks).

Risk Management Branch, BC Provincial Treasury

Participants

Phil Grewar, Executive Director, Risk Management Branch, BC Provincial Treasury

Joel Finlay - KPMG

Current Government Business Continuity Management Plans were developed with a natural disaster in mind (e.g., earthquake). They are now being updated to address a response to Pandemic Influenza.

Government has defined "critical areas" for Government Pandemic Preparedness Planning They are broadly defined as:

Mission Critical

- Business processes that, should they not be performed, could lead to loss of life (safety), personal hardship to citizens (e.g., includes welfare payments), major damage to the environment, or significant loss of revenue and/or assets.

Business Priority

- Business processes that are not Mission Critical, but, should they not be performed, could lead to the loss of a major business function (including areas that if not functioning would result in a substantial loss of revenue to the Government).

Essential Services

- Business processes defined as either Mission Critical (public safety and security) or Business Priority
- Potentially largest impact on government of Pandemic Influenza would be on the Government's ability to implement the Provincial Emergency Preparedness Program – as the Emergency Preparedness Program is dependant on Government staff (from a range of Ministries in a variety of locales). Absenteeism due to the Pandemic is therefore a major concern.
- The Provincial Government role in providing and supporting essential services is regarded as a priority (e.g., direct responsibilities for Policing, Staffing Correctional Facilities, Ambulance Service and support to municipal services such as Fire and Municipal Policing). Absenteeism is regarded as having a large potential impact on the provision of these services.
- Susceptibility to Local/Global Advisory/ Prohibition was considered as having a medium impact on the Provincial Government – as such advisories would impact the tourism/convention industry – and a downturn in this sector would have a potential negative impact on provincial revenues.
- No specific Provincial Government Service areas were considered as posing a significant economic bottleneck to BC industry and business.
- The following picture was agreed upon during the interview.

Industry Sector	Labour Intensity	Export Dependency	Import Dependency	Susceptibility to Local/Global Advisory/ Prohibition	Enterprises that Bring People Together	Just-in-Time Production Process	Seasonality	Potential Economic Bottleneck
Provincial Government Sector	**M**	**L**	**L**	**M**	**L**	**L**	**L**	**L/M**

APPENDIX 7: ECONOMIC IMPACT INDICATOR FILTER

The following filter contains the assumed importance of the variables to the individual sectors in BC. Assumptions are based on the authors' subjective judgment and opinions expressed during interviews with industry representatives. The importance of each variable as a driver of the economy in each sector is classified as low ('L'), medium ('M') or high ('H'), relative to the assumed importance of the variable for the economy in other sectors and the importance of the other variables on the sector itself.

	Supply specific indicators			Demand specific indicators			Other indicators	
Industry Sector	**Labour Intensity**	**Just-in-Time Production Process**	**Import Dependency**	**Export Dependency**	**Enterprises that Bring People Together**	**Seasonality**	**Susceptibility to Local / Global Advisory / Prohibition**	**Potential Economic Bottleneck**
Crop and Animal Production	M	L	L	L	L	L	H	L
Forestry & Logging	L	M / H	L	L	L	M	L	M
Fishing, Hunting and Trapping	M	L	L	L	L	M	L	L
Support Activities for Agriculture & Forestry	L	L	M	L	L	L	L	L
Mining, Oil & Gas Extraction	M	M / H	M	H	L	L	L	M
Utilities	L	M	M	M	L	L	L	M
Construction	L	L	L	L	L	L	L	L
Manufacturing	L	M / H	M / H	H	L / M	L	L / M / H	L
Wholesale Trade	L	L	H	L	L	L	M	M
Retail Trade	M / H	L / M	H	L	H	L	L / M	L
Transportation & Warehousing	M	M / H	L / M / H	L / M / H	L / M	L	M	H

	Supply specific indicators			Demand specific indicators			Other indicators	
Industry Sector	**Labour Intensity**	**Just-in-Time Production Process**	**Import Dependency**	**Export Dependency**	**Enterprises that Bring People Together**	**Seasonality**	**Susceptibility to Local / Global Advisory / Prohibition**	**Potential Economic Bottleneck**
Information and Culture	L	L	L	L	M	L	L	L
Finance, Insurance and Real Estate	L	L	L	L	L	L	L	M
Professional, Scientific & Technical Services	H	L	L	L	M	L	L	L
Administrative & other Services	H	L	L	L	M	L	L	L
Educational Services	H	L	L	L	H	M	H	L
Health Care & Social Assistance	H	L	L	L	H	L	H	M
Arts, Entertainment & Recreation	H	L	M	L	H	L	M	L
Accommodation and Food Services	H	L	M	L	H	L	M	L
Other services (Except Public Administration)	H	L	L	L	M	L	L	L
Non-profit Institutions serving households	H	L	L	L	M	L	M	L
Government Sector	M	L	L	L	L	L	M	L/M

Sectors with high labour input. Labour intensive sectors may suffer disproportionate losses due to illness-driven labour disruptions. In addition, there may be longer-term labour market changes in the months after a pandemic, and workers will be attracted to organizations that offer better career prospects.

Sectors that depend on just-in-time supplies, particularly those with numerous suppliers. Following a pandemic, some suppliers may go out of business and if a substitute cannot be found, then production of the company's final product will cease once the stock on-hand is depleted.

Sectors that import a substantial amount of their input materials. This is because of both logistical problems caused by disruptions to the global shipping and air cargo systems, and also because of supply shortages in the originating countries.

Sectors that export a substantial amount of their production. This is because of both logistical problems caused by disruptions to the global shipping and air cargo systems, and also because of economic downturns in other countries (i.e., demand shocks).

Enterprises which bring people together, such as public transport, restaurants, theatres, sporting events and casinos. This is because people may be less willing to be in close proximity to others.

Seasonality. Industry of business sectors that have seasonal variations and where "busy" season coincides with the traditional influenza season.

Susceptibility to local/global advisories or prohibitions on trade or travel. This is because of the potential to transmit disease between jurisdictions.

Sectors that could be an economic bottleneck. These are sectors that provide financial, regulatory, communication and physical infrastructure necessary for the efficient conduct of trade (e.g., transportation providers, financial institutions, customs/immigration agencies, regulatory bodies).