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**A NEW ROLE FOR COST-BENEFIT  
ANALYSIS IN CANADIAN  
TRANSPORTATION  
INFRASTRUCTURE INVESTMENT**

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# **A New Role for Cost-Benefit Analysis in Canadian Transportation Infrastructure Investment**

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## **Abstract**

Encouraging greater reliance on Cost Benefit Analysis(CBA) as the organizing framework for facilitating discursive democratic procedures is an area in which the Canadian federal government can reinvigorate its role in the development of transportation infrastructure and physical infrastructure in general. The authors examine the microeconomic foundations of traditional CBA models. They find them too narrow to support the promise of CBA as a materially useful tool to help arrive at evidentiary consensus on major transportation infrastructure projects. To achieve its full promise, CBA requires an integration of advances in welfare economics, probability, discourse theory, and capability analysis. A framework for a reformulated CBA is presented along with an application of the approach in the case of gaining community evidentiary consensus on expansion of the Vancouver International Airport in the early 1990s. Potential implications for the federal government infrastructure policies today are explored and recommendations are made.

# A New Role for Cost-Benefit Analysis in Canadian Transportation Infrastructure Investment

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## Executive Summary

Because infrastructure expenditure can be ramped up quickly when sluggish or recessionary levels of employment and output motivate the need to stimulate economic activity, there is a risk that policy makers will be distracted from the need to find infrastructure investments that promote best value. Equally distracting can be the priority occasioned by the need to eliminate public sector deficits that accumulate during a period of stimulus spending.

Today's infrastructure requirements are in part being shaped by: declines in infrastructure spending during the deficit-fighting years in the 1980s and early 1990s; mounting congestion pressure points in urban centres; shifting patterns of international trade with resulting pressures on trade gateway infrastructure; and difficulty finding consensus on what to build and where to build it, with associated delay. What is required is a long-term and consistent approach to infrastructure that promotes sound and timely investments throughout the economic cycle. Cost-Benefit Analysis (CBA) must play a central role in this process.

As commonly viewed, CBA can help separate prospectively good projects – those whose costs are exceeded by their positive effects on productivity, livings standards, and economic development –from prospectively bad ones. CBA can also help prioritize promising candidates for investment in order of their economic and social merit. Another role for CBA, one that has received less attention, is helping facilitate public engagement in the search for infrastructure investments that advance the public good.

Questions such as where to site a new bridge, whether to build a new runway, and the like, are often the source of endless controversy and stakeholder debate in which evidence is misunderstood and manipulated depending on preconceptions and self-interest. The result at best is grid-lock in decision making and at worst decisions to sacrifice good investments or proceed with bad ones. According to the federal government's 2016 review of the *Canada Transportation Act*:

“Cities in Europe and Asia plan whole systems, often building multiple lines simultaneously to implant networks and shape development patterns which balance the positives and negatives of urban growth. Meanwhile, Canadian cities struggle to build consensus on a single line—a process that can take years, entailing costly delays, worsening congestion, and environmental degradation.” (Canada, 2016: 10)

The review goes on to propose that: “Improved dialogue between the federal, provincial, and municipal governments would facilitate better understanding of the issues and long-term solutions.” (Canada, 2016, 10) In that same vein, this report shows why and how CBA can also serve as a mechanism through which reasoned stakeholder (and citizen) engagement can enable coherent public deliberation, develop broadly-based evidentiary consensus, and help lead society to recognize a collective will.

Major findings of this report are:

- The technical apparatus of CBA rests comfortably enough on its theoretical foundations in microeconomics. However, these foundations are too narrow to support the promise of CBA as a materially useful tool to help arrive at evidentiary consensus. To achieve its full promise, CBA requires an integration of advances in welfare economics, probability, discourse theory, and capability analysis.
- As a mode of facilitation, CBA can be stripped of the presumption that on its own it reveals welfare maximizing solutions. It can become a means of enabling the citizenry or its elected representatives to determine what does and does not constitute welfare-improving change. There are a variety of requirements for deploying a reformulated CBA within a democratic discursive process to reach evidentiary consensus and, ideally, collective will (policy) consensus. One of these requirements is addressing the problem of trust. More so than in the past people are aware of the inherent uncertainty in forecasts and tend to be skeptical about projections that are not transparent about the risk of error. As to values, a number of social scientists have pointed out that peoples’ values can change during the course of deliberation. Against these realities, traditional CBA studies presume the suspension of disbelief.
- The reformulated CBA must rest on attaching probabilities to uncertainty inherent in preferences and forecasts. Once a quantitative sense of consequences has been established, opening the discussion to the broader language of justice, qualitative reasoning, and the creation of opportunity (capability) aligns the discussion with everyday language of social life. The difference from an entirely informal discourse is that deliberations are:
  - rigorously versed in evidence and its bearing on probable and improbable consequences; and, yet
  - are not bound to an ethical framework tied exclusively to consequentialist-based choice (namely, the neo-classical utilitarian framework of traditional CBA).

- Multi-jurisdictional planning for a second runway at Vancouver International Airport in British Columbia during the 1990s is a Canadian example of how the reformulated CBA has been applied with success. Up until the deployment of the reformulated CBA, political and evidentiary grid-lock had stymied a decision on whether or not to build the runway for over twenty years. Success in this case is measured by the democratic process for achieving evidentiary consensus and a degree of collective will, and not merely by the fact that a political decision was taken to build the second runway (very shortly after the conclusion of the deliberations in which the reformulated CBA was embedded).
- The report identifies a number of challenges to deploying CBA within a discursive democratic process. In summary:
  - **Participation and representation.** In the case of the Vancouver deliberative process, willingness to participate by citizens did not emerge as a stumbling block. A greater challenge lies in addressing issues of representation both with respect to the participation of citizens and experts. There are various approaches that may be taken geared to the circumstances at hand (ranging from informal and common-sense decisions to sophisticated sampling strategies). Critically, those ultimately responsible for final decision-making (e.g. governments) are denied an authority role during the entire process.
  - **Efficiency.** The Vancouver Airport example shows how the reformulated CBA can complement and be integrated with existing assessment processes to speed assessment times. The reformulated CBA process does not have to be costly. Whereas other forms of public engagement processes unfold over years, often over decades, the proposed process, by treating multiple viewpoints simultaneously and rigorously, can take less than a year, offering substantial savings in money and time.
  - **Political decision making and accountability.** There is risk that the reformulated CBA process may be perceived by final decision-makers as reducing their space for making political choices. At least in the case of the Vancouver Airport this risk did not prove to be material, as the deliberative process strengthened political accountability by testing and revealing to elected representatives the evidence-basis for alternative courses of action. The proposed reformulated CBA process does not foreclose the possibility of a direct referendum as providing a way of gauging citizen preferences. In this context, it can greatly strengthen direct referenda given that they can be highly vulnerable to the non-evidence based influence of special interest groups (this

reality was illustrated in 2015 in Vancouver itself with the carrying out and subsequent defeat of a referendum on a multi-year, multi-modal surface transportation plan).

- **Scale and jurisdictional scope of project.** The reformulated CBA process is likely to be cost effective when applied to infrastructure projects of sufficient scale measured in financial or other terms. The Vancouver Airport example suggests that the reformulated CBA can be aligned with the realities of multijurisdictional projects. It provides one mechanism for clarifying for decision-makers the evidence base underlying different starting views on priorities at local, regional, and national levels.
- All levels of Canadian government could benefit from paying greater attention to best practice procedures, such as the reformulated CBA, as they seek to direct infrastructure dollars in the public interest. The Canadian Constitution's Section 36(1) commits federal and provincial governments to: promoting equal opportunities for the well-being of Canadians; furthering economic development to reduce disparity in opportunities; and providing essential public services of reasonable quality to all Canadians. Over the past twenty years, federal infrastructure policy has generally been passive in relation to these obligations. Other constitutional considerations (division of powers between federal and provincial levels of government) have on occasion been cited as one reason for the federal government's retreat from a leadership role.
- There are many areas where the federal government role in transportation infrastructure can be reinvigorated. Greater reliance on CBA as the organizing framework for facilitating discursive procedures is one such area. This report recommends:
  - the federal government re-new the work of Transport Canada and the Treasury Board conducted over a decade ago on state-of-the-art CBA.
  - the federal government consider taking on the role of a convener in bringing together provincial governments, various stakeholder groups, and infrastructure financing and engineering experts, in developing state-of-the-art CBA guidelines. These guidelines might include: the ways and means of defining, identifying and measuring option value, existence value (i.e., technical expressions of capability); and the application of CBA as a democratic procedure that seeks to ensure "process equity", citizen voice, and value-formation through discussion (discursive democracy). Such guidelines might



then be operationalized in various forms:

- when investment prospects with scope for federal funding arise in multi-jurisdictional contexts;
- when investment prospects arise with scope for federal funding in relation to urban environments that cut across multiple socio-economic and ethnic groups; and,
- when investment prospects arise with scope for federal funding that have different implications for environmental justice and human rights for different groups.

The Prime Minister of Canada wrote in his November 2015 Mandate Letter to the Canadian Minister of Transport that:

“We have also committed to set a higher bar for openness and transparency in government. It is time to shine more light on government to ensure it remains focused on the people it serves. Government and its information should be open by default. If we want Canadians to trust their government, we need a government that trusts Canadians. It is important that we acknowledge mistakes when we make them. Canadians do not expect us to be perfect – they expect us to be honest, open, and sincere in our efforts to serve the public interest.” (Trudeau, 2015)

Enabling the practice of CBA as the organizing framework for facilitating discursive procedures within a democratic process would be consistent with this mandate.

# A New Role for Cost-Benefit Analysis in Canadian Transportation Infrastructure Investment

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## INTRODUCTION\*

Economic efficiency, poverty, inequality, and social exclusion are tied to personal mobility and the accessibility of goods and services facilitated by public infrastructure. Evidence of the economic role of transport infrastructure in promoting better living standards and greater wellbeing can be seen in the effects of both overall public investment in transport infrastructure and in the impacts of specific transport policies, projects and multi-project plans.

At the macro-level of overall public expenditure, transport capital investment can measurably promote growth in productivity. This is significant because productivity growth is a major driver for growth in incomes and living standards, closing income disparities, and increasing access to life-chances for people in different regions and sub-regions. On the premise that, in reasonably well functioning (i.e. competitive) economies, workers share in the gains to productivity, it can plausibly be inferred that aggregate infrastructure investment lifts well-being and living standards.

Several studies provide evidence of significant private sector productivity gains from public transportation infrastructure investments (see US, 2010, for a review of the literature). In some cases, returns to public investment are greater than returns to private investment. The research record indicates that transportation infrastructure investments can result in positive spillovers in such diverse areas as economic development potential, energy efficiency, and public health (Gramlich, 1994, Giller and Levinson, 2004, Quintan-Domeque et. al., 2010). At the level of specific policies, investments and plans, transport infrastructure can improve the economic wellbeing for a wide range socially disadvantaged groups, including the poor, elderly people, people with disabilities, children, young adults, and women. Such benefits include greater accessibility to work and other life-chances and reduced stigmatic harms associated with social exclusion.<sup>1</sup>

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<sup>1</sup> A 2008 economic analysis of the Greater Toronto region's 30-year, \$31 billion multimodal regional transportation plan projected an overall positive social rate of return (Metrolinx, 2008). At \$356 million (in present-day value) the plan's estimated benefits to low income people together with cross-sector benefits are significant. Due to the huge congestion-relieving effects of the plan, benefits to low income travelers per se constitute less than one percent of the \$46 billion in total benefits. However, this percentage understates the true value to disadvantaged groups. The large delay reductions counted under "congestion management" may be expected to have a disproportionately

Yet not all prospective infrastructure projects are equally worthwhile, and some will not be economically or socially worthwhile at all. Cost-Benefit Analysis (CBA) is the gold-standard by which good projects can be distinguished from bad ones and by which the most worthy projects can be identified when resources are insufficient to finance all meritorious candidates. It is well established that CBA can help governments establish investment priorities among the inevitable nation-wide demand for more infrastructure capital than that available. CBA continues to be used in Canadian public policy decision making although its use varies from federal department to department and from province to province. But a closer examination of the theoretical foundations (and practical applications) for CBA suggest that its traditional focus on the economic concept of utility is both its major strength and an area of vulnerability. Can CBA be reformulated to strengthen transportation infrastructure decision making?

This report shows how CBA can be reformulated and deployed within a facilitation process to help communities of interest collectively decide on how to direct their public infrastructure investments. The report is presented in three sections:

- Section I examines how the practice of CBA is grounded in principles crafted by philosophers and economists during the course of the 18<sup>th</sup>, 19<sup>th</sup> and early 20<sup>th</sup> centuries. It identifies where the practices of CBA must be dug out of these old foundations and what it means to establish new ones.
- Section II identifies the main features of a new model for CBA. An illustrative example of how the new model has been deployed in Canada is presented, along with lessons learned.
- Section III explores how the reformulated CBA could help Canadian federal and provincial governments strengthen their transportation infrastructure decision-making processes and deliver real economic, social, and political management benefits.

## **SECTION I –A CRITIQUE OF COST-BENEFIT ANALYSIS**

### **1.0 Approach**

This section shows that the technical apparatus of CBA rests comfortably enough on its theoretical foundations in microeconomics. But these foundations are shown to be too narrow to support the promise of CBA as a materially useful tool to help arrive at evidentiary consensus. To achieve its full promise, CBA requires an integration of welfare economics, probability, and discourse and capability theory.

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positive impact on low income groups by broadening the accessibility of labour markets and increasing worker productivity.

This section begins with an examination of the ethical, analytical and democratic foundations of CBA. The traditional institutional roles and procedures of CBA are then presented and three conceptual frameworks for repositioning the procedures of CBA are examined (justice as fairness; discourse theory and discursive democracy; and capability theory). Finally, the importance of applying subjective probability techniques to elicit subjective values is highlighted as a central technical means to move CBA from a purely utilitarian instrument to one with real potential to forge evidentiary consensus and, possibly, collective will.<sup>2</sup>

## **1.1 Ethical, Analytical and Democratic Foundations of CBA**

### **1.1.1 Ethical Foundations**

The earliest articulation of CBA as a formal analytical process for evaluating the worth of prospective capital projects was presented in 1848 by French engineer Jules Dupuit (1804-1866). British economist Alfred Marshall (1842-1924), considered the father of neo-classical economics, refined Dupuit's technical framework and established the formal principles that ultimately became what we know today as CBA. However, to understand and critique the practice of CBA we need to look deeper than the technical principles established by Dupuit and Marshall and consider CBA's ethical and philosophical foundations.

In summarizing the work of Edmund Burke, John Maynard Keynes stated: "The government which sets the happiness of the governed before it serves a good purpose whatever the ideological theory from which it draws its inspiration" (Skidelsky, 1991:155). Supporting this belief is the essence of what CBA purports to do, but the source of 'happiness' is assumed to be what philosophers and economists call 'utility' – a concept that, as discussed later in this section, should be broadened in the 21<sup>st</sup> century.

Keynes identifies Edmund Burke (1729-1797) as the first utilitarian political philosopher – the first to espouse consistently the "greatest happiness" principle. But it was Jeremy Bentham (1748-1832) who gave the term "utility" economic meaning. Bentham defined utility as "that property in any object whereby it tends to produce pleasure, good or happiness, or to prevent the happening of mischief, pain, evil or unhappiness to the party whose interest is considered" (Bentham, 1789). For Bentham, the object of all government action must be the greatest utility for the greatest number.<sup>3</sup> The greatest happiness principle of utilitarianism remains the core ethic of welfare economic theory as well as the theory's principal workhorse, CBA.

The French economist Vilfredo Pareto (1848-1923) injected scientific objectivity into the utilitarian ethical framework by defining what constitutes an "optimal improvement" in utility

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<sup>2</sup> "Will-formation," is a term coined by Jurgen Habermas for the will to achieve particular ends through collective discourse. Will-formation is not decision-making, but rather a basis for decision making.

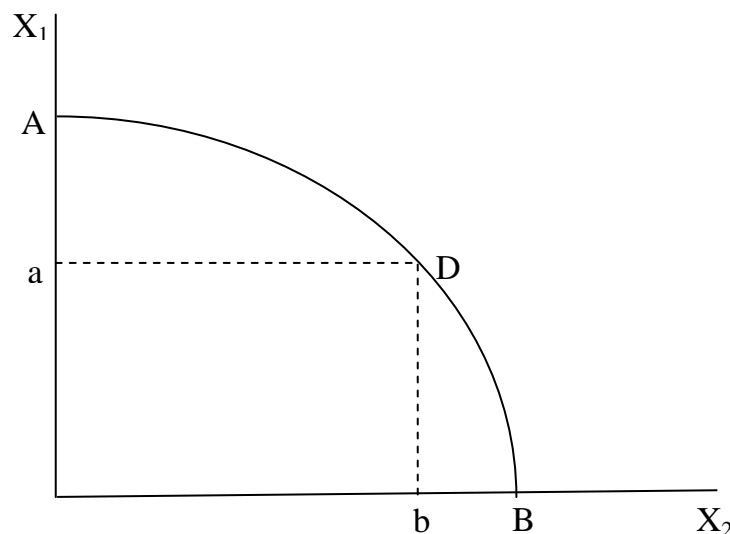
<sup>3</sup> John Stuart Mill (1806-1873), a follower of Bentham, advanced the view that some happinesses ("pleasures") are in kind better than others. But like Bentham, "sought to use utilitarianism to inform law and social policy." (Driver, 2014)

(economic welfare). The definition reduces to a “rule” which states that any social change is desirable which results in everyone being better off, or someone being better off and no one being worse off, than before the change. A “Pareto improvement” is actually a movement toward the more general case of a “Pareto Optimum”, a resource allocation in which any further shift in resources would make someone worse off and no-one better off. Under the Pareto scheme, there are many resource allocations that might represent optima.

John Rawls, the US political philosopher, points out that the Pareto rule is itself an ethical proposition, a value statement. In one respect the rule commands wide acceptance for it equates the term “better off” with “in that position voluntarily chosen.” (Rawls, 1999) In other words, individual preferences are taken to indicate changes in wellbeing. A person is said to be better off when he or she voluntarily changes his or her position from one to another. On the other hand, many different distributions of economic resources may constitute a Pareto improvement, an ethical proposition of rather less practical appeal in policy making.

### Rawls’ on the Pareto Principle and the Pareto Efficient Frontier

“Consider Figure 1 in which a fixed stock of commodities is to be distributed between two people,  $X_1$  and  $X_2$ . The point 0, the origin, represents the position before any resources are distributed. The line AB represents the points such that given  $X_1$ ’s gain at the corresponding level, there is no way to distribute the commodities so as to make  $X_2$  better off than the point indicated by the curve. Consider the point  $D = (a,b)$ . Holding  $X_1$  at the level  $a$ , the best that can be done for  $X_2$  is the level  $b$ . The points on the line AB are the Pareto efficient points. Each point on AB can be seen to satisfy Pareto’s criterion for efficiency. There is no redistribution that makes either person better off without making the other worse off. Clearly, there are many Pareto efficient points, namely all the points on line AB. The Pareto principle does not indicate one particular distribution of resources as the single-most appropriate one.”



Source: Rawls (1999, 3<sup>rd</sup> ed.: 59)

Note: The X-axis denotes quantity of fixed stock distributed to person  $X_1$  while the Y-axis denotes quantity of fixed stock distributed to person  $X_2$

Society has shifted ground in relation to pure utilitarianism: witness the emergence of belief systems such as environmental justice and accessibility for persons with disability as a human right that run counter to the widely-held ethical proposition in economics of indifference to the distribution of resources, rights and obligations. Traditional CBA, on the other hand, remains rooted in the utilitarian ideal. CBA typically makes no distinction, other than obvious common sense ones, between sources of economic satisfaction and sources of satisfaction grounded in concepts of justice, liberty, duty, obligation and due process.<sup>4</sup> Under the Pareto principle it does not matter how the sum of satisfactions is distributed among individuals. The Pareto-optimal distribution is an allocation of resources in which it is impossible to make any one individual better off without making at least one individual worse off. Under this rule, and under the rules of CBA, society must allocate its means of satisfaction whatever these are – resources, rights, and duties – so as to achieve (or make progress towards – a “Pareto improvement”) this outcome. In CBA there is no reason in principle why the violation of the liberties of a few might not be made right by the greater good shared by many.

Of course the greatest sum of advantages is not actually attained in the way described above. As noted by Rawls, the strictness of common sense precepts of justice is brought to bear in limiting major injustice and insidiously injurious actions. (Rawls, 1999) But the utilitarian believes that to affirm this “strictness of common sense precepts” as a first principle of welfare economics would be a mistake. Excepting constitutionally enshrined liberties, all is fair game in seeking to secure the maximum satisfaction for the greatest number. Standard economic teaching holds that this is as it should be – that matters of “social justice” are inherently political and as such are properly left to elected representatives to deal with. Elected representatives, on the other hand, feel underserved when CBA studies leave them without systematic guidance on what might be the more pressing decision variables at-hand.

### **1.1.2 Analytical Foundations**

Bentham’s ambition was to achieve a means of quantifying utility so as to obtain, through the measurement of peoples’ satisfaction with things, the steps by which governments might secure the greatest happiness of the greatest number. He never achieved his “felicific calculus” but others, notably the economists Dupuit, Marshall, and Pigou, took to the task.

Based on Marshall, and the principles laid down by Pareto, Cambridge professor A.C. Pigou (1877-1959) recognized that market prices provide a practical framework within which to measure and aggregate individual preferences so as to evaluate the merits of social change – a numerical means by which to learn the nature of Pareto improvements. The notion of peoples’

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<sup>4</sup> This is the case notwithstanding attempts in the economics literature to permit such things as the introduction of numerical weights for different income distributional consequences (see Adler, 2012 & 2013).

*willingness to pay* as an index of benefit has since been extended to non-marketed goods and services (e.g., through a contingent valuation framework). However, the willingness to pay framework remains the conceptual and operational center of CBA.

### *The Compensation Principle*

Theoretical refinement of the Pareto conditions for optimality was the stuff of much intellectual endeavor among 20<sup>th</sup> century economists. An influential refinement arose in the form of the “compensation principle” which makes a distinction between actual and potential increases in welfare.

Satisfying the Pareto rule requires that no one is made worse off by a change in policy. But changes satisfying it are rarely observed in the real world. This circumstance led to the development in the early part of the century of the “compensation principle”. The compensation principle, as formulated by Nicolas Kaldor (1908-1986), John Hicks (1904-1989) and Tibor Scitovsky (1910-2002), states that a social change can be deemed a Pareto improvement if the value of total gains (benefits) is sufficient, through lump sum transfer payments, to compensate those who stand to lose and still leave society as a whole better off. This principle requires only that prospective gains in net social benefit are sufficient to create the potential for such compensation, not that it actually occur.

This is not a denial of the importance of distributional effects. Rather, it argues that, in a democratic society, only elected representatives should decide whether compensation is appropriate in cases where overall welfare improvements would nevertheless leave some people worse off.

### *The Social Welfare Function*

Doubting the ethical purity of the compensation principle, in the 1940s economists Abram Bergson and Paul Samuelson reintroduced certain Benthamite ethical norms through the device of the “social welfare function.” Mohring (1976) reports that the following exchange took place between a graduate student and Paul Samuelson:

“What’s wrong with the compensation principle, Sir?” the young graduate student asked with a tug of the forelock.

“Compensation isn’t paid,” the great Samuelson replied.

“Is that all?”

“That’s enough.”

Conceptually, the social welfare function incorporates fully the required information concerning the relative importance of conflicting aims, including the relative importance of separate

individuals within the social group. The function orders all possible states of society and reveals the single best allocation accordingly.

### *The Impossibility Theorem*

Undesirable ethical implications of the social welfare function were revealed in the early 1950s when Kenneth Arrow published his famous impossibility theorem (Arrow,1951). The impossibility theorem demonstrates that in trying to obtain an integrated social preference from diverse individual preferences, it is not possible to find even mild-looking conditions that would satisfy elementary demands of reasonableness for public choice in a democratic society. Arrow had originally set out to prove that a social welfare function could satisfy, simultaneously, four conditions.

1. Provide the social ordering for every possible combination of individual preferences.
2. Allow the ranking of any two social states to depend on peoples' preference only over that pair of alternatives, with no dependence on how other, unrelated alternatives, are ranked. (Economists call this condition the "independence of irrelevant alternatives", or just "independence").
3. Permit no individual or group of individuals to prevail over the social ordering regardless of what others prefer (Arrow called this condition "non-dictatorship").
4. Allow the group of all individuals, taken together, to prevail over the social ordering (namely the "Pareto principle" requiring that any change in the social ordering leave some individuals better off without leaving others worse off).<sup>5</sup>

What Arrow ended up proving is that it is not feasible to have a social welfare function that satisfies, simultaneously, independence, the Pareto principle and non-dictatorship. Arrow reaches this conclusion by revealing the problems that arise in seeking to translate the logic of individual utility maximization to that of collective welfare maximization while still preserving the basic axioms of individual rationality.

For example, the formulation of a social welfare function assumes the existence of "transitive preferences," which states that an individual who prefers x to y and y to w will, logically and rationally, prefer x to w. Consider three alternative road projects, one that offers increased speed, one increased safety, and one better air quality. If, at the margin, a person prefers the faster road to the safer one, and prefers the extra safety to the additional air quality, welfare

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<sup>5</sup> This condition can be weakened to require only that any change in the social ordering generate net gains that are large enough to compensate the "losers" while still leaving some individuals better off.



theory hinges on the premise that he or she will prefer the extra speed to the improvement in air quality. Arrow shows that while transitivity holds for individuals, it can break down in the context of groups, such as a group of voters. Within such a group a majority might well vote for speed over safety, safety over environment and, yet, environment over speed. Since maximizing a social welfare function assumes the existence of *collective* transitivity, the key result of Arrow's work is the recognition that maximizing a social welfare function cannot be relied upon as a basis for rational choice without accepting that government might need to impose undue (non-democratic) authority to achieve it.

### 1.1.3 Democratic Foundations

Arrow viewed his results not only as a flaw in the social welfare function, but in democracy itself. He viewed the breakdown of transitivity at the collective level as nothing less than an obstacle to rational choice in the context of democratic majority rule.

Taking issue with Arrow, in 1954 the US economist James Buchanan argued that the breakdown of transitivity at the collective level is not a fundamental problem but merely an artifact of the assumption of the social welfare function that the logic of individual choice is a "good thing" for social groups as well.

"Rationality or irrationality as an attribute of the social group implies the imputation to that group of an organic existence apart from that of its individual components. If the social group is so considered, questions may be raised relative to the wisdom or unwisdom of this organic being. But does not the very attempt to examine such rationality in terms of individual values introduce logical inconsistency at the outset? Can the rationality of the social organism be evaluated in accordance with any value ordering other than its own?" (Buchanan, 1954: 116)

Buchanan's argument is that different concepts of "rationality" apply to a whole society as distinct from a single individual. The impossibility theorem points to voting as a source of inconsistent and potentially irrational decisions. But Buchanan argues that such "irrationality" is actually a desirable attribute of social choice. He explains that, in the historical and philosophical context, majority decision evolved as a means through which a social group makes collective choices among alternatives when consensus among the individuals comprising the group cannot be attained. Correctly speaking, according to Buchanan, majority decision must be viewed primarily as a device for breaking a stalemate, allowing for collective action. A decision reached through the approval of a majority with minority dissent has never been, and should never be, correctly interpreted as anything other than a provisional or experimental choice of the whole social group. As a tentative choice, the majority-determined policy is held to be preferred to inaction, but is not to be considered as irrevocable:

"The fact that such decisions may be formally inconsistent provides one of the most important safeguards against abuse through this form of voting process. If logical

consistency were a required property of decision, majority rule would not prove acceptable, even as a means of reaching provisional choices at the margins of the social decision surface.” (Buchanan, 1953: 118)

Buchanan’s critique of Arrow’s impossibility theorem, and of the Bergson-Samuelson social welfare function in general, gives rise to an alternative view of the institutional role of welfare economics and CBA

The Bergson-Samuelson welfare function derives the optimal allocation of resources from an assessment of collective or “social” values. In contrast, an approach inspired by Buchanan begins with the proposition that no social values exist apart from individual values. Instead of revealing a social optimum, the role of economic analysis is to search for “social compromises” on particular issues. In this sense, a CBA is to be viewed as merely hypotheses about individual values, hypotheses to be tested through the choice process itself. Actual values are revealed only through the political action of individuals, and consensus among individual members of the choosing group becomes the only possible affirmation of a “social” value and a welfare-improving change.<sup>6</sup>

A social welfare function approach represents a decision criterion independent of the choice process, but a Buchanan-inspired alternative evaluates results only in terms of the choice process itself. A CBA finding of a net gain in social benefit to be viewed as but a hypothesis, one that can be validated only through discussion, through a direct referendum or through the decision of an elected legislative body. If a majority rejects the change, the Cost-Benefit finding (of a welfare gain) is refuted. The finding of a welfare gain is equally refuted if *a minority dissents*; minority dissent is interpreted as the need for further options, including compensation provisions for damaged minorities. *Only options that yield consensus without minority dissent can be regarded as welfare improvements.*

A Buchanan-inspired approach views the practice of welfare economics as using CBA to facilitate, not “inform”, the decision process. The analysis must seek to evaluate relevant options with analytically derived assumptions about the values and preferences of individuals while all the time remaining open as to how values should be modified based on discussion and consensus. The compensation principle is gone. In its place, at least in principle, is the search for options or sufficient actual compensation to garner not merely majority rule, but consensus without minority dissent.

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<sup>6</sup>To clarify, Buchanan does adhere to the notion of Pareto Optimality. What he argues is that mutual approval from all parties is the only way to ensure that a policy change is welfare improving in the Pareto sense. What Buchanan rejects is the idea of the social welfare function, on the grounds that he believes it requires a degree of omniscience regarding individual preferences which no economist possesses. (The authors are grateful to a referee for making this clarification).

Gone as well is the Bergson-Samuelson social welfare function as a device for revealing the single best allocation of resources. It is replaced with the search for consensus through discussion. The discussion and consensus process is to be structured and informed with the apparatus of CBA; but it is the decision process itself, not the conclusions drawn from third-party CBA studies, that reveals welfare-improving policies.

Under a Buchanan-inspired framework, CBA would be applied to facilitate the search for consensus within a political process. The reality of course is that CBA has not evolved as a facilitation tool. On the contrary, Cost-Benefit Analyses are almost always performed as third-party (“impartial observer”) studies whose conclusions are framed as findings about the aggregate economic welfare effects of this or that policy option. While this approach is consistent with Pareto, Bergson and Samuelson, for Buchanan such findings exist outside the process of public discourse and say little or nothing meaningful about welfare.

Buchanan’s formulation of welfare implies a fundamental change in the way we estimate welfare costs and benefits. Whereas CBA remains the analytical workhorse of welfare economics, the Hicks-Kaldor-Scitovsky compensating variation criterion for declaring a policy change welfare-positive or welfare-negative is irrelevant. In other words a finding that hypothetical transfers from gainers to losers would leave losers no worse off (while still generating overall net benefits) is no longer sufficient for declaring a change welfare-positive.

The significance of empirically derived economic values is also different under Buchanan. With conventional CBA, values (values of time, life, environment, amenity, and the like) are measured from historical data using either revealed or stated preference (contingent valuation) empirical methodologies. With Buchanan, the assumption is that values take shape during the process of discussing prospective change. In this context, empirically derived estimates from historical data are points of departure in a discursive process – important points of departure, but points of departure nonetheless.

More fundamentally still, Buchanan’s concept of welfare economics can be viewed as a realignment of economic analysis with the realities of modern democratic governance. Traditional CBA is seen as an analytic exercise within a larger frame in which elected officials allocate resources with technical advice from third-party experts (such as economists). As such, traditional CBA is consistent with a Weberian model of governance that involves systematic processes and organized hierarchies that exist to program the government in the interest of society. Politics is seen as a framework for serving the interests of society with technical advice from third-party experts acting through bureaucratic institutions.

Some might insist that Buchanan’s critique demands a Libertarian alternative to the Weberian framework. Others might disagree, arguing instead that “discursive democracy” (or “discourse theory”) is the best framework within which to exercise Buchanan principles. Libertarians, Sugden (1993) for example, argue that the primary role of government is to maintain a

framework of rules and procedures within which individuals are left free to pursue their own rationally-conceived ends within a framework of constitutionally protected liberties, rights and freedoms. Decision-support analysis of any sort is largely irrelevant in this formulation.

Yet researchers, most notably Kahneman (2011) demonstrate that individuals are hard-wired with certain mental heuristics that lead to biased forms of reasoning, especially in matters of complexity; rationally-conceived ends are not, it turns out, so rationally conceived at all. In fact, such biases can have the effect of prompting people to make choices that are inconsistent with *their own* beliefs, values and preference. The procedures of CBA offer one means by which people can be guided around these internal imperfections (Sunstein, 2008). Discourse theory, and the discursive democratic governance model it has spawned, is a middle ground between the third-party remoteness of hierarchical governance and the laissez faire paradigm of libertarianism. It is in this institutional middle-ground in which CBA can, we believe, be practiced according to Buchananesque ideals.

## 1.2 Institutional Roles and Procedures of Cost-Benefit Analysis

The ethical and democratic foundations in which the procedures of CBA were originally grounded have shifted over the last 50 years. Whereas the technical procedures of CBA generate little controversy among academics and practitioners, citizens and decision-makers might regard the product as unhelpful or wrong or irrelevant. For example, CBA in the 1970s and 80s of alternatives for making public transportation physically accessible to people with disabilities found that separate paratransit services would be economically superior to adapting regular bus and rail facilities for those who cannot use stairs, a finding that was widely condemned, particularly by those who regarded access to mainstream public facilities a human right (US, 1979). More generally, ex-post reviews of cost-benefit analyses of major infrastructure investments (rarely undertaken) expose systematic (although not necessarily deliberate) biases in underlying forecasts that lead to understating costs and overstating benefits as these are conventionally measured (Flyvbjerg, 2009).

CBA recognizes the existence of obvious liberties and duties (due process of law and natural rights, for example) but it draws no fundamental distinction between “the good,” “the right,” and “the fair” in seeking out welfare maximizing solutions and opportunities. Such things as acquired rights and environmental justice are viewed as “non-economic” or “political” factors to be introduced into decision-making outside the context of CBA.<sup>7</sup> Welfare maximizing solutions are discovered in studies, outside the choice process itself. The analysis is conducted as a research exercise within a larger context in which decisions about the allocation of resources and the character of fairness, rights and duties are taken by elected or appointed officials who receive advice on the “efficiency dimension” from third-party experts (e.g., economists). Experts treat

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<sup>7</sup> The concept of environmental justice is not to be confused with that of environmental resources. Environmental resources do indeed occasion willingness-to-pay values in CBA. Viewed through a neo-classical microeconomic lens, economic justice might equate to the notion of option or existence value as distinct from use value.

resource values (human life, property, environment, time savings, etc.) as data to be drawn from the empirical analysis of consumer behavior: the decision-making process itself is not regarded as a source of information about resource values.

When decisions veer from the steps recommended in CBA, economists have been accused of looking for the political logic that might explain the divergence from the economically correct course of action. (Howitt and Altshuler, 1999) Does the maximization of welfare (happiness) really exist only within the province of economics, not that of politics? Or, has modern society's view of what constitutes the basis for happiness gone beyond the assumptions of neo-classical utilitarianism? Can the technical apparatus of CBA be made to serve a productive purpose if the procedures of CBA were aligned with modern ethical and democratic realities? Insight into potential answers to these questions is gained from examining three conceptual frameworks for repositioning the procedures of CBA: justness as fairness; discourse theory and discursive democracy; and capability theory.

### 1.3 Theories of Justice and the Veil of Ignorance

One approach to reconciling the public “good” with public “rights” is offered by John Rawls. In *A Theory of Justice*, Rawls develops a framework he calls “justice as fairness.” (Rawls, 1999) He begins by establishing a basic rule within which members of society can establish a social contract. The rule is that discussants have to find consensus from behind a “veil of ignorance” – a state in which no one knows which social role or economic position they might end up occupying. The idea is that if you don't know whether you will end up rich or poor, male or female, boss or worker, you will shape your thinking to adopting principles of justice between each group.

Rawls then offers two principles to guide resource allocation. The first is each person is to have an equal right to the most extensive scheme of basic liberties compatible with a similar scheme of liberties for others. The second is that social and economic inequalities are to be arranged so that they are both reasonably expected to be to everyone's advantage and available to everyone.

Although Rawls' concept of a just and fair society cannot be taken literally as basis for organizing North American societies,<sup>8</sup> its influence since publication in 1971 cannot be ignored. The Clean Air Acts of the US and Canada, and the US *Americans with Disabilities Act*, are examples of utility maximization constrained by lines in the sand regarding acquired rights and freedoms (the right of urban dwellers to clean air, of wheelchair users to accessible toilets, and so on). Significantly for this report's later discussion of CBA procedures (Section II) is Rawls' formal requirement that public policies emerge from institutional procedures erected to facilitate

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<sup>8</sup> The philosopher Simon Blackburn observes that Rawls' framework most closely resembles the social democratic countries of Scandinavia with their substantial welfare floors. Blackburn notes that Rawls is actually more left than them, since even after a welfare floor has been established, those least well off can make claims to further redistribution of resources if such redistribution would not, by dampening incentives to work, shrink the overall endowment of economic resources available to everyone (Blackburn, 2002).

the search for common points of view. As previously noted, traditional CBA – as an institutional procedure – is far removed from such a facilitating role.

#### 1.4 Discourse Theory and Discursive Democracy

Rawls' work contributed to an important view of modern political thought called known as discourse theory. Discourse theory, and the principles of discursive democracy to which it gives rise, refers to the institutionalization of the procedures and conditions of communication as a basis for collective will-formation through consensus (Dryzek, 1990). As previously noted, "will-formation," is a term coined by Jurgen Habermas (1979) and refers to the will to achieve particular ends through collective discourse. Will-formation is not decision-making, but rather a basis for decision making.

Discourse theory suggests similar procedures to Rawls' theory of justice, but is less normative and more practical in application. Discourse theory posits that collective will-formation does not draw its force from a previous convergence of communally shared ethical convictions. Rather, the procedures of deliberation, and the release of peoples' *communicative* instinct to allow better arguments to come into play, precipitate the formulation of values as a basis for collective, welfare-maximizing consensus and policy making.

Discourse theory replaces traditional concepts of rationality (i.e., the maximization of a social welfare function) with the concept of "communicative rationality." Rooted in the interaction of social life, communicative rationality is seen as a property of *subjective* discourse, not individual or social maximization. The idea of communicative rationality, as its proponents are quick to point out, has a respectable heritage. Aristotle was an advocate of public discourse and reasoning. Kant (who advanced the idea of "Reason" as the basis for collective agreement) and Rousseau (the social contract) also figure prominently. Each sought justification of values and principles in "the formal conditions of consensus formation." (Habermas, 1979). Contemporary heirs to this Aristotelian theme include Arendt (1958), Gadamer (1975), MacIntyre (1966), Habermas (1970) and Dryzek (1990).<sup>9</sup>

It is through the mechanisms of discursive democracy that CBA can be re-grounded. CBA offers a means of liberating "the communicative instinct" and helps individuals avoid the mental heuristics that give rise to unintended reasoning biases. As a mode of facilitation, CBA can be stripped of the presumption that it reveals welfare maximizing solutions. It becomes a means of

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<sup>9</sup> The common aim of these philosophers is to resurrect authentic and reasonable public discourse. To paraphrase Dryzek (1990), such discourse has been eroded over the centuries by theories of rationality manifested in hierarchy, administration, and technocracy, by attempts to locate objectivist solid ground, and more recently, by postmodern relativism.

enabling the citizenry or its elected representatives to determine themselves what does and does not constitute welfare-improving change.

A facilitation or “communitarian” role for CBA aligns it with important advances in our understanding of the way peoples’ values and beliefs form. Contrary to the assumption in utilitarian theory of stable values and preferences, it appears that people often do not have well-established values, and that preferences are constructed – not merely revealed – during discussion (Kahneman and Tversky, 2000). Nobel Prize winning economist and philosopher Amartya Sen writes that the practical reach of CBA is considerably reduced by its tendency to ignore value formation through social interactions. According to Sen, many of the more exacting problems of the contemporary world – varying from famine prevention to climate change, *call for* value formation through public discussion (Sen, 1998). As commonly practiced today, value measurement emphasizes the quest for empirical accuracy. The use of structured discussion to alter, validate and legitimize values is alien to CBA as traditionally practiced. Within a re-formulated CBA, third-party estimation of benefits and costs should be only a starting point for policy formulation and discussion.

## 1.5 Capability Theory

Insights from justice as fairness, discourse theory, and discursive democracy, point to areas for re-formulating CBA as one means of organizing and facilitating a public discourse on resources, values, justice, and the likelihood of welfare gains from available courses of potential action. A capability theory of social choice adds a further set of compelling reasons to strengthen, rather than abandon, CBA as a valuable means to achieve these ends.

Capability theory, as advanced by Sen and others,<sup>10</sup> holds that governments should consider not only the kind of lives we manage to lead (the “benefits” in CBA), but also “the freedom that we actually have to choose between different styles and ways of living.” (Sen, 2009: 227) This theoretical perspective emphasizes the opportunities and freedoms available to citizens to achieve social justice.

Capability-based models for decision-making do not reject CBA as a decision support tool. As Sen emphasizes, a capability approach points to an evidence-based focus in judging and comparing overall individual advantages although “...it does not, on its own, propose any specific formula about how that information may be used.” (Sen, 2009: 231)

The considerable informational requirements of capability models make them complementary to a reformulated CBA as a mode of facilitation. The emphasis is placed on assessing what the expressed needs may reveal about desired capabilities required to achieve positive outcomes for individuals. For example (see text box), a capability approach requires attention to the

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<sup>10</sup> The US political philosopher Martha Nussbaum has also made major contributions to establishing and elaborating on the capability perspective.



distributional consequences of infrastructure investment although not in terms of monetary gains and losses (a subject well-addressed through traditional models of CBA).

### **Utility and Capability Approaches**

Consider a hypothetical proposal to build a new subway to reduce transportation congestion.

Under a utility approach (through CBA) one appropriate subject of analysis might be the tax incidence required to finance the subway on different income groups.

Under a capability approach, the subject of analysis might be how the subway might increase (or decrease) the capabilities of different income groups and individuals within those groups to actually access education, nutrition, recreation, labour market, and economic opportunities.

## **1.6 The Communication of Cost-Benefit Analysis and Probability**

The communication problem for CBA is a problem of trust. More so than in the past people are aware of the inherent uncertainty in forecasts and tend to be skeptical about projections that are not transparent about the risk of error. As to values, it is counterintuitive for people to imagine their values being quantified in the absence of discourse and reflection. Against these realities CBA studies presume the suspension of disbelief. Forecasts of costs and benefits that extend decades into the future are portrayed as the basis for decision and economic values (e.g., measured from past behaviour and contingent valuation studies) are treated as “data”. Flyvbjerg (2009) documents many examples of forecasts that have veered sharply away from what unfolded after investments were made, indicating that mistrust is not misplaced.

CBA studies fuel mistrust by either presenting as certain that which is not, or by employing faux experiments to reflect uncertainty. Consider the common “what-if?” experiment in which studies pose hypothetical questions and use models to evaluate associated outcomes. While sensitivity analysis can play a useful analytic role, the “what-ifs” themselves are almost always arbitrary, providing the decision-maker with no guidance as to how to assign the alternative outcomes particular weight.

Variants of the “what-if” experiment include the familiar “best-case/worst-case” and “high case/low case” scenarios. To construct a worst case, analysts suppose that all projections will deviate from the central expectation *in the same direction*. In reality, the likelihood that all forecast assumptions will err simultaneously in one direction is as remote as everything turning out exactly as expected. Another conventional but flawed procedure is “sensitivity analysis” wherein forecast assumptions are varied one or two variables at a time. Needless to say, life does not veer from expectations one or two variables at a time. Shifting CBA to a *probabilistic forecast mode* would enhance its usefulness for a variety of technical reasons but also,



fundamentally, because it makes trust in results an earned rather than given attribute of the CBA process.

### 1.6.1 Communication through Probability

While people do not believe forecasts, they are anxious to know how scientific evidence and expert beliefs might bear on possible outcomes. Meteorologists learned this long ago. The now ubiquitous “probability of precipitation” (PoP) combines reasoned information about uncertainty to present a statement of risk. “*The chance of rain tomorrow is 20 percent*” is not perceived as a professional cop-out: on the contrary, people have always known the forecast to be uncertain.

It is not always appreciated by the general public or by political decision-makers how uncertainty can be incorporated in reasoned decision-making. PoP provides a real world example of the process involved. PoP combines two kinds of probability:

- Objective probability reflects the kind of statistical analysis with which most people are at least vaguely familiar, the “frequentist” procedures for gauging random error and dispersion in observed data, surveys, instrument readings and models; and,
- Subjective probability (the “Bayesian” method) accounts for the opinions and beliefs of experts.

Before any weather forecasting models are run, different meteorologists will have different opinions about the implications for tomorrow of weather patterns being observed today. Regardless of how well-specified a model might be, no single weather analysis can provide absolute, definitive conclusions: even after a given model is calibrated and run, diversity of expert opinion will persist. Before issuing a hurricane evacuation advisory, analysts apply the subjective method (“Bayesian updating”) to incorporate the range of expert beliefs into the final statement of risk. Consumers do the same, comparing the wording of advisories from different sources before making up their own minds.

### 1.6.2 Subjective Probability and Elicitation through Bayesian updating

Bayesian updating involves the elicitation of probability beliefs using a range of protocols (illustrated in the next section of this report) designed to help experts avoid the mental heuristics discussed earlier while revealing a coherent set of personal probabilities. “Coherent” in this context means that the results conform to the axioms of probability (one cannot hold the belief that an outcome is 30 percent likely without also holding the belief that its converse is 70 percent unlikely). The premise is not that experts carry well-formed probability-based judgments around in their heads: they do not. Rather, elicitation has evolved into a synthesis of social psychology, statistical discipline and group facilitation designed to enable experts to give context-sensitive quantitative expression to their well-informed but qualitatively held beliefs. In addition to

meteorology, applications of subjective probability are common in the military, finance and health (see text box for one example).

**Subjective Probability and Elicitation through Bayesian Updating –  
a Health Care Application**

Brophy and Joseph (1995) report how ten years of clinical random trials with two thrombolytic drug strategies for myocardial infarction (two “clot-buster” drugs designed to arrest heart attacks) were updated on the basis of expert beliefs among practicing cardiologists, paramedics and other practitioners. Frequentist evidence from the trials, which indicated one drug to be more effective than the other, was sharply revised in forging a basis for guiding medical practice. They find: “The subjectivity of prior beliefs in the Bayesian approach is not a liability, but rather explicitly allows different opinions to be formally expressed and evaluated.”

Elicitation protocols of subjective probability (Bayesian updating) present a means by which stakeholders and citizens can participate, inform or even take a central role in the analysis process. It is their values we seek to quantify as part of the process of updating “expert” evidence from revealed preference studies, contingent valuations and other frequentist examinations of economic and social behaviour. At the same time, the values brought to the table should be subject to disciplined, evidence-based review and challenge. In short, probability – both objective and subjective – is a powerful operational means by which CBA can be recast from a “study” to a procedural framework for reasoned deliberation and decision by discussion.

*Summary*

The technical apparatus of CBA rests comfortably enough on its theoretical foundations in microeconomics, but these foundations are too narrow to support the promise of CBA as a materially useful tool of facilitation. A general theory of CBA must be an integration of welfare economics, justice, discourse and capability theory, and probability. Each of these component strands is itself a collection of many strands.

- Welfare economics encompasses numerous elements of microeconomics, including the tools of rational analysis and the quantitative expression of value.
- Discourse theory represents a synthesis of moral philosophy, ethics, political science, institutional analysis, and the facilitation of various levels of consensus.
- Capability recognizes freedom to achieve well-being in terms of people's real opportunities to do and be what they have reason to value.

- Probability (or, as Bernoulli first called it in the 17<sup>th</sup> century, “political arithmetic”) combines the mathematics of uncertainty and risk with social psychology and the elicitation of subjective values.

As set out in the next section of this report, despite the discrete and overlapping attributes of its many strands, a braid, properly constructed, holds tight as a single entity: the entity is CBA within a discursive social process to arrive at evidentiary consensus and possibly collective will.

## **SECTION II -CBA WITHIN A DEMOCRATIC DISCURSIVE PROCESS: OPERATIONAL REQUIREMENTS AND AN APPLICATION**

### **2.0 Approach**

This section describes the general operational requirements for deploying a reformulated CBA as an effective tool within a democratic discursive process to reach evidentiary and, ideally, collective will (policy) consensus. A Canadian example of how these requirements have been met in past transportation planning processes is presented: multi-jurisdictional planning for a second runway at Vancouver International Airport in British Columbia during the 1990s. Potential reasons for why the suggested procedures have not been deployed widely, and potential challenges to deploying the reformulated CBA, are examined at the conclusion of this section.

### **2.1 Procedural Requirements and Subject Matter**

Figure 2 illustrates the major subject matter areas, and the procedural process within which CBA is situated, as they are found across a series of deliberative assemblies.

### **Figure 2: Cost-Benefit Analysis within a Discursive Democratic Process**

	<b>Deliberative Assembly 1.0</b>	<b>Deliberative Assembly 2.0</b>	<b>Deliberative Assembly 3.0</b>
<b>SUBJECT MATTER</b>	<ul style="list-style-type: none"> <li>• Problem</li> <li>• Options</li> </ul>	<ul style="list-style-type: none"> <li>• Probabilistic evidence</li> </ul>	<ul style="list-style-type: none"> <li>• Consequences</li> <li>• Justice &amp; Reasons</li> </ul>
<b>PROCEDURES</b>	<ul style="list-style-type: none"> <li>• Reference Brief</li> <li>• Options &amp; Issues</li> <li>• Presentation of CBA model inputs</li> <li>• Elucidation of cause-and-effect relationships</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge Elicitation</li> <li>• Assignment of probabilities to assumptive evidence for CBA</li> </ul>	<ul style="list-style-type: none"> <li>• Population of CBA model with probabilistic evidence</li> <li>• Preliminary ordering of alternatives by net benefits</li> <li>• Testing of quantitatively defined consequences against reasoned thinking on justice and capabilities</li> </ul>
<b>OUTCOMES</b>	<ul style="list-style-type: none"> <li>• Shared understanding of the Reference Brief and deliberative process</li> </ul>	<ul style="list-style-type: none"> <li>• Preliminary evidentiary consensus</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Minimal Outcome:</b> evidentiary consensus</li> <li>• <b>Maximum Outcome:</b> articulation of collective will</li> </ul>

### *2.1.1 Deliberative Assemblies and Participation*

The CBA discursive process occurs within a series of deliberative assemblies comprised of citizens, experts, and facilitators.

- The first set of deliberative assemblies are dedicated to seeking preliminary consensus on the way, or different ways, in which the problem at-hand is to be articulated and the range of associated policy alternatives.
- The second set of deliberative assemblies are devoted to empirical and assumptive evidence, the goal being preliminary technical consensus on the categories of negative and positive policy alternative effects (costs and benefits); the nature of cause-and-effect relationships through which policies create costs and benefits; and the assumptive evidence with which quantitative expression is to be assigned to the CBA model (so as to estimate, probabilistically, the order of costs and benefits).
- The third set of deliberative assemblies considers the preliminary ordering of alternatives by net benefits (derived from application of probabilistic evidence). They then turn from the search for evidentiary consensus to the search for collective will (policy choice). The discussion transcends the strict definition of costs and benefits and extends into the domain of capability theory and general reasons and rationales that participants wish to bring to the table.

## *Participation*

In principle the discursive process within the assemblies should be open to all. But in most cases this is not a practical option. Notwithstanding the Internet, the practical barriers to universal participation in all decisions impose limits on group size. This does not constitute a flaw in the theory of discursive democracy.<sup>11</sup> Statistical representation is one legitimate approach whereby a subset of a concerned group participates through a cross-section of delegates constituted so as to ensure that all perspectives to an issue area are represented. In general, there are strong incentives for individuals or delegates to participate (see text box). Individuals or delegates can also rotate to help broaden the base of participation, although the scope for rotation can be

### **Will people participate in a discursive process?**

Case studies of incipient discursive procedures are reported by Dryzek (1990). Moreover, ours is not the first proposal for deliberative Cost-Benefit Analysis (Nou, 2008). Incipient and proposed procedures do indicate that people do participate, though for various reasons and motivations. One reason might be a stalemate in other areas of decision, such as the courts. Another might be a genuine desire for improved communications with protagonists. A third reason is naked self-interest wherein people see more to gain from participation than from abstention. This third calculus [self-interest] reportedly tends to dominate, “As one might expect in a world of ubiquitous strategic pursuit of self-interest.” (Drysek, 1990:19) Such pursuit is of course anathema to communicative rationality. Hence, as Dryzek observes, rationalized interaction immediately confronts the need to transcend the motivations that attract the participants. This requirement explains why the rational procedures of CBA and a neutral third party are necessary – to ease participants over hurdles leading to an unfamiliar kind of interaction.

The discursive process itself, combined with probabilistic elicitation, can lead people both to participate and to transcend self-interest as an original motivation. Transcendence arises in a number of ways. One dynamic is the appeal to what Habermas (1979) calls the communitarian instinct – an instinct liberated by the propensity of free but rationally framed discourse to allow better arguments to come into play. This seems to be reinforced by the pedagogical and yet non-authoritarian (non-hierarchical) nature of the process. Another dynamic is the appeal to self-interest itself. It appears that the transparency of multi-stakeholder discussion in a free but rationally framed, evidence-based and probabilistically reasoned discourse helps defuse the force of single-issue strategic behaviour. Compromise itself becomes a mode of strategic self-interest: participants are moved to find consensus on what to do even though they might well disagree on why to do it.

impractical when matters under deliberation are especially complex.

<sup>11</sup> Theorists such as Robert A. Dahl (1956, 1989) suggest that communicatively rationalized discourse allows individuals to attend selectively in relation to aspects of a decision, or interactions between aspects of a decision, that concern them. Further economy can be achieved when individuals free themselves from participation to the extent that they agree to common ends, or principles.

Deliberative assemblies include participation by subject matter experts. There are many different ways by which the experts can be selected. For example, they can be selected by lot from a list of available experts, or through informal mechanisms whereby communities of interest agree to a delegation by common consent. The role of the experts in the deliberative assemblies is circumscribed to comment and debate on matters of presented as fact and the reliability of information, including data, cause-and-effect relationships assumed in models, analysis and studies, and the interpretation of analysis and studies.

### **2.1.1 The First Set of Deliberative Assemblies - Subject Matter, Procedures and Outcomes**

Prepared and disseminated in advance of deliberation, a *Reference Brief* provides detailed but accessible information in relation to all but one of the subject areas for deliberation (it does not explicitly address consequences, reasons and justice). The Reference Brief lays down a foundation for deliberation and is entirely preliminary. It is not a report. It is an agenda. The Brief considers in turn:

#### *The Problem*

The reference brief identifies the assumptions and beliefs that give rise to the perception of a problem, issue or opportunity. Alternative ways of expressing the problem are articulated as are foundational assumptions and beliefs. For example, if the “problem” at hand were traffic congestion, the corresponding assumption of free roads would be explained (as would the well-tested hypothesis that, if roads were tolled, there might be less congestion).

#### *Options*

A preliminary scoping of alternative courses of action is provided, including that of no action and the widest possible range of options (e.g., build more roads, build toll roads, attach tolls to existing roads, invest in more public transit, discourage urban sprawl, and so on).

#### *CBA Inputs and Cause-and-effect Relationships*

CBA is employed as the organizing framework for providing participants with the best available information on each alternative:

- The effects (actual values are addressed later in the brief), both positive and negative, of each alternative are listed: market and non-market, internal and

external. While effects are listed in recognizable units of measurement, the focus is on the underlying economic logic:

- how positive effects translate into economic benefits and negative effects into economic costs;
  - how willingness to pay can signal the economic value of any given effect (a foundation for deliberating values later on); and,
  - the *time-value* of economic benefits and costs is also explained (a foundation for deliberating discount rates later on) as is the issue of “double counting” whereby a single economic benefit or cost manifests in more than one measurable form (such as time savings from a new rail line arising as both greater worker productivity and increased land value).
- A state-of-the-art understanding of cause-and-effect relationships that connect policy actions to each of identified effects is set out. The aim is not only to make CBA models accessible to lay persons, but also to allow the facilitator to educate and, through elicitation, enrich the cause-and-effect logic in response to insights generated during later phases of the deliberation procedures.
  - The reference brief provides participants empirical evidence – the data that, when used to populate the cause-effect models, generate estimates of costs and benefits. The presentation of this empirical evidence is governed by two rules.
    1. Only data on model inputs are presented (causal variables and coefficients, collectively called “assumptive evidence”), *not* the costs and benefits that follow from solving the CBA models. Deliberation over assumptive evidence must precede meaningful deliberation of consequences. If the CBA models are “solved” too early in the discursive process, participants are prone to examine estimated costs and benefits first, rather than the assumptions underpinning the estimates. This risks the promotion of strategic behavior. Such behaviour is sharply diluted if “bottom lines” are allowed to emerge later in the deliberative process and after fulsome deliberation of the theory and evidence has occurred. Participants could, in theory, try solving the models and “reverse engineer” their comments, but the complexity of such an exercise makes such an effort unlikely.
    2. Quantitative evidence must be portrayed *probabilistically*. Few non-expert participants may grasp statistical subtleties before the facilitated deliberation. However, many will comprehend the idea of a range and of the risk of error being even or uneven in relation to some central estimate.

This idea mirrors ways of thinking in the everyday decisions of daily life. As well, participants are asked to appreciate from the start that the evidentiary segment of the discursive process is not to be governed by single best-guess values or convenient but arbitrary concepts of risk. One illustration of how quantitative evidence may be portrayed probabilistically to a lay audience is shown in Figure 3.<sup>12</sup>(See also text box)

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<sup>12</sup>There are many other excellent approaches to conveying the essence of probability to lay audiences, many of which ensure that “The math serves the conversation; the conversation doesn’t serve the math.” (Meyer, 2010)



### Uncertainty and Probability: Classical and Bayesian Approaches

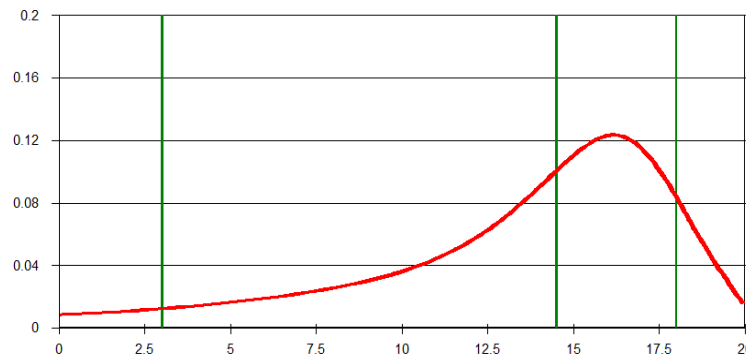
Probability, the most common way of quantifying uncertainty about evidence, can be approached in two ways: the “frequentist” or classical approach; and the subjectivist, or Bayesian approach.

The classical approach defines probability as the frequency with which an event or outcome is observed in studies. Under the subjectivist or Bayesian approach (known also as the Personalist approach) probability is defined as the degree of belief that a person, an expert in the area in question, has that the event or outcome in question will occur (Granger & Henrion, 1990)

The framework proposed in this paper employs both approaches, the former to summarize what is known about key variables from studies and the latter to elicit from experts how they might modify the results of objective studies based on additional information and knowledge they possess.

**Figure 3: Depicting Evidence Probabilistically -- Value of Time in dollars per hour**

<b>Median</b>	<b>10% probability of being this low</b>	<b>10% probability of being this high</b>
<b>\$14.50</b>	<b>\$3.00</b>	<b>\$18.00</b>



Notes:

The vertical axis denotes probability.

The horizontal axis denotes value of time in dollars per hour.

Three attributes of a probability distribution are given for each variable, the median (50th percentile) estimate, and the 10 percent probable estimates both above and below the median. These quantities are drawn from the statistical properties of relevant and available market analysis, contingent valuation studies, formal meta-analysis of the evidentiary record, and other legitimate sources of empirical information. The corresponding shape of the probability range is portrayed. The facilitator employs the chart in explaining the evidence and comments on any associated statistical issues, such as small sample sizes.

### *Expected outcomes of the first Deliberative Assemblies*

The main outcome of the first set of deliberative assemblies is a shared understanding of the reference brief and the agenda for the next stages of the deliberative process. To the fullest extent possible, stakeholder agreement is reached on the nature of the base case and the alternatives, including non-capital alternatives such as pricing, zoning, and innovative applications of technology.

#### **2.1.3 The Second Set of Deliberative Assemblies - Subject Matter, Procedures and Outcomes**

The second set of deliberative assemblies is devoted to empirical and assumptive evidence, the goals being: preliminary technical consensus on the categories of negative and positive policy effects (costs and benefits); the nature of cause-and-effect relationships through which policies create costs and benefits; and the assumptive evidence for which quantitative expression is to be assigned to the models so as to estimate, probabilistically, the order of costs and benefits.

#### *Knowledge elicitation*

Knowledge elicitation lies at the heart of the second deliberative assemblies because it is the means to incorporate the probabilistic expression of quantitative information within CBA. There is a growing body of literature and good practice in the area known as *Expert Knowledge Elicitation* (EKE). For example, the European Food Safety Authority (EFSA, 2014) has developed an extensive guidance on how EKE procedures can be designed to draw out knowledge from one or more *experts* and attaching probabilities to uncertainty attached to things (e.g., preferences, utilities, probabilities, estimates etc.) and specific information (facts, data, sources, requirements, etc.). The EFSA guidance reviews the practical challenges and choices to be made in EKE, including choosing between three major alternative models for EKE or their variants: the Sheffield method; the Cooke's method; and the Delphi method (see text box next page).

EKE processes based on one or more of these models (or variations thereof) have most often been applied in the realm of scientific risk assessment (e.g., in health and environmental areas) rather than in such broad policy areas such as transportation infrastructure planning. However, there is no reason why they cannot be applied in such areas. At the same time, each method carries its strengths and weaknesses with respect to achieving preliminary evidentiary consensus. In the illustrative case of the Vancouver International Airport described later in this section, the approach taken was more in line with (although not identical to) the Sheffield method of behavioural aggregation (the other two models involve more limited and controlled interactions among participants).

### Strengths and Limitations of Three Models for Knowledge Elicitation

1. **The Sheffield method** employs behavioural aggregation, in which the experts meet face to face in an elicitation workshop and are allowed to interact and discuss under the management of the elicitor. There are potential problems in such interaction which may distort the final elicited distribution and lead to a poor result, but the advocates of behavioural aggregation argue that with good facilitation by the elicitor these risks are minimized and are outweighed by the potential advantages of the interaction. The principal claimed advantage is that the final elicited distribution will be better informed through the experts sharing and debating their information and judgments. Another claimed advantage is that behavioural aggregation avoids the need to pick a mathematical aggregation rule. Finally, within a face-to-face workshop it is easier to ensure that the experts understand clearly what is being asked of them.
2. **The Cooke's method** does not allow the experts to discuss their judgments; interaction is limited to initial training and briefing. Instead of behavioural aggregation, Cooke's method employs a form of mathematical aggregation. The potential problems with mathematical aggregation are that the choice of an aggregation rule is somewhat arbitrary, that every choice can be shown to have some undesirable implications and that it is not clear whose judgments the aggregated distribution represents. Nevertheless, the advantage of having an aggregation rule makes the aggregation explicit, auditable and, in a sense, objective. The advocates of Cooke's method argue that their aggregation rule is founded on formal principles and the aggregated distribution represents a rational consensus distribution. The principal claimed advantages are that Cooke's method uniquely is able to be validated and the aggregation rule allows experts whose judgments are poorly made or relatively uninformative to be down weighted (although the efficacy of this weighting is dependent on the degree to which seed questions are comparable to the substantive elicitation questions). Advocates also believe that allowing interaction between experts may lead to poor aggregation and is not justified by the potential increase in information resulting from sharing judgments.
3. **The Delphi method** lies between these two positions. Interaction between experts is allowed but is controlled. Judgments from each round are fed back to the experts in the subsequent round, but in an anonymized form. Although the interaction is very limited, advocates of the Delphi approach argue that it allows some benefits from the sharing of information without the risks of personal factors influencing judgments inappropriately. After all rounds of the Delphi method are completed the final distribution is obtained by a simple equal-weighting mathematical aggregation rule. Although this lacks the complexity of the Cooke rule, advocates of the Delphi method typically doubt the value and efficacy of unequal weighting and prefer the more 'democratic' equal weighting.

Source: EFSA, 2014: 57-58

### *Assignment of probability to assumptive evidence for later incorporation in the CBA model*

The role of the facilitator is crucial whatever model and technical protocol for knowledge elicitation is employed. The process of facilitation should be viewed as one that helps experts construct a set of carefully reasoned and considered judgments. This is more likely to succeed if there can be detailed technical discussion with pointed give-and-take that allows experts to sharpen and refine their thinking. It is particularly important to get experts to explore the full set of evidence available; explain why he or she does or does not place confidence in different data and interpretations; explore and elaborate their perspectives and possible biases with respect to the field; and to employ valid Bayesian protocols to elicit quantitative expressions of uncertainty.

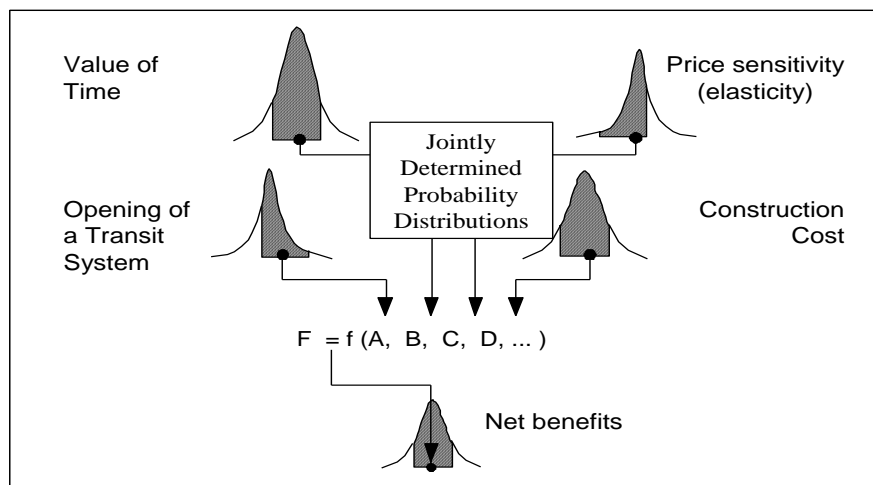
### *Expected outcome of the second set of deliberative assemblies*

The expected outcome is a preliminary consensus on: the logic of cause-and-effect relationships and the assignment of probabilities to assumptive evidence. However, all of these subjects remain open to further scrutiny during the third deliberative assemblies.

#### **2.1.4 The Third Deliberative Assemblies - Subject Matter, Procedures and Outcomes**

The third deliberative assemblies begin with the search for technical consensus on a quantitative expression of consequences – an evidentiary consensus. Well established statistical procedures are used to populate the cost and benefit models with the probabilistic evidence developed by consensus in the second set of deliberative assemblies. They suggest a preliminary ordering of alternatives in relation to net benefits (Figure 4 provides a generic representation of the combining of the probabilities).

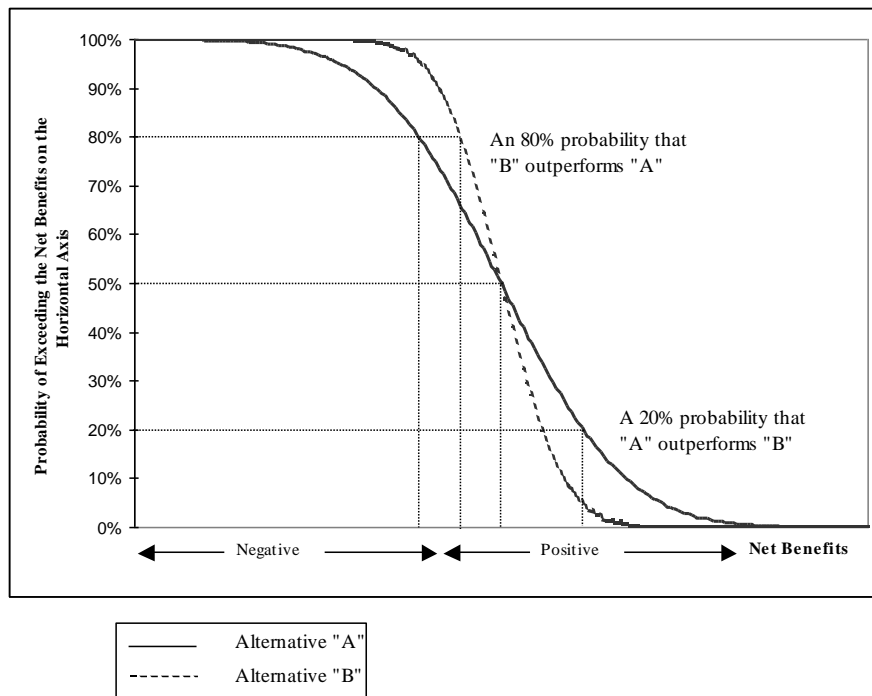
**Figure 4: Combining Probabilities**



Source: Lewis (1995).

The ordering of alternatives could well be different at different levels of probability. For example, Figure 5 shows Alternative "B" outranking Alternative "A" at the 80 percent probability level. Alternative "A" rises to first place if one were willing to accept only a 20 percent probability level of achieving that outcome. Such situations can arise when known technologies or policies are pitted against new or developmental ones. Whereas a new or developmental approach might be associated with significant failure risk (as assessed during evidentiary review in the second set of deliberative assemblies), its consequences for society (its net benefits) might be materially greater than that of conventional methods were it to succeed.

**Figure 5: The Bearing of Evidence on Consequences**



Source: Lewis(1995).

Participants in the third assemblies are encouraged to test alternative probabilistic assumptions to help gain consensus. Idiosyncratic and strategic behaviour is self-limiting since the group will resist requests to test ideas well outside the ranges discussed in the second set of deliberative assemblies. Having said this, the desire to revisit the probabilistic ranges assigned to social values should be expected and encouraged. As explained in Section I of this report, it is only through deliberation that such values take shape.

Yet the discourse in the third assemblies must ultimately turn from the search for evidentiary consensus to the search for collective will with regard to policy choice. Four questions are posed:

1. Is the evidence regarding consequences (benefits, costs and net benefits) a sufficient basis for a collective will to adopt one of the alternatives? If not:
2. Are there matters of justice that, by consensus (using the “veil of ignorance” test and other discursive devices) override the implications of consequences and give rise to collective will in relation to another of the alternatives?
3. Are there reasons or beliefs that, by consensus, override the implications of consequences and give rise to collective will in relation to another of the alternatives?
4. Are there other alternatives that, brought into the picture, would bring about the necessary and sufficient conditions for collective will?

Once a quantitative sense of consequences has been established, opening the discussion to the broader language of justice, qualitative reasoning, and the creation of opportunity (capability) aligns the discussion with everyday language of social life. The difference from an entirely informal discourse is that deliberations are:

- rigorously versed in evidence and its bearing on probable and improbable consequences; and, yet
- are not bound to an ethical framework tied exclusively to consequentialist-based choice (namely, the neo-classical utilitarian framework of traditional CBA).

### *Expected outcomes of the third Deliberative Assemblies*

A range of desirable outcomes of the third deliberative assemblies is possible.

A minimally-desired outcome is that of sufficient evidentiary consensus so as to have removed expert-versus-expert controversy, and related strategic behaviour, out of the public debate, allowing deliberation over policy to move beyond technical issues and into the realm of achieving a collective good.<sup>13</sup> One possible effect of such an outcome is to clear a path for reasoned deliberation among elected officials in full appreciation of the risks and uncertainties inherent in each of the available choices.

The maximum-desirable outcome is a community consensus on the alternative best able to reflect the collective will of a community, namely the alternative that best embodies the community’s expression of its common interest.

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<sup>13</sup> Although evidentiary consensus is a minimally-desired outcome, it must be recognized that it is not always achievable. There is nothing to prevent, for example, the outcome of bimodal distributions.

## 2.2 An Application: The Vancouver International Airport Deliberative Process for a 2<sup>nd</sup> Runway (“The Vancouver Process”) <sup>14</sup>

How does CBA deployed in a discursive democratic context, such as described in the last section, appear in real world practice? What results does it deliver? What broader issues might it rise to, including its compatibility or otherwise with larger political systems for infrastructure planning? To help answer these questions there is one major Canadian example, the multi-jurisdictional planning for a second runway at Vancouver International Airport in British Columbia during the 1990s.<sup>15</sup>

### 2.2.1 Background

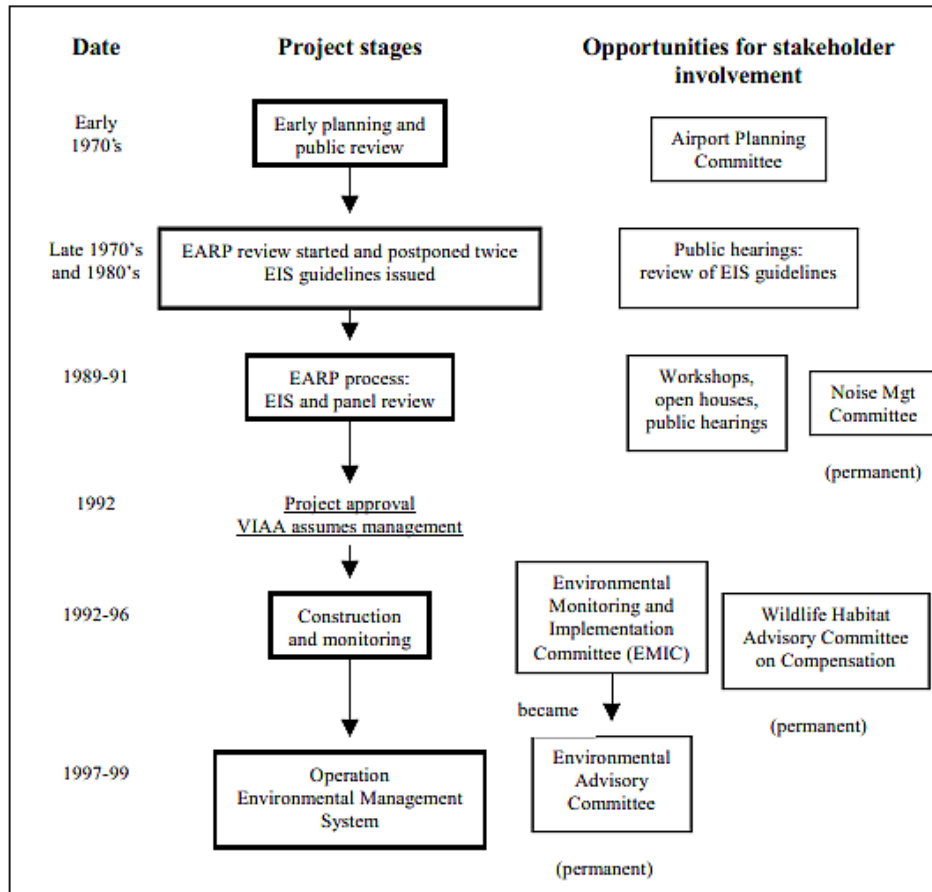
By the early 1990s the issue of severe airport congestion at Vancouver International Airport had been front-page news for more than 20 years (Figure 6) and a cause célèbre in which communities of interest were sharply divided along lines marked by environmental justice, economic development and airport commercial viability. The Canadian federal government, airport management and business interests favored construction of a second main runway (known as the “Parallel Runway”). Residents located in the airport’s noise belt (5,300 homes and two hospitals) argued for a traffic management strategy and no physical expansion, or for the construction of second airport about an hour’s drive south of the city (near town of Abbotsford, British Columbia). Environmental interest groups generally opposed expansion.

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<sup>14</sup> This section draws on material that first appeared in, David Lewis, *The Future of Forecasting*, Transportation Research Board, TRNews, April, 1995.

<sup>15</sup> There are other examples from foreign jurisdictions that provide insight, such as the multi-jurisdictional planning process for the US Central Indiana Regional Transportation System during the 2000s (and which illustrates the range of degrees to which CBA may be adopted as a discursive tool).

**Figure 6—Two Decades of Planning for a Second Vancouver Airport Runway**



Source: Novo (2000).

Acronyms: EARP (Environmental Assessment and Review Panel); EIS (Environmental Impact Statement); VIAA (Vancouver International Airport Authority).

By early 1987 the Canadian federal government (then the owner and operator of Vancouver International Airport) recognized that decades of discussion and analysis had not provided a basis for community or political consensus, decision, and action. In essence, positions had become entrenched and it had become a case of “your expert vs. my expert”.

In 1989 the federal government (Transport Canada) retained an economics consulting firm to propose a new approach in which CBA would be a central tool to help establish expert and community consensus on evidentiary probabilities of consequences from the alternative options.



Over the course of the following nine months, the proposed deliberative approach was advanced and funded by the federal government.<sup>16</sup>

### **2.2.2 The Vancouver Deliberative Assemblies**

Three sets of deliberative assemblies were convened, each with between 15 and 25 participants. The deliberative assemblies were supplemented with subject-matter experts (their number being included in the 15-25 range). There were no restrictions on who could attend as observers.<sup>17</sup> Each assembly lasted between one and three days.

Participants were drawn from the community at-large using various forms of outreach, including contact with known leaders of stakeholder groups, groups both for capacity expansion (such as the Chamber of Commerce) and against expansion (such as neighborhood noise interest groups). Subject-matter experts were selected largely from the academic community. Specialists were identified in aviation economics, aviation demand forecasting, capacity analysis, economic development, and aircraft noise, including a firm with technology to demonstrate noise levels under different runway configurations and assumptions about the mix of aircraft engines in use at any given time of day. Although statistically formal selection processes were not used, care was taken to select participants and subject-matter experts from a wide range of positions and points of view. Federal and provincial officials were invited to attend as observers, but not to hold authority positions in the process. The consulting firm provided facilitators whose role was to guide participants through the process at each of the assemblies.

### **2.2.3 The First Vancouver Assemblies – The Reference Brief**

The Reference Brief explained the scope of the issue, giving the range of available demand forecasts, associated levels of congestion and delay, positive and negative outcomes of airport congestion and expansion including analysis of the implications of delay for economic development and environmental conditions (including noise) in the region.

The Brief also elaborated the options for airport development, including the imposition of congestion pricing to manage demand in lieu of runway development; runway construction alternatives and their associated projected life-cycle costs (including alternative runway lengths and associated restrictions on the type of aircraft that could operate at the airport); and airport expansion options elsewhere in the region along with associated costs.

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<sup>16</sup>This paper grew out of a desire by the authors to explore the question of whether intellectual foundations exist for the methodology applied in the Vancouver Airport process.

<sup>17</sup>Today's digital information and communications technology vastly expands the potential number of persons who could be observers.

### *Outcomes from the First Vancouver Deliberative Assemblies*

The first deliberative assemblies resulted in consensus on the range of investment and non-capital alternatives to be considered and the agendas for technical meetings during the second set of deliberative assemblies. Another significant outcome was a pronouncement by the most strident oppositions of airport expansion – principally those representing noise-affected neighborhoods– that they would continue their participation in the process but not be bound by any technical, policy or other agreements or compromises that might arise.

#### **2.2.4 The Second Vancouver Assemblies – Empirical and assumptive evidence and assignment of probabilities**

Evidentiary consensus on the cause-and-effect modeling relationships for demand and capacity forecasting and the related probabilistic assumptions emerged during the second assemblies. The evidentiary CBA model pertaining specifically to the social costs of noise that emerged from the discursive process was a consensus among expert environmental economists, experts in acoustical science and some resident delegates. Residents gained comfort in the range of prospective noise costs recognized in the CBA model, including property depreciation, changes in householder annoyance and enjoyment values (television, barbecues, etc.), and moving costs for those who elect to move due to additional noise.

In populating the evidentiary probabilities, deliberation centered on technical and scientific evidence (see text box). Selective and strategic use of such information and misinformation (by all parties, including government) had characterized and de-railed rational debate over the three commissions of inquiry between 1965 and 1985. Under the discursive design, however, frequentist and Bayesian elicitation led to a legitimate evidentiary consensus.

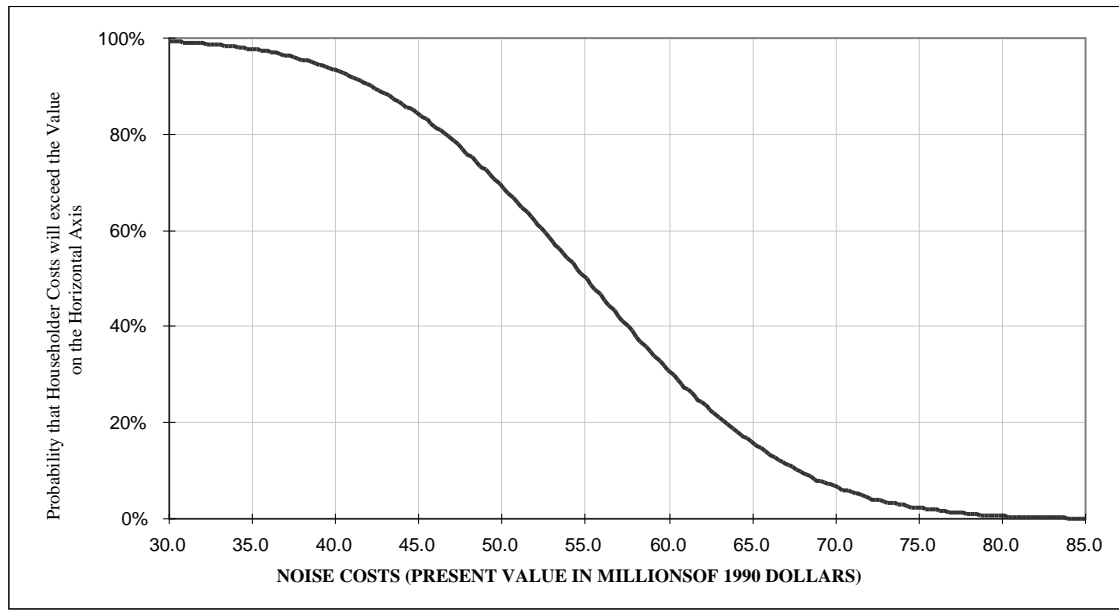
Shown graphically in Figure 7, the preliminary consensus was a >99 percent probability that the noise costs of second main runway would exceed \$30 million (\$6,000 per household).<sup>18</sup>The consensus likelihood of cost consequences exceeding \$85 million (\$17,000) was less than one percent.

#### ***Areas of Technical and Scientific Evidence***

- The decibel level of different aircraft.
- Psychological investigations of the householder disturbance levels implied in any given decibel exposure.
- Aviation industry data pertaining to the mix of different aircraft in the traffic stream going forward, including the rate of introduction of quieter engine technology.
- Real estate evidence regarding the impact of decibel exposure on property values.
- Contingent valuation studies of the nature and monetary-equivalent expression of householders' annoyance and enjoyment values.
- Market information about the propensity of householders to move house due to noise.

<sup>18</sup>Costs are expressed as present-day values over 20-year life cycle.

**Figure 7: Consequences of Costs of Noise with a Second Runway at Vancouver International Airport**



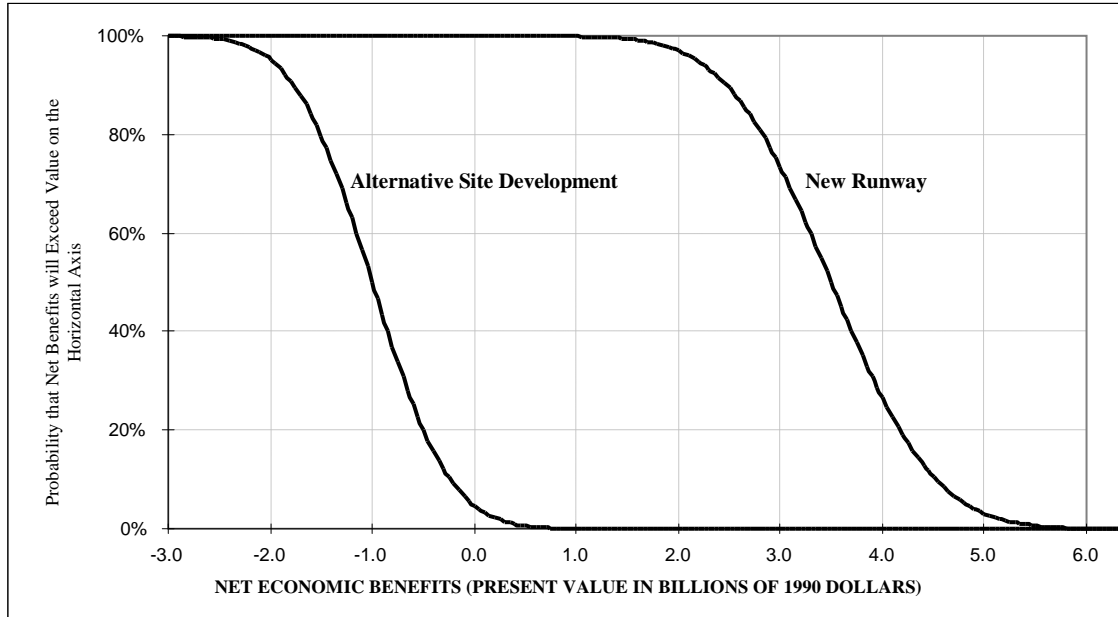
Source: Lewis (1995)

Noise was of course one of many prospective consequences of the various alternatives explored during the nine-month process. Others included:

- the capital expense of airport construction;
- the added maintenance outlays a new runway or a new airport would require;
- the influence of airport construction and operations on passenger delay;
- aircraft operating costs; and,
- the implications of efficient airport operations for economic development, who (in Vancouver and elsewhere) would benefit from it, and how.

The preliminary evidentiary consensus that emerged with respect to the two main alternative siting locations is displayed graphically in Figure 8. The probability of positive net benefits from a second airport near Abbotsford was found to be greater than zero, albeit barely so (about five percent); the odds of costs exceeding benefits by as much as \$1 billion came in at 40 percent. As to a second runway at Vancouver's main airport, the weight of consensus evidence pointed to better than 99.9 percent odds of at least \$1.1 billion in positive net benefits. The odds came in at 80 percent that benefits would exceed costs by \$3 billion, and 20 percent that net benefits would exceed \$4 billion.

**Figure 8: Net Economic and Social Consequences of Airport Development Alternatives for Vancouver**



Source: Lewis(1995).

### *Outcomes from the Vancouver Process Second Assemblies*

In the Vancouver Process, preliminary evidentiary consensus was achieved within the second assemblies for three reasons:

- there was no hierarchy, power structure or bureaucratic authority in the discursive process. There were no “official positions” based on previously conceived (behind closed door) findings about the problem or its solution.
- all alternatives were fair game. In particular, non-capital alternatives were taken seriously, in particular congestion pricing in lieu of runway expansion. (the runway expansion could only be deemed economically net-beneficial if their estimated benefits were projected to exceed their estimated costs with the results of congestion pricing in play).
- participants were never deemed “right or “wrong” other than in relation to strict matters of fact. Evidence was examined probabilistically. A participant’s beliefs pertaining to matters of science, quantities, or values will have been deemed by the group as being more likely or less likely than the beliefs of other participants, but never categorically

wrong or right. In the end, no one was asked to suspend disbelief in forecasts for the convenience of an analytic process.

### *2.2.5 The Third Vancouver Assemblies – The Final Evidentiary Consensus and the search for “Collective Will”*

During the third assemblies, the power of CBA to give probabilistic evidentiary expression to a large range of values that matter to stakeholders surprised, informed and satisfied proponents on all sides. Stakeholders showed themselves willing, moreover, to concede to flawed logic (such as double counting), a result derived from the non-authoritarian yet intellectually disciplined context for the assemblies. For example, contrary to initially held stakeholder beliefs, the consensus CBA model allowed that those who willingly and knowingly elect to buy homes that come on the market at reduced prices due to airport noise must be treated as *beneficiaries* of noise. In other words, the benefits to them, of the housing must exceed the costs, to them of the aircraft noise they encounter, for otherwise they would not choose to purchase the home.

Progress toward evidentiary consensus in the third assemblies led to erosion in certain cognitive biases that are known to create barriers to conflict resolution. One such barrier, called “loss aversion” by psychologists, refers to peoples’ “asymmetric evaluation” of positive and negative outcomes: in the absence of convincing evidence to the contrary, negative possibilities loom larger in peoples’ minds than positive ones.<sup>19</sup> Loss aversion bias tends to favor those defending a status quo because of their probable willingness to pay a higher price and run higher risks if they are facing losses than if they are seeking to make gains. By placing losses and gains and associated probabilities in an evidence-based frame, and achieving consensus within that frame, some previously zealous defenders of the status quo were seen to moderate their willingness to defend it absolutely. Their loss aversion bias toward runway construction was diminished by the evidentiary reality of small risk-adjusted noise costs relative to the size of the risk-adjusted economic benefits in which they too would share.

The veil of ignorance question (whether freedom from additional noise costs ought to occasion the status of an acquired right and thereby end consideration of a second main runway), failed to occasion material support from participants, including noise interests. The veil of ignorance test failed in the minds of some as a matter of principle. It failed for others because the probability of sizeable noise costs was found to be extremely low in comparison with the probable significance of the economic development gains attached to a second runway. Agreement also emerged as well that the sizeable risk of huge economic losses attaching to a second airport meant that this alternative had to be rejected.

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<sup>19</sup> See Kahneman and Tversky (1995) for a full exploration of this circumstance.

The preliminary evidentiary consensus that emerged from the second assemblies shifted the focus of debate in the third assemblies from one of strategic expert-versus-expert debate over facts and forecasts to the question of “what to do.” One focus of attention was mitigation and compensation measures. Such measures would stem costs and injustice for those in the noise belt and to the probability level at which noise cost estimates should be accepted as a basis for sizing a compensation fund. In the third assemblies, such measures surfaced in the form of restricted flight paths for departures from the second runway; time-of-day curfews; and a program of financial compensation payments geared to 75 percent probable annoyance and nuisance values.

The emergence of a collective will was also motivated by trust at the evidentiary level in the third assemblies. Questions of bias were removed by denying government an authority role in the discursive process and by addressing the evidentiary question at the granular level and, of course, transparently. (Over the prior three commissions of inquiry, government officials had consistently “taken a position” on airport noise, namely that new engine technologies and traffic control strategies would guarantee zero increase in residential exposure to noise).

Movement toward the realization of a collective will gathered force from the role of evidentiary consensus and the veil of ignorance test in altering the strategic calculations of noise-affected interest groups.

### *Outcomes from the Third Assemblies of the Vancouver Process and Aftermath*

As an evidentiary consensus emerged, the voice of elected representatives became less confused and equivocal than at any time over the prior two decades. This was apparent on television and radio, in the print media and on the stump. For noise-interests, an emboldened elective class diminished the strategic potency of all-out opposition to airport development on the basis of “expert v. expert” argumentation. The potency of absolute opposition was further diluted by the failure of “absolute limits” (to noise exposure) to find collective support through the veil of ignorance test of social justice. As indicated above, the veil of ignorance test was itself influenced by the evidentiary consensus. Compromise in the form of mitigation and compensation thus emerged as a mode of self-interest.

In 1991 the results of the deliberative process were presented to the Federal Environmental Assessment and Review Panel which accepted the analysis. The Panel’s subsequent report to the federal Ministers of Transport and the Environment concluded that more runway capacity in the Lower Mainland region could best be provided by a new parallel runway and that compensation should be paid to residents of neighbourhoods impacted by aircraft noise. The federal government decided in cooperation with provincial and local interests to construct a second main runway in 1994 and construction was complete by 1996.

Notably it was the issue of compensation for aircraft noise that subsequently became the subject of a class action lawsuit by some residents against the Vancouver International Airport Authority and the Attorney General for Canada. In the first legal proceedings, the Trial Judge found in

favour of the plaintiffs (*Sutherland v. Attorney General of Canada*, 2001 BCSC 1024). However, the verdict was subsequently reversed on appeal. (*Sutherland v. Attorney General of Canada*, 2002 BCCA 416)<sup>20</sup> Neither set of legal proceedings focussed on the technical evidence respecting noise. In the first decision, the court found:

[8] The [Federal Environmental Assessment and Review] panel held public hearings, received briefs, and amassed an impressive array of information, evidence, and reports touching on all aspects of the issue. It considered the option of satellite airports or diversion of air traffic from the YVR to alternate airports. In particular, Boundary Bay, Abbotsford and Pitt Meadows received detailed attention.

[9] In its final report, the panel recommended constructing a third parallel runway at the Vancouver airport. Importantly, it recommended that persons who would be adversely impacted by noise if the runway were built be identified and compensated. The plaintiffs certainly are amongst those the panel contemplated would be adversely affected by noise. It was estimated that the cost of its compensation recommendation would approximate \$43 million

[10] EARP's mandate was only to formulate recommendations; it had no power or authority to see to their implementation.

[11] The Ministry of Transport accepted most of the recommendations of EARP. It did not, however, accept the recommendation to identify and [financially]compensate those adversely affected by noise. It chose instead to address the problem of[compensation for] noise in surrounding areas by requiring certain noise abatement procedures, including limiting traffic landing on the runway and placing a daily landing curfew from 10:00 p.m. to 7:00 a.m. (*Sutherland v. Attorney General of Canada*, 2001 BCSC 1024)<sup>21</sup>

In essence, decision-making respecting to compensate or not to compensate was left with Ministers of the Crown.

### **2.2.6 Lessons from the Vancouver Process**

Why has the Vancouver process, if it is so valuable, not been replicated with greater frequency across Canada or other jurisdictions? There are some examples of where it has been used in modified form, but generally it has not been taken up.<sup>22</sup>

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<sup>20</sup>The Honourable Chief Justice Finch's written reasons include: "I conclude that the defence of statutory authority provides a complete defence for both defendants. I would allow the appeal, and dismiss the plaintiffs' action."(2002 BCCA 416)

<sup>21</sup>The \$43 million figure cited in the judgement was based on the results of the discursive process.

<sup>22</sup>There are a growing number of examples of deliberative processes being applied in health policy fields. Although generally they do not incorporate formal CBA as described in the report, they provide insight into a range of best

One possibility is that, at least to date, Canadian governments have reluctant to have regard and respect for the capacity of citizens to engage in reasoned deliberations on matters of technical complexity. Others might argue that the civil service exists to provide scientific objectivity to elected representatives and that governments have merely been applying this governance philosophy.

There are a number of both design and implementation challenges when deploying a reformulated CBA within a discursive democratic process, including:

- **Participation and representation.** In the case of the Vancouver deliberative process, willingness to participate by citizens did not emerge as stumbling block. A greater challenge lies in addressing issues of representation both with respect to the participation of citizens and experts. There are various approaches that may be taken geared to the circumstances at hand (ranging from the informal and common-sense decisions to sophisticated sampling strategies). Critically, however, those ultimately responsible for final decision-making (e.g. governments) are denied an authority role.
- **Efficiency.** The reformulated CBA process should not be duplicative of other processes, including environmental assessments. The Vancouver Airport example suggests that the reformulated CBA can complement and be integrated with existing assessment processes and help improve their speed and efficiency. The reformulated CBA process does not have to be costly or time-consuming. Whereas other forms of public engagement processes unfold over years, often over decades, the proposed process, by treating multiple viewpoints simultaneously and rigorously, can take less than a year, offering substantial savings.
- **Political decision making and accountability.** There is always some risk that reformulated CBA process may be perceived by final decision-makers as reducing their space for making political choices. At least in the case of the Vancouver Airport this was not the outcome, as the process strengthened political accountability by testing and revealing to elected representatives the evidence-basis for alternative courses of action. It is also for consideration that the proposed reformulated CBA process does not foreclose the possibility of a direct referendum as providing a way of gauging citizen preferences. In this context, it can greatly strengthen direct referenda given that they can be highly vulnerable to the non-evidence based influence of special interest groups (this reality was illustrated in 2015 in Vancouver itself with the carrying out and subsequent defeat of a referendum on a multi-year, multi-modal surface transportation plan).



- **Scale and jurisdictional scope of project.** The reformulated CBA process is likely to be cost effective when it is applied to infrastructure projects of sufficient scale measured in financial or other terms. The Vancouver Airport experience suggests that it may also be particularly well aligned with the realities of multijurisdictional projects within federal states. One reason for this circumstance is that it provides one mechanism for clarifying for decision-makers the evidence base underlying different starting views on priorities at local, regional, and national levels.

## Summary

The section has reviewed one case where the reformulated CBA approach has been employed in Canadian transportation infrastructure planning. It strongly suggests the practical feasibility and social and economic value to be derived from placing CBA within a discursive democratic context. More broadly –and to foreshadow the next section of this report on the Canadian federal government’s role in infrastructure – it illustrates that CBA within a discursive democratic context supports, rather than diminishes, democratic political decision-making and accountability.

## SECTION III - POLICY IMPLICATIONS FOR THE FEDERAL GOVERNMENT

### 3.0 The Challenge for Governments

Democratic governments must direct scarce public sector resources in such a way as to make good on the essential goal of making people better off. This is challenging in relation to public infrastructure because its effects are both consequential (i.e., it generates probable benefits for individuals and firms) and "non-consequential" in the sense that infrastructure can create opportunities to explore life-chances without predictably foretelling what opportunities people (and firms) might actually explore and succeed in gaining associated advantage.

Further challenges arise because the value that people and firms attach to the consequences and opportunities of infrastructure projects are not fixed. They can change in the course of considering alternative projects and plans. Moreover, infrastructure projects have implications for justice, fairness and the protection of human rights and such impacts are different for different socio-economic and ethnic groups.

The practice of CBA as the organizing framework for facilitating discursive procedures is one means to address these challenges. It is a well-suited alternative to choice within a traditional bureaucratic and institutional environment especially for large infrastructure investments that cut across multiple socio-economic, geographic, and political boundaries.

### 3.1 The Role of the Canadian Federal Government

All levels of government in Canada could benefit from paying greater attention to good practice procedures, such as the reformulated CBA, as they seek to direct infrastructure dollars in the public interest. But the federal government has a unique and constitutionally based reason to be a strong proponent of such procedures in large-scale and federally funded infrastructure projects of national reach and broad economic and social importance.

Pursuit of the national interest in transportation infrastructure development requires a strong federal role in prioritizing, planning, and funding. It also requires the active pursuit of the Canadian Constitution's Section 36(1) objectives: promoting equal opportunities for the well-being of Canadians; furthering economic development to reduce disparity in opportunities; and providing essential public services of reasonable quality to all Canadians. Over the past twenty years, federal infrastructure policy has generally been passive in relation to these obligations. In fact, other constitutional considerations (division of powers between federal and provincial levels of government) have more often been deployed explicitly or implicitly as a reason for taking a passive role (see Mulder, 2011).

There are many areas where the federal government's role in transportation infrastructure (and in helping develop the Canada's physical infrastructure more generally) can be reinvigorated. For example, under the current federal approach to infrastructure investment, decisions (about funding) are often made at the project level, without regard for the wider strategic transportation/infrastructure/land-use context. Robust guidelines could facilitate contextualization of projects that come forward for federal financial support, such as have been developed with some success in the US.<sup>23</sup> However, as suggested in this report, greater reliance on CBA as the organizing framework for facilitating discursive procedures also has its place in any new federal infrastructure policy framework.

### 3.2 Federal Leadership in Deploying State-of-the-Art CBA

At a minimum, the federal government should encourage the wider application of state-of-the-art CBA in project evaluation. On this subject the *Final Report of the Canada Transportation Act Review* underlines that CBA is not being widely used (even in its traditional form) today:

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<sup>23</sup> A US federal government program called TIGER – Transportation Investments for Growth and Economic Recovery –was first created in the 2009 *Recovery Act*. Run by the US Department of Transportation (DOT), eight rounds of competitive grants totalling just over US\$4.7 billion for capital investments in surface transportation infrastructure have been made. The TIGER program has awarded more than 350 projects in all 50 states, the District of Columbia and Puerto Rico, including projects to support rural and tribal communities. Demand for TIGER grants has been overwhelming. The DOT has received more than 6,700 applications requesting more than US\$ 134 billion. Though not the only selection criterion, CBA(although not in the reformulated form discussed in this paper) has been of material significance in enabling the government to make funding awards among competing projects. In fact, CBA is a *de facto* requirement for award of a TIGER Discretionary Grant. The DOT has issued CBA guidance for TIGER grant applicants (US, 2015).

While the federal government has spent a significant amount of money on infrastructure projects over the last 15 years, the predominant goal has been to stimulate local economies and create jobs, not necessarily to address longer-term economic development requirements. Projects under the various funding categories were often approved on the basis of “shovel-readiness,” rather than on the basis of an economic cost-benefit analysis, or an identified link to national transportation or trade priorities. A key consideration was to ensure that funds were dispersed on a “fair share” basis across Canada. The bottom-up approach to project identification left little room for the selection of projects of national scope and strategic importance.” (Canada, 2016: 21)

The federal government might also consider taking on the role of a convener in bringing together provincial governments, various stakeholder groups, and infrastructure financing and engineering experts, in developing state-of-the-art CBA guidelines.<sup>24</sup> These guidelines might include: the ways and means of defining, identifying and measuring option value, existence value (i.e., technical expressions of Capability); and the application of CBA as a democratic procedure that seek ensure "process equity", citizen voice, and value-formation through discussion (discursive democracy). These guidelines might be operationalized in various forms:

- when investment prospects with scope for federal funding arise in multi-jurisdictional contexts, such as the development of pipelines that cross provincial and aboriginal boundaries;
- when investment prospects arise with scope for federal funding in relation to urban environments that cut across multiple socio-economic and ethnic groups; and,
- when investment prospects arise with scope for federal funding that have different implications for environmental justice and human rights for different groups.

In his November 2015 Mandate Letter to the Canadian Minister of Transport, the Prime Minister of Canada wrote:

“We have also committed to set a higher bar for openness and transparency in government. It is time to shine more light on government to ensure it remains focused on

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<sup>24</sup> To a certain extent, such a convener role is envisaged within the very first recommendation of the *Final Report of the Canada Transportation Act Review*. The Report recommends that Transport Canada lead the development of a clear performance and evidence-based National Framework on Transportation and Logistics in collaboration with the provinces, territories, and industry, including through: a new Centre of Excellence in Transportation, Logistics and Innovation; and an “integrated Data Platform and Multimodal Data Dashboard” to support evidence-based decision making and more efficient and responsive transportation network among public and private sector stakeholders.” (Canada, 2016: 262) The US federal government has already taken up a convener role with respect to addressing US infrastructure challenges. For example, the US Department of Transportation has been mandated to establish a new “innovative transportation finance centre” to “engage early with stakeholders to support transformational transportation projects across jurisdictions and transportation modes”. (US, 2014)

the people it serves. Government and its information should be open by default. If we want Canadians to trust their government, we need a government that trusts Canadians. It is important that we acknowledge mistakes when we make them. Canadians do not expect us to be perfect – they expect us to be honest, open, and sincere in our efforts to serve the public interest.” (Trudeau, 2015)

Enabling the practice of CBA as the organizing framework for facilitating discursive procedures within a democratic process would be consistent with this new mandate.

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