Evidence-based Policymaking
in Singapore

A POLICYMAKER'S TOOLKIT

Anuradha Shroff | Thia Jang Ping | Elaine Tan | Do Hoang Van Khanh and
Sharon Tham | Leong Wai Yan and Lim Yong Long | Eugene Liow
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A robust and evidence-based approach to public policy is essential to good government. However, the lack of it in the conception, evaluation and review of policies has been long recognised. Values, interests, timing and circumstances have often crowded out the use of an evidence-based approach in the decision-making process.

This booklet is not meant as a technical guide for specialists, or a comprehensive listing of evidence-based policy tools. Instead, it covers a collection of tools commonly used in evidence-based policymaking and how they can strengthen policy design and decision-making. This could range from broad, cross-cutting policy measures, to seemingly operational interventions which contribute to larger policy objectives. Examples from Singapore and other countries will be used to illustrate key learning points.

Chapter 1 provides the context of an increasingly complex environment and the need for evidence-based policymaking. Each following chapter focuses on a specific tool’s effectiveness and limitations. These tools are not mutually exclusive, but are complementary to each other in providing the evidence needed for better policymaking.

The Policy Development Process serves as a framework to make sense of how the tools outlined in this booklet fit into the bigger picture (see Figure 1). While learning about each tool, it would be useful to constantly think about how they can be used and at which stage of the policy cycle.
Lastly, there are practical matters such as timing, legacy issues and socio-political influences that this toolkit does not deal with, as the emphasis is on developing a default evidence-based mindset among policymakers. This is key to accumulating insights into what works better and therefore how best to invest public resources.

Figure 1: Policy Development Process and the Use of Evidence-based Policy Tools

Source: Adapted from “Policy Development in Practice: An Overview of the Policy Process” (2007), Civil Service College
A Complex World: How Do We Know What Works?

Public policymakers face complexity on a daily basis. They are expected to deliver results in an environment that is fast-paced, messy and constantly changing. It is increasingly difficult for policymakers to fully comprehend the range of social, technological, economic and political trends, and to take the best course of action for policymaking. Public policy decisions are made in a more complex environment where many factors are not easy to analyse and the outcome of the interaction of these factors is not predictable ex ante.

Singapore, in its relatively short 50-year history as an independent nation, has undergone a remarkable transformation through a combination of strong leadership, good governance and pragmatic policies. In the course of nation-building, and often out of practicality, several principles of governance emerged. These include zero tolerance for corruption, meritocracy, an emphasis on self-reliance and pragmatism in designing and implementing policies. A stable

“...The Government must change its approach to policymaking. We no longer have the luxury of making policy ‘in a lab’. Today’s environment is more complex and fluid, and our trade-offs more stark. Ideas are more vigorously and widely contested, especially online. Our policy process must adapt to this new landscape. We must gather a wider range of views, especially from outside the Government. We must market-test and adjust our policies more. We must also acquire a better feel of how our policies impact different groups, and what their likely reactions and concerns will be.”

(Prime Minister Lee Hsien Loong 2013, 10)
political environment has also allowed the government to develop long-term thinking, and adopt unpopular policies where needed.

Self-reliance, for example, is a fundamental principle that has been intertwined with our economic policies. In the design of the Workfare Income Supplement (WIS) Scheme, workers receive income supplements from the government only if they remain employed. Through the Central Provident Fund (CPF) system, workers are mandated to set aside savings for their retirement, thereby ensuring fiscal sustainability. More broadly, the government has promoted meritocracy to ensure the best use of talent and create opportunities for everyone.

These principles of governance, along with the Public Service Values of Integrity, Service and Excellence, form a common ethos for public policymakers and serve as a guide to dealing with complex issues that have no obvious or straightforward solutions.

However, governing principles and values cannot ensure that Singapore’s public policies will continue to succeed. Events, trends, and policies will continue to interact with one another in complex ways. This creates interdependencies and second and third order effects that are inexplicable, emergent and difficult to predict. For example, when WIS was implemented, did workers increase or decrease their working hours? Did it change the work patterns of other family members, and in what ways? How should the CPF system change with the rise of self-employment in the sharing economy? How do we nudge the self-employed to save for their retirement?

Beyond the few examples provided, Singapore faces some complex policy challenges — such as its ageing population; rising healthcare costs; impact of climate change; and efficiency and accessibility of public transport. Policies designed to address these challenges often produce winners as well as losers, and normative trade-offs may be required. Satisfying one stakeholder could well make others unhappy.

In addition, the citizenry has become more heterogeneous. Their needs have evolved from basic ones like housing and healthcare to more aspirational goals like a more fulfilling pace of life, environmental sustainability, and holistic education with more diverse pathways. Citizens also demand a more collaborative relationship with the government, and yet they want to hold the government solely accountable for many policy outcomes.

Against this backdrop, policymakers will have to be adaptive and able to develop policies under conditions of incomplete information, ambiguity and constant change. Tackling one part of a complex problem is more likely to lead to new issues in other parts. A key challenge for governments therefore is to move their stakeholders towards a broad alignment of perspectives and goals. But this requires patience, skilful stakeholder engagement and consensus building.

It is thus important for public policymakers to understand complexity in public policymaking. In complex situations, the right answers cannot be ferreted out by simply relying on experts. Instead, the priority should be to seek out evidence that can help to identify key patterns, problems, and interventions that are likely to work better. In some cases, patiently allowing experiments that are safe-to-fail is required so that instructive patterns can emerge.

“The human mind can play tricks on us. We see what we want to see, and sometimes miss out the glaringly obvious. We miss out on signals not only because of the limitations of our tools and methods, but also because of the nature of human cognition.”

(Peter Ho, Ethos Issue 7, January 2010)
It is no coincidence that there has been an increasing emphasis on evidence-based policymaking in recent years. Disciplines such as behavioural insights, data analytics, cost-benefit analysis and randomised controlled trials have also taken on new prominence in the last decade.

Evidence-based policy tools are key to a more robust policy planning cycle because they offer more structured ways to analyse data, to understand how people think and to envision the impact a policy would have on the ground. They provide more evidence on the issues to be addressed, so that policymakers can enlarge their policy lens and find impactful ways to deal with the intractable policy issues of today. To ensure continued policy success for Singapore, these instincts and capabilities will have to be continually developed in the public sector in the years to come.

References


Clear, Impactful, Answerable: The C.I.A. of Good Policy Research

THIA Jang Ping

As my university supervisor once said, “To have a very accurate map of the world, the map will have to be as large as the world, and it will be useless as a map.” The more complex the issue is, the more important it is to scope out questions that can be answered.

What Makes Good Policy Research?

Writing a good research paper is as much about discipline as it is about inspiration. Good research starts with a good question. A good question is naturally interesting and inquisitive about an aspect or phenomenon not explored previously in the policy domain. But at its core, a good question is essentially one that is clear, impactful and answerable (C.I.A.).

Clear

Consider this question, “How is Singapore’s labour market doing?”

The question is framed broadly and seems reasonable at the outset. However, it does not pinpoint the exact problem or aspect of the labour market that requires probing. The lack of clarity may result in a myriad of interpretations, which poses many problems. What aspect of the labour market are we looking at—employment rates, incentives, or discrimination and fair practices? What hypothesis does the question seek to test? What data should the officer use? Often, the officer may appear to be “fishing”, hoping for something impactful to turn up. The different possibilities and interpretations could also land the officer in danger of trying to do too much at a time. Such “stab in the dark” efforts
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are unlikely to answer any question in an insightful manner, nor produce useful findings.

On the other hand, consider, “How is Singapore’s labour market responding to Workfare Income Supplement (WIS) policies?”

It is clear that this second question focuses on ways in which Singapore’s labour market has changed as a result of WIS policies. This allows the officer to form a series of sub-questions to answer the overarching one. For example, is employment up, down or unchanged? Similarly, how have wages evolved? What about employment turnover? A clear research question has the potential to bring out good sub-questions which help the policymaker to gain a deeper understanding of WIS and its impact on the ground.

Try This when Embarking on a Policy Research Project

When embarking on a policy research project, begin with a topic in mind. Then go through the usual process of conducting a literature review, speaking with people to refine it. Write down your research question in no more than 20 words, and show it to an experienced colleague. If he or she has difficulty understanding what the question is asking, take it back to the drawing board and keep working on it. The more complex the topic, the more demanding it is for the researcher to scope out a well-defined question.
Impactful

When selecting projects to undertake, the potential impact of results obtained is crucial. There needs to be significant impact that can inform policy design and approaches in order for the study to be seen as relevant by key stakeholders, i.e., policymakers, academics or the general public. Suppose an officer tries to investigate the effects of WIS on labour supply. Whether WIS increases labour supply by 0.5% or 5% completely changes the impact of the research paper—the latter result is more impactful because the policymaker will know that varying the amount of WIS benefits can potentially result in large changes in labour supply. That said, knowing that WIS has a small effect on labour market is also an important result.

There may be occasions where well-defined and interesting questions are posed. But whether they should be taken on as research projects requires an assessment of how impactful the findings will be. For example, a study of the impact of minimum wage on investment bankers could potentially be interesting if some unexpected effects are found, although it is more likely to draw a blank.

The challenge in selecting impactful projects is that results of studies are never known beforehand. Officers thus need to manage their odds by choosing and framing good research questions. This involves developing a good sensing of the ground, and how various actors and networks interact in society. It is also important to take a keen interest in research conducted by others and keep an open mind.

Answerable

Any research question posed should be one that can be answered in a scientific manner (otherwise, it remains at a philosophical level). This means that there should be quantitative and/or qualitative data that can be used as evidence to support or falsify various hypotheses. If such data is not readily available, there should be a data collection process using various methods such as surveys or experiments. The officer can select the method by which the answers can be teased out—a randomised controlled trial, a natural experiment or using data
analytics techniques. Many of these possible tools will be further discussed in this toolkit.

Whether a study is path-breaking (coming up with new methodologies or answering questions that challenge established beliefs and assumptions) or simply functional (answering questions to improve policy design and implementation), being grounded in the fundamentals of using evidence to answer questions is the common ground. Even as public officers work with more conventional methodologies, there is a need to keep pace with breakthroughs in the field, be it in qualitative research, econometrics or more generally data analytics, so as to bring new methodologies to answer existing questions.

**Conclusion**

The first attempt in research is always the hardest—making sure that it is clear, impactful and answerable requires officers to develop their own instincts and acumen for projects to undertake. Policy research units also need to take a portfolio approach by spreading research work across evergreen domains while investing some resources to more forward-thinking questions.

As public officers involved in research, we face a complex environment with numerous distractions, challenges to address and questions to answer. Instead of trying to answer all these questions in one study, prioritise and focus on a single area. Start with a small (but useful) question. Go through the recommended steps and maintain mental discipline in getting the question answered in an impactful way. Such experiences will build on each other, thus honing research officers’ skills to take on more complex questions over time.
CHAPTER 3

Data Analytics

Elaine TAN

“Information is the oil of the 21st century, and analytics is the combustion engine.”

(Peter Sondergaard 2011)

What Is Data Analytics?

To measure. To understand. To improve.

These are the purposes of data analytics, the art and science of deriving patterns and relationships through numbers. Data analytics has had a long history.\(^1\) What has changed in recent decades is the ever-expanding volume of available data, coupled with exponential growth in computing technology. These mean data analytics now has greater promise and wider reach. New economic roles and activities can be created through data collection, processing and analysis. Properly mined, data can be potent ingredients in improving how we work, play and live. There are, however, important limitations to quantitative analyses, so caution should be exercised both in their execution and interpretation.

For public officers, analytics can be undertaken by tapping on the many rich databases which are assembled in the course of their work. Such data are created each time a resident comes into contact with a public agency, e.g., exits or re-enters Singapore, drives through an ERP gantry, makes a CPF withdrawal, etc. These data may be studied to understand broad patterns and trends, guide

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\(^1\) For example, Charles Baggage’s study in the early 1800s on British factory productivity and workers’ skills used statistical observations from British and overseas factories. One hundred years later, the Nazis in Germany used punch-card technology and counting machines to identify minorities from individual data.
resource allocation and improve productivity. One example of such data mining is SingStat’s study of the modes used by respondents in past surveys in order to improve Census 2010 processes, hence reducing manpower and increasing productivity (see Box 1).

**Box 1**

**Pattern Spotting and Higher Productivity**

How Singstat used data tracking to adapt Census 2010 operations and raise productivity

Data collection for the decennial census is no small task. Census 2010 involved 200,000 households for which information on 58 survey items was required. Respondents selected for the Census were notified by post and given the option to reply via several modes: completing via Internet form; via computer-assisted telephone interview (CATI); or when field interviewers visit their homes. The last mode was labour intensive and made more challenging by difficulties in recruiting interviewers. SingStat’s aim for Census 2010 was to increase the use of CATI and internet modes, and minimise face-to-face interviews.

To achieve that, patterns of household profiles and mode usage from previous surveys were derived. Census 2010 surveys were dispatched in 20 staggered batches. Thus, loads on CATI and internet modes were smoothed out to facilitate utilisation and avoid disruption. SingStat also tracked daily patterns in each batch’s response rate to schedule CATI call reminders just as internet response was tapering off. Finally, only after two reminders were dispatched, field interviewers were sent to visit homes. Compared to Census 2000, internet response rose from 15% to 38% while face-to-face field interviews fell from 22% to 16%; response rate remained at 98% within 52 days after each batch, even as manpower used fell from 290 to 140.
Insights from an agency's internal micro-data can be supplemented with aggregated data from other agencies to obtain a more holistic picture. Aggregated textual data are available from the Government’s open data portal (www.data.gov.sg) and the SingStat website (www.singstat.gov.sg). Geospatial data—which are useful when relative locations and distances are important information in policy decisions—can be easily obtained from OneMap (www.onemap.gov.sg).

Finally, data are also available through specialised surveys, which collect in-depth answers on respondents’ attitudes, behaviour or choices unavailable in existing data. Examples include the Health Promotion Board’s National Health Survey and the Panel Study on Social Dynamics launched recently by the Institute of Policy Studies. Another vehicle of data collection is the field experiment. In it, individuals may be asked to choose among several options, from which researchers infer underlying preferences. As residents’ preferences could determine public reaction to—and hence overall effectiveness—of a policy, these field experiments can be useful for policymakers. One example is MTI’s study, conducted with MOM, on low-income residents’ relative preference for wages paid entirely in cash, or partially in CPF as is the case now. Their results showed 14% preferred jobs with cash-only wages, but around half had a strong preference for part of their incomes to be saved in CPF accounts, implying that the current system remains suitable.² Hence, populist calls for cash-only wages may not, in fact, be welcomed by the majority.

The first step in understanding a dataset is to describe its data items (variables) in broad terms using summary statistics, of which the mean, or average, is most popular.³ However, the mean alone may not be adequate. Policies often target certain groups, and may affect individuals within these groups to varying degrees.⁴ Likewise, individuals vary in their characteristics. This means that

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³ The summary statistics can be easily calculated with any basic statistical software package.

⁴ “Individuals” here refer to individual units, which may be persons, households, companies, etc.
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Data would show distributions of individuals affected by a policy, as well as individuals' costs and benefits from that policy. Distributions are thus best described with several values, including average, median and percentiles (read more about distributions at Box 2).

**BOX 2**

**Distributions**

A normal distribution, more commonly known as the “bell curve”, shows the number or proportion of individuals on the vertical axis, while the horizontal axis shows the variable's values (see Figure 1). The bell curve can be divided into 10 equal areas, with cut-off values at the 10th to 90th percentiles; e.g., 10% of individuals are between the 70th and 80th percentiles, and 90% have values below the 90th percentile. In a normal distribution, mean (μ) is approximately equal to median (the 50th percentile) and mode, while its spread may be measured by standard deviation (σ), with around two-thirds of individuals within one standard deviation on either side of the mean (see Figure 1). A small σ shows a distribution around a narrow band of values near the mean, while a large σ indicates a “stretched-out” distribution. For example, among one group of residents, if benefits from Policy A have a larger σ than Policy B, it implies that benefits are more evenly distributed under the latter. This statistic could aid in assessing the relative strengths of the two policies. Skewness is indicative of how far a distribution is from normal. Positive skewness indicates that a single-mode distribution is right-skewed. That

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5. Median is the middle value when observations are ranked from least to greatest, with 50% of individuals on either side of the median. Mode is the value shared by the most number of individuals.

6. Conversely, negative skewness implies a long left-hand-side tail of a single-mode distribution.
is, the bell curve has a long right-hand-side tail, with very high 95th- and 99th-percentile values, which pulls up the mean. When distributions are skewed, medians may be more representative than means as the former are less affected by very high, or very low, values. One application is income distributions, which tend to have high positive skewness (with some very high earners) so the average is greater than the median. Hence, a large majority of individuals earn less than the average income. This jars with the psychological tendency of most people to think of themselves as average, or above-average, in positive attributes.\(^7\) In such cases, communications with the public could be enhanced with greater sensitivity to statistical skewness.

\begin{center}
\textbf{Figure 1: Percentiles in a Normal Distribution}
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\(^7\) Psychologists term this cognitive bias “illusory superiority”.
When Can Data Analytics Be Used?

Data analytics has a role to play at every stage of the policy cycle. Analytics need not be complex to be useful. For example, apart from describing a dataset, summary statistics can also provide a quantitative “feel of the ground” at the initial stages of policy development. They also paint a picture of the operating environment, as well as provide the basis for policymakers to derive desired policy outcomes and to track progress.

Problem Identification and Analysis

Data analytics can be used to identify and analyse problems before deciding what policy to implement. Suppose the intent of a hypothetical policy is to encourage housewives from low-income households (defined here as earning less than $1,000 per month) to increase their paid working hours to be similar to those of housewives from higher-income households. The policy affects individuals from eligible households (“treated”), but not housewives from households earning slightly more, e.g., $1,001—$1,100 per month (“controls”). A distribution plot of current working hours for the two groups can reveal the gap that the policy seeks to narrow (see Figure 2). Coupled with other quantitative evidence, and even qualitative information (e.g., interviews and case studies), researchers can infer factors behind the gap between the groups.  

Public officers may also quantify policy targets using desired distributions. For instance, should the desired outcome be a working-hours distribution of the treated that is similar to the controls? Or should it involve increasing the working hours of treated housewives who are already working at least 5 hours a week (see Figure 2)? By approximating a targeted outcome distribution, policymakers can use periodic data profiles of the two groups as one simple way to track policy progress.

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8. The distance between the means (or medians) of two distributions can be tested for statistical significance. For instance, the t-test, with or without adjusting for different standard deviations, can be used to test if the distance between the means of two distributions is statistically different from zero. For details on some of the more common tests, see Moore et al. (2009).
Before the initiation of a new policy, there may be a need to determine whether current policies are effective or where current policy gaps are. Such evaluation may be undertaken with administrative data or a survey.⁹ A survey is particularly useful in obtaining a general sensing of an issue—to understand perspectives and opinions—which available data are unable to reflect. One example of this is an MTI-IAL telephone survey of manufacturing firms in Singapore on management practices in operations, monitoring, targets and human resources.¹⁰ The survey found that Singapore’s management was sixth best in the world, and noted that scores were higher for larger firms. It therefore recommended that interventions to improve management quality be focused on small and medium-sized enterprises.

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Figure 2: Outcome Distributions

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⁹. One example of a policy evaluation using administrative data is the study on how wages and decisions to enter into the workforce changed as a result of the Workfare Income Supplement scheme. See “The Impact of the Workfare Income Supplement Scheme on Individuals’ Labour Outcomes”, Economic Survey of Singapore, Second Quarter 2014, pp. 27–36.

Data analytics can also provide critical inputs and guidance when formulating policy content. An appropriate tool is multivariate regression, which approximates statistical associations, or correlations, between each factor and the outcome that policymakers intend to influence (see Box 3). Each factor that is correlated with the outcome points to a possible policy lever. For instance, regression analyses may show that, holding other factors constant, the greater the commuting time from home to workplace, the fewer the paid working hours done by housewives. Such a relationship suggests that one possible lever to encourage housewives to take up more paid employment would be to match them to jobs closer to their homes.

Multivariate Regressions
Are there relationships between variables in a dataset?

Regressions estimate the relationship between two variables. They can be run on a variety of data: cross-sectional, in which a group of individuals is measured for different variables at a certain time point; or time series, in which variables are measured over time but the composition of individuals differs at each time point. Longitudinal (or panel) data track the same individuals across time. A basic linear multivariate regression model with two independent or explanatory variables ($X$) may be expressed as:

$$\text{Outcome (Y)} = \text{Constant} + b_1 \cdot X_1 + b_2 \cdot X_2 + \text{error}$$

Correlation, or statistical association, between independent variable $X_1$ (or $X_2$), and outcome is measured by $b_1$ (or $b_2$). Such correlations may be obtained using Ordinary Least Squares, which estimates the constants, $b_1$ and $b_2$, by minimising the squared-error terms summed up over all the individuals. The direction of the relationship between $X_j$ and outcome is indicated by the sign of $b_j$: a positive (negative) sign indicates that a rise in $X_j$ is associated with a rise (fall) in outcome. When data are in levels, $b_j$ is interpreted as the extent to which average value of the outcome changes with a one-unit change in $X_j$, holding all else constant.

These simple regressions can be run on many common statistical packages. It is worth noting that correlation is not causality. This is because a relationship with another variable outside the model may in fact be driving both the independent variable and outcome (omitted variable bias). Alternatively, the outcome could also be influencing the independent variable (reverse causality). If the intent of the policy research is to estimate causal links, then the researcher may need to employ certain quasi-experimental techniques (see Box 4).
Regression analyses also have the advantage of weighing the relative strengths of different correlations, providing insight into which policies are more likely to translate into desired outcomes. In the case of housewives’ paid employment, a regression-based study may find that, while commuting time is a key factor, availability of childcare is even more important. Policy focus and content will then take a very different shape with this knowledge.

Apart from comparing various policy levers, regression correlations also provide a simple, but useful, basis for simulating outcomes under different scenarios of a proposed policy. Continuing with the hypothetical example of increasing paid working hours of targeted housewives: Policymakers planning locations of childcare centres may approximate, from geospatial and demographic data, how many targeted families each new centre could serve. Using scenario planning for different take-up rates at each centre, as well as regression correlations, they can derive a range of rough estimates of the likely increase in targeted housewives’ paid working hours.\textsuperscript{12} Such “broad strokes” approximations are one approach to assess the impact of different options \textit{before} policy implementation.

One purpose of quantifying the impact of policy alternatives is to weigh them against policy costs, including opportunity costs of the funds involved. Where a policy option’s costs clearly outweigh its benefits, alternatives or changes to policy content are needed. Even though the data may not include all aspects of a cost-benefit analysis—either because they are unobserved or take a long time before they can be measured—conducting data analytics prior to policy implementation can flag up those options that require deeper consideration. That alone makes the exercise worthwhile.

\textsuperscript{12} For instance, suppose the regression coefficient between having a nearby childcare centre and working hours per week is 10, this means that adding a centre is likely to increase working hours of housewives by 10 hours a week on average. Suppose also that a new centre serves 1,000 families. Under the scenario that 10\% of the 1,000 families earn below $1,000 per month, the likely average impact on targeted housewives is 10 hours for 100 families. The regression model may also include interaction terms to estimate different correlations for treated and controls.
Evaluating Policy Outcomes

After a policy has been implemented, data analytics can be used to evaluate it. First, it sheds light on whether the original policy intent is indeed met, and to what extent. Second, it provides more precise estimates of the beneficial impact of a policy, which policymakers can weigh against costs. Third, as Singapore’s operating environment changes, what worked in the past may not work as well in the future. Quantifying the impact of specific policies is thus a window through which structural changes may be contextualised and understood. For instance, an evaluation study by MTI economists shows that less educated and older individuals were incentivised by Workfare Income Supplement payments to enter and stay in the workforce. Their response to policy is also reflective of wider societal characteristics, such as smaller family sizes and relatively few elderly workers. Future interventions may have different effects as these characteristics change, i.e., if the number of elderly workers grows.

Evaluation, such as running a randomised controlled trial (RCT), may also be undertaken after a policy trial run on a small group of individuals. RCTs involve obtaining a representative sample and assigning policy treatment randomly to some individuals, who make up the treated group, but withholding it from the rest, who then make up the control group. The two groups are alike statistically in their characteristics, with policy treatment being the only real difference. Any statistical difference in the outcome may therefore be attributed solely to the policy. Data analytical tools for RCT datasets are relatively straightforward, and include testing differences in means, medians or distributions between the treated and control groups.

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14. When assessing RCT results, policymakers need to keep in mind their applicability when interventions are scaled up to a much larger, or national, level. As RCTs are conducted on a small scale, the implicit assumption is that the treated group has no information or effect on the control group, and vice versa. This may not be applicable when many more people are affected by the policy.

15. See Moore et al. (2009) for a compendium of these statistical tests.
For policies which do not utilise RCTs, evaluation involves applying quasi-experimental statistical techniques (see Box 4). Broadly speaking, these techniques estimate policy effects by comparing observed outcomes of individuals who were affected by the policy with what those individuals would experience in the absence of that policy (“counterfactuals”). Unfortunately, counterfactuals cannot be measured as individuals are either affected by the policy, or not. Moreover, there are selection issues, in that some individuals may change their behaviour to avoid, or to qualify for, the policy under evaluation. Hence, these techniques seek to resolve such issues partially by choosing a control group which is as similar as possible to the counterfactual, in order to mimic a random experiment.¹⁶

¹⁶. See World Bank (2011) for a non-technical introduction to quasi-experimental techniques.
The causal effect of policy is the difference between the observed outcome and what-could-have-been in the absence of the policy, or the counterfactual. It is not straightforward to establish causal links. For example, the difference between what workers earned before and after a training programme may not be attributable to the training. This is because other factors could be at play, e.g., improving economic conditions, or that workers who go for training were already on a higher wage trajectory. As the counterfactual is unobserved—the individual is either treated by the policy or not—the three common techniques used to identify causal links include:

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<th>Propensity score matching</th>
<th>Regression Discontinuity Design</th>
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<td>Intuitively, this model compares the before-and-after outcomes for the treated (first difference), with the before-and-after outcomes of the controls (second difference). The first difference controls for factors which are constant over time in the treated group; the second difference controls for time-varying factors among the controls (which also apply to the treated). When the latter is subtracted from the former, what remains is the time-varying factor (the policy) on the outcome of the treated. Hence, the difference in trends is assumed to be due to policy.</td>
<td>Matching involves selecting as controls—among individuals who are not treated by a policy—those who are closest in characteristics to the treated. This is done by estimating “propensity scores”, or the probability that an individual will be treated, given those characteristics, for both treated and non-treated. Then, those non-treated with the closest scores to the treated are chosen as controls. The difference between the matched controls and treated is the policy effect.</td>
<td>This model makes use of the eligibility criteria in many policies to compare those treated who just meet the criteria (e.g., income of $9,701–$10,000 with a cut-off of $10,000) with those controls who fall just outside the cut-off (e.g., $10,001–$10,300). The underlying assumption is that as the cut-off is exogenously determined by policy, individuals randomly fall on either side of the cut-off. Hence, controlling for other factors, the difference in their outcomes could be attributable to the policy.</td>
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Challenges and Limitations

Although data analytics holds much promise, there are limitations that practitioners need to be aware of. The main pitfalls—and their possible remedies—include:

**Prioritising Size Over Representativeness**

While very large datasets have the advantage of picking up small statistical associations, it may not mean that they are necessarily representative of the whole population. Data representativeness is a key condition for results to be generalised. For instance, data which depend on internet access, e.g., word searches on internet search engines, are unlikely to be representative of the Singapore population. This is because some segments of the population, such as the elderly, are less likely to be included and even those who are included may themselves not be representative of their segment. One solution is to limit studies’ findings to only the groups they do represent and avoid over-generalising.

**Sensitivity of Results to Variable Definitions**

Although many data items have widely accepted definitions, some will be defined by the officer. For instance, in the hypothetical case of raising paid working hours of housewives from low-income households, the officer makes decisions on what is considered “low-income”, as well as whether to count informal employment undertaken by the housewives (e.g., paid babysitting) as part of their paid working hours. The study’s final results may be sensitive to these decisions.

One remedy is to perform robustness checks: repeat the analytics with different definitions to see if the original results hold. If findings differ, the officer could
use them to gain additional insights into policy effects. In the hypothetical example, the policy may be less effective when housewives are already engaged in informal employment.

**Sensitivity of Results to Model Choice**

Just as researchers make decisions on how to define certain data items, they also choose the regression models or quasi-experimental techniques. Findings will typically depend on these choices. Testing across different models can assist in deciding which is more credible. More broadly, each model should be viewed as one estimate, and the researcher should aim for a consensus among different estimates.

**Conclusion**

The strength of data analytics is to provide a systematic, yet simplified, perspective through numbers. However, articles on data analytics tend to focus exclusively on “success” stories. An often cited example of data analytics success is US department store Target’s data mining of past consumer shopping patterns, which it used to infer whether its female patrons were pregnant. Target then sent coupons for related products (e.g., baby cribs) to entice these women to shop with them. Its success is celebrated with the famous case of the retailer knowing that a teenage girl was pregnant even before her father did.¹⁷

Some healthy scepticism is useful. Cases when data analytics works should be weighed against cases when it does not. For example, how often did the store send coupons to women who were in fact not pregnant? Consumers of quantitative research should be alert to one-sided portrayals.

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In a complex environment, policymakers need to go beyond purely relying on quantitative methods to design effective policies. Data analytics needs to be seen as one of the tools that policymakers can draw on to measure, to understand and to improve the policymaking process, thereby pointing to what may work and what may not.

References


CHAPTER 4

Behavioural Insights

DO Hoang Van Khanh and Sharon THAM

“Humans, more than Econs, also need protection from others who deliberately exploit their weaknesses—and especially the quirks of System 1 and the laziness of System 2.”

(Daniel Kahneman 2011, 413)

What Is Behavioural Insights?

Standard economic theories are based on the assumption that people are rational, i.e., self-interested agents who make decisions to maximise their utility. This assumption of economic rationality has influenced public policy designs in many countries, including Singapore.

However, in real life, contradictory to standard economics, people do not always act rationally and often make choices that do not lead to the best possible outcomes for them. We consistently overpay, underestimate, and procrastinate. We fail to understand the profound effects of our emotions on what we want, and we overvalue what we already own. Yet these irrational behaviours are neither random nor senseless—they are systematic and predictable. Humans make the same type of mistakes over and over, because of the basic wiring of our brains.

(Ariely 2008)

Behavioural Insights (BI) is a discipline based on economics, psychology, and sociology. It believes that people are susceptible to influences from their immediate environment (context effects), emotions, short-sightedness and other forms of irrationality. It studies people’s cognitive biases, how they make choices and behave in real life situations, and develop “nudges” (see Box 1)—new methods, mechanisms and other interventions—that would help people
achieve what they want. As people’s behaviours are usually context-dependent, BI as a discipline and its interventions are heavily reliant on empirical evidence.

**BOX 1**

**How People Think: System 1 versus System 2**

A relevant and quick way to understand the basis of our cognitive biases is to consider the distinction between System 1 (automatic) and System 2 (in-depth) thinking.

For instance, if a ball and a bat cost $1.10 and the bat costs $1 more than the ball, what is the price of the ball? If your immediate response was 10 cents, you are probably not different from the majority who would have responded likewise. This is a result of relying on the System 1 (automatic) thinking. System 2 thinking takes longer but you will arrive at the correct answer of 5 cents.

People go about most of their daily lives using System 1 thinking, as System 2 thinking requires greater mental effort and is used only on specific occasions. System 1 makes judgements based on biases while System 2 opts for detailed calculations, relying on analytical reasoning and is less influenced by biases.
**What is a ‘Nudge’?**

The premise of BI is that people’s mistakes in decision-making are systematic. Put simply by Darling and Mullianathan (2013), when someone makes a mistake, it is important to understand the context that led to that mistake. From this, patterns begin to emerge. Instead of labelling people as irrational (e.g., consistently lazy, stupid, or hot-tempered), BI research identifies specific situations in which they may appear irrational. This can inform policymakers on what to avoid and how to nudge people to make better decisions (see **Box 2**).

**Examples of Nudges in Public Policy**

Various BI interventions have become effective in influencing behaviour. The use of choice architecture, such as defaults with an opt-out option has successfully increased participation rates in organ donation (under the Human Organ Transplant Act). Other useful nudges include framing, making use of social norms, and setting up commitment devices to lock in desired behaviour.

Singapore’s Ministry of Manpower has used social norms (“96% of foreign domestic worker employers pay their levies on time”) together with other nudges to encourage employers to pay their overdue Foreign Worker Levy, resulting in an estimated $1.5 million increase in fees paid (also see **Box 3**). The Singapore Workforce Development Agency introduced commitment devices such as a booklet for job seekers to set personal goals and monitor their own progress in job searching.
According to Richard Thaler and Cass Sunstein (2008), authors of *Nudge: Improving Decisions About Health, Wealth, and Happiness*, a nudge is “any aspect of the choice architecture that alters people’s behaviour in a predictable way without forbidding any options or significantly changing their economic incentives. To count as a mere nudge, the intervention must be easy and cheap to avoid. Nudges are not mandates.”

However, it is easy to get confused between what constitutes a nudge and other ways to change behaviour, such as incentives, penalties and legislation. When exploring the option of using nudges, it is important to keep the following principles in mind.

First, a key feature of a nudge is that it *preserves the element of choice*. People should still be able to choose the option they desire. The difference is that nudges facilitate and make it easier for people to make better choices. For example, putting fruits at eye level in the cafeteria counts as a nudge, while banning junk food does not. Nudges also generally work better if subjects are unaware of the fact that they are being nudged.

Second, financial incentives can be considered nudges if they *do not significantly alter the economic incentives people face* (Thaler and Sunstein 2008), i.e., they have to be small relative to the effect of behaviour change. The context around the incentive, i.e., its size, when it is delivered, how salient it is made, are all critical to its effectiveness. Uncovering these contextual lessons is one of the broad goals of Behavioural Insights. For example, imposing a 10-cent charge for a plastic bag in stores is a nudge. However, slapping a $100 charge for not bringing your own bag is not a nudge. In other cases, providing a substantial subsidy for a skills upgrading course cannot be considered a nudge. But behavioural insights can help us to think of better ways to frame the subsidy, either as a discount or as a free module, to nudge more people to sign up.
Third, the context of financial incentives can be considered nudges. Attention needs to be paid to how large the incentives are in their specific contexts, when and how they are presented, and how salient they are. The EAST framework (see Figure 1) developed by the UK Behavioural Insights Team (BIT) summarises how nudges can be designed effectively—they need to be Easy (simple and causing least friction), Attractive (attracting attention), Social (taking advantage of social norms, team spirit) and Timely (delivered at the right time by the right person).

Figure 1: The EAST Framework
Source: UK Behavioural Insights Team 2014
For example, it is commonly understood that people usually demand less of a good when its price goes up. However, the change in price first needs to be noticed in order for any change in behaviour to be observed. Nudges can help with making changes in prices more salient. Making the increases in the price of electricity more salient is likely to have a greater effect on reducing consumption. Hence, cost-disclosing thermostats might have a greater impact than a modest price increase alone designed to decrease the use of electricity.

Fourth, nudges are not about manipulating behaviours, but about helping people make better choices for themselves. These choices tend to be in line with people’s intentions but they are unable to execute them due to certain cognitive biases. It is widely recognised that people often know what is good for them but unable to follow through (e.g., people continue to consume junk food even though they are aware of the health risks). In addition, the environment we live in already nudges us one way or another, where our choices are often manipulated by more intrusive or subtle measures such as taxation, regulation, marketing and advertising. As Thaler and Sunstein (2008) put it, “… there is no such thing as a ‘neutral’ design”, and “… some kind of nudge is inevitable, and so it is pointless to ask government simply to stand aside. Choice architects, whether private or public, must do something.”

Thus, the role of a nudge is to help people make choices that they would have wanted to make, and avoid making decisions that they would have considered as mistakes. In this sense, nudging is acceptable when used in public policymaking to change behaviour—as long as the freedom of choice of citizens is preserved, and the ends nudged towards are consistent with general preferences of citizens (e.g., to have fewer health problems; to have adequate savings for retirement; and to tap on available financial assistance schemes).
When Should BI Be Used?

BI can be applied to policies that aim to influence behavioural elements. It can help in the design of new policies, make improvements to existing ones, or elucidate why target groups of a policy reacted in a particular way. There are three main domains where BI applications can be most effective (Bavel et al. 2013):

i. *When behavioural change is the main objective of the policy.* For example, getting people to eat healthier, quit smoking, or drive slower.

ii. *When people’s behavioural response can influence the effectiveness of a related policy.* Policies intended to protect the consumer are a good example—they do not seek to change consumer behaviour, but seek to prevent abuse by industry in response to how people behave. If policymakers know that consumers are vulnerable to pre-set default options by industry players, regulators can take action and limit their use to protect consumer interests.

iii. *In the policymaking process itself.* Policymakers are also subjected to biases and a number of other influencing factors. Being aware of these potential pitfalls can help when developing and implementing new policies.

There is no single BI model or theory that can explain human behaviour in its totality. Any attempt at explaining behaviour in a particular context requires specific empirical observations. BI interventions are often contextual, which means a specific nudge might work in one context but might not work, or even backfire, in another. Hence, to fully understand the effectiveness of a nudge, it needs to be tested out using Randomised Controlled Trials (RCTs) or quasi-experiments. Policies involving people’s expected behaviour need to be first tested, then reassessed (i.e., implemented, modified or dropped) according to the results.
As more trials are conducted in different contexts, certain patterns may emerge which will bring further insights to guide policymaking. Popular interventions such as incorporating social norms, personalisation, and saliency in messages or letters could work well in some contexts while producing lacklustre results in others. The example in Box 3 sent the right message that attention was needed for more timely response but was perceived negatively when applied to a public survey.

**BOX 3**

**Context Matters—Pink Letters**

One of the trials conducted by the Ministry of Manpower’s Work Pass Division and the Central Provident Fund Board was to nudge employers of foreign domestic workers to make timely levy payments. For employers who defaulted, MOM sent them a letter to remind them to make payment. In the trial, a randomly selected half of 1,000 people received the usual monthly letter on white paper. The other half received a letter on pink paper which had a simplified layout, containing clearer important information in addition to the social norm that 96% of the employers pay their levies on time. The pink letter was intended to invoke the norm of overdue bill notices sent by telecommunications and utility companies and reinforce the message that the due levy payment was late. The pink letters resulted in an increase in compliance of 3% to 5%, which was equivalent to $1.5 million more in levies collected.

However, when another agency—based on the success of this RCT—decided to use pink letters for their surveys to encourage more returns, it resulted in complaints from the public. The pink letter in this context did not invoke the appropriate norm as there was no overdue payment. Instead, it confused and annoyed the recipients.
These two examples illustrate the importance of applying the appropriate context with BI interventions, which policymakers can only validate through testing and experiments.

Source: Gallagher 2014

Challenges and Limitations

For policymakers, BI cannot replace economic theories. When designing policies to change behaviours, policymakers cannot ignore the effect of economic incentives and only focus on BI. Instead, BI should be embedded within the discipline of economics to help improve our understanding of human behaviour. Likewise, BI’s applications must be seen in the wider context of wider economic environment and economic policy.

In addition, there are also specific contexts in which BI would not be applicable or have very limited use:

i. Correcting externalities where a third party is financially harmed. Government intervention in this scenario would require economic incentives in the form of taxes or regulation to mitigate the problem.

ii. Preventing certain types of crimes, such as violent crimes and drug abuse. BI in these cases is not quite enough. Legislation which could include outright bans and strong deterrence like jail sentences are needed.

Conclusion

Broadly speaking, people continue to respond to incentives as predicted by standard economic theory, but their decisions are also greatly influenced by the context they are in. From improving take-up rates of assistance schemes
to helping people find jobs, harnessing the strengths of both incentives and nudges will increase the effectiveness of many policies aimed at addressing society's problems. However, the effect of nudges cannot be expected to stay the same over time. As conditions in our environment and expectations change, new challenges that emerge will require us to assess the effectiveness of interventions previously put in place.

In the longer term, there is great potential for academics and policymakers to accumulate experience and gain further insights into which BI interventions work better, and when.

References


**Further Readings**


“Once you have a plan in place, all you have to do is apply a bit of coin flipping, or randomisation. You’ll want to compare the difference in results between a ‘control’ and an ‘experimental’ situation.”

(Uri Gneezy and John List 2013, 242)

What Is a Randomised Controlled Trial?

A randomised controlled trial (RCT) is a study in which the studied sample is randomly split into a control group (those who will receive the standard intervention) and a treatment group (those who will receive the intervention being tested) (see Figure 1).
Random allocation means participants would have an equal chance of being assigned to either of these groups. If the sample size is large enough, the control and treatment groups can be expected to have the same characteristics. In addition, procedures are controlled to ensure that all participants in both groups are treated the same except for the new intervention that is being tested. The results of the trial can then be attributed to the new intervention instead of other confounding factors\(^1\).

RCTs can sometimes be confused with simple pilots, since both are associated with testing a new intervention on a selected group of people. The key difference is that pilots do not require a concurrent control group and allocation is not always random (see Box 1).

**BOX 1**

What Is the Difference between an RCT and a Simple Pilot (Pre-Post Test)?

Pilots (pre-post tests) are studies, in which an intervention is introduced to a selected group (treatment group). Changes observed in the same group are then measured over time. The results of the intervention are thus measured as the difference in observations before and after the intervention is introduced.

Unlike RCTs, pilots do not have a concurrent control group that could account for possible confounding factors—factors other than the intervention being tested that could influence the outcome. These

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1. A confounding factor is an extraneous variable whose presence affects the variables being studied so that the results you get do not reflect the actual relationship between the variables under investigation.
factors could lead to distortions (downwards or upwards) in the observed outcome of the intervention. Hence, an evaluation based on pilot results is less accurate and rigorous compared to an RCT.

In practice, pilots are commonly used by governments to test out policies in many domains, such as education, energy and transport, before they are implemented at a national level. However, in many instances, pilots could have been easily designed as RCTs to obtain more reliable data on the effects of the intervention. This simply entails recruiting and collecting data concurrently on a comparable control group to more accurately ascertain the effects of the intervention.

RCTs are thus considered the golden standard for evaluation because they enable a robust and clean evaluation of how effective a new intervention is. The key advantages of using an RCT design compared to other evaluation methods are that:

i. Random assignment ensures that factors (known and unknown) that could affect the outcome of the trial are evenly distributed across conditions; and

ii. Random assignment and the use of a control group eliminate the potential effects of confounding factors on the results. This establishes a causal relationship between the intervention tested and the difference in outcomes observed between the treatment and control groups.

For public policy, RCTs are useful in evaluating the overall effectiveness of programmes. This helps policymakers to determine where resources should be channelled and how they should be used (see Box 2). RCTs are also useful in testing which aspects of a programme yield the greatest effect towards desired outcomes, which is valuable information for policy refinements.
The Moving to Opportunity (MTO) experiment offered randomly selected families living in high-poverty housing projects in the U.S. housing vouchers to move to lower-poverty neighbourhoods. The experiment used administrative data from tax returns to access the impacts of MTO on children’s long-term outcomes.

The study found that moving to a lower-poverty neighbourhood had significantly positive impacts on children who were young (below the age of 13) when their families moved. In their mid-twenties, children from the treatment group were likely to have an annual income that is $3,477 (31%) higher, on average, relative to their counterparts in the control group. Children in the treatment group also lived in better neighbourhoods themselves as adults, were less likely to become single parents, and had higher college attendance rates.

On the other hand, for children who were older than 13 years when their parents moved, the treatment had negative long-term impacts, perhaps because of disruption effects.

The findings imply that resources should be channelled to programmes that help families with young children move from high-poverty neighbourhoods to lower-poverty neighbourhoods. These programmes would not only reduce intergenerational persistence of poverty but might ultimately generate positive returns for taxpayers.

Source: Chetty et al. 2015
When Can RCTs Be Used?

RCTs can be a powerful tool to test and evaluate policy, especially if:

i. The intervention is well-defined and/or simple and easy to standardise, e.g., sending reminder text messages, altering payment structure;

ii. The outcome of the treatment can be easily and consistently measured;

iii. The intervention can be implemented consistently; and

iv. The intervention is likely to have large impact.

However, RCTs would not work well in certain situations. For example, it is impossible to randomise the treatment when a policy has already been rolled out to a selective group, potentially resulting in self-selection or sampling biases. RCTs are also not appropriate if there are likely to be interferences between treatment and control groups; and when it is not possible to ensure minimal attrition and good compliance of the treatment. To illustrate, a hospital planning to test a new house visit programme to improve health outcomes would not be able to conduct a robust RCT if large numbers of patients are likely to drop out or refuse to continue with the treatment halfway.

Under such circumstances, the next best alternative would be to explore the use of quasi-experiments to evaluate the interventions. The reliability and rigour of quasi-experiments can range from a very simple pre-post analysis to more sophisticated techniques like statistical matching (or propensity-score matching) and regression discontinuity design, which are much closer to the standard of RCTs.²

To ensure rigour, quasi-experiments may require extensive knowledge, context and a literature review to identify all possible external factors, other than the treatment, that can affect the outcome. Researchers and policymakers may also need to carry out further data analyses (e.g., statistical regression) to control for these external factors.

Challenges and Limitations

Ethical Concerns

While RCTs are considered the golden standard for evaluations, there may be concerns that they are unethical or unfair because a new intervention is being withheld from people who could benefit from it. This concern is heightened when additional money is being spent on programmes which might improve the health, wealth, or educational experience of the treatment group.

In this respect, policies that are planned to be rolled out slowly and on a staggered basis—due to financial or other resource constraints—would present natural opportunities for experimentation in the public policy sphere (see Box 3). In such cases, even without RCT, only a selected group of citizens would have received the intervention via pilots. By selecting a group to receive the treatment through randomisation and by tracking the data of a comparable control group, policymakers can assess the effectiveness of the intervention in a more rigorous manner.
BOX

3

A Natural Opportunity for RCT: PROGRESA (Conditional Cash Transfer Programme in Mexico)

PROGRESA combines a traditional cash transfer programme with financial incentives for recipient families to invest in human capital (health, education, nutrition) of their children. In order to receive the cash transfers, families must accept preventive healthcare and participate in growth monitoring and nutrition supplements programmes.

Due to resource constraints, approximately 10% (506) of the 50,000 PROGRESA eligible communities were chosen to receive the programme immediately, while the rest would receive it two years later. This resulted in a natural opportunity to conduct an RCT for the programme. The communities were randomly assigned to the treatment group that received PROGRESA first, while the rest became part of the control group that received the benefits later. The trial showed that the utilisation of public health clinics increased faster in PROGRESA villages than in control areas, with significant improvements in the health of both adult and child beneficiaries.

Source: Gertler and Boyce 2001

The “wait list” approach is an alternative way to address ethical concerns, especially if the intervention is anticipated to be popular or favoured by a large number of people. In this instance, policymakers can solicit sign-ups for limited slots in a programme. Once the slots are filled, the participants are randomly assigned to the treatment group (those who would receive the intervention immediately) while the rest would be assigned to the wait list or control group (those who would receive the intervention at a later stage or after the trial has been completed). To qualify for the wait list, participants would need to agree to be tracked during the trial period. With this approach, everyone who signed up would have a chance to benefit from the intervention, albeit with some time difference, hence minimising ethical concerns.
Interestingly, from a citizen’s perspective, pilots are not too different from RCTs. Both include a small sample receiving the treatment or intervention prior to the rest of the population. Hence, they share common ethical concerns, centred on the “unfairness” of only a selected group benefiting from an intervention. This means that whenever pilots are considered, RCTs can easily substitute pilots to yield more rigorous and reliable evaluation without aggravating ethical concerns.

**Administrative Challenges (Cost and Time)**

In reality, complete randomisation is often extremely costly and may take a long time to administer. This is one of the reasons why RCTs are often substituted by simple experiments or pilots, even though they lack rigour and reliability and are prone to selection bias.

However, high costs can be overcome in certain scenarios. For instance, experiments could be carried out on current policy when outcome data is already being collected from routine monitoring systems (whether administrative or survey data). In such cases, the cost of the experiment can be narrowed down to the time taken to design and set up the trial. In addition, if randomisation at the individual level is impossible or too costly, policymakers could randomise at larger units of measurement (i.e., at cluster level)—such as by classes in schools or housing blocks.

In the case of timelines, while RCTs may require a longer planning time, the actual experiment itself should not take longer than a simple pilot.

**Political Considerations**

Sometimes, experimentations in policy might not be possible due to political reasons, i.e., some policies may have to be implemented within a very short time frame without requiring evidence on their effectiveness. In these instances, RCTs can still be used to provide insights on how certain aspects of a policy can be tweaked for greater effectiveness. For example, as researchers could not test
the overall effectiveness of the Singapore Work Support Programme since the policy had already been implemented on a national level in 2011, they sought to test different versions of the policy instead, varying the amount and duration of assistance (Do and Tham 2013). This was to find out how best to help recipients attain financial independence and sustained employment over time.

**Conclusion**

Conducting a pure RCT might not always be possible in public policy as carrying out complete randomisation and having an ideal control group can be challenging. However, this should not discourage policymakers from using RCTs or setting some RCT standards when designing and evaluating policies. To ensure a high level of rigour in the analysis, the following three key principles should be kept in mind:

i. *Randomise* the selection of people to be in the control and treatment groups as far as possible;

ii. *Track* data for the most comparable control group possible, before the data is lost or difficult to retrieve thereafter; and

iii. *Be aware* and clearly state the possible confounding factors in the trial.
References


CHAPTER 6

Cost Benefit Analysis

LEONG Wai Yan and LIM Yong Long

“We need to think about cost-benefit analysis more in terms of bringing procedural rationality to the decision-making process, than providing support for decisions, sometimes already made. The reality is that we often learn more about our options from the process of doing a CBA than we do from the final numerical results.”*

(Richard P.C. Brown 2015)

What Is Cost Benefit Analysis?

Cost Benefit Analysis (CBA) is a decision-making tool that uses a quantitative approach to assess the merits of a project. It evaluates the value of a project by assessing the costs and benefits to a community if the project is undertaken, compared to not undertaking it. To do so, two hypothetical scenarios are envisioned and compared—one with the project implemented, and one without. The investment will be deemed worth pursuing if the benefits produced by the project are greater than its opportunity costs (see Box 1).

For policymakers, undertaking a CBA requires them to consider the net impact of a project on society. This means going beyond revenue and costs generated by the project to take into account benefits and costs that might not be captured by market prices—externalities borne by third parties that are not involved in the consumption or production of the project.

* Richard Brown, quote for Cost Benefit Analysis provided to the Civil Service College via email, May 18, 2015.
BOX 1

**Cost Benefit Analysis**

- **Decision**
  - Undertake the project
    - Scarce resources allocated to the project
    - Value of the project output
      - Project Benefit = $X
  - Do not undertake the project
    - Scarce resources allocated to alternative uses
    - Value of output from resources in alternative uses
      - Project Opportunity Cost = $Y

- **If $X > $Y, recommend the project**

Source: Campbell and Brown 2003

Notes: For this example, the costs of the project and alternate project are the same as they utilise the same resources, hence for CBA only, the differences in benefits will be evaluated.

- First scenario where the project is implemented—Identify and measure the benefits of the project, i.e., the value of the extra output brought about by the project. This is usually measured by the amount that consumers are willing to spend—($X).

- Second scenario where the project is not implemented—Identify the highest-value alternative usage of the resources and measure the value of the extra output brought about by it—($Y).

- All future benefits and costs have to be discounted to present value. A riskless market rate of interest is usually applied as the discount rate.

- Evaluate and compare the present values of the two scenarios and recommend the project if the benefits exceed the costs, or if $X > $Y.
When Can Cost Benefit Analysis Be Used?

Policymakers can use CBA at different stages of policy planning, for project appraisal and evaluation to improve the decision-making process. It can be used before a project is undertaken, during and after a project is implemented.

Before a Project Is Undertaken

When policymakers are deliberating over a project or making a comparison between options, CBA can provide information in two ways:

i. Will the project result in a net benefit or net cost to society?

To measure the social net benefit of the project (i.e., an aggregated CBA), a CBA can be done. A positive social net benefit means that the benefits of the project exceed its costs, making it worthwhile to proceed. The evaluation of the North East Line (NEL) on the Mass Rapid Transit network in Singapore is an example of how wider economic benefits were used to measure social net benefit before it was constructed (see Box 2).

ii. Will the project bring about any potential income redistribution effect?

To identify any potential income redistribution effects, a CBA can be carried out for various sub-groups that are significantly affected by the policy (i.e., disaggregated CBA). This would quantify the gains of one group compared to the losses of another, thereby informing policymakers about the income redistribution effects of the project. Potential income redistribution effects may be more critical for policies where resource distribution and accessibility to the policy are key to its effectiveness, e.g., MediShield Life.
Evidence-based Policymaking in Singapore: A Policymaker’s Toolkit

During and after a Project Has Been Implemented

Other than deciding on whether it is worth pursuing a project, it is equally important to evaluate the outcomes during and after it has been implemented to affirm initial projections. When deciding on whether to embark on a particular project, policymakers need to make projections to estimate the future benefits and costs despite the uncertainties faced. After the project has been implemented, a CBA based on actual data can be conducted to evaluate the progress of the project. This helps policymakers gain insights to how the project can be refined to maximise benefits. If costs outweigh the benefits, areas where remedial actions can be taken should be highlighted, or in the most extreme case, discontinuing the project could be justified. Furthermore, the CBA could provide crucial learning points on how future projects can be designed more robustly.

Incorporating Wider Economic Benefits in the Evaluation of the North East Line (NEL)

When evaluating the cost of infrastructural projects, the government takes into account the direct costs of construction, such as manpower and land uptake, as well as indirect costs such as temporary disamenities arising from noise pollution and diversion of traffic.

The Land Transport Authority (LTA) calculates the potential benefits of transport infrastructure via a Transport Model. Before the NEL was constructed, the Transport Model was used to model commuters’ decisions based on travelling time and cost—to show travel time and cost savings arising from the NEL. For example, travel times from Seng Kang to town via the NEL versus taking a bus were compared to estimate any potential time savings enjoyed by commuters. The CBA also took into account additional wider economic benefits arising from the development potential of land. This was evident in the rapid development of Seng Kang and Punggol Towns and commercial developments along the NEL corridor (e.g., NEX, City Square mall). These benefits were estimated using the wider economics benefits methodology adopted in the UK.
Challenges and Limitations

CBA is appealing as it is a relatively simple and reliable decision-making tool that monetises the costs and benefits of a project. However, there are various challenges to using CBA in the context of public policy.

Value Judgement and Subjectivity

In many cases, it is a lot more difficult to assign monetary values to non-marketed and non-traded goods as compared to marketed goods. When evaluating policies that have an impact on marketed goods, such as a CBA on the impact of a minimum wage law, the policymakers can take into consideration parameters such as wage rate, unemployment rates and output of the firm. These are readily measured as the outcome of trade and interactions in the labour and goods markets.

However, CBAs are also performed in cases where goods are non-marketed and non-traded. For example, in the case of transport infrastructure, it would be difficult to monetise the value of time saved by commuters since this could be highly subjective. When assessing if the development of a park has benefited residents, it would be equally challenging to monetise any increased well-being arising from living in a greener environment. Some level of value judgement and subjectivity becomes unavoidable when making approximations of more intangible costs and benefits.

Nonetheless, one should still be as objective as possible in getting an accurate representation of the value of goods that are non-marketed and non-traded. To determine the value of travel time, stated preference surveys are routinely used to obtain an individual’s trade-off between money and time. It is important to ensure that the survey sample drawn is representative of the population. Hedonic price models can also be used to measure the implied value of certain non-marketed goods through its impact on market prices. An example would be the Active, Beautiful and Clean Waters (ABC Waters) Programme where environmental benefits of the park project were measured through the increase in the property prices around the park (see Box 3).
Alternatively, policymakers can consider using the benefit-transfer method, which uses the non-market values derived from other similar studies, as an approximation of the cost/benefit of the non-monetary component.

**BOX 3**

**Cost Benefit Analysis of the Active, Beautiful and Clean Waters Programme**

Launched in 2006, the Active, Beautiful and Clean Waters (ABC Waters) Programme is a long-term initiative by PUB (Singapore’s National Water Agency) to transform Singapore’s drains, canals and reservoirs into streams, rivers and lakes that are well integrated with surrounding parks and spaces, thereby creating new recreational spaces and focal points for community activities.

ABC Waters projects bring a variety of benefits including the direct use value that residents place on activities (e.g., jogging, enjoying the views). To quantify the direct use values that residents are willing to pay for, the price trends of properties located near the ABC Waters project at the Bishan-Ang Mo Kio Park (Bishan-AMK Park) were analysed. Specifically, a difference-in-difference methodology was employed to control for macroeconomic factors which may have affected the prices of all properties. The treatment and control groups were constructed based on the distance from the Bishan-AMK Park. In addition to the difference-in-difference framework, hedonic characteristics of the properties were also included as additional controls to account for the impact of other amenities near the property.

The results indicated that the completion of the ABC Waters project caused an increase in HDB resale prices for homes closer to the project—an indication of willingness by households to pay for the improvement.
in the landscape and amenities associated with the project. The results were robust to choices of different treatment and controls groups, based on varying distances to Bishan-AMK Park. Overall, it was estimated that the premium in property prices would have more than offset the costs associated with the Bishan-AMK Park ABC Waters project. Nonetheless, the valuation obtained from the hedonic pricing methodology is likely to be an underestimate as the study did not account for other benefits. For instance, the indirect use value of features that would clean stormwater run-off for better quality water was not included in the study. Furthermore, the valuation only included use values of residents near Bishan-AMK Park and excluded the use values of all other park users.

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**Uncertainty and Irreversibility**

An important feature of CBA is the need to account for the time value of money when calculating future benefits and costs of a project. A dollar today will have a greater value than a dollar in the future due to inflation and the possibility that interest can be accrued on the dollar today. Hence, all benefits received and costs incurred at different points in time should be converted to present-day value to arrive at a *Net Present Value* (NPV), so that more accurate comparisons can be made. This is done by using a “discount rate”, or the prevailing rate at which future cash flows are adjusted to the present day (e.g., a riskless market rate of interest)\(^1\) (see **Box 4**). A positive NPV means that present values of a project’s benefits outweigh the present values of its costs, meaning it will generate a positive return over time, and vice versa for a negative NPV.

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1. In Singapore’s public service context, the typical discount rate used is the average after-tax yield of the 10-year Singapore Government Securities bond.
Although the NPV rule is simple to apply, the challenge is that uncertainty in the external environment and irreversibility of large-scale projects make it difficult to make reliable decisions. How should one estimate the expected stream of costs and benefits, and what discount rate should be used, are among the uncertainties that policymakers face. For projects that produce streams of costs and benefits over time, there are also many uncertainties in the external environment that may impact the estimation of the NPV. Another uncertainty is that the NPV of an investment may seem small when viewed in isolation, but may actually create options or opportunities that the government can choose to undertake in the future. A good example is research and development (R&D) where there could be underinvestment if the calculated NPV does not take into account the opportunities that R&D investments can create.

**Worked Example on Calculating Net Present Value (NPV) in a CBA**

Consider a project with an initial cost of $100 that generates benefits of $20 in Year 1 and $90 in Year 2. The project may seem to generate a positive net benefit if we were to just compare the absolute value of the costs ($100) and benefits ($110). However, if the time value of money is accounted for at a 10% discount rate, the Net Present Value (NPV) is negative, which makes taking up the project unfavourable.

<table>
<thead>
<tr>
<th>Year</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Cash Flow</td>
<td>-100</td>
<td>20</td>
<td>90</td>
</tr>
<tr>
<td>Net Benefit (absolute value of Cash Flow)</td>
<td></td>
<td></td>
<td>10</td>
</tr>
</tbody>
</table>
| Net Present Value of Benefit (based on 10% discount rate) | \[
\frac{20}{(1.1)} + \frac{90}{(1.1)^2} - 100 \\
= -7.44
\] | | |
In addition, when a decision has been made to invest in a large-scale project, it is not possible to simply reverse the decision if it turns out to be less than ideal midway, due to the large amount of resources and sunk costs incurred. This means the project will continue to draw on resources to keep it alive. With such irreversibility and the possibility of yielding a lower NPV than estimated, there is a need to manage risks by setting a higher bar before making an investment decision. In other words, the present value of the project must not just be positive, but must exceed the cost of the project by an amount equal to the value of keeping this investment option alive (Dixit and Pindyck 1995).

**Conclusion**

While CBA helps to inform the policymaking process, policymakers should not rely on it solely when making decisions. Instead, CBA should be seen as a guideline that adds to better decision making, and the assessment should be made in the context of other considerations that are key to a policy’s effectiveness, e.g., social acceptability, distribution of wealth and environment sustainability. Policymakers would also need to make a judgement call on the validity of the assumptions used in the CBA and if there are other non-market benefits that would still justify a project with a seemingly negative CBA result.

**References**


“I want to understand the world from your point of view. I want to know what you know in the way you know it. I want to understand the meaning of your experience, to walk in your shoes, to feel things as you feel them, to explain things as you explain them. Will you become my teacher and help me understand?”

(James Spradley 1979, 34)

What Is Qualitative Research?

Qualitative research has two primary objectives: (i) to be used as a means to interpret significance and (ii) to give a voice (Ragin 1994, 51), that is, providing opportunity for the subject to speak for himself/herself in relation to a particular situation so that one can understand why he/she chooses to act in a certain manner. This provides richer and more nuanced data that sheds light on aspects not answered by quantitative approaches. If someone wants to know what it is like to live on $600 a month, or the experience of being a foreign domestic worker or foreign construction worker who has to deal with discrimination and unequal power relations at the workplace in contemporary Singapore, qualitative research is most suited for this task. It uncovers aspects of social life that go unnoticed in quantitative research.

The starting point of qualitative research is to recognise that the objects of analysis are “studied in their complexity and entirety in their everyday context” (Flick 2002, 5). In particular, qualitative research looks to uncover the everyday practices and interactions of those being studied. This is because qualitative research recognises “that viewpoints and practices in the field are different.

1. The field is basically the place where the research is being carried out, better known as fieldwork. The undertaking of fieldwork is also referred to as entering the field.
because of the different subjective perspectives and social backgrounds related to them” (6). Discovering these subjective worldviews and realities are thus part of the aims of qualitative research. In doing so, it recognises that there exists a variety of perspectives regarding any social phenomena.

Reality is regarded as socially constructed (Denzin and Lincoln 1994, 3). What seems natural and unchanging—like family, religion, gender relations, crime, poverty and consumption—are created and sustained by interactions between different groups in society. Hence, qualitative research tries to make sense of these social phenomena from the perspectives of informants by unearthing how people create and give meaning to social experiences.

Qualitative research is based on a variety of theoretical approaches and methods. It is relatively unstructured and highly flexible, so that officers can choose the approach that best fits the objective of study. Hence, a research project encompassing both quantitative and qualitative research methods could present a more comprehensive picture of the social issue being studied (see Box 1).

**Approaches of Qualitative Research**

The nature of qualitative inquiry is underpinned by three approaches:

i. Understanding the insider’s interpretation and view regarding what is going on;
ii. Understanding the underlying rationale to people’s actions, i.e., how people create, sustain and attribute meaning in their interactions with the social world;\(^2\) and
iii. Making observations of behaviour of individuals or groups of people in a natural setting.\(^3\)

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2. This is known as **symbolic interactionism**.

3. This is known as **ethnography**. There has been some confusion about the term ethnography. It has been equated with in-depth interviews or as a synonym for qualitative research. The former is but one of many research methods that can be used in qualitative research. As for it being a synonym for qualitative research, this is inaccurate since a structured quantitative research method (like a survey) can conceivably be used in an ethnographic study.
How Quantitative and Qualitative Methods Complement Each Other

Quantitative data provide macro level statistics like total numbers, proportions etc. but many questions are left unanswered. Consider the single mother experiencing poverty. How is her self-esteem affected? How does it affect her relations with her relatives, friends and larger society? How are those experiencing poverty dealing with the stigma of being poor or unemployed? How does poverty affect the chances of success in the educational realm? What is the worldview of those in poverty? How does this shape their philosophical outlook of life, and response to situations? In contrast, how will this experience and perspective of poverty differ from a civil servant’s or that of the seventh richest person in the country? Questions such as these are what qualitative researchers concentrate on, and the data that is yielded contributes to the understanding of what it means to experience poverty.

When Can Qualitative Research Be Used?

When deciding on whether to use qualitative research methods, it is important to understand its objectives:

i. To understand the underlying rationale for behaviours
ii. To observe human behaviour in its natural setting
iii. To provide space for participants to express their perspectives, their thought processes, emotions et al.

It is also pertinent to note that the open-ended and inductive nature of qualitative research makes it challenging to reliably generalise the results or compare between groups and any sort of testing (Guest, Namey, and Mitchell 2013, 25).
Selected Methods of Qualitative Research

There are a variety of qualitative research methods but two of the most common ones are observation and semi-structured interviews.

Observation

In general, three modes of observation can be described:

i. Complete Observation (non-participant observation)
ii. Partial Observation
iii. Participant Observation

Complete observation (non-participant observation)

Complete observers (Flick 2002, 135–139; Dorsten and Hotchkiss 2005, 133–135) are researchers whose roles are not known to the members of the group being studied. The subjects may not even know that they are being observed. However, unlike participant observation, the researchers do not interact with the subjects. This method is used when access to the field is easily available, such as in public places. Thus, if you want to study the interactions of patrons and staff at a coffeehouse, this will be the method of choice. You can buy a cup of coffee, sit down in a corner, and observe.

Partial observation

Researchers carrying out partial observation are known to members of the group being studied, but they are not regarded as part of the group. This method is used when it is difficult to obtain access to a field without the permission of the group being studied. A potential drawback of this mode is that the subjects might alter their behaviour as they are aware that they are being observed.
Participant observation

Participant observation entails “diving headlong into the field, observ[ing] from a member’s perspective but also influenc[ing] what is observed due to his or her participation” (Flick 2002, 139). The point is to better the knowledge of the field through an increased assimilation into that world as a participant. Aside from observations, participant observation is also a field strategy that simultaneously combines document analysis, interviewing of respondents and informants, direct participation and observation (Denzin 1989, 157–158). It also entails being cognisant of the researcher’s own conscious thoughts, thought processes and emotions. Erving Goffman Asylums (2009) provides one of the best examples of participant observation (see Box 2).

BOX 2

Method in Madness

Erving Goffman, a Canadian sociologist, undertook a year of fieldwork from 1955 to 1956 at St. Elizabeth’s Hospital in Washington DC. He posed as an assistant to a director (Goffman’s activities were only known to the hospital’s top management).

Goffman spent his days with the patients and actively avoided sociable contact with the staff members and the carrying of a key (because only staff members do so and he wanted to experience the asylum as how the inmates did). He did this to understand a mental patient’s social world because it is a “world that is subjectively experienced by him” (Goffman 2009, xvii).
This quote by Goffman aptly underscores the reasons for engaging in participant observation:

[...]ny group of persons—prisoners, primitives, pilots, or patients—develop a life of their own that becomes meaningful, reasonable, and normal once you get close to it, and that a good way to learn about any of these worlds is to submit oneself in the company of the members to the daily round of petty contingencies to which they are subject (xviii).

Semi-structured Interviews

Semi-structured interviews comprise open-ended questions to allow subjects to freely express their views, thought process and feelings. An interview guide is used to frame the interview situation, but the questions are not standardised (as in a survey), and further probes can be made to responses. This enables some comparability of the data from the interviews, as the guide provides some general structure without removing the merits of openness and contextual information.

Challenges and Limitations

Resource Intensive

A drawback to qualitative research is that doing proper analysis of text is a time-consuming affair. Aside from having to interview the informant, which can take tens of hours, one also needs to transcribe, code and analyse the data (Guest, Namey, and Mitchell 2013, 25). The level of detail that goes into qualitative research is one of its main strengths. The trade-off though is that due to the intensity of time and energy needed in the data-collecting process, the officer usually deals with a much smaller sample size as compared to quantitative research.
To get round the resource intensive issue, researchers can consider using a software\textsuperscript{4} to help with the coding of qualitative responses. This is especially useful when the sample size of respondents is sizable, and where the interviews can number in the hundreds.

**Ethical Concerns**

As public service officers undertake qualitative research, it is also important to understand that being a government employee means that there are greater sensitivities at hand. Officers need to be keenly aware of the power they hold over informants, especially if the latter perceive that they are already taking a risk in being open with the former. This is especially true for informants who are disadvantaged (e.g., foreign workers and foreign domestic workers) and vulnerable. By opening up to the officer conducting the research, the informant is entrusting information that can affirm the latter’s rights, interests and sensitivities; conversely, the information can be used against the latter or be used to violate them (Spradley 1979, 36). Officers can thus inadvertently do enormous damage towards the informant if they are not careful. They should also guard against becoming overly aggressive and presenting a situation where informants may feel obliged to provide responses because of the perceived power that a public officer holds.

In addition, public officers should be cognisant that responses from informants may be skewed to what they think the officer wants to hear. Consequently, the data obtained may not reflect their honest views and perspectives. Thus, public officers should seek better ways to frame and position their interviews and surveys to minimise such effects.

\textsuperscript{4} An example of such software is NVIVO.
Access to the Field

The question of gaining access to the field is a critical factor in doing qualitative research, as this determines the researcher’s choice of research methods. Insurmountable barriers to any study include factors such as a researcher’s ascriptive\(^5\) status (e.g., an ethnic Jew wanting to study a neo-Nazi group will likely not get very far, and will in fact end up endangering himself/herself) or the nature of the field itself (many social settings are interesting but impossible for most researchers to study, e.g., top one percent income earners in a country).

Conclusion

Qualitative research is carried out to answer the *why* and *how* of the way people think and act. It can thus provide greater depth and insights to broad patterns and trends observed. Its strength lies in bringing about an understanding of the reasons and motivations behind choices, decisions and behaviour. Having such information will in turn enable us to better design public policies.

References


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5. An ascribed status refers to a social position that is assigned to you at birth, or which is imposed upon you later on in life. You do not have a choice over whether or not you want that status, nor can you earn it. Examples include ethnicity and sex. Ascribed status is often contrasted with *achieved* status, which refers to a social position that you earn on the basis of merit. Thus, you have a choice whether or not you want that status. An example will be that of a world-famous football star.


**Further Readings**

*For greater detail into specific qualitative research methods:*


Acknowledgements

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Evidence-based Policymaking in Singapore: A Policymaker's Toolkit

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