A STEP-BY-STEP GUIDE
Conducting Experiments in Public Policy
# CONTENTS

**How to Use this Guide**  iii

**Overview: 5-Step Approach to Conducting Experiments in Public Policy**  1

## 5-Step Approach

- **Step 1: Analyse Problem**  2
- **Step 2: Problem Statement**  3
- **Step 3: Design Interventions**  4
- **Step 4: Select a Testing Approach**  6
- **Step 5: Evaluate Experiment Outcomes**  9

## Annexes

- **Annex A: Cost Benefit Analysis**  11
- **Annex B: Evaluation Methods**  12
- **Annex C: Randomisation on Excel**  13
- **Annex D: Calculating Sample Size**  14
- **Annex E: t-Test on Excel and Interpreting P-values**  15
- **Annex F: Null Hypothesis and Alternative Hypothesis**  17

## Additional Resources

## References
HOW TO USE THIS GUIDE

The Civil Service College, Singapore, first published “Evidence-based Policymaking in Singapore: A Policymaker’s Toolkit” in 2016. It provided an overview of tools commonly used in evidence-based policymaking, and how they fit into the policy development process.

This step-by-step guide is a deeper dive into the 3 stages within the policy development and evaluation cycle, which are Problem Definition, Solution Development, and Analysis and Recommendation (see Figure 1).

It outlines 5 key steps, which will help you work through these stages more effectively. They include understanding the root of the problem that you are trying to solve, designing potential solutions, and testing whether or not these proposed solutions work in solving the problem.

Throughout the guide, a project collaboration between CSC and the Land Transport Authority, Singapore called “Project Tap-Out”, has been used to illustrate the 5 steps (see Figure 2). This project aimed to nudge commuter habits with Behavioural Insights. The published article on this project and its findings can be found at https://www.csc.gov.sg.

Lastly, we encourage you to explore the resources listed in the final section to elevate your ability to apply the steps outlined in this guide. These resources have been put together based on our experience of commonly-asked questions and challenges, in our discussions with public officers.

We hope you will find this guide a useful complementary resource to your work!
This guide brings you through the process involved in the first 3 steps of the policy development and evaluation cycle (see Figure 1).

5-STEP APPROACH TO CONDUCTING EXPERIMENTS IN PUBLIC POLICY

1. **ANALYSE PROBLEM**
   - Find out the who, what and why of the problem.

2. **PROBLEM STATEMENT**
   - Start your project with a well-defined research question.

3. **DESIGN INTERVENTIONS**
   - Generate possible interventions and select the intervention(s) for your project.

4. **SELECT A TESTING APPROACH**
   - Decide on your testing approach to know what would work and would not work.

5. **EVALUATE EXPERIMENT OUTCOMES**
   - Assess the experiment results, and continue to track and monitor to guide scaling up efforts.

---

**Figure 1: Policy Development and Evaluation Cycle**

Source: Adapted from “Policy Development in Practice: An Overview of the Policy Process” (2007), Civil Service College

**Figure 2: 5-Step Approach to Conducting Experiments in Public Policy**

Note: It is not always a linear step-by-step approach. You may have to revisit some of the steps at times.
STEP 1: ANALYSE PROBLEM

When faced with a policy or intervention review, start by analysing the problem with the following questions:

a) **Who is the target group?** For example, do they belong to a certain demographic or socioeconomic group?

b) **What has been the baseline behaviour (i.e. current behaviour)?** This will help you identify the gap between the current and desired behaviour, which is important in evaluating the effectiveness of a new intervention.

c) **Why is the target group not showing the desired behavioural outcome?** This information will guide the design of interventions that can help address the barriers to desired behaviour.

To answer these questions, you will need to gather **quantitative** and **qualitative data**, which can surface deeper insights to design suitable interventions.

<table>
<thead>
<tr>
<th>QUANTITATIVE DATA</th>
<th>QUALITATIVE DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Administrative data</td>
<td></td>
</tr>
<tr>
<td>o Surveys</td>
<td></td>
</tr>
<tr>
<td>o Interviews</td>
<td></td>
</tr>
<tr>
<td>o Focus Group Discussion (FGD)</td>
<td></td>
</tr>
<tr>
<td>o Pilot or test prototypes with target group to obtain their feedback</td>
<td></td>
</tr>
<tr>
<td>o Ethnographic research: observe target group in their own environment and interview them during the process. E.g. create a journey map that outlines all the touchpoints of the target group in the process.</td>
<td></td>
</tr>
</tbody>
</table>

**Problem Analysis for Project Tap-Out: Nudging Commuter Habits with Behavioural Insights**

**Problem:** Given that Monthly Concession Pass (MCP) holders pay a flat fee for unlimited bus rides within the month, they do not have any incentive to tap out when exiting a public bus. This affects the accuracy of data that is used for bus route planning and bus loading computations.

**Gather Quantitative and Qualitative Data**

- **Who? (Target Group):** This problem was identified among the MCP holders, especially Polytechnic students who had the highest non-tap-out rates among MCP holders.

- **What is the Baseline Behaviour?:** The average tap-out rate of Polytechnic MCP Holders was 41%. In contrast, the average tap-out rate for all MCP holders was 47.4%.

- **Why? (Reason for Baseline Behaviour):** Based on insights from the FGDs, many polytechnic students did not tap out due to peer influence ("my friends told me there was no need to do so.").

When students at the FGDs were told that tapping out helps the government plan bus services better, they seemed to respond positively. This provided an insight for the design of the intervention.
STEP 2: PROBLEM STATEMENT

Start with a Specific Question

Getting insight to what works depends heavily on how well-defined your problem statement is, right from the start.

Check if the problem statement is:

C LEAR
The lack of clarity may result in a myriad of interpretations. For instance, “How is Singapore’s labour market doing?” is framed too broadly and does not pinpoint the exact problem or aspect of the labour market. Is the question interested in employment rates, incentives or discrimination practices?

I IMPACTFUL
The potential impact of the 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.

A ANSWERABLE
Any research question posed should be one that can be answered in a scientific manner. Are there quantitative and/or qualitative data that could be used as evidence to support or falsify what we believe is true?

A Specific Problem Statement

How can we use Behavioural Insights to increase the tap-out rates of Monthly Concession Pass (MCP) Holders on public buses for polytechnic students?

- CLEAR
  The specific problem (tap-out rates) and target group (Polytechnic MCP Holders) are identified.

- IMPACTFUL
  MCP holders are subsidised by full-fare paying commuters. If MCP holders do not tap out, they appear to be travelling longer distances and enjoy a larger amount of fare subsidy. Hence, a higher tap-out rate ensures that the accurate amount of fare subsidy goes to the MCP holders.

- ANSWERABLE
  The effectiveness of the possible interventions can be measured objectively and evaluated by tracking the tap-out rates of Polytechnic MCP holders.

Note: LTA was interested in using BI as an alternative approach to traditional policy instruments like heavy penalties or regulations.

Source: Evidence-based Policymaking in Singapore: A Policymaker’s Toolkit”, Civil Service College 2016
STEP 3: DESIGN INTERVENTIONS

(a) Identify Possible Interventions

Now that you are clear about the root of the problem, generate possible interventions (e.g. nudges) that will address the barriers to desired behaviour identified in Step 1. Going through past research on similar projects is a good starting point to gather ideas.

The EAST framework developed by the UK Behavioural Insights Team (BIT) provides the key principles to designing effective nudges. They need to be:

- Easy (simple and causing least friction);
- Attractive (attracting attention);
- Social (social norms and team spirit);
- Timely (delivered at the right time by the right person).

Depending on the context, nudges need not be designed with all the elements of the EAST framework.

Combine this with other useful tools such as Design Thinking to come up with interventions to test and try out.

Identifying Possible Interventions for Project Tap-Out: Using Behavioural Insights to Increase the Tap-Out Rates of Polytechnic Monthly Concession Pass (MCP) Holders on Public Buses

This project designed the following interventions based on data collected in Step 1.

1) **Information only group**: Students were told why tapping out is important.

2) **Gain group**: Students were told the same information as the information only group, and were paid a **bonus** for tapping out.

3) **Loss group**: Students were told the same information as the information only group, and were charged a **penalty** for not tapping out.

4) **Lottery group**: Students were told the same information as the information only group, and were entered into a **lottery** if they tapped out.

Applying the EAST Framework

**✓ ATTRACTIVE**

Small financial incentives (gain and lottery group) were used to motivate the desired behaviour.

**✓ TIMELY**

The gain, loss and lottery groups received fortnightly emails which included updates on their tap-out behaviour as well as the incentives/lottery outcomes. The email notifications sent were timed this way, so that participants were frequently reminded of their progress and incentives.
**STEP 3: DESIGN INTERVENTIONS**

**(b) Prioritise the Interventions to Test**

Given limited budget and resources, you will not be able to test all the possible interventions. Prioritise the interventions by considering the following questions:

- Based on the data gathered from FGDs and literature reviews, which intervention is most likely to work?

- Will the project generate net benefits? Proceed with testing only if your Cost Benefit Analysis (see Annex A) reveals that the best case scenario would result in a positive net impact. You will have to make projections to estimate the future benefits and costs.

- What is the likelihood of getting approval for the intervention from your stakeholders?

- What kind of support do you need to carry out the experiment?

**(c) Refine Intervention Before Testing**

Before testing, present the first iteration of the intervention(s) to a small group to elicit feedback. This group should be representative of the demographics of the target group (i.e. at least one from each demographic group).

Based on the feedback collected, refine the intervention(s) to maximise the desired impact (see Box 4).

---

**Box 4**

**Prioritising Interventions to Test in Project Tap-Out**

Students at the Focus Group Discussions were shown examples of possible information nudges as seen below. They seemed to respond positively to tapping out when given a simple reason to do so. However, when the students were introduced to a more complex reason, the message was lost on them and did not seem useful as a nudge.

**Examples of Information Messages**

- **Simple Reason:** “It is important that you tap out … This is because by tapping out, you give the government more accurate information about your bus journeys and how crowded buses truly are. With this information, the government can do a better job of improving bus services across Singapore.”

- **Complex Reason:** “I already enjoy a subsidy when I travel on a monthly concession pass. If I do not tap out whenever I take the bus, other public transport users / government may have to further cross-subsidise my bus fares. This is unfair to other public transport users.”

This insight was useful in refining the intervention for the project, which eventually used the simple message as one of the interventions.
STEP 4: SELECT A TESTING APPROACH

(a) Select a Testing Approach

Testing your intervention is important to determine whether it works. Figure 3 summarises the common evaluation methods.

Out of the evaluation methods, Randomised Controlled Trials (RCTs) are considered the golden standard for evaluation because they enable a robust and clean evaluation of how effective a new intervention is. However, RCTs can sometimes be misperceived to be unethical and costly.

Fact #1: RCTs can be ethical.

If you have plans to run a pilot or introduce a policy in phases, why not take an opportunity to run an RCT? Groups that are scheduled to receive the intervention at a later stage can be the control group in the RCT. Running an RCT before full implementation is crucial because we can never be certain if the intervention will be ineffective or harmful. As long as the control group is not made worse off relative to the status quo, RCTs can be ethical.

Fact #2: RCTs need not be expensive.

In cases where complete randomisation is costly and may take a long time to administer, you could explore the following:

• Carry out experiments on interventions where outcome data is already being collected systematically (e.g. administrative and survey data). The cost of administration and running the trial can be lowered.

• Consider randomising at larger units of measurements (e.g. classes in schools, housing blocks) instead of randomising at the individual level.

---

Figure 3: Common Evaluation Methods

<table>
<thead>
<tr>
<th>Methodology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Randomised Controlled Trial (RCT)</td>
<td>Assigns the intervention randomly to individuals (treatment group), and withhold the intervention from the rest (control group). Both groups should be alike statistically in their characteristics. Read Annex C to find out how you can randomise on Excel.</td>
</tr>
<tr>
<td>Regression Discontinuity Design</td>
<td>Makes use of the eligibility criteria in policies to compare those who received the intervention (i.e. meet the criteria) with those who fall outside the cut-off.</td>
</tr>
<tr>
<td>Multiple Linear Regression</td>
<td>Compares impact on the treatment group and control group by adjusting for observable characteristics (e.g. income, gender, age) that might cause differences in outcomes between both groups.</td>
</tr>
<tr>
<td>Differences in Differences</td>
<td>Measures the effect of the intervention by finding the difference between the change in the outcome of the treatment group and the change in the outcome of the control group.</td>
</tr>
<tr>
<td>Pre-Post Test (Least reliable approach)</td>
<td>Measures the change in outcome before and after the intervention; there is no concurrent control group. Use this method if the intervention is the only factor influencing the outcome, but normalisation is necessary to ensure that the results can be easily compared.</td>
</tr>
</tbody>
</table>

Source: Abdul Latif Jameel Poverty Action Lab 2016

Read Annex B for more information on evaluation methods.
STEP 4: SELECT A TESTING APPROACH

When Not to Use RCTs?

RCTS would not work well in these situations:

× When a policy has already been rolled out to a selected group, which could potentially result in self-selection or sampling biases.

× Where there are likely to be interactions between control and treatment groups, which could result in contamination of the experiment.

× When it is not possible to ensure minimal attrition and good compliance of the treatment.

Under such circumstances, the next best alternative would be to explore the use of quasi-experiments (see Figure 3). If you are unable to use more sophisticated quasi-experimental techniques like regression discontinuity design, we encourage you to conduct a simple pre-post test to determine the effectiveness of your intervention.

Selecting a Testing Approach for Project Tap-Out

An RCT was conducted for this project. The data collection was facilitated by the fact that each student had an individual travel card that could be easily tracked in a backend system.

Attrition was not likely as travelling to school daily by bus was not likely to change, and students did not need to put in any extra effort to have their data captured in the system.

There was contamination across the treatment groups, but this was contained by sending students personal email reminders.

The eventual RCT design included 1 control group and 4 treatment arms as mentioned in Box 3 earlier. The control group provided the baseline behaviour to compare the effectiveness of interventions.
**STEP 4: SELECT A TESTING APPROACH**

(b) Key Elements of Running an Evaluation

Now that you have selected an evaluation method, these are the key elements to think about when running an evaluation.

**True Randomisation or Stratification?**

**True randomisation** involves randomly assigning individuals to the treatment or control group. However, if the sample size is not large enough, this could result in certain groups showing a higher likelihood of reacting to the intervention (e.g., a treatment group in a clinical trial has a greater proportion of unhealthy individuals compared to the control group).

**Stratified randomisation** is one way to get around this problem. This method involves these steps:

(i) Construct categories (i.e., strata) according to key factors that could affect the outcome. For example, in the context of encouraging companies to increase their donation amount to charities, sort the companies into two strata (i.e., frequent and infrequent donors).

(ii) In each stratum, randomly assign the participants to the treatment or control group.

The purpose is to ensure that the composition between the control and treatment group is not vastly different. This approach is especially important if your sample size is small given that there is a higher likelihood of imbalances among the groups.

---

**How Large Should the Sample Size Be?**

A large sample size increases the chances of obtaining a statistically significant result. Read Annex D to find out how to calculate the minimum sample size required for your intervention.

**When Is a Small Sample Size Acceptable?**

If there is more homogeneity in the sample (e.g., similar demographics), you would not need such a large sample size given that there would be a smaller variance between the control and treatment group.
Every experiment carries the hope of having statistical significant results. This means that the intervention tested brings about a real change to the treatment group compared to the control group, and this difference in outcome did not occur by chance.

In statistics, null and alternative hypotheses (see Annex F), and p-value are used to check if the results occurred by chance. The general assumptions are:

- Null hypothesis ($H_0$): the results are due to chance
- Alternative hypothesis ($H_a$): the results are not due to chance.
- P-value: the probability that the null hypothesis is true.

Every experiment carries the hope of having statistical significant results. This means that the intervention tested brings about a real change to the treatment group compared to the control group, and this difference in outcome did not occur by chance.

In statistics, null and alternative hypotheses (see Annex F), and p-value are used to check if the results occurred by chance. The general assumptions are:

- Null hypothesis ($H_0$): the results are due to chance
- Alternative hypothesis ($H_a$): the results are not due to chance.
- P-value: the probability that the null hypothesis is true.

**Result is statistically significant if:**

<table>
<thead>
<tr>
<th>P-value</th>
<th>benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 0.05 or 0.1</td>
</tr>
</tbody>
</table>

To find out more about conducting a t-test and interpreting p-values, refer to Annex E.

Read the “Evidence-based Policymaking in Singapore: A Policymaker’s Toolkit” for more on data analytics tools.

**Box 6**

**Assessing the Results for Project Tap-Out**

Key findings from the RCT shed light on what worked and other related aspects such as framing information effectively and habit formation:

- The increase in tap-out rates for the loss group was statistically significant when compared to the information group, but ...
- Providing information alone already resulted in a significant increase in tap-outs compared to the control group.
- The full effect of behaviours were reached and sustained within the first two weeks of the experiment.

**Post-RCT FGD (Qualitative Insights)**

- It was revealed that the action of tapping out was not too onerous and for some students, the information nudge was sufficient to motivate them to tap out. However, the information has to be simple to understand, credible and focused on the tangible benefits (e.g. timelier arrivals of buses).
STEP 5: EVALUATE EXPERIMENT OUTCOMES

(b) Post Experiment: Scale Up or Discontinue?

• Continue tracking and monitoring the results even after the experiment. They provide invaluable insight to habit formation and sustainability. There might be changes in the outcomes in the longer term. Be prepared to continue iterating and refining the intervention.

• Determine whether the results justify scaling up the intervention. Depending on the context, you may need to refine the intervention using the feedback and results obtained after the experiment.

---

Tracking and Monitoring Project Tap-Out Post-Experiment

To determine if the change in behaviour would be sustained, participants’ tap-out rates were tracked for 8 weeks after the experiment.

• It was found that all participants tapped out more than pre-experiment rates, albeit there was some decline.

• However, by week 6 after the experiment ended, the tap-out rate from the information group was higher than the tap-out rates from the monetary intervention groups. This suggests habit formation was more ‘sticky’ and sustained in the information only group.

These insights were useful in understanding how to use information more effectively for similar policy challenges.
ANNEX A: COST BENEFIT ANALYSIS

What Is Cost Benefit Analysis (CBA)?

It is a useful decision-making tool to estimate the net value of a project. Specifically, it assesses the costs and benefits of undertaking the project compared to not undertaking it (see Figure 5). If the benefits generated by the project exceed its opportunity costs, the project is worth pursuing.

CBA also includes going beyond the monetary benefits and costs, and should take into account non-quantifiable benefits and costs that are not reflected in market prices (e.g. benefits of a recreational park).

When Can CBA Be Used?

In this guide, we gave an example of using CBA before the project (see Step 3). However, CBA can also be used after a project to determine the project’s net impact on society. Conducting a CBA after the project has been implemented enables you to use actual data to evaluate the project’s progress. This would be useful in refining the intervention to maximise the benefits.

Source: Evidence-based Policymaking in Singapore: A Policymaker’s Toolkit”, Civil Service College 2016
ANNEX B: EVALUATION METHODS

These are common evaluation methods to test whether the intervention worked.

<table>
<thead>
<tr>
<th>Methodology</th>
<th>Description</th>
<th>When can it be used?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Randomised Controlled Trial (RCT)</td>
<td>Assigns the intervention randomly to individuals (treatment group), and withhold the intervention from the rest (control group). Both groups should be alike statistically in their characteristics; the intervention should be the only difference.</td>
<td>Randomisation is possible and there should not be contamination across the control and treatment groups. The outcome(s) should also be easily measured.</td>
</tr>
<tr>
<td>Regression Discontinuity Design</td>
<td>Makes use of the eligibility criteria in policies to compare those who received the intervention (i.e. meet the criteria) with those who fall outside the cut-off.</td>
<td>Individuals who meet the eligibility criteria and those who fall outside the cut-off should be statistically identical. The cut-off point should not be manipulated to ensure that certain individuals receive the intervention.</td>
</tr>
<tr>
<td>Multiple Linear Regression</td>
<td>Compares impact on those who received the intervention and those who did not receive the intervention by adjusting for observable characteristics (e.g. income, gender, age), which might cause differences in outcomes between both groups.</td>
<td>Characteristics that were excluded from the experiment do not affect the outcome or do not differ between both groups.</td>
</tr>
<tr>
<td>Differences in Differences</td>
<td>Measures the effect of the intervention by finding the difference between the change in the outcome of the treatment group and the change in the outcome of the control group.</td>
<td>Without the intervention, the outcome for participants and non-participants would experience the same identical trajectories during the study period.</td>
</tr>
<tr>
<td>Pre-Post Test (Least reliable approach)</td>
<td>Measures the change in outcome before and after the intervention, where there is no concurrent control group.</td>
<td>Use this method if the intervention is the only factor influencing the outcome, but normalisation is necessary to ensure that the results can be easily compared.</td>
</tr>
</tbody>
</table>

Source: Abdul Latif Jameel Poverty Action Lab 2016
ANNEX C: RANDOMISATION ON EXCEL

Step 1: Enter the full list of participants in Column A.

Step 2: Type =RAND() in cell B2. Copy this cell and paste this down Column B till the end of the list of participants.

Step 3: Select all the values in Column B and right click on these cells. Select COPY. Next, right click on the highlighted cells again and select PASTE VALUES.

Step 4: Type =RANK(B2,B$2:B$16) in cell C2. Copy this cell and paste this down Column C till the end of the list of participants.

Step 5: Click on Cell C1. Next, click the DATA tab and click on SORT FROM A to Z.

Step 6: Assuming you have 1 control group and 1 treatment group, allocate an equal number of participants to the control and treatment group as shown in Column D.
ANNEX D: CALCULATING SAMPLE SIZE

Use the formula below to calculate the minimum sample size \( (n) \) required for your intervention.

\[
 n = \frac{(z + b)^2 \times 2s^2}{d^2}
\]

- \( z \) represents the confidence interval, which indicates the likelihood of drawing a false positive conclusion. A false positive conclusion is when the experiment results happened given that the null hypothesis is true. Conventionally, the standard confidence level is 95% (i.e. \( z = 1.96 \)).
- \( b \) represents the beta, which is the likelihood of a false negative conclusion. A false negative conclusion arises when the null hypothesis is not rejected when it is false. The conventional value for \( b \) is 0.2, which means that there is a 20% chance of a false negative conclusion.
- \( s \) represents the standard deviation, which is a measure of variability in the data set. This value is determined based on the expected variance.
- \( d \) is the expected effect size you would like to see between the 2 groups.

Source: Behavioural Insights Playbook for Channel Shift, Public Sector Service Delivery Council 2017
ANNEX E: T-TEST ON EXCEL AND INTERPRETING P-VALUES

Step 1: Key in the data for your control and treatment group in Column A and B. Click FILE and OPTIONS. Click the Add-Ins category. Under Manage box, select Excel Add-Ins and click Go.

Step 2: In the Add-ins box, check Analysis Toolpak and click OK.

Step 3: Click the DATA tab and then DATA ANALYSIS.

Step 4: Select the type of t-test you need. The common t-test used is the ‘two sample assuming unequal variance’.

Continue to the next page for Steps 5 – 9.
ANNEX E: T-TEST ON EXCEL AND INTERPRETING P-VALUES

Step 5: Select the cells from the start of your data point to the end of the data point in the control group.

Step 6: Select the cells from the start of your data point to the end of the data point in the treatment group.

Step 7: Check the ‘Label’ box. In most studies, we can leave the alpha value (significance level) as 0.05.

Step 8: Select the OUTPUT RANGE option and click on the cell (e.g. D2) you would like to input the t-test results. Next, click OK.

Step 9: Your t-test result is now shown. For a more rigorous evaluation of the results, look at the two-tail values.

• If the t stat is greater than the t critical (two tail), we can reject the null hypothesis. You can ignore the negative sign when comparing the two t-values.

• The results are statistically significant if the p-value is lower than a benchmark (usually 0.05 or 0.1), which means that the probability of the null hypothesis being true is less than 5% or 10%. This is a small enough probability that we can reject the null hypothesis and conclude that the results are not due to chance.

In this case, we cannot reject the null hypothesis given that the t-stat value (1.03) is less than t critical value (2.04).

Note: You might be interested in using a one-tailed test but consider the effect of not knowing the other direction of the effect. Only use a one-tailed test if there is no implication or relevance of knowing the other direction of the effect.
ANNEX F: NULL HYPOTHESIS AND ALTERNATIVE HYPOTHESIS

To run a statistical analysis like a t-test, you need to determine the null and alternative hypothesis of your experiment.

<table>
<thead>
<tr>
<th>Description</th>
<th>Null Hypothesis ($H_0$)</th>
<th>Alternative Hypothesis ($H_a$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The null hypothesis statement states the outcome/fact that you are trying to disprove in your experiment</td>
<td>The alternative hypothesis states the outcome you are trying to prove in the experiment. There are 2 types of alternative hypotheses:</td>
</tr>
<tr>
<td>Example</td>
<td>The average waiting time for public buses in Buona Vista is 15 minutes.</td>
<td>(1) <strong>One-sided</strong>: A hypothesis that is used to determine if the outcome differs from the hypothesised value in a <strong>specific direction</strong>.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2) <strong>Two-sided</strong>: A hypothesis that is used to determine if the outcome is either greater or less than the value under $H_0$. (i.e. direction does not matter).</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>One-sided</strong>: With the introduction of bus lanes, the average waiting time for public buses in Buona Vista is shorter than 15 minutes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Two-sided</strong>: With the introduction of bus lanes, the average waiting time for public buses in Buona Vista is shorter or longer than 15 minutes.</td>
</tr>
</tbody>
</table>
ADDITIONAL RESOURCES

CSC’s WORKSHOPS
- A Public Officer’s Toolkit for Designing and Evaluating Policies and Programmes (PDE10)
- Introduction to Behavioural Insights (EPD10)
- Cost Benefit Analysis for Beginners (CBAFC)
- Cost Benefit Analysis for Practitioners (CBASC)
- Cost-Effectiveness Analysis for Beginners (PKV10)
- STATA for Public Policy (ST101)

RESOURCES ON DEMAND

Publications
- Ethos Issue 17 (Behavioural Insights)
- Ethos Issue 12 (Randomised Controlled Trials in Policymaking)

Other Guides/Toolkits
- Evidence-based Policymaking in Singapore: A Policymaker’s Toolkit
- Public Service Innovation Framework Process Guide (Download the guide from the Workplace Group “[WOG] Public Service Innovation”)

COMMUNITY
- Want to share your agency’s work or hear from others? Click here to join the Behavioural Insights & Design Thinking Community of Practice supported by CSC.
REFERENCES


