

2. Project 1: Design a Single-stage Personnel Survey

Our primary goal is to equip survey researchers with the tools needed to design and weight survey samples. This chapter gives the first of several projects that mirror some of the complexities that are found in applied work. The task here is to determine the allocation of a single-stage sample to strata in a multipurpose survey. As you proceed through the following chapters in Part I, we suggest that you return to this chapter periodically, refresh your memory about the aims of Project 1, and think about how the methods in Chapters 3-6 can be used in the development of the sampling design.

2.1 Specification for the Study

The Verkeer UltraValid (VUV) Corporation is preparing to conduct its bi-annual climate survey of employees in their Survey Division. The climate survey assesses employee satisfaction in various areas such as day-to-day work life, performance evaluations, and benefits. The VUV Senior Council has decided to administer the intranet survey only to a random sample of employees within the Survey Division because of the large increase of staff over the past two years. The council requires a report from your design team that specifies the total number of employees to be selected, as well as their distribution by the important characteristics noted below. The Senior Council wishes the quality and precision of the estimates to be the same or better than the last survey.

Three business units are contained in the Survey Division: (i) the Survey Research Unit (SR) houses both survey statisticians and survey methodologists; (ii) the Computing Research Unit (CR) contains programmers who support analytic and data collection tasks; and (iii) Field Operations (FO) is populated by data collection specialists. The Senior Council would like to assess the climate within and across the units, as well as estimates by the three major salary grades (A1-A3, R1-R5, and M1-3) and by tenure (i.e., number of months employed) within the units. However, the climate survey will only be administered to full- and part-time employees within these units. Temporary employees and contractors are excluded from the survey.

The Senior Council has identified three questions from the survey instrument that are most important to assessing the employee climate at VUV. They are interested in the

percentages of employees answering either “strongly agree” or “agree” to the following questions:

- Q5. Overall, I am satisfied with VUV as an employer at the present time.
- Q12. There is a clear link between my job performance and my pay at VUV.
- Q15. Overall, I think I am paid fairly compared with people in other organizations who hold jobs similar to mine.

Note that the response options will remain the same as in previous years. Namely, a five-level Likert scale: Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree. A sixth response option, Don’t know/Not Applicable, is also available.

Additionally, the Senior Council would like estimates of the average number of training classes attended by the employees in the past 12 months. Relevant classes include lunch-time presentations, formal instructional classes taught at VUV, and semester-long courses taught at the local universities.

2.2 Questions Posed by the Design Team

After receiving the study specifications document from the Senior Council, you convene the design team to discuss the steps required to complete the assigned task. At this initial meeting, the following information was determined from the specifications from the document.

- Data will be collected from employees through a self-administered intranet (i.e., Web site internal to the corporation) questionnaire.
- All full- and part-time employees in the three business units within the Survey Division are eligible for the survey. Employees in other units within VUV, as well as temporary employees and contractors, are ineligible and will be excluded from the sampling frame.
- The sample of participants will be randomly selected from a list of all study-eligible employees provided by the head of VUV’s Human Resources (HR) Department.
- A single-stage stratified sampling design is proposed for the survey because (i) study participants can be selected directly from the HR (list) sampling frame, and (ii) estimates are required for certain groups of employees within VUV.

- The stratifying variables will include *business unit* (SR, CR, and FO), *salary grade* (A1-A3, R1-R5, and M1-M3), and potentially a categorized version of *tenure*.
- The analysis variables used in the allocation work include three proportions, corresponding to each of the identified survey questions, and one quantitative variable. Estimates from the previous climate survey will be calculated by the team from the analysis data file maintained by HR.

Based on their initial discussion, the team submitted the following clarifying questions to the Senior Council and received the responses noted below each.

1. Currently, HR defines tenure as the number of months of employment at VUV. Is there a grouping of tenure years that would be informative to the analysis? For example, analysis of the previous climate survey suggests that responses differ among employees with less than 5 years of employment at VUV in comparison to those with a longer tenure. Answer: *Yes. Dichotomize tenure by less than 5 years and 5 years or greater.*
2. What is the budget for the climate survey? Answer: *The climate survey has sufficient funds to include approximately the same number of Survey Division employees as the last round of the survey.*
3. We are interested in classifying a difference between two estimates as being substantively meaningful. Could you provide use with a meaningful difference? Answer: *A five percentage point difference between any two sets of estimates is a meaningful difference.*
4. Should the proportion answering “strongly agree” or “agree” to the three questions include or exclude the “don’t know/not applicable” response category? Answer: *Exclude.*
5. How precise should individual estimates be for this round of the survey? The quality of the data from prior versions of the climate survey has been measured in terms of estimated coefficients of variation. Answer: *At least as precise as the estimates from the last survey, however precision was defined there.*
6. Are there additional requirements for the design, such as estimates by gender, by number of dependents, etc. in addition to estimates by business unit, business unit by salary grade, and business unit by tenure? Answer: *No.*

2.3 Preliminary Analysis

HR provided the team with two data files. The first file contained information on all current VUV employees such as name, division, business unit, tenure in months, part-time/full-time status, and temporary/permanent employee status. The team eliminated all records for employees currently known to be ineligible for the survey, created a dichotomized version of tenure, and calculated the following population counts for the 18 design strata.

Table 2.1. Distribution of Eligible Employees by Business Unit, Salary Grade, and Tenure: VUV Climate Survey Cycle 8, Survey Division

		Business Unit			Total
Salary Grade	Tenure	SR	CR	FO	
A1-A3	Less than 5 Years	28	86	200	314
	5+ Years	40	42	100	182
R1-R5	Less than 5 Years	96	36	280	412
	5+ Years	230	40	118	388
M1-M3	Less than 5 Years	70	12	40	122
	5+ Years	40	28	40	108
A1-A3	<i>Total</i>	68	128	300	496
R1-R5	<i>Total</i>	326	76	398	800
M1-M3	<i>Total</i>	110	40	80	230
<i>Total</i>	Less than 5 Years	194	134	520	848
	5+ Years	310	110	258	678
<i>Total</i>	<i>Total</i>	504	244	778	1526

Note to reviewers: These are preliminary counts that will be finalized after a solution is Project 1 is developed.

The second file contained one record for each employee selected for the previous climate survey. In addition to the survey status codes (ineligible, eligible respondent, and eligible nonrespondent) and the survey responses, this file included the characteristics noted for the sampling frame with the exclusion of employee name to maintain the confidentiality promise made to all participants. Sample members were classified as ineligible if, for example, they had transferred to another business unit within VUV or retired after the sample was selected but before the survey was administered. The team isolated the Survey Division records, created the sampling strata defined

for the current climate survey design, and created the binary analysis variables with the following specifications for Q5, Q12, and Q15:

Table 2.2. Documentation for Recode of Question Responses to Binary Analysis Variable: VUV Climate Survey Cycle 8, Survey Division

Question Responses	Binary Analysis Variable
1 = Strongly Agree	1 = Strongly Agrees or Agrees
2 = Agree	1 = Strongly Agrees or Agrees
3 = Neutral	0 = Does not (Strongly) Agree
4 = Disagree	0 = Does not (Strongly) Agree
5 = Strongly Disagree	0 = Does not (Strongly) Agree
6 = Don't know/Not Applicable	< missing category >

The total number of Survey Division sample members from the previous climate survey was 500. This number will be used as a maximum sample size in the design task. The following information was tabulated from the Survey Division records.

Table 2.3. Distribution of Response Status by Business Unit, Salary Grade, and Tenure: VUV Climate Survey Cycle 7, Survey Division

Business Unit	Salary Grade	Tenure	Total			Eligible				
			Sample n	Ineligible n	pct	Total n	Respondent n	pct	Nonrespondent n	pct
SR	A1-A3	Less than 5 Years	9	0	0.0%	9	8	88.9%	1	11.1%
		5+ Years	13	0	0.0%	13	11	84.6%	2	15.4%
	R1-R5	Less than 5 Years	31	3	9.7%	28	16	57.1%	12	42.9%
		5+ Years	75	1	1.3%	74	59	79.7%	15	20.3%
	M1-M3	Less than 5 Years	23	0	0.0%	23	21	91.3%	2	8.7%
		5+ Years	13	2	15.4%	11	11	100.0%	0	0.0%
CR	A1-A3	Less than 5 Years	28	2	7.1%	26	8	30.8%	18	69.2%
		5+ Years	14	1	7.1%	13	7	53.8%	6	46.2%
	R1-R5	Less than 5 Years	12	0	0.0%	12	6	50.0%	6	50.0%
		5+ Years	13	0	0.0%	13	7	53.8%	6	46.2%
	M1-M3	Less than 5 Years	4	0	0.0%	4	4	100.0%	0	0.0%
		5+ Years	9	1	11.1%	8	8	100.0%	0	0.0%
FO	A1-A3	Less than 5 Years	66	20	30.3%	46	26	56.5%	20	43.5%
		5+ Years	33	0	0.0%	33	13	39.4%	20	60.6%
	R1-R5	Less than 5 Years	92	2	2.2%	90	60	66.7%	30	33.3%
		5+ Years	39	1	2.6%	38	28	73.7%	10	26.3%
	M1-M3	Less than 5 Years	13	0	0.0%	13	13	100.0%	0	0.0%

	5+ Years	13	2	15.4%	11	11	100.0%	0	0.0%
Total		500	35	7.0%	465	317	68.2%	148	31.8%

**Table 2.4. Estimates for Four Key Questions by Business Unit, Salary Grade, and Tenure:
VUV Climate Survey Cycle 7, Survey Division**

Business Unit	Salary Grade	Tenure	Proportion (Strongly) Agree ^a			Avg Number of Classes ^a	
			Q5	Q12	Q15	Mean	SE ^b
SR	A1-A3	Less than 5 Years	0.93	0.88	0.77	8.2	0.29
		5+ Years	0.75	0.71	0.62	12.4	0.35
	R1-R5	Less than 5 Years	0.84	0.80	0.69	22.3	0.47
		5+ Years	0.80	0.76	0.66	24.0	0.39
	M1-M3	Less than 5 Years	0.91	0.86	0.75	8.3	0.29
		5+ Years	0.95	0.90	0.79	3.6	0.19
CR	A1-A3	Less than 5 Years	0.99	0.94	0.92	7.2	0.27
		5+ Years	0.80	0.76	0.74	10.9	0.33
	R1-R5	Less than 5 Years	0.82	0.78	0.76	19.6	0.44
		5+ Years	0.90	0.86	0.84	21.1	0.46
	M1-M3	Less than 5 Years	0.97	0.92	0.90	7.3	0.27
		5+ Years	0.97	0.92	0.90	3.2	0.18
FO	A1-A3	Less than 5 Years	0.50	0.48	0.45	4.6	0.17
		5+ Years	0.52	0.49	0.47	6.9	0.21
	R1-R5	Less than 5 Years	0.75	0.71	0.68	12.5	0.28
		5+ Years	0.70	0.67	0.63	13.4	0.29
	M1-M3	Less than 5 Years	0.93	0.88	0.84	4.6	0.22
		5+ Years	0.94	0.89	0.85	2.0	0.14

^a Estimates calculated using analysis weights and accounting for the sampling design.

^b Standard error.

Table 2.5. Estimates By Reporting Domain: VUV Climate Survey Cycle 7, Survey Division

Business Unit	Salary Grade	Tenure	Proportion (Strongly) Agree			Average Number of Classes
			Q5	Q12	Q15	
SR			0.84	0.80	0.69	18.1
CR			0.91	0.87	0.85	11.5
FO			0.67	0.63	0.60	8.9
SR	A1-A3		0.82	0.78	0.68	10.7
	R1-R5		0.81	0.77	0.67	23.5
	M1-M3		0.92	0.88	0.76	6.6
CR	A1-A3		0.93	0.88	0.86	8.4
	R1-R5		0.86	0.82	0.80	20.4
	M1-M3		0.97	0.92	0.90	4.4

**Table 2.5. Estimates By Reporting Domain:VUV Climate Survey Cycle 7, Survey Division
(continued)**

Business Unit	Salary Grade	Tenure	Proportion (Strongly) Agree			Average Number of Classes
			Q5	Q12	Q15	
FO	A1-A3		0.51	0.48	0.46	5.4
	R1-R5		0.74	0.70	0.66	12.8
	M1-M3		0.94	0.89	0.84	3.3
SR		Less than 5 Years	0.88	0.83	0.73	15.2
		5+ Years	0.81	0.77	0.67	19.9
CR		Less than 5 Years	0.94	0.90	0.88	10.6
		5+ Years	0.88	0.84	0.82	12.7
FO		Less than 5 Years	0.67	0.63	0.60	8.8
		5+ Years	0.67	0.63	0.60	9.2

**Table 2.6. Target Coefficient of Variation by Reporting Domain:
VUV Climate Survey Cycle 7, Survey Division.**

Reporting Domain	Target CV
Business Unit	0.08
Salary Grade	0.08
Tenure (<5 yrs, 5+ yrs)	0.08
Unit × Salary Grade	0.12
Unit × Tenure	0.12

2.4 Next Steps

A proposed solution to the sampling design task discussed in this chapter will be revealed in Chapter 7. The methods discussed in subsequent chapters in Part I (i.e., Chapters 3-6) will provide you with the tools to solve the allocation problem yourself. We will periodically revisit the VUV design team discussions prior to Chapter 7 to provide insight into their decisions and procedures.