

TECH 646 Analysis of Research in Industry and Technology

PART III

The Sources and Collection of data: Measurement, Measurement Scales, Questionnaires & Instruments, Sampling Ch. 14 Sampling

Lecture note based on the text book and supplemental materials:

Cooper, D.R., & Schindler, P.S., *Business Research Methods* (12th edition), McGraw-Hill/Irwin

Paul I-Hai Lin, Professor of ECET
<http://www.etcs.pfw.edu/~lin>
A Core Course for M.S. In Technology
Purdue University Fort Wayne

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Sampling

Learning Objectives ... Understand

- The two premises on which sampling theory is based.
- The accuracy and precision for measuring sample validity.
- The five questions that must be answered to develop a sampling plan.

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Sampling

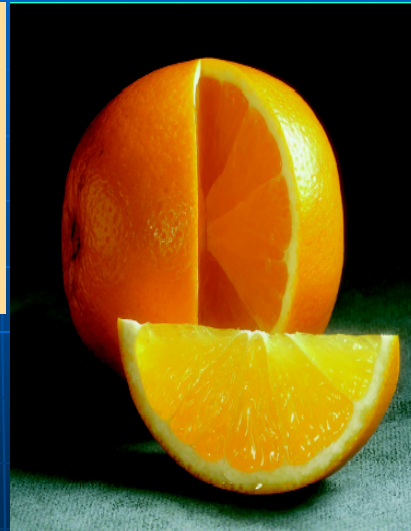
Learning Objectives ... Understand

- The two categories of sampling techniques and the variety of sampling techniques within each category.
- The various sampling techniques and when each is used.

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The Nature of Sampling

- **Population**
- **Population Element**
- **Sampling Frame**
- **Census**
- **Sample**



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Why Sample, Rather Than a Census?



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What is a Sufficiently Large Sample?

- “In recent Gallup ‘Poll on polls,’ . . . When asked about the scientific sampling foundation on which polls are based . . . most said that a survey of 1,500 – 2,000 respondents—a larger than average sample size for national polls—cannot represent the views of all Americans.”

Frank Newport

The Gallup Poll editor in chief
The Gallup Organization

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When is a Census Appropriate?

- **Two conditions**
 - **Feasible**
 - When population is small
 - **Necessary**
 - The elements are quite different from each other
 - The variation within the population is high

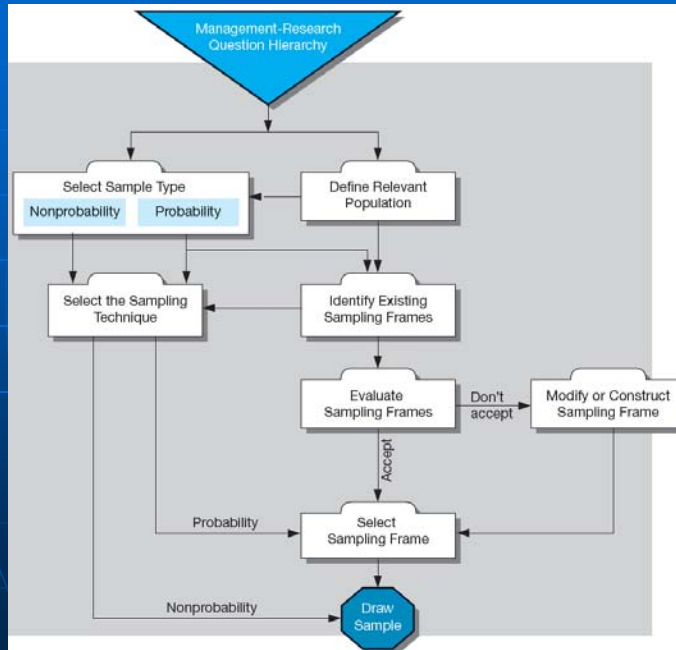
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What is a Valid Sample?

- Validity of samples depends on two considerations
 - **Accuracy**
 - The degree to which bias is absent
 - An accurate (unbiased) sample
 - Systematic variance – sufficiently minimized
 - **Precision**
 - Sampling error (or random sampling error)
 - Reflects the influence of chance in drawing the sampling members
 - Measured by Standard Error of Estimate; a type of Standard Deviation measurement

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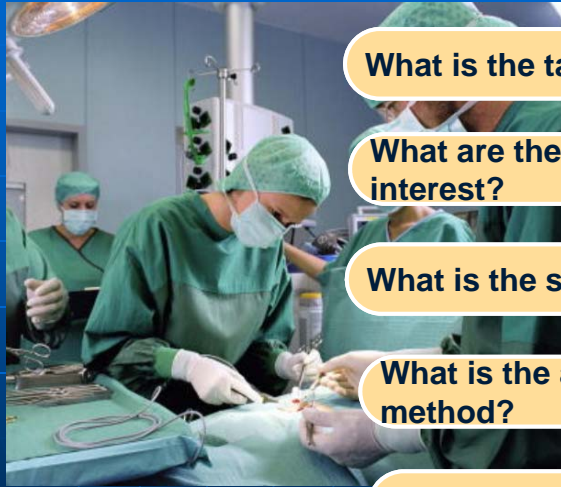
Sampling Design within the Research Process



Types of Sampling Design

Element Selection	Probability	Nonprobability
Unrestricted	Simple Random Sampling	Convenience Sampling
Restricted	Complex Random Sampling <ul style="list-style-type: none"> • Systematic Sampling • Cluster Sampling • Stratified Sampling • Double sampling 	Purposive Sampling <ul style="list-style-type: none"> • Judgment sampling • Quota sampling Snowball Sampling

Steps in Sampling Design



What is the target population?

What are the parameters of interest?

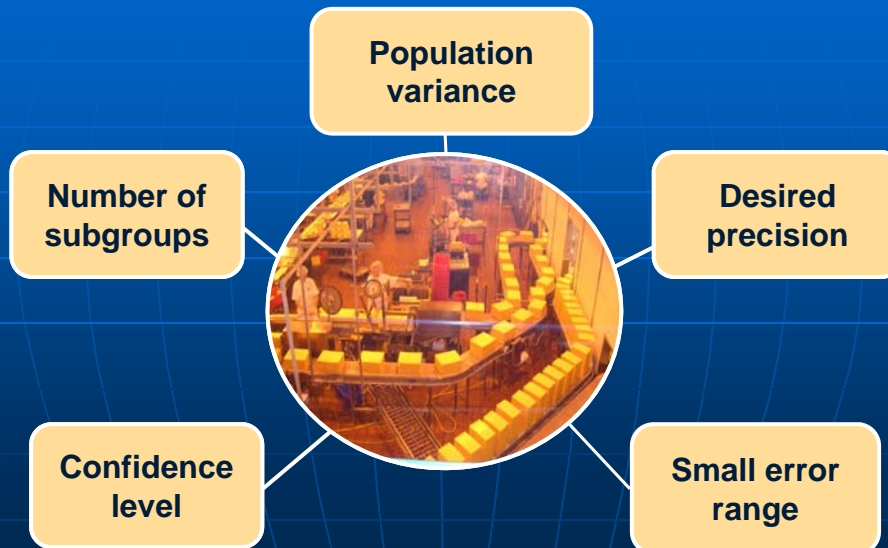
What is the sampling frame?

What is the appropriate sampling method?

What size sample is needed?

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When to Use Larger Sample Sizes?



Simple Random

Advantages

- Easy to implement with random dialing

Disadvantages

- Requires list of population elements
- Time consuming
- Uses larger sample sizes
- Produces larger errors
- High cost

Sample Frame



List of elements in population

Complete and correct

Error rate increases over time

May include elements that must be screened out

International frames most problematic

Example: Population Parameters

- CityBus study
 - Population Parameter of Interests
 - Frequency of ridership within 7 days
 - Data Level & Measurement Scale
 - Ordinal (more than 10 times, 6 to 10 times, 5 or fewer times)
 - Ratio (absolute number of rides)

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Example: Population Parameters (cont.)

- MindWriter study
 - Population Parameter of Interests
 - Perceived **quality of service**
 - Proportion by gender of Laptop **9000 customers with problems**
 - Data Level & Measurement Scale
 - **Interval** (scale of 1 to 5, with 5 being “exceeded expectations”): perceived quality of service
 - **Nominal** (percent female, male): gender portion

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Example: Population Parameters (cont.)

- Metro U study
 - Population Parameter of Interests
 - **Frequency** of eating on or near campus within the last 30 days
 - **Proportion** of students/employees expressing interest in dining club
 - Data Level & Measurement Scale
 - **Ratio** (actual eating experience)
 - **Nominal** (interested, not interested)

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Systematic Sampling

Advantages

- Simple to design
- Easier than simple random
- Easy to determine sampling distribution of mean or proportion

Disadvantages

- Periodicity within population may skew sample and results
- Trends in list may bias results
- Moderate cost

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Stratified Sampling

Advantages

- Control of sample size in strata
- Increased statistical efficiency
- Provides data to represent and analyze subgroups
- Enables use of different methods in strata

Disadvantages

- Increased error if subgroups are selected at different rates
- Especially expensive if strata on population must be created
- High cost

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Cluster Sampling

Advantages

- Provides an unbiased estimate of population parameters if properly done
- Economically more efficient than simple random
- Lowest cost per sample
- Easy to do without list

Disadvantages

- Often lower statistical efficiency due to subgroups being homogeneous rather than heterogeneous
- Moderate cost

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Stratified Sampling vs. Cluster Sampling

Stratified

- Population divided into few subgroups
- Homogeneity within subgroups
- Heterogeneity between subgroups
- Choice of elements from within each subgroup

Cluster

- Population divided into many subgroups
- Heterogeneity within subgroups
- Homogeneity between subgroups
- Random choice of subgroups

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Area Sampling (Cluster Sampling)



Well defined political or geographical boundaries

Low cost

Frequently used

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Double Sampling

- Sequential or Multiphase Sampling

Advantages

- May reduce costs if first stage results in enough data to stratify or cluster the population

Disadvantages

- Increased costs if discriminately used

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Nonprobability Samples



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Nonprobability Sampling Methods

Convenience Sampling

Judgment Sampling

Quota Sampling

Snowball Sampling

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Key Terms

- Area sampling
- Census
- Cluster sampling
- Convenience sampling
- Disproportionate stratified sampling
- Double sampling
- Judgment sampling
- Multiphase sampling
- Nonprobability sampling
- Population
- Population element
- Population parameters
- Population proportion of incidence
- Probability sampling

Key Terms

- Proportionate stratified sampling
- Quota sampling
- Sample statistics
- Sampling
- Sampling error
- Sampling frame
- Sequential sampling
- Simple random sample
- Skip interval
- Snowball sampling
- Stratified random sampling
- Systematic sampling
- Systematic variance

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Snapshot: Ford Reenergized by Changing Sampling Strategy



Dealers control 75% of advertising

Recruited 30 influential dealers

Morpace conducted focus groups

72-hour marathon of questions

Gave voice to important group

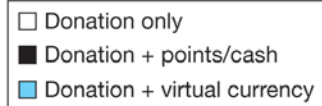
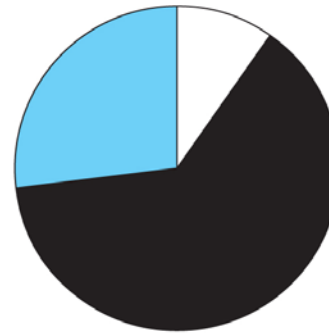
www.ford.com,
www.morpace.com,
www.teamdetroit.com

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Snapshot: Research for Good: Using Charity as an Incentive

- **Incentive Sampling Model**

Research for Good Sample Composition



www.researchforgood.com
www.saysoforgood.com

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PicProfile: Mixed-Access Sampling

Percent of U.S. Households Accessible by Phone Method of Sampling Invitation

Land Line + Cell Phone 55	Cell Phone Only 32
Landline Only 11	Neither Cell nor Landline 2

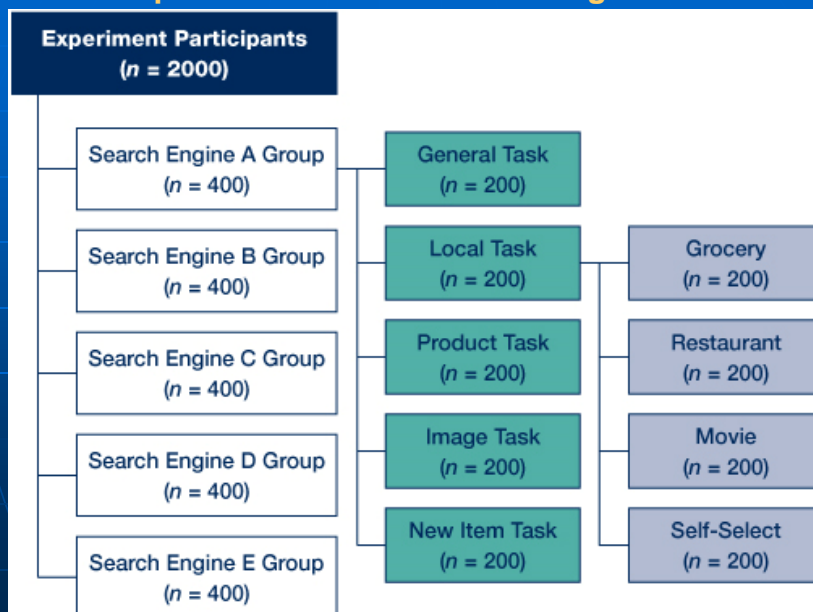
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CloseUp: Keynote Experiment Participant Allocation in Search Engine Test

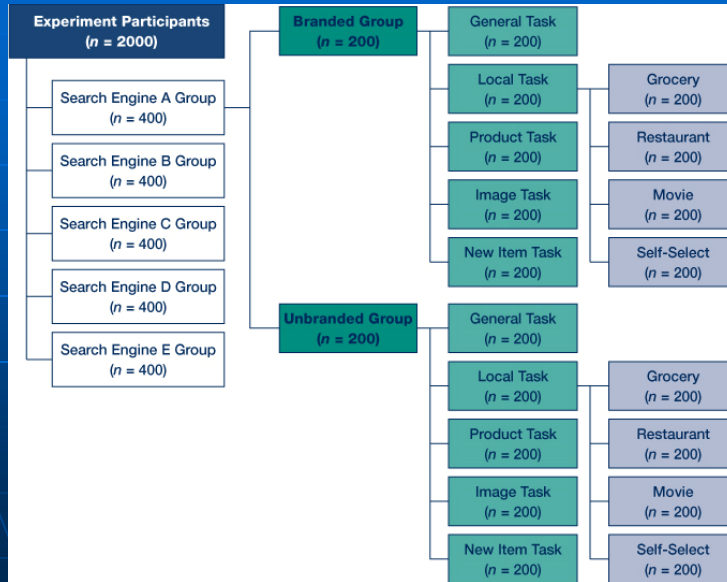
- 2,000 people are randomly drawn from more than 160,000 panel members, and invite to participate via Email.
- Randomly assigned to five groups of 400 each.
- Each group is assigned to a particular search engine.
 - General Task
 - Local Task
 - Product Task
 - Image Task
 - New Item Task

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CloseUp: Keynote Experiment Participant Allocation in Search Engine Test



CloseUp: Keynote Experiment Participant Allocation in Brand Power Test



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Summary

Q&A

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