TECH 646 Analysis of Research in Industry and Technology

Research Design: An Overview

Based on the textbook and supplemental materials from the textbook:

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Chapter 6

Learning Objectives

- The basic stages of research design
- The major descriptors of research design
- The major types of research designs
- The relationships that exist between variables in research design and the steps for evaluating those relationships
What is Research Design

- Research Design Definitions:
  - **Blueprint**: Constitutes the blueprint for the collection, measurement, and analysis of data.
  - **Guide**: Aids the researcher in the allocation of limited resources by posing choices in methodology.
  - **Plan**: Is the plan and structure of investigation so conceived as to obtain answers to research questions.
  - **Framework**: Expresses both the structure of research problem—the framework, organization, or configuration of relationships among variables of a study—and the plan of investigation used to obtain empirical evidence on those relationships.

What is Research Design

- **Research Design**
  - An activity- and time-based **plan**
  - A **plan** always based on the research question.
  - A **guide** for selecting sources and types of information
  - A **framework** for specifying the relationship among study’s variables
  - A **procedure outline** for every research activity
What Tools are Used in Designing Research?

Critical Path Method (CPM) – CPM chart, a project and project Management tool

Critical Path: S-1-3-4-7-8-9-E
Time to Completion: 49 working days

Critical Path Method (CPM) – CPM chart, a project and project Management tool

Project Plan: Gantt chart

MindWriter Project Plan in Gantt chart format
Exhibit 6-1 Design in the Research Process

- Proposal Approved
- Research Design Strategy
  - (type, purpose, time frame, scope, environment)
  - Data Collection Design
  - Sampling Design
  - Instrument Development
  - Data Collection & Preparation

PulsePoint: Research Revelation

- Yankee Group, the global connectivity experts, 
  [http://www.yankeegroup.com/home.do](http://www.yankeegroup.com/home.do)
- 451 Research, Analyzing the Business of Enterprise IT Innovation, 
  [https://451research.com/](https://451research.com/)
- The millions of Americans actively text messaging, according to Yankee Group.

The percent of mobile phone subscribers worldwide who use SMS text messaging.

Descriptors of Research Design

1. Question Crystallization
2. Data Collection Method
3. Experimental Effects
4. Purpose of Study
5. Time Dimension
6. Topical Scope
7. Research Environment
8. Perceptual Awareness
Degree of Research Question Crystallization

**Exploratory Study**
- Loose structure
- Expand understanding
- Provide insight
- Develop hypotheses
- May be qualitative and quantitative techniques
- Rely more heavily on qualitative (meaning, definition, analogy, model, or metaphor characterizing something)

**Formal Study**
- Precise procedures
- Begin with Hypotheses
- Answer Research Questions

Approaches for Exploratory Studies/Investigations

- Participant observation
- Film, photographs
- Case studies
- Expert interviews
- Document analysis
- etc
Desired Outcomes of Exploratory Studies

- An Exploratory Study is completed when the researcher has
  - Established **range and scope** of possible management decisions
  - Established major dimensions of **research tasks**
  - Defined a set of **subsidiary questions** that can guide research design
  - Developed **hypotheses** about possible causes of management dilemma
  - Learned which **hypotheses** can be **safely ignored**
  - Concluded **additional research** is not needed or not feasible

Commonly Used Exploratory Techniques

- **Secondary Data Analysis**
- **Experience Surveys**
- **Focus Groups**
Experience Surveys
(Open-ended Expert Interviews/Key Info Surveys)
Or called Expert Interviews, Key Information Surveys

- What is being done?
- What has been tried in the past with or without success?
- How have things changed?
- Who is involved in the decisions?
- What problems areas can be seen?
- Whom can we count on to assist or participate in the research?

Focus Groups

- Group discussion
- 6-10 participants
- Moderator-led
- 90 minutes-2 hours
Exhibit 6-3 Descriptors of Research Design

1. Question Crystallization
2. Data Collection Method
3. Experimental Effects
4. Purpose of Study
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Descriptors of Research Design

- **Data Collection Method**
  - Monitoring - Inspect the activities of a subject or the nature of some material without attempting to elicit responses from anyone
    - Traffic counts
    - License plates recording (a specific location)
    - A search of library collection
    - An observation of the actions of a group of decision makers
    - WindWriter case: "following a computer through the repair process, documenting each activity ..."
  - Communication Study
Exhibit 6-3 Descriptors of Research Design

Data Collection Method
- Monitoring
- Communication Study
  1. Interview or Telephone Conversation
  2. Self-administered or self-reported instruments sent through the mail, left in convenient locations, or transmitted electronically or by other means
  3. Instruments presented before and/or after a treatment or stimulus conditions in an experiment

Descriptors of Research Design

Time Dimension
- Cross-sectional studies
  - Carry out once and represent a snapshot of one point in time
- Longitudinal studies
  - Repeated over an extended period
  - Can track change over an extended period
Descriptors of Research Design

- The Topical Scope
  - Statistical studies
    - Breadth
    - Population inferences
    - Hypotheses are tested quantitatively
    - Generalization about findings are presented based on sample and the validity of the design
  - Case Studies
    - Collect information from multiple sources
    - Depth
    - Detail
    - Qualitative

Exhibit 6-3 Descriptors of Research Design

- Research Environment
  - Field Conditions - actual environment conditions
  - Lab Conditions - staged or manipulated conditions
  - Simulations
Purpose of Study

- Reporting Study
- Descriptive Study
- Casual-Explanatory Study
- Causal-Predictive Study

The Purpose of Study

- Reporting study
  - A summation of data, often recasting data to achieve a deeper understanding, or
  - Generate statistics for comparison
  - Examples
- Descriptive study
  - Concerned with finding population characteristics
  - WHO, WHAT, WHERE, WHEN, HOW MUCH
- Causal-explanatory study
  - How one variable produces change in another
  - Relationships among variables
- Causal-predictive study
  - Predict an effect on one variable by manipulating another variable while holding all other variables constant
Descriptive Studies

- Descriptions of population characteristics
- Estimates of frequency of characteristics
- Discovery of associations among variables

Exhibit 6-3 Descriptors of Research Design

1. Question
2. Data Collection Method
3. Experimental Effects
4. Purpose of Study
5. Time Dimension
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Descriptors
### Experimental Effects

- **Ex Post Facto Study**
  - After-the-fact report on what happened to the measured variable

- **Experiment**
  - Study involving the manipulation or control of one or more variables to determine the effect on another variable

- Example: WindWriter – planning an Ex Post Facto design

### Ex Post Facto Design

<table>
<thead>
<tr>
<th>Age</th>
<th>Fishing Club Member</th>
<th>Non-Fishing-Club Member</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High Absentee</td>
<td>Low Absentee</td>
</tr>
<tr>
<td>Under 30 years</td>
<td>36</td>
<td>6</td>
</tr>
<tr>
<td>30 to 45</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>45 and over</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Purpose of Study

- **Causal-explanatory study**
  - How one variable produces change in another
  - Relationships among variables

- **Causal-predictive study**
  - Predict an effect on one variable by manipulating another variable while holding all other variables constant

Causation and Experimental Design

- Control/Matching
- Random Assignment
**Exhibit 6-4 Mills Method of Agreement**

- The Method of Agreement, proposed by John Stuart Mill in 19th century states:
  
  "When two or more cases of a given phenomenon have one and only one conditions in common, then that condition may be regarded as the cause (or effect) of the condition."

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**Exhibit 6-4 Mills Method of Agreement**

<table>
<thead>
<tr>
<th>Descriptive Factors</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1 A B C</td>
<td>Z</td>
</tr>
<tr>
<td>No. 2 C D E</td>
<td>Z</td>
</tr>
</tbody>
</table>

Therefore

- We find Z and only Z in every case where we find C, and no other (A, B, D, or E) are found with Z, then we can conclude that C and Z are causally related.
Exhibit 6-5 Mills Method of Difference

“If there are two or more cases, and in one of them observation Z can be made, while in the other it cannot; and if variable C occurs when observation Z is made, and does not occur when observation Z is not made; then it can be asserted that there is a causal relationship between C and Z.”
Causal Studies

- Symmetrical
- Reciprocal
- Asymmetrical

Correlation ≠ Causation
Does not imply a Cause-and-Effect relationship

Three possible relationships between 2 variables
- Symmetrical Relationship
  - Two variables vary together, but not due to changes in the other
- Reciprocal Relationship
  - Mutual influence or reinforce each other
- Asymmetrical Relationship
  - One variable (IV) is responsible for changes in another Dependent Variables
Understanding Casual Relationships

Four Types of Asymmetrical Casual Relationships
Exhibit 6-6 Asymmetrical Casual Relationships

<table>
<thead>
<tr>
<th>Relationship Type</th>
<th>Nature of Relationship</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulus-response</td>
<td>An event or change results in a response from some object.</td>
<td>• A change in work rules leads to a higher level of worker output.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• A change in government economic policy restricts corporate financial decisions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• A price increase results in fewer unit sales.</td>
</tr>
<tr>
<td>Property-disposition</td>
<td>An existing property causes a disposition.</td>
<td>• Age and attitudes about saving.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Gender attitudes toward social issues.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Social class and opinions about taxation.</td>
</tr>
<tr>
<td>Disposition-behavior</td>
<td>A disposition causes a specific behavior.</td>
<td>• Opinions about a brand and its purchase.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Job satisfaction and work output.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Moral values and tax cheating.</td>
</tr>
<tr>
<td>Property-behavior</td>
<td>An existing property causes a specific behavior.</td>
<td>• Stage of the family life cycle and purchases of furniture.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Social class and family savings patterns.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Age and sports participation.</td>
</tr>
</tbody>
</table>

Evidence of Causality

- Covariation between A and B
- Time order of events
- No other possible causes of B
Exhibit 6-3 Descriptors of Research Design

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Participants’ Perceptual Awareness

- No deviation perceived
- Deviations perceived as unrelated
- Deviations perceived as researcher-induced
### Descriptors of Research Design

<table>
<thead>
<tr>
<th>Category</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>The degree to which the research question has been crystallized</td>
<td>• Exploratory study</td>
</tr>
<tr>
<td></td>
<td>• Formal study</td>
</tr>
<tr>
<td>The method of data collection</td>
<td>• Monitoring</td>
</tr>
<tr>
<td></td>
<td>• Communication Study</td>
</tr>
<tr>
<td>The power of the researcher to produce effects in the variables under study</td>
<td>• Experimental</td>
</tr>
<tr>
<td></td>
<td>• Ex post facto</td>
</tr>
<tr>
<td>The purpose of the study</td>
<td>• Reporting</td>
</tr>
<tr>
<td></td>
<td>• Descriptive</td>
</tr>
<tr>
<td></td>
<td>• Causal-Explanatory</td>
</tr>
<tr>
<td></td>
<td>• Causal-Predictive</td>
</tr>
<tr>
<td>The time dimension</td>
<td>• Cross-sectional</td>
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<tr>
<td></td>
<td>• Longitudinal</td>
</tr>
<tr>
<td>The topical scope—breadth and depth—of the study</td>
<td>• Case</td>
</tr>
<tr>
<td></td>
<td>• Statistical study</td>
</tr>
<tr>
<td>The research environment</td>
<td>• Field setting</td>
</tr>
<tr>
<td></td>
<td>• Laboratory research</td>
</tr>
<tr>
<td></td>
<td>• Simulation</td>
</tr>
<tr>
<td>The participants’ perceptual awareness of the research activity</td>
<td>• Actual routine</td>
</tr>
<tr>
<td></td>
<td>• Modified routine</td>
</tr>
</tbody>
</table>