



Wollo University

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Research methods in Animal science (AnSc3073) Cr. Hr (2(2+0))

**By:
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Wollo University College of Agriculture, Department of Animal Science Research methods in Animal science (AnSc3073) Course outline

Chapter 1: Introduction

- 1.1. Concepts of Scientific research
- 1.2. Purpose of studying research methods
- 1.3. What is research?
- 1.4. Research and scientific methods
 - 1.4.1. Knowledge and its sources
 - 1.4.1.1. Authority
 - 1.4.1.2. Tradition
 - 1.4.1.3. Experience
 - 1.4.1.4. Reasoning
 - 1.4.1.4.1. Deductive reasoning
 - 1.4.1.4.2. Inductive reasoning
 - 1.4.1.5. Scientific methods
- 1.5. History of Agricultural research in Ethiopia

Course outline (Continued)

1.6. Types of research

1.6.1. Basic vs. applied research

1.6.2. Quantitative vs. Qualitative research

1.6.3. Conceptual vs. empirical research

1.6.4. Adaptive research

1.6.5. Descriptive research

Chapter 2: Defining Research Problems

2.1. What is the research problem?

2.2. Selection of research problem

2.3. Techniques in selecting a research problem

2.3.1. What is our research?

2.3.2. Why do we want to do research?

2.3.3. Who will be our participants/ respondents?

2.3.4. Where are we going to conduct our research?

2.3.5. When are we going to do our research?

Course outline (Continued)

Chapter 3: Developing a Research Proposal

- 3.1. The purpose of proposals
- 3.2. Structuring a research proposal
- 3.3. Reasons why research proposals fail

Chapter 4: Methods of Research

- 4.1. Descriptive types of research and Experimental type of research
 - 4.1.1. Survey
 - 4.1.1.1. Exploratory (Informal) survey
 - 4.1.1.2. Diagnostic (Formal) survey
 - 4.1.2. Methods of data collection in survey work
- 4.2. Experimental research
 - 4.2.1. Types experiments

Chapter 5: Sampling Techniques

- 5.1. Census and sample survey
- 5.2. The need for sampling
- 5.3. Steps in sampling design

Course outline (Continued)

Chapter 6: Methodologies in Livestock Production Research

- 6.1. Animal production research and animal breeding research
- 6.2. Feeds and feeding research
- 6.3. Animal health research

Chapter 7: Scientific Report Writing

- 7.1. Need of scientific paper
- 7.2. Scientific report writing/ article to published
- 7.3. Parts of scientific report/ publication
- 7.4. Content of Seminar paper
- 7.5. Content of research project proposal

Concept of Scientific Research

- **Research** is a logical and systematic search for new and useful information, further knowledge and understanding on a particular topic/subject.
- It is an investigation of finding solutions to scientific and social problems through **objective and systematic analysis**.
- It is the process by which **science** is produced
- Research is seeking again, or an intensive search with a view of becoming certain.

Purpose of studying research methods

- Understand the importance of the scientific method.
- Explain the steps in conducting research in agriculture.
- To improve the knowledge and skills of the participants for effective proposal and scientific paper writing

What is Research?

- A systematic means of problem solving (Tuckman 1978)
- 5 key characteristics:

What is Research?

1. Systematic – research process
2. Logical – induction/deduction
3. Empirical – evidence based
4. Reductive – generalisation
5. Replicable – methodology.

What is the Purpose Research?

- To discover new facts
- To verify and test important facts
- To analyse an event or process or phenomenon
- To identify the cause and effect relationship
- To develop new scientific tools, concepts and theories to solve and understand scientific and nonscientific problems
- To find solutions to scientific, nonscientific and social problems and
- **To overcome or solve the problems occurring in our every day life.**

Knowledge and its sources

1. Beliefs

- A statement, principle, or doctrine that a person or group accepts as true/
- Faith in God or in a religion's gods

2. Tradition

- A long-established action or pattern of behavior in a community or group of people, often one that has been handed down from generation to generation
- **Accepted unwritten Christian doctrines:** the body of Christian doctrines that are accepted as the teachings of Jesus Christ and the apostles without written evidence

3. Authority

- Gaining knowledge from those viewed as authority figures

Knowledge and its sources

4. Emotions

- Gaining knowledge by close-fitting persistent way to repeated ideas, despite evidence to the contrary

5. Empiricism

- Gaining knowledge through observations of organisms and events in the real world

6. Intuition

- Personal spiritual experience.

7. Rationalism

- Gaining knowledge through logical reasoning

8. Science

- Gaining knowledge through empirical methods and logical reasoning

IN REVIEW

Sources of knowledge	Advantage & Disadvantage
Beliefs	✓ Not empirical or logical
Tradition	✓ Not empirical or logical
Authority	✓ Not empirical or logical; authority figure may not be an expert in the area
Emotions	✓ Not empirical or logical
Empiricism	✓ Empirical but not necessarily logical or systematic
Intuition	✓ Not empirical or logical
Rationalism	✓ Logical but not empirical
Science	✓ The only acceptable way for researchers/ scientists to gain knowledge

History of Agricultural research in Ethiopia

- Agricultural research it was first initiated by IECAMA (Imperial Ethiopian College of Agriculture and Mechanical Arts, now Haramaya University).
- In fact, for more than a decade, the College and its central experiment station at Debre Zeit had a national mandate to carry out and co-ordinate agricultural research.
- In 1966, the Imperial Government transferred the responsibility for agricultural research to the newly established Institute of Agricultural Research (IAR).

History of Agricultural research in Ethiopia

- The IAR was established in February, 1966 with a mandate to formulate the national agricultural research policy, to carry out agricultural research on crops, livestock, natural resources, and related disciplines in various agro-ecological zones of the country, and to coordinate national agricultural research (Negarit Gazeta, 1966).
- Agricultural research underwent significant reform in the 1990s when the new government committed itself to put in place a decentralized political system in the country. More precisely, in 1993, some IAR centers were decentralized to create independent research centers run by the respective regional governments, and became the Regional Agricultural Research Centers) generally under their respective regional bureaus of agriculture.

History of Agr. Res.

- Over the past ten years, seven of the nine regional states of the country, namely the Afar, the Amhara, the Gambella, the Oromia, the Somali, the Southern and the Tigray regions have established their respective **Regional Agricultural Research Institutes (RARIs)**, which have *agricultural research as their central mandate and coordinate research activities of agricultural research centres within their respective regions.*
- In 1997 under Proclamation number 79/1997, EARO established with its objectives are: **to generate, develop and adapt agricultural technologies** that focus on the needs of the overall agricultural development and its beneficiaries; **coordinate research activities of agricultural research centers or higher learning institutes and other related establishments which undertake agricultural research on contractual bases.**

History of Agr. Res.

The Ethiopian National Agricultural Research System (NARS) on 25th October 2005 is made up of five types of institutions:

1. Ethiopian Institute of Agricultural Research (EIAR) (consisting of the different research institutions/Centers)
2. The Regional Agricultural Research Centers/Institutions (RARCs/ RARIs): conduct research that addresses the specific needs of a particular region.
3. Institutions of Higher Education (IHE)
4. Commercial Farm Operators (large commercial farm operators and farm operators in the high-value export sector)
5. Non-governmental Organizations that have a culture of undertaking adaptive/applied research to support the development needs of their intervention areas.

Types of research

Basic vs Applied research: Distinction is normally made between basic and applied research.

- **Basic research** refers to research geared to advancing basic scientific knowledge whereas **applied research** is geared towards solving existing problems.
- Both types of researches are necessary because they are complementary to each other.
- However, in developing countries where research resources are limiting, it appears logical to give more focus to **problem solving research with immediate practical application**. But this does not mean that developing countries should completely shy away from basic research.

Basic Research

- Basic Research is designed to add to an organized body of scientific knowledge and does not necessarily produce results of **immediate practical value**. Such a research is time and cost intensive.
- This research is conducted largely for the enhancement of knowledge, and is research which does not have immediate **commercial potential**.
- The research which is done for human welfare, animal welfare and plant kingdom welfare. It is also called, pure or **fundamental research**.

Applied Scientific Research

- This is about finding out the answer to a specific problem such as ***'Does a new type of medicine really help sick animals?'***
- **Applied research look for answers to specific questions** that help humanity, for example agricultural, medical, environmental research, Such research **generally takes a specific question and tries to find a definitive and comprehensive answer.**
- The purpose of research is about **testing theories**, often **generated by pure science**, and applying them to **real situations**, addressing **more than** just abstract principles.

Adaptive research

- Adaptive research is designed **to adjust new technology to a specific set of environmental conditions.**
- No new scientific principle is to be discovered.
- However, it involves development work related to adaptation and modification of existing technology developed elsewhere to suit the conditions and needs of a given country or area.
- It is the most applied type of research, and involves taking applied research results from elsewhere and adapting them to a specific situation or environment.

Quantitative vs qualitative research

- Research can also be grouped as **quantitative** and **qualitative** research based on the ***attributes to be measured and techniques used for data collection and analysis.***
- **Quantitative research:** based on the quantitative data & the measurement of quantity or amount. It is applicable to phenomenon that can be expressed in terms of quantity.

- **Qualitative research:** Concerned with qualitative phenomenon, i.e., phenomenon relating to or involving quality or kind. The aid is to describe certain aspects of a phenomenon qualitatively. Eg. *Perception of farmers about a given agricultural technology.*
- **NB1:** There is also mixed research method in which the researcher employ the combination of the two techniques.
- **NB2:** the considerable points to classify are- the data nature and its analysis. A phenomenon which is expressed qualitatively can be analyzed quantitatively.

***Example- religious distribution in the classroom
40% Muslim and 60% Christian.***

Empirical research

Empirical research: is data-based research, experimental type of research. Such research is thus characterized by the experimenter's control over the variables under study and his deliberate manipulation of one of them to study its effects.

Research Continuum

Basic

Applied

- Theoretical?
- More Invasive?
- Laboratory Based?
- Tightly Controlled?
- Lacks External Validity?
- Focus on Mechanism
- More Reductionist

Internal Validity?

- Quick Answers?
- Less Invasive?
- Field Based?
- Loosely Controlled?
- Externally Valid?
- Focus on Effect
- Less Reductionist.

Research Continuum

Basic

e.g.

➤ Does Caffeine Ingestion Improve Ca^{2+} binding with troponin?

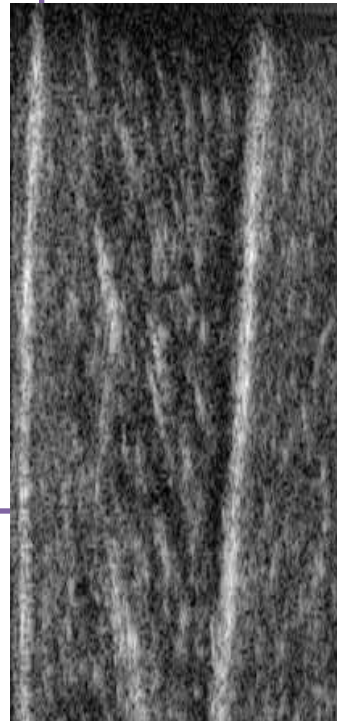
-Would this Facilitate Acto-Myosin Coupling?

-Would this aid contraction?

Applied

e.g.

➤ Does Caffeine Ingestion Improve Athletic Performance?



Research Continuum

Basic

Applied

e.g.

➤ Does Caffeine Ingestion Inhibit Glycogen Phosphorylase?

➤ Does Caffeine Ingestion Increase Lipid Metabolism?

-Would this Spare Endogenous Glycogen?

e.g.

➤ Does Caffeine Ingestion Improve Athletic Performance?

Research Continuum

Basic

Applied

e.g.

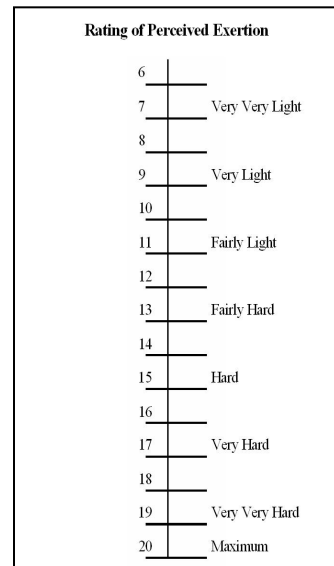
➤ Does Caffeine Ingestion Stimulate the CNS?

- Would this Increase Motor Unit Recruitment

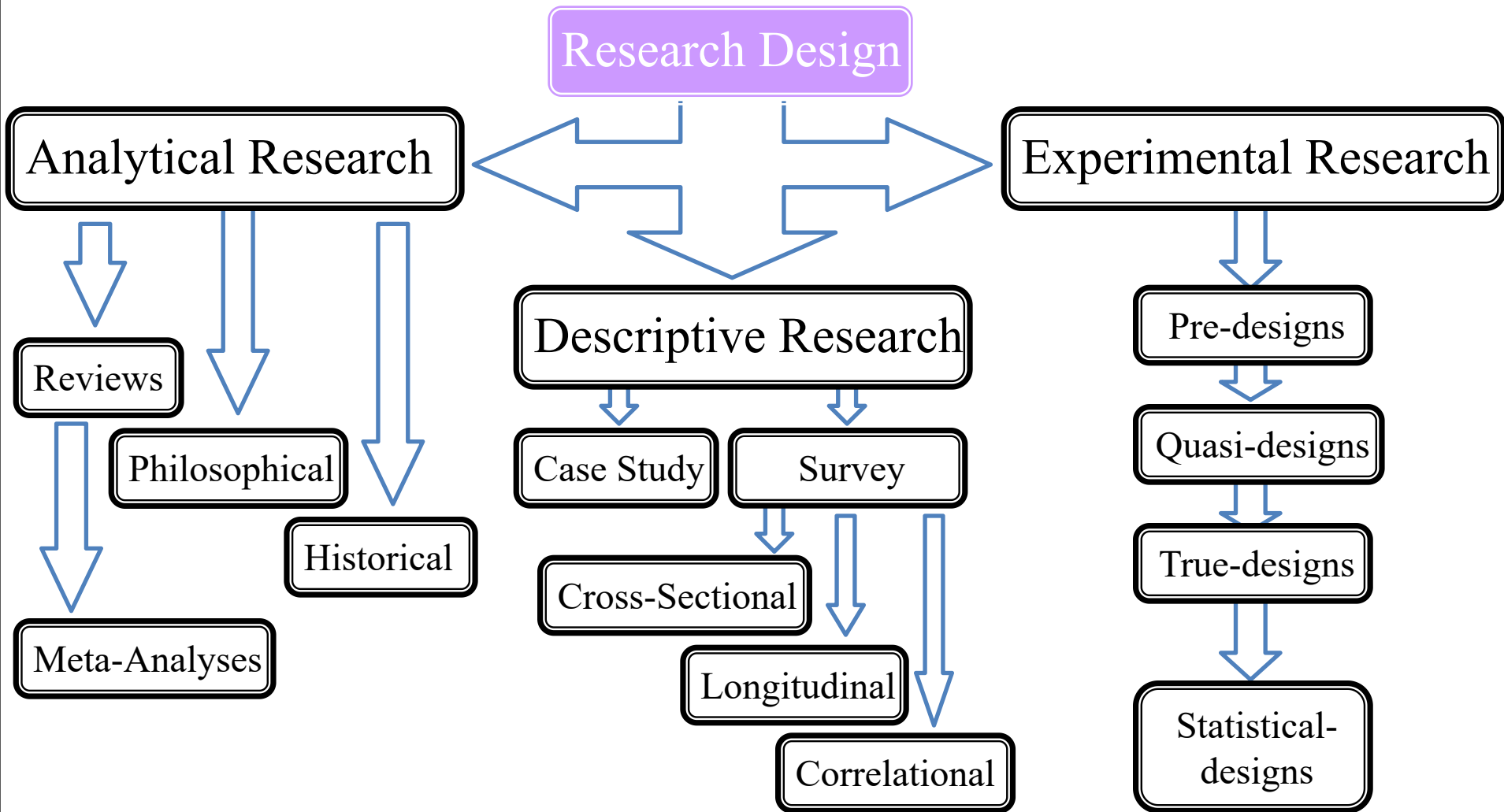
- Would this Reduce Perceived Effort?

e.g.

➤ Does Caffeine Ingestion Improve Athletic Performance?



Research Design Continuum



Analytical Research

- Reviews
 - A critical account of present understanding
 - A meta-analysis (Combination of many trial result) is a quantitative method of review
- Historical Research
 - Accessing both primary (e.g. witnesses) or secondary (e.g. literature) sources to document past events
- Philosophical Research
 - Organising existing evidence into a comprehensive theoretical model

Descriptive Research

- **Case Study**

- Accrual of detailed information from an *individual*



Refutable?

- **Survey**

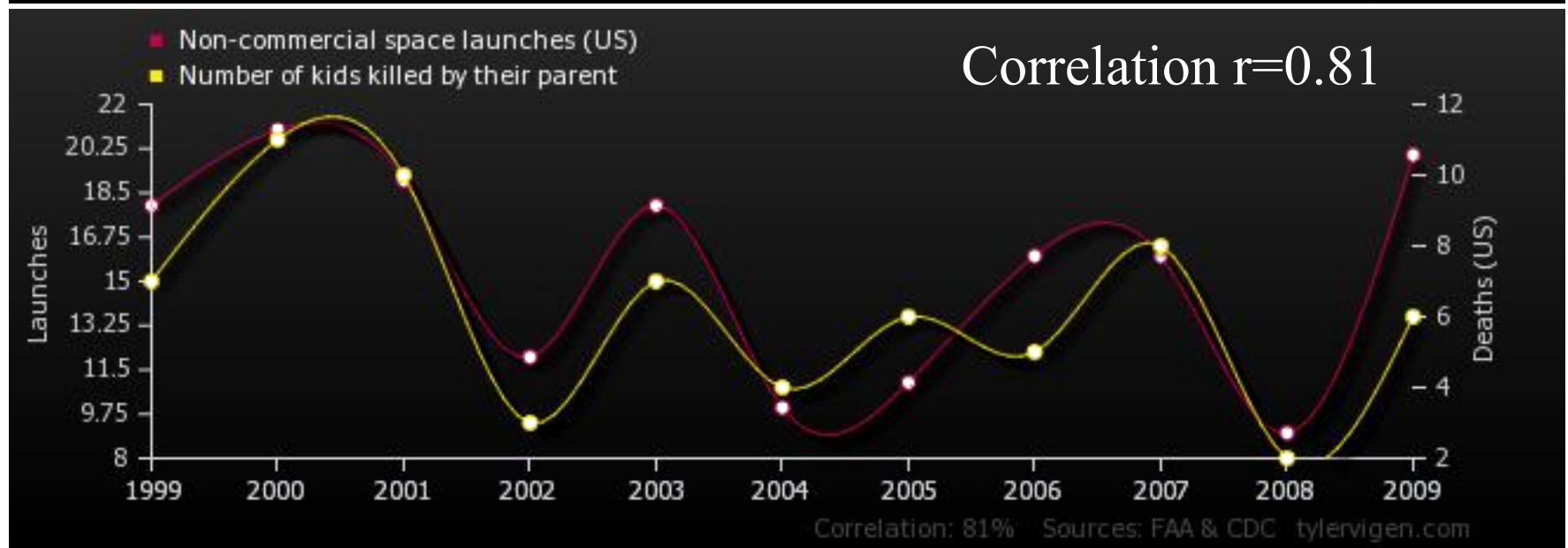
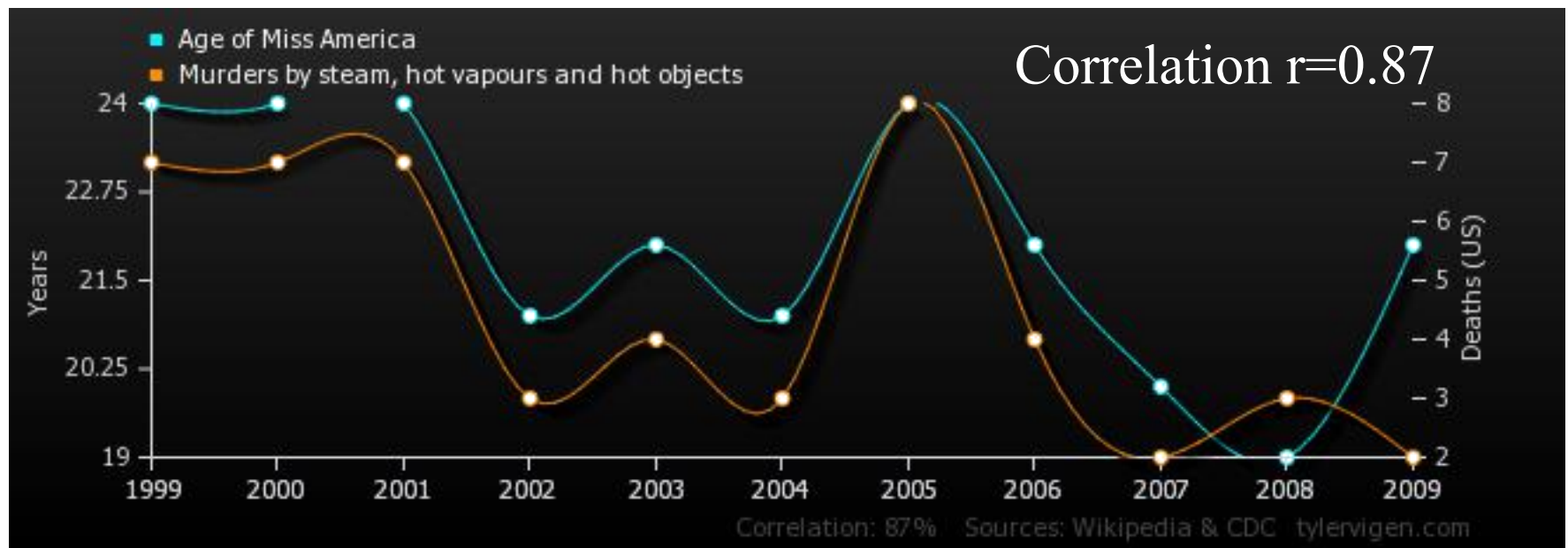
- Cross-sectional: Status of a various groups at a given point in time
- Longitudinal: Status of a given group at various points in time
- Correlational: Relationships between variables

Correlational Evidence

- When variable X increases, variable Y also increases
- So, does X increase Y?
 - or does Y increase X?
- Alternatively, does Z increase both X and Y?



Correlations do not infer Causality
(and *vice versa*?)



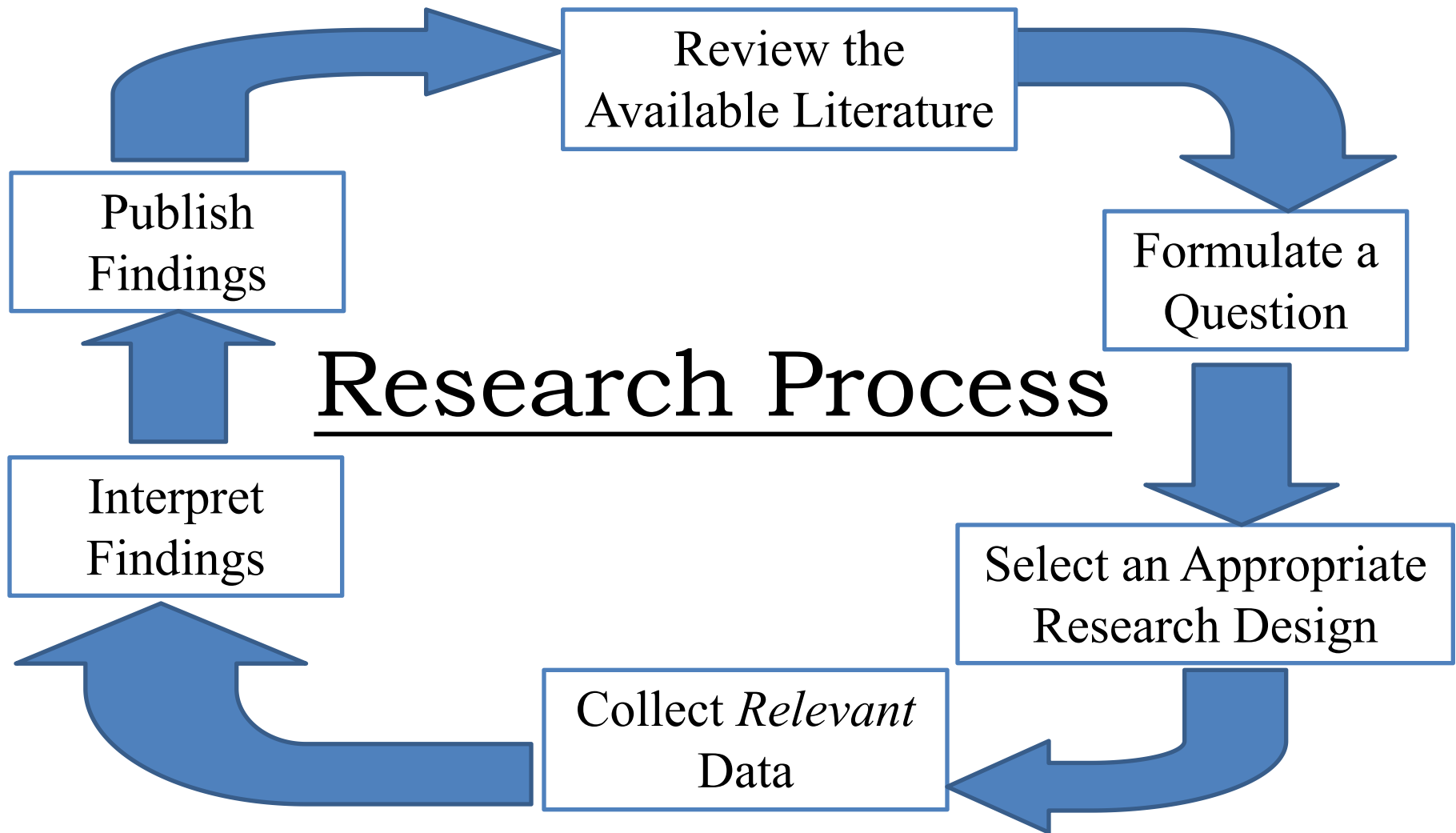
<http://t.co/vWOyN0N1IB>

Experimental Research

- Experimental research involves a direct assessment of how one variable influences another.
- This allows the establishment of causality.
- All extraneous variables must be held constant while a single variable is manipulated and the effect measured.

The Research Process

Research Process consists of series of action or steps necessary to effectively carry out research and the desired sequencing of steps.



The Process of Research

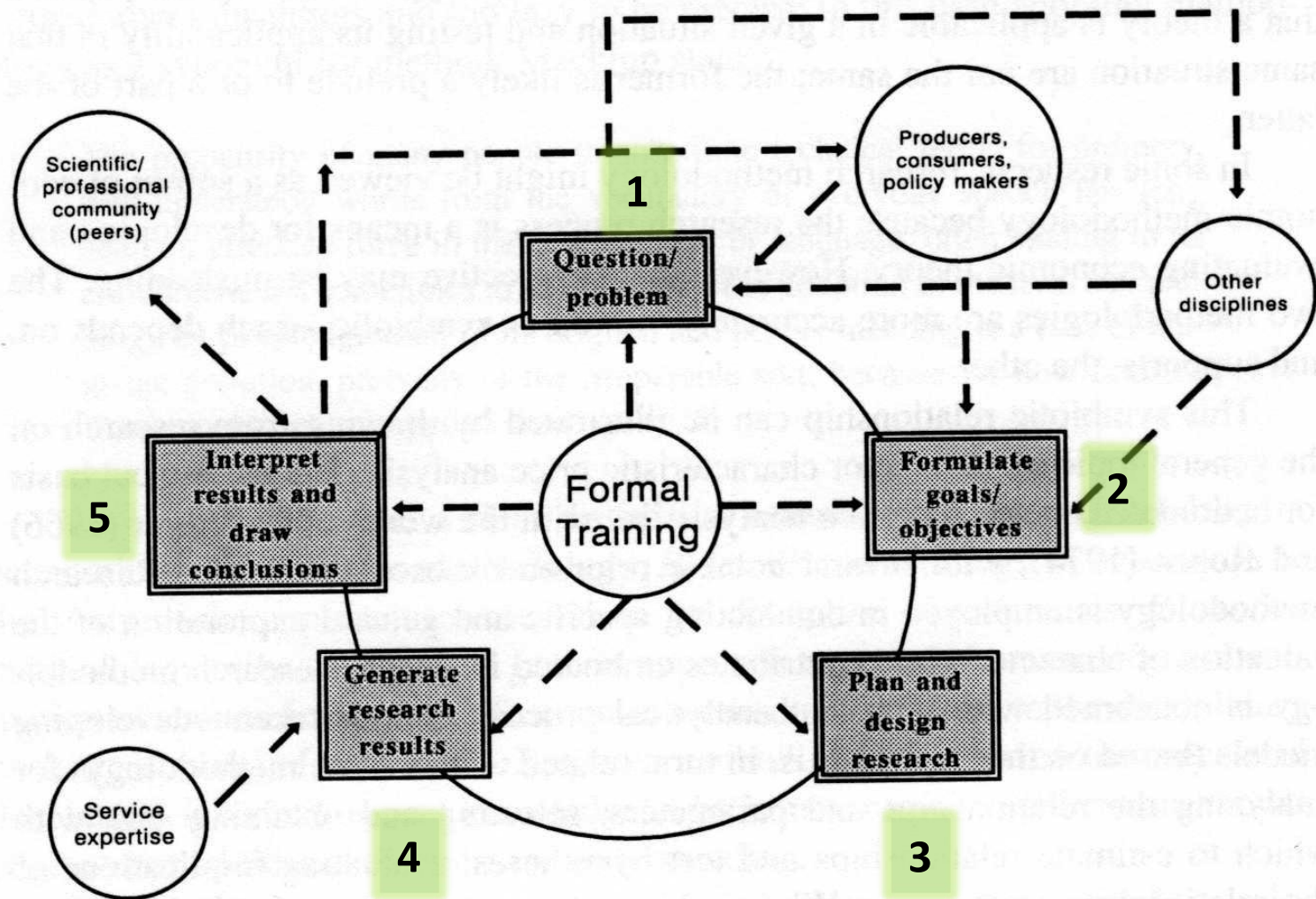


Figure 2.2. Schematic of research process.

“12 Steps of Research”

What are the steps in conducting research?

1. Identify the research question

- Identifying the problem to be investigated.
- Typically, this is best stated in the form of a question.
- The research problem should grow from (researcher's areas of interest and personal experience, Review of Research, Authorities (Opinion Leaders and Funding Sources))

2. Initial review of literature

- The researcher should utilize various sources to gain knowledge about the problem to be tested.

3. Distilling the question to a researchable problem

4. Continued review of literature

5. Formulation of hypothesis

- The next step in the process is to predict the results of the experiment.
- A *hypothesis* is a tentatively accepted theory that explains the relationship between two variables.
- The researcher should utilize background knowledge and experience in this area to formulate the hypothesis.

6. Determining the basic research approach

- Research Design to conduct the experiment.

7. Identifying the population and sample

8. Designing the data collection plan

- Either through experiment, survey (Observation, Interview, Questionnaire)

9. Selecting or developing data collection instruments

- Paper based data collection
- CAPI (Computer Assisted Personal Interview) equipment
- Online data collection

11. Implementing the research plan

- Conduct the research/experiment and collect the data

10. Choosing the method of data analysis:

- Narrative Analysis, ranking methods, by using statistical software programs like (SPSS, SAS, R)

12. Interpreting the results

Chapter 2:

Defining Research Problems

Defining Research problem

- **A problem** is any significant, confusing & challenging situation, real or artificial.
- The solution of which requires serious thinking; a perplexing (Confusing) situation after it has been **translated into a question or series of questions** that help determine the direction of subsequent inquiry (examination/analysis).

Problem Identification

Keep the following things in mind when you identify and write your statement of the problem

- **Outline the general context of the problem area**
- **Highlight key theories, concept& ideas current in this area.**
- **What appear to be some of the underlying assumptions of this area?**
- **Why are this issues identified important?**
- **What needs to be solved?**

Read the subject area to get know the background and to identify unanswered questions or controversies, and/or to identify the most significant issues for further exploration.

How to writing statement of problem

- **Statement of the problem is a very significant aspect of a research.** Researchers and project designers acknowledge that it is here that a researcher ought to demonstrate their power to put up in a very clear terms & convincingly what they concretely want to research on.
- The statement of the problem involves the **demarcation and formulation of the problem in terms** of five 'WHs' questions. i.e. the who/what, where, when, why & how. **It usually includes outlining basic research questions, statement of the hypothesis, identifying general and specific objectives.**

Formulating Research Problem

- Formulation of the problem means **defining the problem precisely. A problem defined a half solved.**
- Is **the first and most important step in the research process.** It is like determination of the destination before undertaking a journey.

Formulating of a problem involves the following:

- ✓ **Statement of the problem in a general way**
- ✓ **Understanding the nature of the problem**
- ✓ **Surveying the availability of its literatures and reading them**
- ✓ **Developing the idea through discussion**
- ✓ **Rephrasing the research problem into working plan**

Importance of stating & Defining the Problem Well

1. **It lays ground for the further:** development of the research objectives, methodology & etc.
2. **Makes easier to find information & reports** of similar studies from which ones own study design can benefit it.
3. Enables the researcher to **systematically point out why the proposed research on the problem should be undertaken & what one hopes to be achieve with the study results.**

**List the Sources of
Research
Problems???**

Problem Sources

1. *Professional experience:* the day to day observation of the incidences in the working place & out of the working environment.
2. *Contact & discussion of the people:* in the research-oriented conferences, seminars or public lectures and active membership in professional associations in various fields.
3. *Inference from Theory:* Application some general principles involved in various theories to specific situation makes an important starting point for research.

Problem Sources

4. Professional literature: consultation of research reports, country master plans, abstracts, country GTP, general references and research guides of research institutions (Strategic plans & Progress reports), important sources of research problem.

5. Technological & Social changes: All technological & Social changes, directly or indirectly, exert an influence in the function of an organization and bring about new problem for research. For example, change may affect policy issues in which case they may arouse interest in investigating new policies among the policy analysts or other concerned personalities.

Criteria to select research Problem

1. *Personal criteria:*

- ✓ Interest,
- ✓ cost, time,
- ✓ training

2. *External criteria:*

- ✓ Newness,
- ✓ significance cooperation

3. *Research related criteria:*

- ✓ Importance
- ✓ Feasibility
- ✓ Interesting
- ✓ Novelty (innovation/ Originality)
- ✓ Immediate application
- ✓ Amenability

Chapter 3:

Developing a Research Proposal

The purpose of proposals

- Any study should have a proper proposal in written form before it is actually carried out
- It is like a blue print of a building plan before the construction starts
- A good research proposal is based on scientific facts and on the art of clear communication
- Writing a formal research proposal should be started by the time one has decided on the topic for the study

Structure of research proposal

- Project Title
- Objective
- Justification
- Introduction
- Review of literature
- Methodology
- Time frame and work schedule
- Personnel needed / available
- Facilities needed / available
- Budget

Objectives

- This is a very important and pivotal section and everything else in the study is centered around it
- The objective of the proposed study should be stated very clearly
- The objective stated should be specific, achievable and measurable
- Too many objectives to be avoided
- Even just one clearly stated relevant objective for a study would be good enough
- If there is more than one objective the objectives can be presented in the appropriate order of importance

Introduction

- The problem proposed to be studied is introduced in this section
- It should help the reader to acquaint with the topic
- Introduction should be short about one or two pages
- The problem should be stated in such a way that it's importance and relevance is realized by any one who reads it

Review of literature

- This section reflects extensive review of literature done by the investigator
- In this section what is already known about the topic is written including the lacunae
- Just quoting the literature verbatim will not serve the purpose
- It is important to make it coherent, relevant and easily readable knowledge
- It helps the investigator to gain good knowledge in that field of inquiry
- It also helps the investigator to have insight on different methodologies that could be applied

Research methodology

- Research methodology is a way to systematically solve the research problem.
- It may be understood as a science of studying how research is done scientifically
- It is necessary for the researcher to know not only the research methods/techniques but also the methodology.
- Research Methodology – the study of the general approach to inquiry in a given field

- Research Method – the specific techniques, tools or procedures applied to achieve a given objective
 - Research methods include regression analysis, mathematical analysis, operations research, surveys, data gathering, etc.
- Researchers not only need to know how to develop certain indices or tests and how to calculate the mean, the mode, the median or the standard deviation or chi-square etc.,
- It is essential to discuss procedures clearly and completely with considerable amount of details

- Study design
- Study population / Sampling specifications
- Sample size needed
- Instrumentation
- Specific procedures

Definition: A study design is a specific plan or protocol for conducting the study, which allows the investigator to translate the conceptual hypothesis into an operational one.

- The study design should be clearly stated
- The study design to be used should be appropriate for achieving the objective of the study

Study population / Sample specifications

- It is important to describe which would be the study population
- How study subjects would be selected, randomization process and other details should be given

Sample size

- It is important to mention in the protocol what would be the minimum sample required and how it is arrived
- Determination of sample size is a bargain-basement between precision and the price (Resources & expenses involved)

Description of process

- Proposal should include the details of all process to be adopted in the study
- How exposures, outcome variables and other variables are going to be measured should be described in detail
- A brief description of how the data will be processed and use of statistical package if any should be given
- What statistical tests of significance would be used?

Time Frame & Work Schedule

- The proposal should include the sequence of tasks to be performed,
- The anticipated length of time required for its completion and the personnel required
- It can be presented in tabular or graphic form

Facilities

- The proposal should also include the important facilities required / available for the study namely computers, laboratories, special equipment etc

Personnel

- Proposal should include who are the primary investigators and co-investigators, their qualifications, research experience etc
- The proposal may also include the Major roles to be taken up by different investigators

Budget

- The budget translates project activities into monetary terms
- It is a statement of how much money will be required to accomplish the various tasks

References

- Whenever you draw upon previously published work, you must acknowledge the source
- Any information not from your experiment and not 'common knowledge' should be recognized by a citation

Chapter 4:

Methods of Research

Survey

Exploratory (Informal) survey

Diagnostic (Formal) survey

- Methods of data collection in survey work

Experimental research

- Types experiments

What is Survey?

❖ A *survey* is a data collection tool used to gather information about individuals or any area of interest to the researcher. A general view, examination, or description of someone or something.

Types of Survey

- There are various types of surveys you can choose from. Basically, the types of surveys are broadly categorized into three:
 - ✓ According to instrumentation
 - Questionnaire and
 - Interview
 - ✓ According to the span of time involved
 - ***Cross-sectional surveys:*** Researcher collects data at a particular time from a sample of respondents across a population.
 - ***Longitudinal surveys:*** gather information at different points in time in order to study changes over extended periods of time
 - ✓ According to their focus and scope
 - ***Census:*** A survey that covers the entire population of interest is referred to as a census.
 - ***Sample surveys:*** In research, however the population is used to refer to the entire group of individuals to whom the findings of a study apply.

Defining Informal survey

- A survey undertaken without a formal sampling procedure, questionnaire and other means that permits statistical analysis.
- Enables rapid collection of agro-ecological and socio-economic information
- It is cost effective

Defining Informal survey...

- If properly executed, it can give:
 - A rich description of life in a farming community
 - An understanding of how farmers, local traders, extension workers and others perceive their condition and make decision;
- Can also give comprehension of local farming system and ecology
- It is the most crucial part in the diagnostic phase
- The process involves visits to the target area by a team of **biological and social scientists**

Objectives of Informal survey

1) To understand the local farming system (what? who? how? why?) in order to identify:

- Priorities and decision criteria,
- Management strategies,
- Resource use pattern,
- Relative importance of enterprise,
- Social and customary constraints to reallocation of resources
- Attributes common to most of the farm population
- Local terminology, unit of measurement

Objectives of Informal survey...

- 2) To identify production constraints or missed opportunities
- 3) To identify new feasible technologies or development option based on management flexibility and constraints
- 4) Provides the **basic information required for the design and execution of formal survey**

Procedure in Informal survey

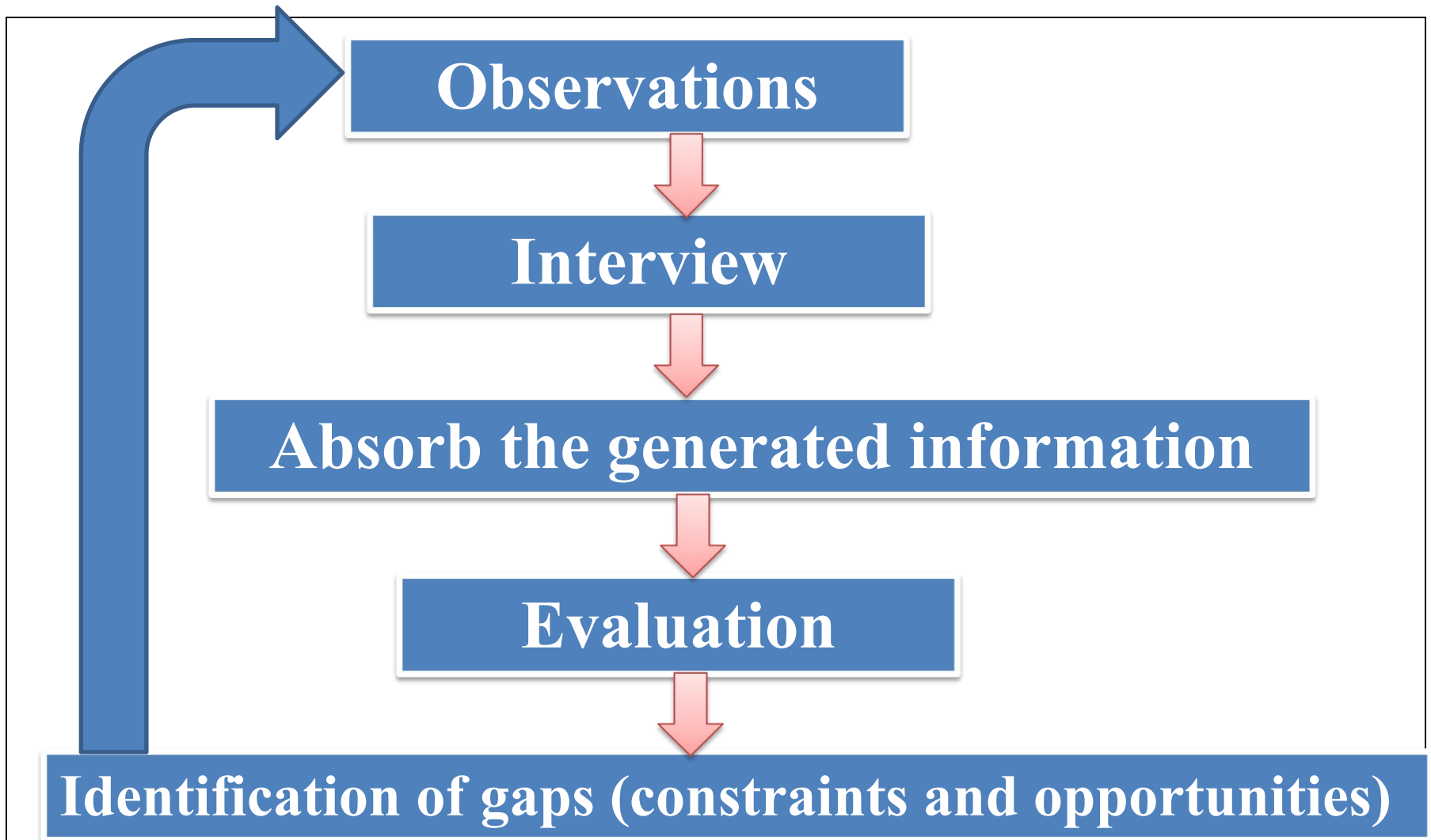
The following steps are commonly followed for an informal survey:

1. Review secondary data and information
2. Decide the composition of survey team members Biophysical scientists (discipline composition)
 - Social scientists
 - Other partners (Experts from MoA and other relevant government offices, Traders, exporters, brokers etc)
3. Allocation of responsibilities among team members **based on area of specialization** (Establishment sub teams)

Procedure in Informal survey...

1. Selection of informal survey methods and tools (RRA, PRA or other) [Presentation1.pptx](#)
2. Preparation of checklists for the different tools by sub teams
3. Logistics (time, location and resource)
4. Data collection (observation, interviewing, etc)
5. brainstorming each day and narration of each day's result with all team members
6. Supplementary data collection based on the result from each day's discussion
7. Compilation of the each day narrated reports and writing the final report

Procedure in Informal survey...



Some notes for consideration during informal survey

- It is important to seriously observe the farmers' circumstances before and while discussing with farmers
- Don't behave in a manner which might create some suspicion
- Be friendly and open, create a relaxed atmosphere
- Introduce yourself according to local customs. Give your name and organization
- Open your conversation with some general remarks. Talk about weather. How his crops are doing, livestock rear?

Some notes for consideration during informal survey

- Discuss with farmers, make notes, compare notes, identify information gaps and fill the gaps identified by subsequent interviews
- Farmer-researcher interaction continues until the researchers are confident that they thoroughly understood those aspects of local farming
- The researchers jointly look for new improved management practices which better exploit the biological potential and at the same time are consistent with the farmers priorities and objectives
- Make sure that the local authorities are fully aware of your visit and farmers are informed about your activities
- Choice of farmers is critical in the informal survey
- Get off the main roads to get representative farmers

Some notes for consideration during informal survey

- **Location:** Whenever possible interviews are carried out in farmers field. If not possible, tour the farm first and then start the dialogue
- **Duration of interview:** don't extend more than 30-45 minutes unless the farmer is in a talkative mood. No need to discuss the entire question guidelines with one farmer
- **Timing:** if possible interview at time of the day convenient to farmers. Do not interfere with farm work. An informal survey takes about 2-3 weeks to complete depending on the size of the target area and also heterogeneity observed
- **Language:** Always interview in farmer's native language

Some notes for consideration during informal survey

- Don't suggest answers or ask biased questions.
- Avoid sensitive questions to start with. When farmers are co-operative and relaxed explore sensitive issues.
- Don't promise anything that your team can't deliver
- Departure: Politely terminate your conversation and make sure that you thank him for his assistance

Formal survey

General objectives of formal survey

1. To verify the information obtained from informal survey
2. To test the hypothesis developed
3. To obtain additional information about the priority problems identified
4. To quantify certain parameters
5. To enhance credibility
6. To test farmers opinion and attitudes about proposed technologies

Steps in Formal survey

1. Questionnaire developpement (Content, format, organisation)
2. Questionnaire translation
3. Sample selection
4. Recruitment and training of enumerators
5. Pre-testing of questionnaire
6. Implementation of field survey
7. Analysis and documentation of survey results
(Interpretation, Identifying and prioritizing problems, Identifying possible interventions)

Questionnaire Development

1. The questionnaire consists of sheets of paper containing a list of questions.
 2. The answers form the data which is analyzed subsequently.
 3. The aim is to collect a standard set of data from a number of farmers.
 4. Questions therefore need to be clear, consistent and unambiguous
- The content of the questionnaire is: -
 1. Specific for each survey
 2. Unique for the target group under consideration
 3. Dictated by the informal survey

Questionnaire Format

1. Title page.

- Date
- Starting time: Ending time:
- Organization carrying out the survey
- Serial number of the questionnaire

2. Each page of questionnaire should be numbered

3. Sequencing of questions

- General to specific
- Simple to complex
- Maintain a logical flow

Questionnaire Format

- Early questions help elaborate later ones
- Opinion questions – specific management problems
- Sensitive questions - yield, income, livestock number

4. Number all questions

5. Group questions and introduce each section

6. Language of the questionnaire: use the common language in that area. Instructions, for interviewers should be set out very clearly and in bold print

Questionnaire Format

Type of questions

- **Factual vs opinion type**
- **‘Factual’** type seek to elicit facts e.g. dates, quantities etc.
- **Opinion** type is less specific which seeks, opinion from the respondent.
- Opinion questions are sometimes called ‘subjective’ questions.

Questionnaire Format

Type of questions

- There are many different types of question you can use to get the information you need. In the main, these fall into **open** and **closed** questions.
- An open question allows the respondent to use their own words to answer, e.g. *“what do you think are the main causes of racism?”*.
- A closed question gives them pre-defined options, e.g., *“which of the following do you think are the main causes of racism: a, b, c, d”*.

Differences Between Opened and Closed Questions

OPENED QUESTIONS	CLOSED QUESTIONS
Elicit “rich” qualitative data.	Elicit quantitative data
Encourage thoughts and freedom of expression.	Can encourage ‘mindless’ replies
May discourage responses from less literate respondents.	Are easy for all literacy levels to respond to.
Take longer to answer and may put some people off.	Are quick to answer and improve your respond rate.
Are more difficult to analyze-responses can be misinterpreted.	Are easy to ‘code’ and analyze

Questionnaire Format

Organization of questions

1. Subject matter to be covered during the interview, must be grouped into sections which focus on a single topic e.g. Land Tenure, Marketing, Input use etc.

2) Sequence of ordering of sections: Each must be placed so as to facilitate the introduction of the succeeding section. The general plan can be: Set according to functional organization. i.e. activities e.g. weeding, fertilizer application.

- Set according to structural organization of the farm i.e. by enterprise.

Questionnaire Format

Organization of questions

3. Ordering of questions in each section. Each new section should have an introduction.

- As far as possible proceed from general to particular; simple to complex.
- Ask about recent events first.
- In question ordering a time, and subject matter sequence should be observed. If there is conflict and both cannot be accommodated then retain the subject matter sequence.
- Useful to request the more familiar information, followed by less familiar data e.g. prices of produce at different location or sale point; ask the price at the local sale point before asking the urban market price.

Questionnaire Format

Organization of questions

4. Types of questions in each section. Make sure that all questions are pertinent to the study and that there are no unnecessary repetitions.

- All touchy questions should be put near the end of the schedule.
- Cross check questions should be used to detect on the spot the accuracy of the information.
- Enough space should be provided for all answer-ii and margins should be left for making remarks or notes.

5. Questionnaire Translation Questionnaires are usually formulated in English

- In actual implementation the questions are asked in the native language spoken by the farmers

Experimental research

What is an
experiment?

What is an experiment?

- It is a **planned investigation** carried out **to discover something** about a particular process or to compare the effects of several conditions on some phenomena.
- It is a **planned enquiry to obtain new facts or to confirm or refute the results of previous experiments.**
- It allows researchers to obtain observations

What is an experiment?

- **Experimentation** - Manipulation of the values (or levels) of one or more **(independent) variables or treatments and observation of the corresponding change in the values of one or more (dependent) variables or responses**

- $$\frac{E \quad x \quad a \quad m \quad p \quad l \quad e}{\text{Effects of level of concentrate supplementation on growth performance of Arsi-Bale and Boer} \times \text{Arsi-Bale male goats consuming low-quality grass hay}}$$

What is an experiment?

- *E x a m p l e*
Effects of level of concentrate supplementation on growth performance of Arsi-Bale and Boer×Arsi-Bale male goats consuming low-quality grass hay
- *List Independent variables?*
- *List Dependent variables?*

Why experiment?

- To determine the *cause(s) of variation in the response*
- To find conditions under which the *optimal* (maximum or minimum) response is achieved
- To *compare responses at different levels of* controllable variables
- To develop a model for *predicting responses*

What characterizes an experiment?

- The treatments to be used
- The experimental units to be used
- The way that treatments levels are assigned to experimental units (or visa-versa)
- The responses that are measured
- According Steel and Torrie (1980) experiments fall roughly into 3 categories (*Preliminary experiment, Critical and Demonstrational experiments*)

Types of experiments

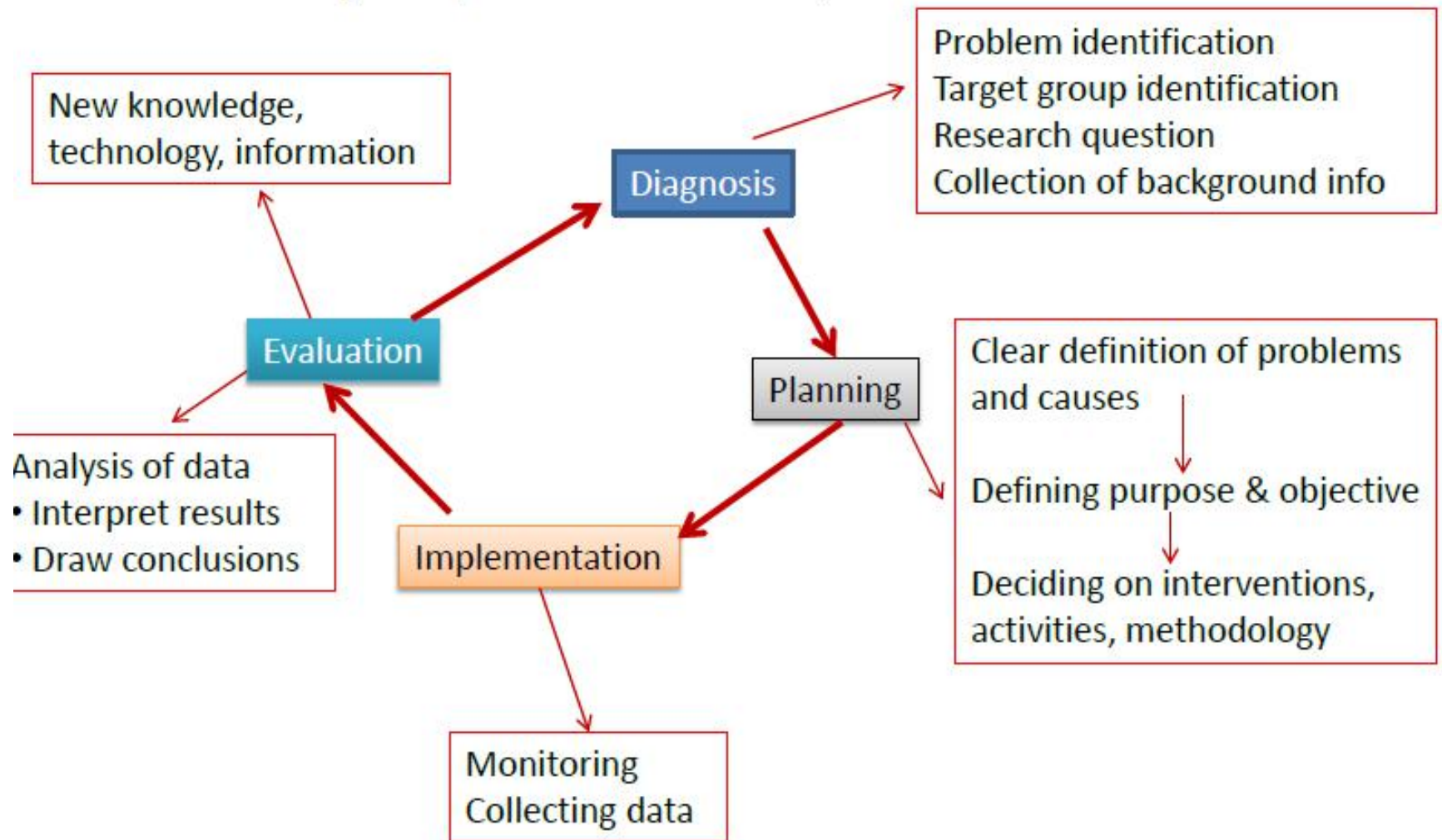
- **Preliminary experiments** – the researcher investigates several treatments in order to get some kind of insight about the responses, which could be useful for future research. Since it is a sort of pilot experiment, most treatments appear only once (not replicated).
- **Critical experiment** – the researcher compares responses to different treatments using adequate number of observations, which enable him/her to draw sound inferences.
- **Demonstrational experiments** – are those undertaken by extension practitioners to compare treatments with a standard

Planning of experimental research

- Identification of research problem
- Choice of factors and levels (treatments)
- Selection of response variables
- Choice of experimental design
- Determination of replication and randomization procedures
- Performing the experiment
- Data analysis and interpretation; conclusions and recommendations
- Write up, publication and dissemination

Experimental Research

Project cycle and research process



Chapter 5: Sampling Techniques

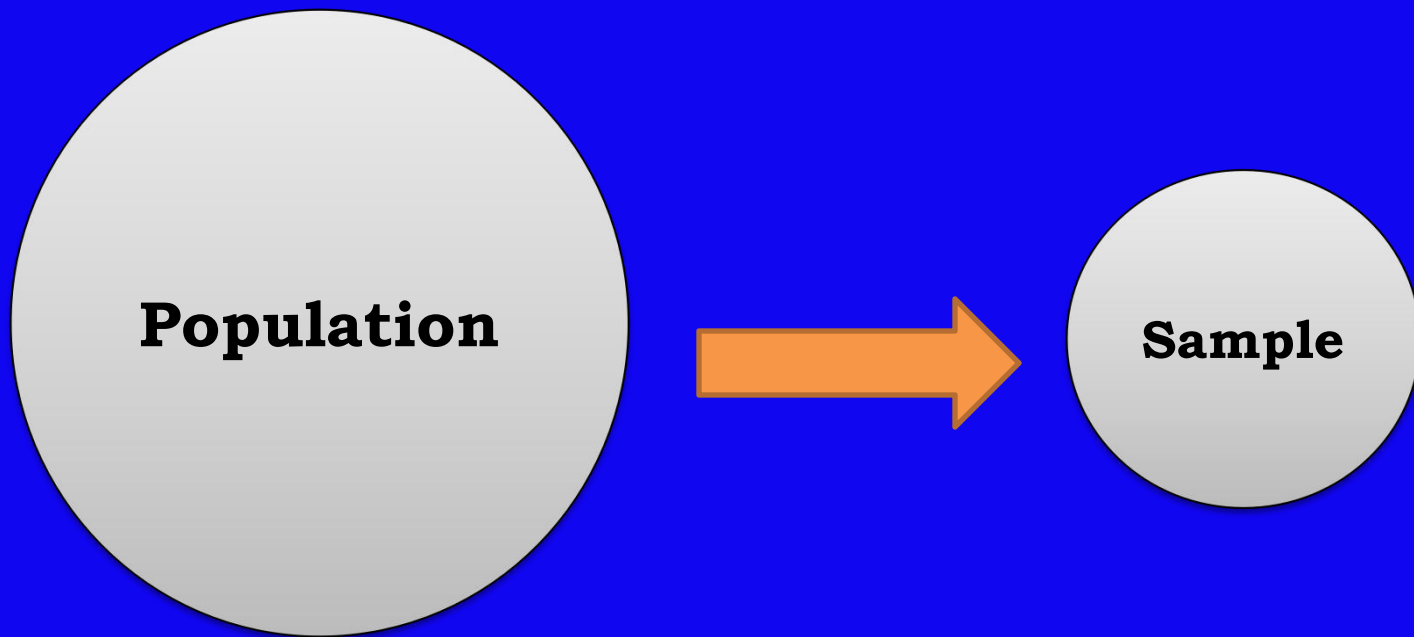
What is Census survey?

What is Sample survey?

Census and Sample survey

- A **census** is an attempt to gather information about every individual in a population.
- The use of **Census survey** is usually employed for statistical research, population count or business marketing purposes.
- A **Sample survey** is a part of the population that is actually examined in order to represent the whole.

It is a part of fraction of population
selected on some basis.



Sample Survey

- The process of collecting information by selecting some **true representative** to get **information** is known as Sample survey.
- It is generally beyond simple enumeration
- It up on the **scope and objective** of the study

Advantage of Census Over Sample Survey?

Advantage of Census survey

- Increase confidence interval
- Everyone is invited
- Maximum chance of identifying of negative feedback
- More accurate

Advantage of Sample Survey Over Census?

Advantage of Sample survey

- Less time Consuming
- Feasible and Manageable
- Cost effective
- Within the scope and objective of the study

Why sample?

Why sample?

- The population of interest is usually too large to attempt to survey all of its members.
- To select **a subset of the population**, which has the same characteristics of the **whole group** or is **representative of the population**
- A carefully chosen sample can be used to **represent the population**.
 - The **sample reflects** the **characteristics of the population** from which it is drawn.

Sampling

- If the characteristics of all Members of a Population were exactly the **same** there is **no need for sampling**, we just **select one individual**
- However, the **diversity** in biological, social and economic environment requires **sampling several individuals**
- Minimizes the survey cost
- Enables to make some **valid generalization** about the **target group**

Key Terms in Sampling

- ❖ **Population:** all the elements from which the sample is actually selected. The population to be sampled is defined by the purpose of the study.
- ❖ **Sample:** a representative portion of the population under study
- ❖ **Sampling Units:** units on which information is to be collected
- ❖ **Sampling Frame:** a list or map or other acceptable description of the objects under study or population from which sampling units are selected.

Key Terms in Sampling

- ❖ **Cluster:** a collection of units.
- ❖ **Strata:** when a population is divided up into homogeneous group with respect to the characteristics to be measured and a sample is selected from each group, the groups are called strata.

Sampling Methods

- There are two major methods of sampling

1. Probability Samples

2. Non-probability samples

Probability Sampling: Risk of sampling bias is minimized

- Possible to draw inferences for the population with **levels of confidence** that could be **estimated statistically**

Major types of probability sampling:

- ◆ Simple Random Sample
- ◆ Stratified Random Sample
- ◆ Cluster sampling
- ◆ Systematic sampling



Simple Random Sample

- Every subset of a specified size (n) from the population (N) has an equal chance of being selected.

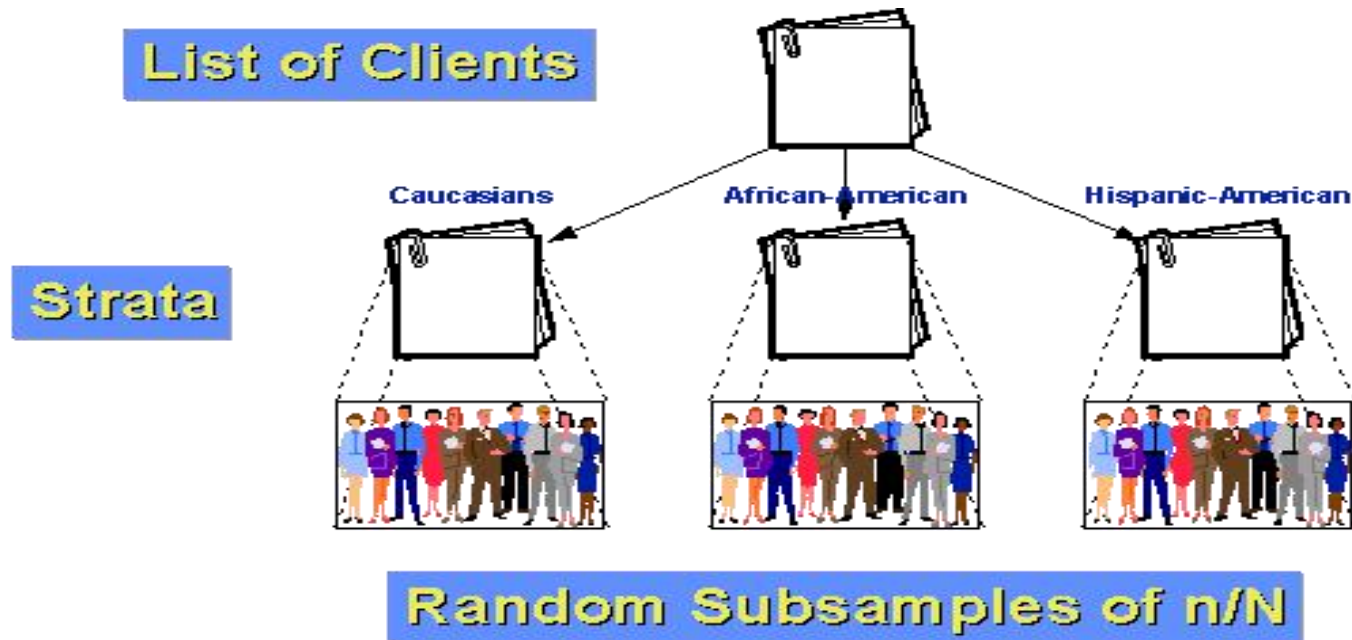


*A subset of the
population.*

- *Selected by using chance or random numbers*

Stratified Random Sample

- The population is **divided into two or more groups called strata**, according to some **criterion**, such as geographic location, grade level, age, or income, and subsamples are randomly selected from each strata.



Stratified Sampling

- Results in a more representative sample

Women

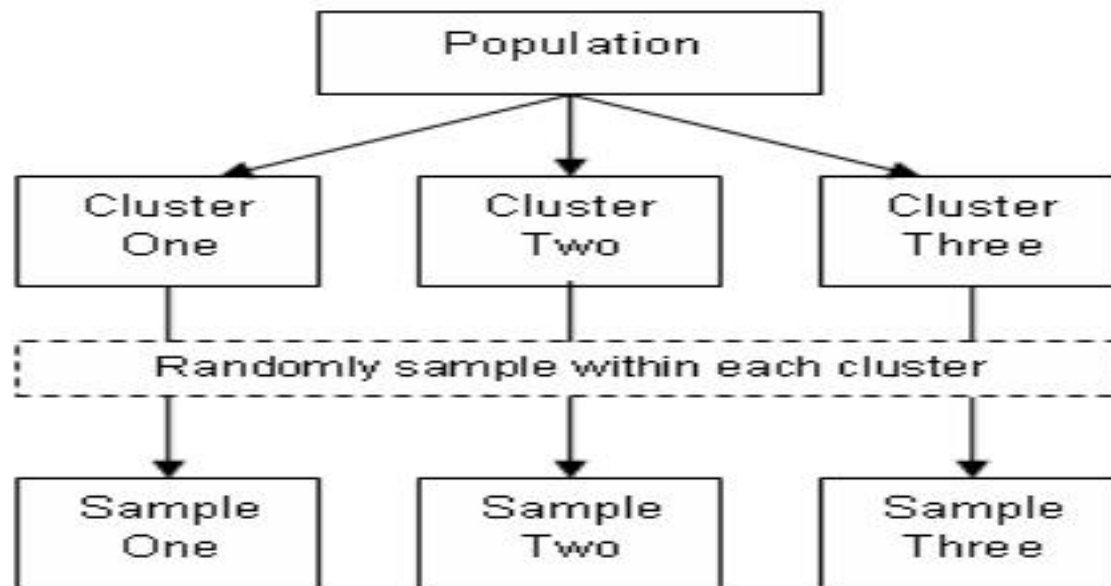


Men



Cluster Sample

- The **population** is divided into **subgroups (clusters)** like families. A **simple random sample** is taken of the subgroups and then all members of the cluster selected are surveyed.



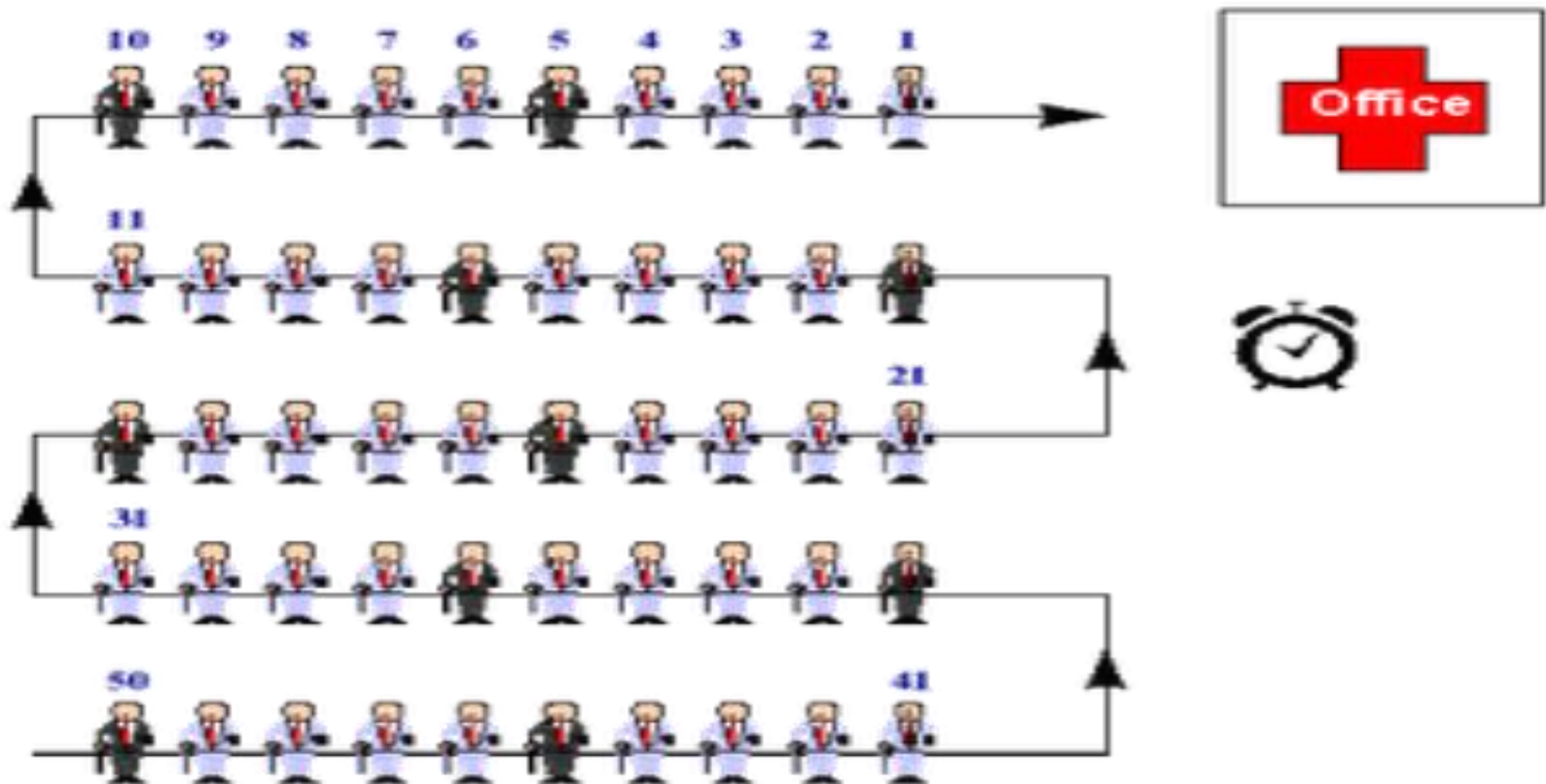
Systematic Sampling

- Select a random starting point and then select every k^{th} subject in the population
- Simple to use so it is used often



Systematic Sample

- Every k th member (for example: every 10th person) is selected from a list of all population members.



Major types of Non-probability sampling includes:

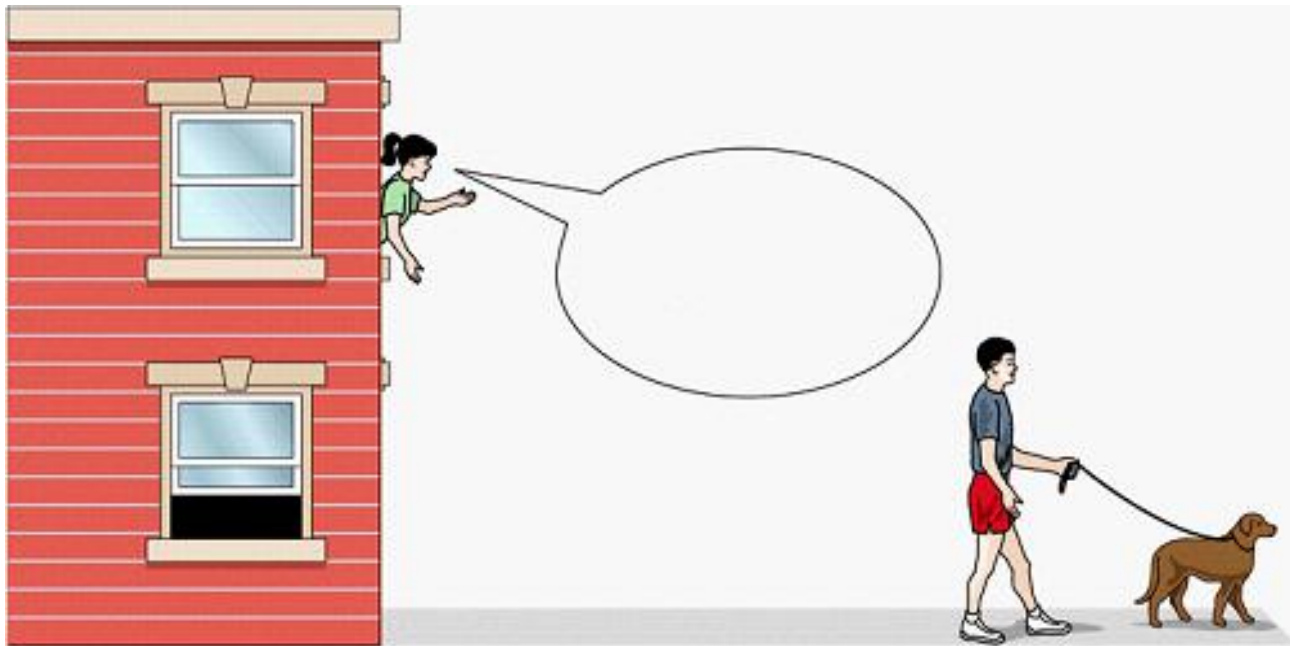
- Convenience sampling
- Judgment sampling
- Quota sampling
- Snowball sampling

Convenience Sampling

- **Convenience sampling** is used in exploratory research where the researcher is interested in getting an inexpensive approximation.
- The sample is selected because they are convenient.
- It is a **nonprobability method**.
 - Often used **during preliminary research** efforts to get an **estimate without incurring the cost or time** required to select a random sample

Convenience Sample

- Selection of whichever individuals are easiest to reach
- It is done at the “convenience” of the researcher



Judgment Sampling

- **J u d g m e n t s a m p l i n g** is a common nonprobability method.
- The sample is selected based **upon judgment**.
 - an extension of convenience sampling
- When using this method, the researcher must be confident that the chosen sample is truly representative of the **entire population**.

Quota Sampling

- Quota sampling is the **nonprobability equivalent of stratified sampling**.
 - First identify the **stratums** and their **proportions** as they are **represented in the population**
 - Then **convenience or judgment sampling** is used **to select the required number** of subjects from each stratum.

Snowball Sampling

- **Snowball sampling** is a special nonprobability method used when the **desired sample characteristic is rare**.
- It may be extremely **difficult or cost prohibitive** to locate respondents in these situations.
- This technique relies on referrals from initial subjects to generate **additional subjects**.
- It lowers search costs; however, it introduces bias because the technique itself reduces the likelihood that the sample will represent a good cross section from the population.

Major practical steps in Sampling

- Define the sampling unit
- Obtaining the sampling frame
- Determining the sampling method
- Determining the sample size
- Sampling Method

Chapter 6:

Methodologies in Livestock Production and Health Research

Three main study types in Livestock Production and Health:

- (I) Descriptive studies,*
- (II) Analytical studies, and*
- (III) Experimental studies*

I. Descriptive studies

- *Are those undertaken without a specific hypothesis*
- *Describe a new disease/ feeds in order to characterize it, quantify its frequency, & determine how it varies in relation to individual/ species, place & time*

1. Case report

- *Describes some sequence of events that may suggest previously unsuspected causal relationships*

2. Cases series

- *Case report shows that **something can happen once**, a case series shows that it can happen repeatedly*
- *Identifies **common features among multiple cases and describes patterns of variability among them***

3. *Descriptive studies based on 'Rates'*

- Quantify the burden of **disease on a population using incidence, prevalence, mortality or other measures of disease frequency**
- Can be a rich source of hypotheses that lead later to analytic studies
- ***Incidence:*** *Measures how frequently initially susceptible individuals become disease cases as they are observed over time*
- ***Prevalence:*** *Is the number of cases of a given disease or attribute that exists in a population at a specified time*
- ***Mortality:*** *Death rate*

II. Analytical/ observational studies- *are undertaken to test a hypothesis that certain exposure causes an outcome (not mere association)*

— e.g. does cigarette smoking cause lung cancer?

1. Cross-sectional study

- Individuals randomly sampled from a population at a point in time*
- Examined for the presence of disease & their status with regard to the presence or absence of specified risk factors*
- Commonly involve surveys to collect data*

- *A random sample of individuals from a population is taken at one point in time, and examined for the presence of disease and their status with regard to other risk factors*
- *Advantages - are relatively quick to conduct & moderately costly,*
- *Disadvantages - cannot provide information on the incidence of disease in a population — only an estimate of prevalence - Difficult to investigate cause and effect relationships*

2. Cohort study

- *Compare disease incidence over time between groups (cohorts) that are found to differ on their exposure to a factor of interest*
- *Can be distinguished as either prospective or retrospective*

Prospective cohort

- *begins with selection of two groups of non-diseased: one exposed to a factor postulated to cause a disease & the other unexposed*
- *followed over time & change in disease status is recorded during the study period*

Retrospective cohort

- *Starts when all of the disease cases have been identified*
- *History of each study participant is carefully evaluated for evidence of exposure to the agent under investigation*
- ***Advantages** - provide estimates of the absolute incidence of disease in exposed & non-exposed individuals - well-suited for studying rare exposures*
- ***Disadvantages** - require a long follow-up period - in case of rare diseases large groups are necessary - often quite expensive to run*

3. Case-control study

- Animals with the disease (cases) & without the disease (controls) are selected & their status with regard to potential risk factors is examined*
- Allow the investigation of preliminary causal hypotheses & are quick & of relatively low cost*

Advantages - *efficient method for studying rare diseases - because subjects have experienced the outcome of interest at the start of the study, are quick to run & cheaper*

Disadvantages - *reliant on the quality of past records or recollection of study participants - very difficult to ensure an unbiased selection of the control group, representativeness of sample selection process is difficult to guarantee*

III. Experimental studies

- Experimental research involves a direct assessment of how one variable influences another.
- This allows the establishment of causality/connection/interconnections.
- All extraneous variables must be held constant while a single variable is manipulated and the effect measured.
- Common experimental designs in animal Nutrition research
 - CRD,RCBD, Latin Square, Split plot
 - Factorial arrangement of treatments
 - Each design has its own models for data analysis

Chapter 7: Scientific Report Writing

What is scientific paper?

- A published manuscript with original contributions to extending human knowledge in some field.
- A published manuscript with original contributions to extending human knowledge in some field A scientific paper is a written and published report describing original research results (Robert A. Day).

Why publish scientific papers?

- Science and scientific research are essential components in the process of development
- Agricultural research is critical to the progress of countries that are agriculturally based
- Research results have to be disseminated to be put to some use and have a clear impact. Otherwise they will be ineffective.

Without publication, science is dead (Gerard Piel)

Why Writing is Important

As a University staff, As researcher, As experts,

- If you are not researching, you are not writing!
- If you are not writing, you are not reading!
- If you are not reading, you are not teaching!

“Reading makes a full man; conference a ready man;
but writing an exact man”Francis Bacon

"In science, the credit goes to the man who convinces
the world, not to the man to whom the idea first
occurs." ---Sir William Osler

What do you want from your published scientific paper?

- Paper should reach a wide audience
- To report scientific findings
- Recognition at work (Enhance reputation, Help promotion prospects,
- Help career prospects)
- Peer recognition
- Recognition by a wider (global) audience

Characteristics of scientific writing

Good scientific writing is:

- Clear - it avoids unnecessary detail;
- Simple - it uses direct language, avoiding vague or complicated sentences.
- Avoid Technical terms and jargons – they are used only when they are necessary for accuracy
- Neutral - it avoids making assumptions (Everyone knows that ...) and unproven statements (It can never be proved that ...).
- It presents how and where data were collected and supports its conclusions with evidence;

Characteristics of scientific writing

Good scientific writing is:

- Structured logically - ideas and processes are expressed in a logical order.
- The text is divided into sections with clear headings;
- Accurate - it avoids vague and ambiguous language such as about, approximately, almost;
- Objective - statements and ideas are supported by appropriate evidence that demonstrates how conclusions have been drawn as well as acknowledging the work of others.

What are you writing and who for?

- Research papers
 - refereed journals
 - conference papers
- Research/technical reports
 - Press, Policy papers, technical reports for funding agency.
- MSc / PhD Theses
- Read successful examples – *critically*.

Audiences

- ✿ Researchers within a specific field of research
- ✿ Researchers with a peripheral interest in a field of research
- ✿ Research managers
- ✿ Extension agents
- ✿ University teachers
- ✿ Students
- ✿ Policy makers
- ✿ Donors
- ✿ NGOs engaged in development work
- ✿ Technicians
- ✿ Private sector (commercial interests)
- ✿ Farmers

Avenues of communication of research results

- Journal articles
 - Research articles
 - Research reviews
 - Short communications and research notes
- Conference papers and posters
- Theses and dissertations
- Books and book chapters
- Annual reports
- Working papers
- Newsletters
- Project proposals and reports
- Websites
- Blogs and discussion groups

Elements of the Scientific Paper

1. Title
 2. ABSTRACT
 3. Introduction (Background and justification)
 4. Materials and methods
 5. Results
 6. DISCUSSION
 7. Conclusion
 8. Acknowledgements
 9. References
 10. Appendices
- 
- sometimes combined

Title

- Make the title specific:
 - A good title should describe the contents of the paper in the fewest possible words.
 - Keep to 15 words or less (some journals < 25 words).

Compare

- A study of the effect of forage legume supplementation on milk yield and body condition of dairy cows
- Effect of forage legume supplementation on milk yield and body condition of dairy cows
- It should make people want to read the paper (use high impact words early in the title).

ABSTRACT

- An abstract is a very concise statement of the major elements of your research project (i.e. the purpose, methods, findings and conclusion of the research).
- An abstract is a condensed version of a full scientific paper. It is a *brief account of what was done in a nutshell or provides a very short summary of the work*
- The abstract should be the best part of the paper!
- It is the most frequently read part of an article after the title.
- Always written last

Content of an Abstract

- Define purpose and scope of study, ie, the question
- Describe materials and methods used
- Summarize the results
- State the conclusions and their implications

A good Abstract

- Is short—usually 200 to 250 words, usually in one paragraph (some require < 150 words)
- Stands on its own, is complete in itself (it may be published separately in secondary sources)
- Reports the objective of the research, its extent or scope, the methods used, the main results including any newly observed facts, the principal conclusions and their significance
- Contains all the key words by which the paper should be indexed. These are sometimes listed separately below the abstract

Characteristics of the Abstract

- Accurate, coherent, and readable
- Concise, specific, and selective
- Self-contained, ie, stand alone
- Complete and internally consistent
- No references
- No tables or figures
- No or few abbreviations (must be defined)
- Conclusions should be based on data/info presented within the abstract

Four C's of Abstract Writing

- **Complete** — it covers the major parts of the paper
- **Concise** — it contains no excess wordiness or unnecessary information.
- **Clear** — it is readable, well organized, and not too jargon-laden.
- **Cohesive** — it flows smoothly between the parts.

Introduction

- Clearly state the:
 - Problem being investigated
 - Background that explains the problem
 - Reasons for conducting the research
- Summarize relevant research to provide context
- State how your work differs from published work
- Identify the questions you are answering
- Explain what other findings, if any, you are challenging or extending
- Briefly describe the experiment, hypothesis(es), research question(s); general experimental design or method

A good introduction is relatively short.

- **In general it**
 - tells why the author carried out the research
 - gives the background the reader needs to understand and judge the paper
- **Specifically it**
 - defines the nature and extent of the problems studied
 - relates the research to previous work—perhaps by a brief review of the literature, but only that which is clearly relevant to the problem
 - explains the objectives and method of investigation, including, if necessary, the reason why a particular method was chosen

Materials and methods - includes

- The design of the experiment
- Any plants or animals involved, with exact descriptions (genus, species, strain, cultivar, line, etc.)
- The materials used, with exact technical specifications and quantities and their source or method of preparation.
- The methods followed, usually in chronological order, described with as much precision and detail as necessary.
- Standard methods need only be mentioned, or may be described by reference to the literature as long as it is readily available.
- Modifications of standard techniques should be described.
- If the method is new it should be described in detail.
- Methods of interpreting data should be described as well as methods of finding data

Materials and methods - Watch that—

- All quantities are in standard units
- All chemicals are so specifically identified that another scientist can match them exactly in repeating the work
- Every step is stated, including the number of replications
- All techniques are described, at least by name if they are standard or in as much detail as needed if you have modified a standard technique or devised a new one
- Nothing is included that does not relate to the results that follow
- There are no unnecessary details that may confuse the reader

Results section

- Present only relevant data
 - data that serve as evidence to accept or reject hypothesis
- Use the best presentation method to display data
 - Table or Figure? (**A picture can be worth 500 words!**)
 - Highlights the most important information prominently

Results ...

- Big picture on results
- Impartial presentation
- Representative data
- Presentation of results must be
 - clear, accurate, and concise
 - do not duplicate data already shown earlier *e.g.*, using a table and figure to display the same data

Use of figures and tables

Tables are most useful for

- Recording data (raw or processed data)
- Explaining calculations or showing components of calculated data
- Showing the actual data values and their precision
- Allowing multiple comparisons between elements in many directions

Figures are most useful for

- showing an overall trend or “picture”;
- comprehension of the story through “shape” rather than the actual numbers; and
- allowing simple comparisons between only a few elements.

Choosing between table and figure

Parameters	Treatments (genotypes)			SEM
	Afar	LES	SES	
IW (Kg)	15.4 ^b	17.8 ^a	17.3 ^a	0.23
FW (Kg)	22.67 ^c	27.01 ^a	25.16 ^b	0.44
ADG(g/kg)	60.55 ^c	76.80 ^a	65.55 ^b	1.81
WC (Kg)	7.26 ^c	9.21 ^a	7.86 ^b	0.21
FCE (gDM/ gADG)	9.95 ^a	8.97 ^{ab}	9.61 ^a	0.17

Table : Live Weight Gain and Feed Conversion Efficiency of three Ethiopian Goat Breeds fed improved grass hay and supplemented with concentrate mix during the feeding trial.

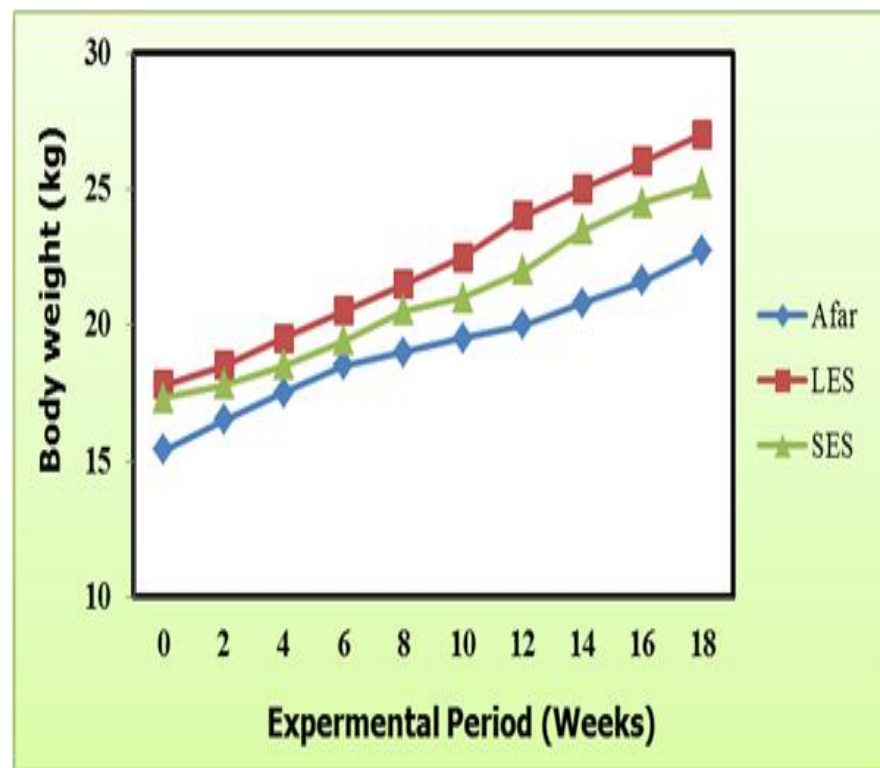


Figure: Trends in body weight of Afar, Long eared Somali (LES) and Short eared Somali (SES) goat breeds fed improved grass hay and supplemented with concentrate mix during the feeding trial.

DISCUSSION

- In Results, you described the observed trend
 - what was the trend?
- In Discussion, you explain the observed trend
 - why is the trend like that?
 - support results from your own study and from previous studies
- Here you explain what the results mean and their implications for future study.
- This is the most difficult part of the paper, in which you pull everything together and show the significance of your work.
- Your reader should not end up saying, 'So what?'

Discussion Section

- Exceptions and unsettled points/unexpected results
- Results compared with previous work
- Implications, applications, beneficiaries
- Clear conclusions
- Evidence summarized for each conclusion
- Possible future research arising, if any
- It is not enough to simply present your data again in a slightly different way
- Discuss their significance and implications.
- Discuss the meaning of individual results in this section; but wait until the conclusions section to tie everything together

A good Discussion

- Does not repeat what has already been said in the review of literature
- Relates the results to the questions that were set out in the introduction
- Shows how the results and interpretations agree, or do not agree, with previously published work
- Discusses theoretical implications of the work
- States conclusions, with evidence for each
- Indicates the significance of the results
- Suggests future research that is planned or is needed to follow up the results

Conclusion

- Do not extend your conclusions beyond what is directly supported by your results.
- Outline the next steps for further study

Acknowledgements

- If you received any significant help in thinking up, designing, or carrying out the work; or received free materials from someone you must acknowledge their assistance and the service or material provided.

References

- Whenever you draw upon previously published work, you **must** acknowledge the source
- Any information not from your experiment and not ‘common knowledge’ should be recognized by a citation

Thank you