**ASSIGNMENT 1 FRONT SHEET**

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| **Qualification** | **BTEC Level 5 HND Diploma in Computing** | | |
| **Unit number and title** | Unit 13:Computing Research Project | | |
| **Submission date** |  | **Date Received 1st submission** |  |
| **Re-submission Date** |  | **Date Received 2nd submission** |  |
| **Student Name** |  | **Student ID** |  |
| **Class** |  | **Assessor name** |  |
| **Student declaration**  I certify that the assignment submission is entirely my own work and I fully understand the consequences of plagiarism. I understand that making a false declaration is a form of malpractice. | | | |
|  |  | **Student’s signature** |  |

**Grading grid**

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| **❒ Summative Feedback: ❒ Resubmission Feedback:** | | |
| **Grade:** | **Assessor Signature:** | **Date:** |
| **Internal Verifier’s Comments:** | | |
| **Signature & Date:** | | |

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Abstract

[Draw your reader in with an engaging abstract. It is typically a short summary of the document.   
When you’re ready to add your content, just click here and start typing.]

[Document title]

[Document subtitle]

# Introduction.

IoT stands for the phrase Internet of Things, one of the main pillars of the industrial revolution 4.0. IoT is known as a wide network of things across the globe connected to the Internet. In simpler terms, IoT is all the devices that people use that have the ability to connect and interact with each other through the Internet. From there, people easily collect, process and transmit information data.

IoT can completely help predict possible natural disasters. From there, people can limit the risks that may occur by natural disasters.

## Purpose.

Vietnam is a country with a relatively harsh climate. In the dry season, high temperature and low rainfall are conditions to lead to drought. For example, in 2016, During this drought, 13 provinces in the Mekong Delta were affected by saline intrusion. 10 provinces have declared natural disasters, of which many provinces have declared level 2. In many estuaries, salinity has increased to more than 30g/l. 20 million people in the Mekong Delta have been affected. According to estimates by the Ministry of Agriculture and Rural Development of Vietnam, about 160,000 hectares of rice were damaged, and an estimated 800,000 tons of rice were lost. The most affected provinces in this drought are Kien Giang (more than 54,000 ha), Ca Mau (nearly 50,000 ha), Ben Tre nearly (14,000 ha), Bac Lieu nearly (12,000 ha). The amount of water in ponds, lakes and irrigation works will be depleted and will cause great damage to the agricultural industry in the Central Highlands. By the end of March, the amount of damage caused by drought in the Central Highlands provinces was over 100 billion VND.

Besides, because it is a country with a long and wide east coast. Every year, Vietnam experiences about 10 to 15 storms from moderate to severe. Rainfall in this season is extremely high and flooding is inevitable. For example, the flood in Central Vietnam in 2020 is a storm, flooding throughout Central Vietnam, starting from the night of the 6th to the early morning of October 7, 2020 to the beginning of December 2020, focusing mainly on the coastal areas. Nghe An, Ha Tinh, Quang Binh, Quang Tri, Thua Thien Hue provinces of the North Central region, a part of the South Central region including Da Nang, Quang Nam, Quang Ngai, Binh Dinh, Phu Yen and the North Central Highlands. During October and November, the circulation of tropical depressions, monsoons, and tropical cyclones formed and fluctuated continuously in the East Sea. Starting with two waves of low pressure and typhoon Linfa in just one week, the historic flood of 2020 was complicated with many low pressures and big storms in October such as typhoon Nangka, storm Saudel, storm Molave; then in November with storm Goni, storm Etau, storm Vamco, heavy rainfall poured into the area, causing many localities in the Central region to be flooded on a large scale, in many places the flood water rose, dividing the areas. (Wikipedia, 2020)

We can recognize these disasters early by looking at the rise and fall of water levels in lakes, rivers or hydroelectric dams that hold water. So I came up with the idea of ​​designing a device to measure the water level and warn of possible natural hazards.



## Project aims.

* Create a water level measurement system in ponds, rivers, hydroelectric dams, etc.
* Manage measurement data by phone
* Notificate disaster risk to the phone.

## Project Objects

* Rivers
* Hydroelectric dams
* Natural lake, water reserve lake, large artificial lake.
* Etc.

## Scope

In my opinion, this study is the first to focus on using water level sensors to measure water levels in lakes, rivers and streams and analyze the measured data to identify hazards. chance of a disaster.

When the development is successful, the proposed model is expected to help users to accurately monitor environmental fluctuations so that actions can be taken to mitigate the consequences of disasters.

In the initial phase, I'll research design issues and come up with appropriate system applications. Then, for each component of my application, I'll develop studies to provide the required results, and I'll determine the right level of confidence in the studies by including them into the research. Finally, I'll test the base application by deploying it.

# Literature review

## Discuss research methodologies

### Primary and secondary research:

#### Secondary research.

Secondary research or desk research is a research method that involves using already existing data. Existing data is summarized and collated to increase the overall effectiveness of research.

Secondary research includes research material published in research reports and similar documents. These documents can be made available by public libraries, websites, data obtained from already filled in surveys etc. Some government and non-government agencies also store data, that can be used for research purposes and can be retrieved from them.

Secondary research is much more cost-effective than primary research, as it makes use of already existing data, unlike primary research where data is collected first hand by organizations or businesses or they can employ a third party to collect data on their behalf.

Secondary Research Methods with Examples

Secondary research is cost effective and that’s one of the reasons that makes it a popular choice among a lot of businesses and organizations. Not every organization is able to pay huge sum of money to conduct research and gather data. So, rightly secondary research is also termed as “desk research”, as data can be retrieved from sitting behind a desk.

Following are popularly used secondary research methods and examples:

(1). Data available on the internet: One of the most popular ways of collecting secondary data is using the internet. Data is readily available on the internet and can be downloaded at the click of a button.

This data is practically free of cost or one may have to pay a negligible amount to download the already existing data. Websites have a lot of information that businesses or organizations can use to suit their research needs. However, organizations need to consider only authentic and trusted website to collect information.

(2). Government and nongovernment agencies: Data for secondary research can also be collected from some government and non-government agencies. For example, US Government Printing Office, US Census Bureau, and Small Business Development Centers have valuable and relevant data that businesses or organizations can use.

There is a certain cost applicable to download or use data available with these agencies. Data obtained from these agencies are authentic and trustworthy.

(3). Public libraries: Public libraries are another good source to search for data for this research. Public libraries have copies of important research that were conducted earlier. They are a storehouse of important information and documents from which information can be extracted.

The services provided in these public libraries vary from one library to another. More often, libraries have a huge collection of government publications with market statistics, large collection of business directories and newsletters.

(4). Educational Institutions: Importance of collecting data from educational institutions for secondary research is often overlooked. However, more research is conducted in colleges and universities than any other business sector.

The data that is collected by universities is mainly for primary research. However, businesses or organizations can approach educational institutions and request for data from them.

(5). Commercial information sources: Local newspapers, journals, magazines, radio and TV stations are a great source to obtain data for secondary research. These commercial information sources have first-hand information on economic developments, political agenda, market research, demographic segmentation and similar subjects.

Businesses or organizations can request to obtain data that is most relevant to their study. Businesses not only have the opportunity to identify their prospective clients but can also know about the avenues to promote their products or services through these sources as they have a wider reach. (questionpro, n.d.)

#### Primary research

Primary research is defined as a methodology used by researchers to collect data directly, rather than depending on data collected from previously done research. Technically, they “own” the data. Primary research is solely carried out to address a certain problem, which requires in-depth analysis.

Businesses or organizations can themselves conduct primary research or can employ a third party to conduct research on their behalf. One major advantage of primary research is, this type of research is “pinpointed”, research is carried around only a specific issue or problem and all the focus is directed to obtain related solutions.

For example, a brand is about to launch a new model of mobile phone and wants to conduct a research about the looks and features mobile phone they are soon going to introduce. Organizations can select a qualified sample of respondents that closely resembles population and conduct primary research with them, to know their opinions. Based on this research, the brand can now think of probable solutions to make necessary changes in looks and features of mobile phone.

Primary Research Methods with Examples

In this technology-driven world, meaningful data is more valuable than gold. Organizations or businesses need highly validated data to make informed decisions. This is the very reason why many companies are proactive to gather their own data so that the authenticity of data is maintained and they get first-hand data without any alterations.

Here are some of the primary research methods organizations or businesses use to collect data:

1. Interviews (telephonic or face-to-face): Conducting interviews is a qualitative research method to collect data and has been a popular method for ages. These interviews can be conducted in person (face-to-face) or over the telephone. Interviews are open-ended method which involves dialogues or interaction between interviewer (researcher) and interviewee (respondent).

Conducting face-to-face interview is said to generate a better response from respondents as it is a more personal approach. However, the success of face-to-face interview depends heavily on researcher’s ability to ask questions and his/her experience related to conducting such interviews in the past. The types of questions that are used in this type of research are mostly open ended questions. These questions help to gain in-depth insights into opinions and perceptions of respondents.

Personal interviews usually last up to 30 minutes or even longer depending on the subject of research. If a researcher is running short of time conducting telephonic interviews can also be helpful to collect data.

2. Online surveys: Once conducted with pen and paper, surveys have come a long way since then. Today, most researchers use online surveys to send it to respondents to gather information from them. Online surveys are convenient and can be sent on emails or can be filled out online. These can be accessed on handheld devices like smartphone, tablets, IPads and similar devices.

Once a survey is deployed, a certain amount of stipulated time is given to respondents to answer survey questions and send it back to researcher. In order to get maximum information from respondents, surveys should have a good mix or open ended questions and close ended questions. Survey should not be lengthy, else respondents lose interest and tend to leave it half done.

It is a good practice to reward respondents on successfully filling out surveys for their time and efforts and valuable information. Most organizations or businesses usually giveaway gift cards from reputed brands that respondents can redeem later.

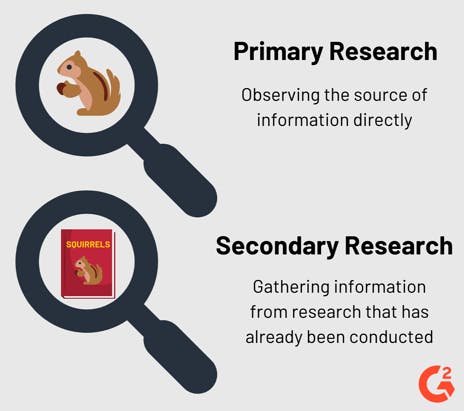
3. Focus groups: This popular research technique is used to collect data from a small group of people, usually restricted to 6-10. Focus group brings together people who are experts in subject matter, for which research is being conducted.

Focus group has a moderator who stimulates discussions among the members to get greater insights. Organizations and businesses can make use of this method specially to identify niche market to learn about a specific group of consumers.

4. Observations: In this primary research method, there is no direct interaction between researcher and person/consumer being observed. Researcher observes the reactions of a subject and makes notes.

Trained observers or cameras are used to record reactions. Observations are noted in a predetermined situation. For example, a bakery brand wants to know how people react its new biscuits, observer notes the first reaction of consumers and evaluates collective data to draw inference. (questionpro, 2021)

#### Compare primary and secondary research



|  |  |
| --- | --- |
| Primary Research | Secondary Research |
| Research is conducted first hand to obtain data. Researcher “owns” the data collected. | Research is based on data collected from previous researches. |
| Primary research is based on raw data. | Secondary research is based on tried and tested data which is previously analyzed and filtered. |
| The data collected fits the needs of a researcher, it is customized. Data is collected based on the absolute needs of organizations or businesses. | Data may or may not be according to the requirement of a researcher. |
| Researcher is deeply involved in research to collect data in primary research. | As opposed to primary research, secondary research is fast and easy. It aims at gaining a broader understanding of subject matter. |
| Primary research is an expensive process and consumes a lot of time to collect and analyze data. | Secondary research is a quick process as data is already available. Researcher should know where to explore to get most appropriate data. |

### Quantitative and Qualitative research

#### Quantitative

Quantitative research is the process of collecting and analyzing numerical data. It can be used to find patterns and averages, make predictions, test causal relationships, and generalize results to wider populations.

Quantitative research is the opposite of qualitative research, which involves collecting and analyzing non-numerical data (e.g. text, video, or audio).

Quantitative research is widely used in the natural and social sciences: biology, chemistry, psychology, economics, sociology, marketing, etc.

**Quantitative research methods**

You can use quantitative research methods for descriptive, correlational or experimental research.

* In descriptive research, you simply seek an overall summary of your study variables.
* In correlational research, you investigate relationships between your study variables.
* In experimental research, you systematically examine whether there is a cause-and-effect relationship between variables.

Correlational and experimental research can both be used to formally test hypotheses, or predictions, using statistics. The results may be generalized to broader populations based on the sampling method used.

To collect quantitative data, you will often need to use operational definitions that translate abstract concepts (e.g., mood) into observable and quantifiable measures (e.g., self-ratings of feelings and energy levels). (Bhandari, 2020)

#### Qualitative

Qualitative research involves collecting and analyzing non-numerical data (e.g., text, video, or audio) to understand concepts, opinions, or experiences. It can be used to gather in-depth insights into a problem or generate new ideas for research.

Qualitative research is the opposite of quantitative research, which involves collecting and analyzing numerical data for statistical analysis.

Qualitative research is commonly used in the humanities and social sciences, in subjects such as anthropology, sociology, education, health sciences, history, etc.

**Approaches to qualitative research**

Qualitative research is used to understand how people experience the world. While there are many approaches to qualitative research, they tend to be flexible and focus on retaining rich meaning when interpreting data.

Common approaches include grounded theory, ethnography, action research, phenomenological research, and narrative research. They share some similarities, but emphasize different aims and perspectives.

**Qualitative research methods**

Each of the research approaches involve using one or more data collection methods. These are some of the most common qualitative methods:

* Observations: recording what you have seen, heard, or encountered in detailed field notes.
* Interviews: personally asking people questions in one-on-one conversations.
* Focus groups: asking questions and generating discussion among a group of people.
* Surveys: distributing questionnaires with open-ended questions.
* Secondary research: collecting existing data in the form of texts, images, audio or video recordings, etc.

**Research example**

To research the culture of a large tech company, you decide to take an ethnographic approach. You work at the company for several months and use various methods to gather data:

* You take field notes with observations and reflect on your own experiences of the company culture.
* You distribute open-ended surveys to employees across all the company’s offices by email to find out if the culture varies across locations.
* You conduct in-depth interviews with employees in your office to learn about their experiences and perspectives in greater detail.

Qualitative researchers often consider themselves “instruments” in research because all observations, interpretations and analyses are filtered through their own personal lens.

For this reason, when writing up your methodology for qualitative research, it’s important to reflect on your approach and to thoroughly explain the choices you made in collecting and analyzing the data. (Bhandari, 2020)

#### Compare quantitative and qualitative research

|  |  |
| --- | --- |
| Quantitative research | Qualitative Research |
| Focuses on testing theories and hypotheses | Focuses on exploring ideas and formulating a theory or hypothesis |
| Analyzed through math and statistical analysis | Analyzed by summarizing, categorizing and interpreting |
| Mainly expressed in numbers, graphs and tables | Mainly expressed in words |
| Requires many respondents | Requires few respondents |
| Closed (multiple choice) questions | Open-ended questions |
| Key terms: testing, measurement, objectivity, replicability | Key terms: understanding, context, complexity, subjectivity |

### Scientific method

At the core of biology and other sciences lies a problem-solving approach called the scientific method. The scientific method has five basic steps, plus one feedback step:

1. Make an observation.
2. Ask a question.
3. Form a hypothesis, or testable explanation.
4. Make a prediction based on the hypothesis.
5. Test the prediction.
6. Iterate: use the results to make new hypotheses or predictions.

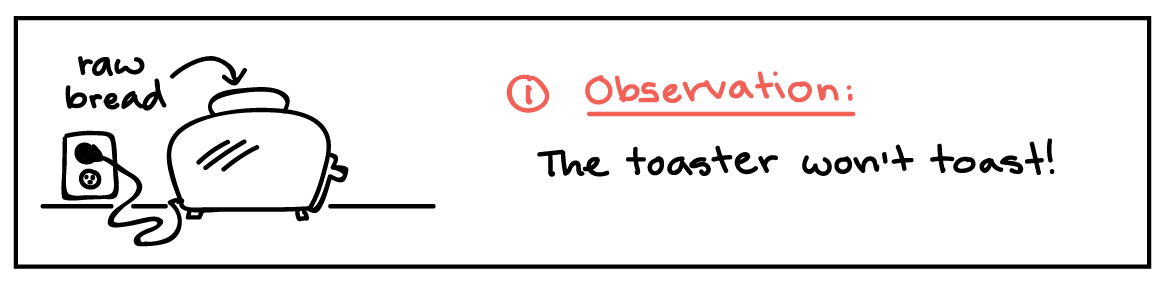
The scientific method is used in all sciences—including chemistry, physics, geology, and psychology. The scientists in these fields ask different questions and perform different tests. However, they use the same core approach to find answers that are logical and supported by evidence.

Scientific method example: Failure to toast

Let's build some intuition for the scientific method by applying its steps to a practical problem from everyday life.

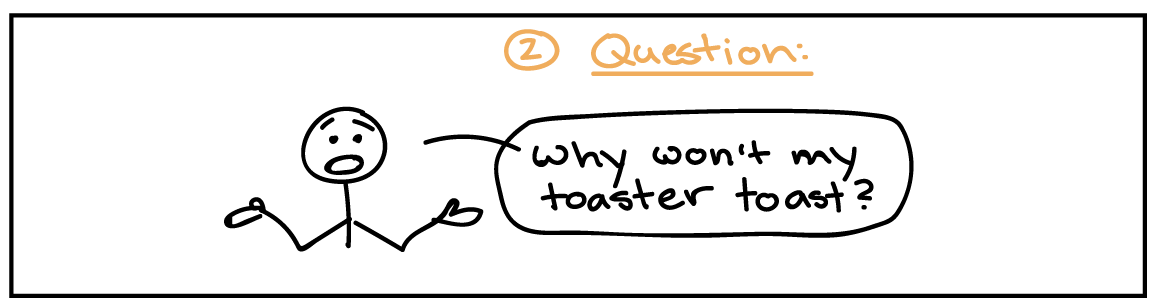
**1. Make an observation.**

Let's suppose that you get two slices of bread, put them into the toaster, and press the button. However, your bread does not toast.



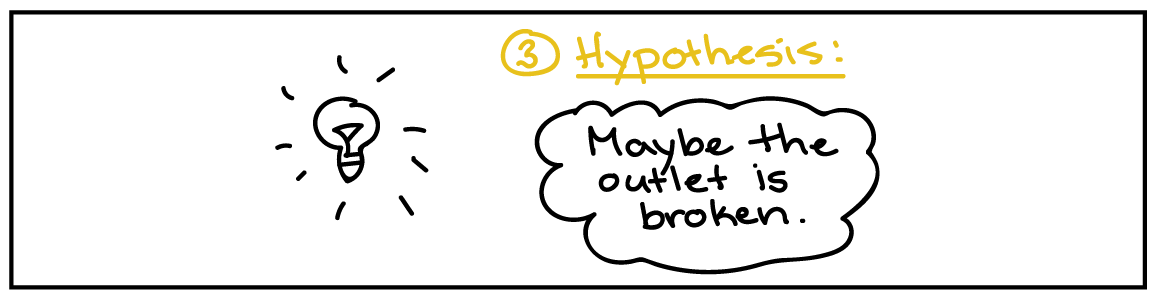
**2. Ask a question.**

Why didn't my bread get toasted?



**3. Propose a hypothesis.**

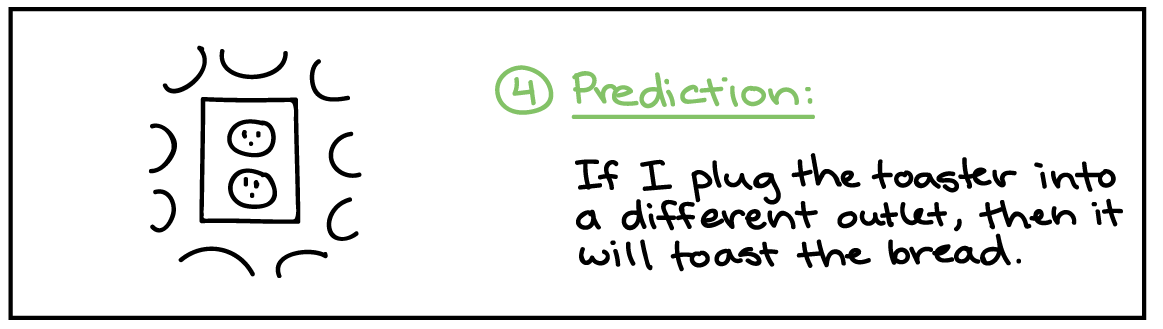
A hypothesis is a potential answer to the question, one that can somehow be tested. For example, our hypothesis in this case could be that the toast didn't toast because the electrical outlet is broken.



This hypothesis is not necessarily the right explanation. Instead, it's a possible explanation that we can test to see if it is likely correct, or if we need to make a new hypothesis.

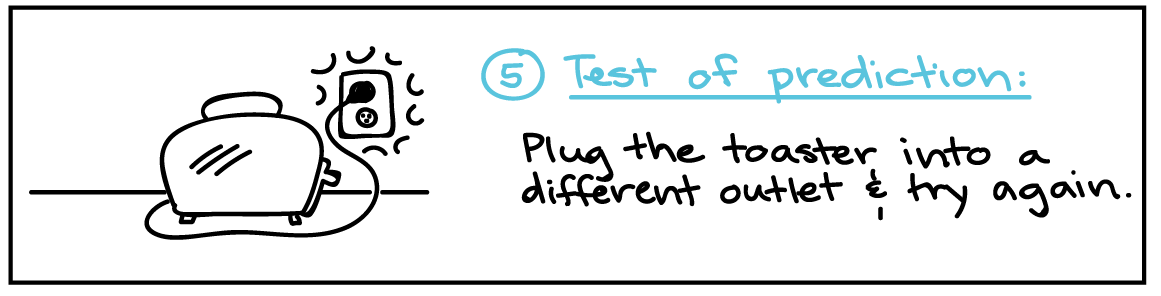
**4. Make predictions.**

A prediction is an outcome we'd expect to see if the hypothesis is correct. In this case, we might predict that if the electrical outlet is broken, then plugging the toaster into a different outlet should fix the problem.



**5. Test the predictions.**

To test the hypothesis, we need to make an observation or perform an experiment associated with the prediction. For instance, in this case, we would plug the toaster into a different outlet and see if it toasts.



* If the toaster does toast, then the hypothesis is supported—likely correct.
* If the toaster doesn't toast, then the hypothesis is not supported—likely wrong.

The results of a test may either support or contradict—oppose—a hypothesis. Results that support a hypothesis can't conclusively prove that it's correct, but they do mean it's likely to be correct. On the other hand, if results contradict a hypothesis, that hypothesis is probably not correct. Unless there was a flaw in the test—a possibility we should always consider—a contradictory result means that we can discard the hypothesis and look for a new one.

**6. Iterate.**

The last step of the scientific method is to reflect on our results and use them to guide our next steps.

And the result is:

Left panel: My bread toasts! Hypothesis is supported.
Right panel: My bread still won't toast. Hypothesis is not supported.

6. Iteration time!

Left panel (in case of hypothesis being supported): But what is actually wrong with the outlet?
Right panel (in case of hypothesis not being supported): Hmm...maybe there is a broken wire in the toaster.

* If the hypothesis was supported, we might do additional tests to confirm it, or revise it to be more specific. For instance, we might investigate why the outlet is broken.
* If the hypothesis was not supported, we would come up with a new hypothesis. For instance, the next hypothesis might be that there's a broken wire in the toaster.

In most cases, the scientific method is an iterative process. In other words, it's a cycle rather than a straight line. The result of one go-round becomes feedback that improves the next round of question asking. (Khan, 2016)

### Research process

There are a variety of approaches to research in any field of investigation, irrespective of whether it is applied research or basic research. Each particular research study will be unique in some ways because of the particular time, setting, environment, and place in which it is being undertaken. Nevertheless, all research endeavors share a common goal of furthering our understanding of the problem and thus all traverse through certain basic stages, forming a process called the research process. An understanding of the research process is necessary to effectively carry out research and sequencing of the stages inherent in the process.

These 8 stages in the research process are;

* Identifying the problem.
* Reviewing literature.
* Setting research questions, objectives, and hypotheses.
* Choosing the study design.
* Deciding on the sample design.
* Collecting data.
* Processing and analyzing data.
* Writing the report.

#### Identifying the Problem

The first and foremost task in the entire process of scientific research is to identify a research problem. A well-identified problem will lead the researcher to accomplish all-important phases of the research process, starting from setting objectives to the selection of the research methodology. But the core question is: whether all problems require research. We have countless problems around us, but all that we encounter do not qualify as research problems, and thus, these do not need to be researched. Keeping this point in view, we must draw a line between a research problem and a non-research problem.

Intuitively, researchable problems are those who have a possibility of thorough verification investigation, which can be effected through the analysis and collection of data, while the non-research problems do not need to go through these processes.

Researcher need to identify both;

* Non-research Problem, and
* Research Problem.

**Non-Research Problem**

A non-research problem is one that does not require any research to arrive at a solution. Intuitively, a non-researchable problem consists of vague details and cannot be resolved through research. It is a managerial or built-in problem that may be solved at the administrative or management level. The answer to any question raised in a non- research setting is almost always obvious. The outbreak of cholera, for example, following a severe flood, is a common phenomenon in many communities. The reason for this is known. It is thus not a research problem. Similarly, reasons for the sudden rise in prices of many essential commodities following the announcement of the budget by the Finance Minister need no investigation. Hence it is not a problem that needs research.

**Research Problem**

In contrast to a non-research problem, a research problem is of primary concern to a researcher. A research problem is a perceived difficulty, a feeling of discomfort, or a discrepancy between the common belief and reality. As noted by Fisher et al. (1993), a problem will qualify as a potential research problem when the following three conditions exist:

* There should be a perceived discrepancy between “what it is” and “what it should have been.” This implies that there should be a difference between “what exists” and the “ideal or planned situation”;
* A question about “why” the discrepancy exists. This implies that the reason(s) for this discrepancy is unclear to the researcher (so that it makes sense to develop a research question); and
* There should be at least two possible answers or solutions to the questions or problems.

The third point is important. If there is only one possible and plausible answer to the question about the discrepancy, then a research situation does not exist. It is a non-research problem that can be tackled at the managerial or administrative level.

#### Reviewing of Literature

A review of relevant literature is an integral part of the research process. It enables the researcher to formulate his problem in terms of the specific aspects of the general area of his interest that has not been so far researched. Such a review, not only provides him exposure to a larger body of knowledge but also equips him with enhanced knowledge to efficiently follow the research process. Through a proper review of the literature, the researcher may develop the coherence between the results of his study and those of the others.

A review of previous documents to similar or related phenomena is essential even for the beginning researchers. To ignore the existing literature may lead to wasted effort on the part of the researchers.

Why spend time merely repeating what other investigators have already done?

If the researcher is aware of earlier studies of his topic, or related topics, he will be in a much better position to assess the significance of his work and to convince others that it is important. A confident and expert researcher is more crucial in his questioning of the others’ methodology, the choice of the data, and the quality of the inferences drawn from the study results.

In sum, we enumerate the following arguments in favor of reviewing the literature:

* It avoids duplication of the work that has been done in the recent past.
* It helps the researcher to find out what others have learned and reported on the problem.
* It helps the researcher to become familiar with the types of methodology followed by others.
* It helps the researcher to understand what concepts and theories are relevant to his area of investigation.
* It helps the researcher to understand if there are any significant controversies, contradictions, and inconsistencies in findings.
* It allows the researcher to understand if there are any unanswered research questions.
* It might help the researcher to develop an analytical framework.
* It will help the researcher to consider the inclusion of variables in his research that he might not otherwise have thought about.

#### Setting research questions, objectives, and hypotheses

After discovering and defining the research problem, researchers should make a formal statement of the problem leading to research objectives. An objective will precisely say what should be researched, to delineate the type of information that should be collected, and provide a framework for the scope of the study. The best expression of a research objective is a well-formulated, testable research hypothesis. A hypothesis is an unproven statement or proposition that can be refuted or supported by empirical data. Hypothetical statements assert a possible answer to a research question.

#### Choosing the study design

The research design is the blueprint or framework for fulfilling objectives and answering research questions. It is a master plan specifying the methods and procedures for collecting, processing, and analyzing the collected data. There are four basic research designs that a researcher can use to conduct his or her study;

* survey,
* experiment,
* secondary data study, and
* observational study.

The type of research design to be chosen from among the above four designs depends primarily on four factors:

* The type of problem
* The objectives of the study,
* The existing state of knowledge about the problem that is being studied, and
* The resources are available for the study.

#### Deciding on the sample design

Sampling is an important and separate step in the research process. The basic idea of sampling is that it involves any procedure that uses a relatively small number of items or portions (called a sample) of a universe (called population) to conclude the whole population. It contrasts with the process of complete enumeration, in which every member of the population is included. Such a complete enumeration is referred to as census.

A population is the total collection of elements about which we wish to make some inference or generalization. A sample is a part of the population, carefully selected to represent that population. If certain statistical procedures are followed in selecting the sample, it should have the same characteristics as the population as a whole. These procedures are embedded in the sample design.

Sample design refers to the methods to be followed in selecting a sample from the population and the estimating technique, vis-a-vis formula for computing the sample statistics. The basic question is, then, how to select a sample? To answer this question, we must have acquaintance with the sampling methods. These methods are basically of two types: probability sampling and non-probability sampling. Probability sampling ensures every unit a known nonzero probability of selection within the target population. If there is no feasible alternative, a non-probability sampling method may be employed.

The basis of such selection is entirely dependent on the researcher’s discretion. This approach is variously called judgment sampling, convenience sampling, accidental sampling, and purposive sampling. The most widely used probability sampling methods are simple random sampling, stratified random sampling, cluster sampling, and systematic sampling. They have been classified by their representation basis and unit selection techniques.

Two other variations of the sampling methods that are in great use are multistage sampling and probability proportional to size (PPS) sampling. Multistage sampling is most commonly used in drawing samples from very large and diverse populations. The PPS sampling is a variation on multistage sampling in which the probability of selecting a cluster is proportional to its size, and an equal number of elements are sampled within each cluster.

#### Collecting data

The gathering of data may range from simple observation to a large-scale survey in any defined population. There are many ways to collect data. The approach selected depends on the objectives of the study, the research design, and the availability of time, money, and personnel. With the variation in the type of data (qualitative or quantitative) to be collected, the method of data collection also varies.

The most common means for collecting quantitative data is the structured interview. Studies that obtain data by interviewing respondents are called surveys. Data can also be collected by using self-administered questionnaires. Telephone interviewing is another way in which data may be collected. Other means of data collection include the use of secondary sources, such as the census, vital registration records, official documents, previous surveys, etc. Qualitative data are collected mainly through in-depth interviews, focus group discussions, KII, and observational studies.

#### Processing and Analyzing Data

Data processing generally begins with the editing and coding of data. Data are edited to ensure consistency across respondents and to locate omissions, if any. In survey data, editing reduces errors in the recording, improves legibility, and clarifies unclear and inappropriate responses. In addition to editing, the data also need coding. Because it is impractical to place raw data into a report, alphanumeric codes are used to reduce the responses to a more manageable form for storage and future processing.

This coding process facilitates processing the data. The personal computer offers an excellent opportunity in data editing and coding processes. Data analysis usually involves reducing accumulated data to a manageable size, developing summaries, searching for patterns, and applying statistical techniques for understanding and interpreting the findings in the light of the research questions.

Further, the researcher, based on his analysis, determines if his findings are consistent with the formulated hypotheses and theories. The techniques to be used in analyzing data may range from simple graphical technique to very complex multivariate analysis depending on the objectives of the study, research design employed, and the nature of data collected. As in the case of methods of data collection, an analytical technique appropriate in one situation may not be appropriate for another.

#### Writing the report – Developing Research Proposal, Writing Report, Disseminating and Utilizing Results

The entire task of a research study is accumulated in a document called a proposal. A research proposal is a work plan, prospectus, outline, an offer, a statement of intent or commitment from an individual researcher or an organization to produce a product or render a service to a potential client or sponsor. The proposal will be prepared to keep in view the sequence presented in the research process. The proposal tells us what, how, where, and to whom it will be done.

It must also show the benefit of doing it. It always includes an explanation of the purpose of the study (the research objectives) or a definition of the problem. It systematically outlines the particular research methodology and details the procedures that will be utilized at each stage of the research process.

The end goal of a scientific study is to interpret the results and draw conclusions. To this end, it is necessary to prepare a report and transmit the findings and recommendations to administrators, policymakers, and program managers for the intended purpose of making a decision. There are various forms of research reports: term papers, dissertations, journal articles, papers for presentation at professional conferences and seminars, books, and so on. The results of a research investigation prepared in any form are of little utility if they are not communicated to others.

The primary purpose of a dissemination strategy is to identify the most effective media channels to reach different audience groups with study findings most relevant to their needs. The dissemination may be made through a conference, a seminar, a report, or an oral or poster presentation. The style and organization of the report will differ according to the target audience, the occasion, and the purpose of the research. Reports should be developed from the client’s perspectives.

A report is an excellent means that helps to establish the researcher’s credibility. At a bare minimum, a research report should contain sections on:

* An executive summary;
* Background of the problem;
* Literature review;
* Methodology;
* Findings;
* Discussion;
* Conclusions and
* Recommendations.

The results of the study can also be disseminated through peer-reviewed journals published by academic institutions and reputed publishers both at home and abroad. These journals have their format and editorial policies. The contributors can submit their manuscripts adhering to the policies and format for possible publications of their papers.

There are now ample opportunities for the researchers to publish one’s work online as well. Many interesting studies have been conducted by the researchers without having any effect in actual settings. Ideally, the concluding step of a scientific study is to plan for its utilization in the real world. Although researchers are often not themselves in a position to implement a plan for utilizing research findings, they can contribute to the process by including in their research reports a few recommendations regarding how the results of the study could be utilized for policy formulation and program intervention.

### Population and sample in research.

#### Definition.

A population is the entire group that you want to draw conclusions about.

A sample is the specific group that you will collect data from. The size of the sample is always less than the total size of the population.

In research, a population doesn’t always refer to people. It can mean a group containing elements of anything you want to study, such as objects, events, organizations, countries, species, organisms, etc.

#### Population vs sample

|  |  |
| --- | --- |
| **Population** | **Sample** |
| Advertisements for IT jobs in the Netherlands | The top 50 search results for advertisements for IT jobs in the Netherlands on May 1, 2020 |
| Songs from the Eurovision Song Contest | Winning songs from the Eurovision Song Contest that were performed in English |
| Undergraduate students in the Netherlands | 300 undergraduate students from three Dutch universities who volunteer for your psychology research study |
| All countries of the world | Countries with published data available on birth rates and GDP since 2000 |

#### Collecting data from a population

Populations are used when your research question requires, or when you have access to, data from every member of the population. Usually, it is only straightforward to collect data from a whole population when it is small, accessible and cooperative.

For larger and more dispersed populations, it is often difficult or impossible to collect data from every individual. For example, every 10 years, the federal US government aims to count every person living in the country using the US Census. This data is used to distribute funding across the nation.

However, historically, marginalized and low-income groups have been difficult to contact, locate and encourage participation from. Because of non-responses, the population count is incomplete and biased towards some groups, which results in disproportionate funding across the country.

In cases like this, sampling can be used to make more precise inferences about the population.

#### Collecting data from a sample

When your population is large in size, geographically dispersed, or difficult to contact, it’s necessary to use a sample. With statistical analysis, you can use sample data to make estimates or test hypotheses about population data.

Ideally, a sample should be randomly selected and representative of the population. Using probability sampling methods (such as simple random sampling or stratified sampling) reduces the risk of sampling bias and enhances both internal and external validity.

For practical reasons, researchers often use non-probability sampling methods. Non-probability samples are chosen for specific criteria; they may be more convenient or cheaper to access. Because of non-random selection methods, any statistical inferences about the broader population will be weaker than with a probability sample.

#### Reasons for sampling

* Necessity: Sometimes it’s simply not possible to study the whole population due to its size or inaccessibility.
* Practicality: It’s easier and more efficient to collect data from a sample.
* Cost-effectiveness: There are fewer participant, laboratory, equipment, and researcher costs involved.
* Manageability: Storing and running statistical analyses on smaller datasets is easier and reliable.

#### Population parameter vs sample statistic

When you collect data from a population or a sample, there are various measurements and numbers you can calculate from the data. A parameter is a measure that describes the whole population. A statistic is a measure that describes the sample.

You can use estimation or hypothesis testing to estimate how likely it is that a sample statistic differs from the population parameter.

**Sampling error**

A sampling error is the difference between a population parameter and a sample statistic. In your study, the sampling error is the difference between the mean political attitude rating of your sample and the true mean political attitude rating of all undergraduate students in the Netherlands.

Sampling errors happen even when you use a randomly selected sample. This is because random samples are not identical to the population in terms of numerical measures like means and standard deviations.

Because the aim of scientific research is to generalize findings from the sample to the population, you want the sampling error to be low. You can reduce sampling error by increasing the sample size. (Bhandari, 2020)

## Discuss IoT application “Flood and drought early warning system”

### Internet of things definition.

#### What is IOT?

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

A thing in the internet of things can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low or any other natural or man-made object that can be assigned an Internet Protocol (IP) address and is able to transfer data over a network.

Increasingly, organizations in a variety of industries are using IoT to operate more efficiently, better understand customers to deliver enhanced customer service, improve decision-making and increase the value of the business.

#### Why is IoT important?

The internet of things helps people live and work smarter, as well as gain complete control over their lives. In addition to offering smart devices to automate homes, IoT is essential to business. IoT provides businesses with a real-time look into how their systems really work, delivering insights into everything from the performance of machines to supply chain and logistics operations.

IoT enables companies to automate processes and reduce labor costs. It also cuts down on waste and improves service delivery, making it less expensive to manufacture and deliver goods, as well as offering transparency into customer transactions.

As such, IoT is one of the most important technologies of everyday life, and it will continue to pick up steam as more businesses realize the potential of connected devices to keep them competitive. (Gillis, 2021)

#### IOT applications.

##### Smart home

Smart Home clearly stands out, ranking as highest Internet of Things application on all measured channels. More than 60,000 people currently search for the term “Smart Home” each month. This is not a surprise. The IoT Analytics company database for Smart Home includes 256 companies and startups. More companies are active in smart home than any other application in the field of IoT. The total amount of funding for Smart Home startups currently exceeds $2.5bn. This list includes prominent startup names such as Nest or AlertMe as well as a number of multinational corporations like Philips, Haier, or Belkin.

##### Wearables

Wearables remains a hot topic too. As consumers await the release of Apple’s new smart watch in April 2015, there are plenty of other wearable innovations to be excited about: like the Sony Smart B Trainer, the Myo gesture control, or LookSee bracelet. Of all the IoT startups, wearables maker Jawbone is probably the one with the biggest funding to date. It stands at more than half a billion dollars!

##### Smart City

Smart city spans a wide variety of use cases, from traffic management to water distribution, to waste management, urban security and environmental monitoring. Its popularity is fueled by the fact that many Smart City solutions promise to alleviate real pains of people living in cities these days. IoT solutions in the area of Smart City solve traffic congestion problems, reduce noise and pollution and help make cities safer.

##### Smart grids

Smart grids is a special one. A future smart grid promises to use information about the behaviors of electricity suppliers and consumers in an automated fashion to improve the efficiency, reliability, and economics of electricity. 41,000 monthly Google searches highlights the concept’s popularity. However, the lack of tweets (Just 100 per month) shows that people don’t have much to say about it.

##### Industrial internet

The industrial internet is also one of the special Internet of Things applications. While many market researches such as Gartner or Cisco see the industrial internet as the IoT concept with the highest overall potential, its popularity currently doesn’t reach the masses like smart home or wearables do. The industrial internet however has a lot going for it. The industrial internet gets the biggest push of people on Twitter (~1,700 tweets per month) compared to other non-consumer-oriented IoT concepts.

##### Connected car

The connected car is coming up slowly. Owing to the fact that the development cycles in the automotive industry typically take 2-4 years, we haven’t seen much buzz around the connected car yet. But it seems we are getting there. Most large auto makers as well as some brave startups are working on connected car solutions. And if the BMWs and Fords of this world don’t present the next generation internet connected car soon, other well-known giants will: Google, Microsoft, and Apple have all announced connected car platforms.

##### Connected Health (Digital health/Telehealth/Telemedicine)

Connected health remains the sleeping giant of the Internet of Things applications. The concept of a connected health care system and smart medical devices bears enormous potential (see our analysis of market segments), not just for companies also for the well-being of people in general. Yet, Connected Health has not reached the masses yet. Prominent use cases and large-scale startup successes are still to be seen. Might 2015 bring the breakthrough?

##### Smart retail

Proximity-based advertising as a subset of smart retail is starting to take off. But the popularity ranking shows that it is still a niche segment. One LinkedIn post per month is nothing compared to 430 for smart home.

##### Smart supply chain

Supply chains have been getting smarter for some years already. Solutions for tracking goods while they are on the road, or getting suppliers to exchange inventory information have been on the market for years. So while it is perfectly logic that the topic will get a new push with the Internet of Things, it seems that so far its popularity remains limited.

##### Smart farming

Smart farming is an often overlooked business-case for the internet of Things because it does not really fit into the well-known categories such as health, mobility, or industrial.

However, due to the remoteness of farming operations and the large number of livestock that could be monitored the Internet of Things could revolutionize the way farmers work. But this idea has not yet reached large-scale attention. Nevertheless, one of the Internet of Things applications that should not be underestimated. Smart farming will become the important application field in the predominantly agricultural-product exporting countries. (Lueth, 2015)

### Project overview.

#### Current measure water level

#### Advantages and limitations of Flood and drought early warning system.

#### Improvement and the gap in literature reviews