

**Course Code: GEC 324**

**Course Title: Technical Communication**

## **CHAPTER 2**

### **I. BASIC PRINCIPLES OF TECHNICAL COMMUNICATION &**

### **II. THE MAIN ELEMENTS OF A TECHNICAL REPORT**

#### **I. BASIC PRINCIPLES OF TECHNICAL COMMUNICATION**

The two basic tasks that writing involves are namely, **finding something to say**, and **saying it clearly, simply and effectively**. While the first-named task is relatively straight forward, the second one, that of writing clearly, is easier to suggest than to carry out. Fortunately, this task can be broken down into manageable component parts such as: determining the readership or audience; deciding on the purpose and scope of the writing and tightening up on use of language. The fundamental principles of report writing are embodied in the discussion of these basic tasks.

#### **2.1 Finding Something to Say**

If there is nothing to say, there will be no useful, informative or interesting facts to convey or to request for, then clearly, there would be no justifiable reason to write. Thus, having something worthwhile to communicate to others is a fundamental requirement on writing anything - a memorandum, a letter, a feasibility report or a journal article.

Finding something to say is not a problem to most people. Someone who has carried out a research study may wish to publish the results, or simply write a dissertation; an engineer or an architect may need to write a design report or progress report on a project; and, any professional may have to prepare a write-up in support of or against an impending policy

decision. Furthermore, the need to write letters and memoranda would increase with time for most professionals, and often there is something to say.

In many cases, the topic of a report is given or it can be easily determined. Examples include report of a laboratory experiment or field work, description of a process, progress report, and book review. In other situations, the writer is given only the subject area or field of study and he is requested to choose his own topic. This category includes invited papers, title of thesis and dissertations, and when a completed research work is being scrutinized for possible publication in a journal. This is more demanding and requires that the writer should have a wide knowledge of the subject area. In addition, extensive literature search is inevitable so as to avoid choosing a topic which has already been presented by another author in the same field of study.

Unfortunately, a sizeable number of professionals write even when they have not gathered enough information on what they are writing about. They write letters, memoranda, process descriptions and even reports without using the relevant files and other reference materials for background information. This, of course, is not good practice.

Consider for the purpose of this discussion an essay topic such as *Science and Technology for National Development*. A secondary school student may attempt to write the essay without reference to any resource material, especially as he would be required to write the essay in class. However, it would be seriously inappropriate and inadequate for a university student or a graduate professional to write such an essay without consulting relevant reference materials. The writer at such higher levels should indeed be writing a paper rather than a conventional essay. He would search for relevant materials from libraries. He might consult dictionaries, encyclopedia, and other sources for definitions of ‘science’, ‘technology’, ‘development’. He might, if possible and depending on the relative importance of the work, visit the Ministry of Science and Technology, the Ministry of National Planning

and any other relevant government agencies to collect statistical or policy data. Clearly, a person who approaches the essay in this way would have more to say on the subject than one who plans to write off-hand.

## **2.2 Determining the Readership**

Another fundamental principle of technical report writing is to determine the level of readership, or, in the case of oral presentation, the audience. The writing should be aimed at a specific level of readership in terms of appropriate choice of vocabulary, type of graphic aids used and the quantum and quality of information provided. Consider, for example, the topic *Sewage Treatment*. One could write a paper on this topic for presentation to ten-year old primary school pupils. The same topic, suitably handled could be of interest and relevance to secondary school students, a general university audience, or environmental engineering consultants at a seminar, workshop or conference. Each level of readership requires a different form of presentation. Certain terminologies used in one presentation could be completely unsuitable, even if defined, in another. For example, you could inform the environmental consultants at the conference that: *“The average Biochemical Oxygen Demand of the sewage was 900 milligrammes per litre and, as its temperature was also high, solubility of oxygen in it was low, resulting in the septic condition that was observed.”* To that audience, this statement is clear, in all its ramifications. On the other hand, such a statement as presented would be meaningless, may even be pompous when addressed to readership at the other levels. The write-up used for the readership at the general audience level on that subject would be too simple, boring and even insulting if directed at the professionals.

One more example should suffice. A speaker at a workshop attended by aircraft pilots and aeronautic engineers could inform his specialist audience that:

*“An uncommanded slat deployment suddenly occurred while the airplane was airborne and at cruise speed which sent the plane porpoising, resulting in the crash.”*

Again this statement would be clearly understood by that audience since the professional minds of members present would be operating at a level of knowledge of how airplane wings are designed, constructed and operated in such a way to create an upward force to keep such a heavy body aloft and how abuse of that special feature, deliberately or accidentally, could lead to a monumental catastrophe.

As a general rule, therefore, the writer should determine the level of readership before proceeding to write; he should assume that the reader is intelligent and is interested in getting useful information from the paper.

### **2.3 Deciding the Purpose and Scope**

As mentioned earlier, in the course of teaching Technical Writing as a course to senior undergraduate students in the Faculty of Technology at Ile-Ife, I have graded thousands of term papers written by students. Many of the reports would have an instructor’s comment, commonly at the end of the introduction section, as follows:

*‘No clear statement of objective!’*. Without a clear statement of objective or purpose, the writing drifts in one direction, then another and perhaps, back again in the first direction while the reader tries to follow the train of thought of the writer. No good, readable report can be produced unless and until the writer has decided what the exact purpose of the report is. With the purpose firmly established, the writer is in a position to ensure that every sentence makes a clear contribution to the fulfillment of that purpose, and makes it at the right time.

In addition to the purpose, the scope of the report is also often stated. This is to define the limit of treatment or coverage given to the subject. The scope of the report is indicated either by listing or stating the objectives in details, in which case whatever is not listed is

deemed to be excluded; or by stating specifically the areas not covered. An example of the latter type can be seen in the following statement:

*“The objective of this report is to present the results of a study of alternative methods by which water can be supplied to the Teaching Hospitals Complex. For the reasons stated earlier, only surface water sources are considered in this study. Therefore, no consideration is given to use of boreholes or other forms of harnessing underground water.”*

The location of the statement of objective of a write-up is another matter that requires some thought. In some cases, especially in letters or memoranda, the statement could form the opening sentence. Examples of this form include the following:

*“I write to convey .....*”

*“The purpose of this letter is to express appreciation for .....*”

In other cases, the statement comes at the end of the introductory paragraph (in letters and memoranda) or the introductory chapter (in formal reports, dissertations, journal articles and so on).

The statement of objective and scope may be a sentence, a paragraph, or several paragraphs, depending on how much detail is deemed necessary in a particular situation. Where the statement covers several paragraphs, it is often given a heading.

## **2.4 Use of Language**

The tasks of determining the readership and deciding the purpose and scope of a report constitute what is generally called *reader adaptation*. The term means writing the report to suit the needs, knowledge and interests of the reader. Using language that is simple, concrete and familiar is a necessary ingredient which when super-imposed on reader adaptation enriches it, and, together they result in clear and effective communication.

There are some rules or guidelines in the use of language in formal technical writing. The following are considered fundamental and important:

#### **2.4.1 Keep style impersonal**

Keeping style impersonal is achieved by excluding or at least drastically reducing use of personal pronouns, this produces a style consistently in tone with objectivity and absence of any attempt to arouse emotion. Closely associated with choice of person (first person, second person and third person) are the number (singular or plural) and the voice (active or passive).

The recommended choice for technical report writing is the use of third person, passive voice. Thus, the statement:

*...fifty samples were collected and analysed...*

is to be preferred to “*I collected and analysed fifty samples....*”

With the choice of the third person passive voice over the first person active voice form, emphasis is placed on the action or the subject matter rather than on the person who took the action.

#### **2.4.2 Use simple, familiar words**

The general rule here is that the language should be adapted to the vocabulary level of the intended reader, without being simplistic of course. Another way of putting this is that the style of the technical paper should be simple, straightforward and dignified.

The technical report writer would use the word ‘*fire*’ rather than ‘*conflagration*’. The bright high school student offering Literature as a School Certificate Examination subject is naturally attracted to, and excited by, statements such as:

“.....you are a sophisticated rhetorician intoxicated with the exuberance of your own verbosity” or

“....petulant and assertive, incorrigibly foolish in talk and of morbidly vigilant egoism...”

These sorts more properly belong to Language Arts. The technical report writer should avoid use of high-sounding words and show preference, instead, for simple, concrete, concise, familiar words.

### **2.4.3 Avoid using vague words**

The technical report writer is advised to use words that are, among other characteristics, concrete. This means that each word used should convey the exact meaning intended or demanded. For example, a professional engineer after a detailed study reported that:

....”..the water would need to be chemically treated”.

Considering that it was a report of a detailed study, the question might arise as to what was meant by the term ‘*chemically treated*’. Would it involve coagulation with aluminum sulphate and settling to reduce turbidity or is it a case of disinfection by chlorination to kill off microorganisms, or both?

If the writer constantly keeps in mind the purpose of his report and the readership, he should be able to determine and avoid words that are vague. He would, for example, reflect upon his statement that:

“The two metals were joined together.”

He then decides that perhaps the word ‘joined’ should be replaced by the word ‘*welded*’, ‘*soldered*’, ‘*bolted*’ as may be more appropriate - more concrete.

#### 2.4.4 Guard against miscellaneous pitfalls

Pitfalls in writing may be in terms of spelling errors and structurally deficient sentences. A good writer, student and professional alike, would carefully watch out for these and other pitfalls in his writing.

In addition to the ones already mentioned, certain words seem to be problematic for all except the careful writer. The following words and phrases are particularly prone to being misused: *could, should, shall, has, had, have, are, were, few, a few, majority, much, as well as, along with, etc.*

#### 2.5 Exercises

1. Outline the fundamental principles of technical report writing.
2. What do we mean by “*reader adaptation*” and what is its relevance in technical writing?
3. How would you solve the problem of finding something to say in a given feasibility study report? Select your own subject matter for the purpose of discussion.
4. Fill in the gaps with appropriate words or phrases (from among the ones listed) in the following sentences.
  - a. The lecturer asked for my homework and I told him that:
    - (i) I \_\_\_\_\_ not done it. (have, had)
    - (ii) ‘I \_\_\_\_\_ not done it’ (have, had)
    - (iii) I \_\_\_\_\_ not know that we \_\_\_\_\_ supposed to submit it. (have, had, did, do, was, were, are)

- (iv) I \_\_\_\_\_ not aware that ... (has, had, was, do)
- (v) I \_\_\_\_\_ not been informed that submission of home works \_\_\_\_\_ required (have, had, was, were).
- (b) Many of the concrete cubes \_\_\_\_\_ been crushed; many more are \_\_\_\_\_ tested but much of the work \_\_\_\_\_ yet to be done. (is, are, have, was were, been, being)
- (c) \_\_\_\_\_ people came to the meeting even though full attendance was expected. (few, a few)
- (d) It rained heavily but \_\_\_\_\_ people still came. (few, a few)
- (e) If I \_\_\_\_\_ free these slaves I \_\_\_\_\_. (can, still, could, will, should, would)
- (f) Adamu as well as Yinka \_\_\_\_\_ indicated interest. (has, have)
- (g) The man, along with his sister, \_\_\_\_\_ to be arrested. (is, are)

## II. THE MAIN ELEMENTS OF A TECHNICAL REPORT

### 2.6 Types of Reports

Professional and business organizations are involved in various types of reports. They include 1. dissertations, 2. articles for publication in journals or in proceedings of conferences, seminars, or workshops, 3. project proposals, 4. feasibility reports, 5. design reports, 6. tender reports, 7. operations and maintenance manuals, 8. progress reports, 9. environmental impact assessment reports, 10. environmental audit reports and so on.

It is necessary to discuss the general contents of key sections such as introduction, methodology, etc. contained in most formal reports. Prior to such a discussion, brief

statements regarding the general coverage of each of the different types of reports are presented.

### **2.6.1 Dissertations**

A dissertation is a written document embodying results of original research with a view to advancing a position or proposition or substantiating a specific view. Such a document is also often referred to as a thesis. A dissertation or thesis may be written by a candidate for an academic degree or one for scholastic honours.

The main elements of most dissertations are: introduction, literature review, methodology (or experimental procedure, or simply, procedure), results and discussion, conclusion and recommendation. A capsular summary of the work is also included as an abstract. A complete list of all references cited in the text is of course mandatorily included as the last part of the text, just before Appendices (if any).

### **2.6.2 Articles for publication**

The author of a dissertation may decide to publish the work. Similarly, a person who has conducted an original research may decide to publish the results. The works are written out as articles for publication in a journal. If the article is presented at a conference, seminar or workshop, it may be published along with others as part of the proceedings of the conference.

The main elements of such articles are, by and large, the same as those of dissertations - abstract, introduction, materials and methods, etc.

### 2.6.3 Project proposals

Project proposals are written to put forward comprehensive suggestions for consideration. For example, an engineering consulting firm could prepare a proposal for expanding the water supply system for *Landmark University*. The proposal may have been asked for by the management. It may also be unsolicited (the consultants observed a need for expansion and decided to propose to the management that a study should be ordered).

A proposal could also be prepared by a candidate for a higher academic degree, such as a Ph.D. degree, prior to conducting the research. In this case, the candidate presents his plans for carrying out the research.

A proposal for a development project study and/or design, solicited or unsolicited, should contain three or four main sections (i.e. chapters). These are 1. INTRODUCTION; 2. PROPOSED METHOD OF WORK; 3. COST ESTIMATES; AND 4. FACILITIES, PERSONNEL AND WORK PLAN. Sub-headings under the introduction chapter may include: Background, Aim of Project, Justification, Objectives and Scope. In most solicited proposals, the Terms of Reference (TOR), which are usually provided by the client, is included as well. Steps for carrying out the proposed work are presented in reasonable detail under suitable subheadings. It should be sufficient in quantum and quality (clarity) so that the client could feel persuaded that the firm submitting the proposal is capable of doing the job satisfactorily. The contents of the remaining chapters are quite obvious — detailed cost of carrying out the job and evidence of availability of personnel and equipment plus proposed schedule of work. Table of Contents, List of Tables, List of Figures (and Plates, if any), List of Abbreviations and Acronyms, List of Appendices and Executive Summary are normally presented in the preface section of such a report.

In the case of an academic proposal such as is usually submitted in partial fulfilment of the requirements for a Ph.D. qualifying examination, there should be about 4 chapters,

namely: 1.INTRODUCTION; 2.LITERATURE REVIEW; 3.PROPOSED METHODOLOGY; 4.EXPECTED CONTRIBUTION TO KNOWLEDGE AND STAGE REACHED. These should, of course, be followed by 'References' where all works cited in the text are listed (in alphabetical order usually). 'APPENDICES' would follow (if any, such as questionnaires that would be used). A summary (rather than an Abstract) should suitably be included in the preface section along with the usual contents of that section.

Writing the methodology section of a proposal often constitutes a problem for many. Whereas in a thesis or studies already carried out, such a chapter is written in past tense, it is written in future tense in the case of the proposal. For example: one would write: '*population data and other demographic information would be collected from the National Population Commission (NPC)*' under proposed methodology in a proposal. In contrast, '*population data and other demographic information were collected...*' would be written in the other types of report (thesis, feasibility study, progress report, etc.).

#### **2.6.4 Feasibility reports**

Following acceptance of a project proposal, the client (an institution, a community, a company or an individual) may order a feasibility study. Pressing further on the example of water supply system used earlier the following scenario (supposition only) may be helpful in discussing feasibility studies.

Several consulting firms had submitted proposals to Landmark University for a feasibility study for the provision of a fail-safe water supply system. The management selected one of the firms to carry out the study. The firm selected was considered the best based on the quality of the proposal, particularly in terms of its apparent understanding of the problem (introduction), activities that would be carried out if given the study (proposed methodology), the length of time to carry out the study and submit its feasibility report and

the cost of carrying out the feasibility study. The firm selected commenced its work promptly. It identified various alternative means by which the institution could be supplied with water. The alternatives included:

- (a) harnessing rain water collected from roofs;
- (b) finding a river nearby to dam or, simply, to equip with an intake structure;
- (c) conducting a geophysical survey (seismic or resistivity) to determine availability or otherwise of groundwater to be tapped through boreholes;
- (d) investigating the possibility of having adequate water piped in or brought in by tankers from elsewhere, and so on.

Each alternative was extensively discussed, a conclusion drawn and recommendations made as to the best alternative based on adequacy and consistent reliability of the source and the cost of developing it.

The management of the hospital accepted the feasibility report, studied it and took a decision on its choice among the alternatives.

From the scenario it can be seen that the key elements to the preparation of a feasibility report are an understanding and clear expression of the problem (introduction), consideration of alternatives (methodology), and making a decision based on correct analysis (conclusions and recommendations).

### **2.6.5 Design reports**

When a decision has been taken to proceed with a project after a feasibility study has been carried out, the next stage is design. A detailed design consists of detailed analysis, computation, drawing of plans, profiles and sections of the various units in the system separately and together. A design report is finally produced which includes an introduction

and the presentation of working drawings, bill of quantities, specifications and forms of tender and of contract

### **2.6.6 Tender reports**

Following the production of tender documents (drawings, bill of quantities, specifications, forms), contractors are invited to collect the documents, prepare their bids and submit tenders. The method adopted may be **selective tendering** which means some specific ones among the registered contractors are invited to collect the documents or it may be **open tendering** which means tendering is open to all duly registered contractors.

After the deadline date for submission of bids, the authorized body meets and formally opens all the tenders submitted by contractors. The amount of money required to do the construction work as indicated by each contractor is recorded, along with the length of time required by it to complete the work.

Thereafter the professionals (engineers, architects, quantity surveyors) would study the submission made by each contractor in detail. All the tenders are then tabulated and discussed in a written report. The report by the professionals after the opening of tender is the **tender report**. It generally consists of an introduction, method of assessment and analysis (including visits to sites of works previously carried out by each contractor) and a recommendation which is usually a ranking of the contractors. The tender report is then submitted to the Tenders Board for the award of the contract

### **2.6.7 Operation and maintenance manuals**

When a design or construction work has been completed and put in use for some time it is necessary for the consultant in charge of the work to prepare and submit to the client an operations and maintenance manual.

In general, the element of the manual should include the introduction, plant or building description (with as-built-drawings), systems operating procedure, maintenance work and schedule, etc.

The use of these manuals is not widespread in Nigeria. In our view, it should be required by law that on medium-to-large construction projects, operations and maintenance manuals should be prepared and submitted (including as-built-drawing). When suitably prepared, such a manual would guide users as to how to operate and maintain the system. It would also provide guidelines for protection of the environment. The Federal Environmental Protection Agency (FEPA) may be interested in developing a legal framework for this.

#### **2.6.8 Environmental impact assessment reports**

An Environmental Impact Assessment, often simply referred to as an EIA, is mainly concerned with the expected negative impact of a project on the human, ecological and physical environment.

Every major project such as construction of a dam, development of a highway, establishment of an atomic reactor system, construction of a refinery etc. is justified in terms of its utility function. Regrettably, every such project has a potential to be environmentally unfriendly in some respects. This may be in terms of displacement of humans from their villages, loss of croplands, introduction of new pests and diseases, increasing the concentration of suspended particulates in air, soil degradation and so on.

An environmental impact assessment covers analysis of the potential impact of the project on the environment and a determination of how the negative impact can (and would) be mitigated or reduced. It also includes a programme of monitoring the mitigation efforts and its effectiveness.

Again, the main elements of such a report relevant to the current discussion are Introduction, Project Description, Method of Baseline Data Collection, Results, Conclusions and Recommendations. The Federal Ministry of Environment (FME) often issues general guidelines useful to persons intending to carry out an EIA in the country. An outline to guide the writing of EIA reports based on the FME suggestion is available.

### **2.6.9 Environmental audit reports**

An environmental audit is a study carried out to determine if, and to what extent, an existing outfit (which may be municipal, commercial, institutional or industrial) is impacting negatively on the environment. Whereas, as indicated, an EIA is conducted prior to the construction and commissioning of a developmental project, an environmental audit is conducted on an already existing one. It is therefore a management tool consisting of a systematic, documented, periodic and objective evaluation of how the outfit is performing especially with respect to the human, ecological and physical environment.

A consulting firm appointed to conduct an environmental audit visits the site for consultations and inspection of the facilities, obtain relevant documents and data (historical, design and specifications, operations, management structure, socio-economic and health relationship with the host community, and so on). Furthermore, new or additional baseline data are collected reflecting impact of the outfit on land, water and air within and outside the premises up as far away as the outfit may be perceived to impact on the environment.

Issues of interest for baseline data generally include vegetation, soil type, land use pattern, quantity and quality of water resources in the area, infrastructure (i.e. roads, water supply, waste management, housing, health facilities, etc.), concentration of particulates, level of noise, etc.

Again, the audit report is written generally to contain Introduction, Methodology, Results, Conclusions and Recommendations. A suitably modified version of the EIA report outline may be useful in writing an environmental audit report. In addition, a list of abbreviations and acronyms that are commonly used in EIA and EA reports are also available.

#### **2.6.10 Summary list of key elements**

From the general coverage of the various reports, it is clear that the important elements or sections that writers of reports often have to write include introductions, literature reviews, methodologies, results and discussions, recommendations, and abstracts or summaries.

A brief discussion to guide the writing of each of these elements is presented:

**(a) Introductions** - The introduction chapter or section of a report should provide the background information, the purpose and the scope of, and justification for work being reported on.

There is no standard format for writing introductions. What is important is that the introduction should properly set the stage for what is contained in the report. It should be clear to the readers by the time the introduction has been read, what the problem being addressed is; how it came about; what part of it has been dealt with elsewhere and what remains to be done; what the implications are, for not doing the work and also for doing it; specifically what part of what remains is being addressed in the report.

Thus, an introduction could contain diverse sub-headings such as history, current status, projected problems, background to the problems, objective and scope of the report and

so on. The importance and location of the statement of objective and scope in an introductory chapter is very relevant.

**(b) Literature Reviews** - Literature update is an essential part of scientific methods and other methods of systematic inquiry (recognition and formulation of a problem, collection of data through observation and experiment and the formulation and testing of hypothesis).

Literature review is commonly presented as a separate chapter following the introductory chapter of reports involving studies. Examples of such reports include dissertations, journal articles, articles for presentation at conferences, workshops and seminars and academic project reports.

Literature is reviewed in order to establish the state of knowledge in the subject under consideration, so that areas needing further work are pointed out, and so that knowledge already well-established and published are not needlessly repeated.

**(c) Methodologies** - In reports on research works (dissertations, journal articles), feasibility studies, analysis of tenders and numerous others, it is important that the method(s) used in carrying out the work be carefully reported. Reports as to method(s) used commonly come under the heading *Materials and Methods, Procedure, or Methodology*.

The presentation of the method should be orderly and if possible, chronological. The materials used and the way they are used are described systematically so that the reader is in no doubt as to what was done and how it was done to achieve the results obtained. A description as to how the data were analysed and conclusions drawn may also be appropriately included as part of methodology. However, where standard analytical methods or other procedures already described elsewhere (e.g. ASTM, BSI, CP, etc.) are involved, they should not be included in the text in detail. Instead, they are simply referenced or placed in the appendix.

Where a study or experiment consists of many procedures, graphic aids may be used to clarify the description. A notable example of this is the use of *flow diagrams* in describing programming procedures and processes.

One important way to check if materials and methods have been adequately presented is to ask oneself if one could, using the description, reproduce the work and its results (reproducibility) or if someone else could carry out the same thing, with the same effect (repeatability).

**(d) Results and Discussions** - Results obtained from observation and experimentation are presented as a very important aspect of the report. Presentation of results and discussions as to what the results mean are commonly presented together in a single chapter titled: '*Results and Discussion*'. Such a section conveniently presents the result and interprets them.

Results obtained through observation and/or experimentation have quantitative aspects. They are therefore presented in the form of tables, and figures (charts, drawings, etc.). The data should be properly grouped to facilitate discussion.

**(e) Conclusions and Recommendations** - The chapter on conclusion is usually the last in a book or technical report. When taken along with recommendations, it is the last part of the main text. If the study has been carried out diligently and logically in consonance with the stated objectives, then by the time the results are presented and discussed, conclusions should be easy to draw. The conclusion section is prepared by collating the important elements of the results section. It states the extent to which the objectives of the study have been met and summarizes the contribution of the project findings to knowledge. Any possible application of the results should also be stated.

The chapter is usually concluded with a statement of list of recommendations based on the result of the study. Suggestions for further study are also included where appropriate.

**(f) Abstracts** - An abstract is a condensed form of the whole report. It is also known by other names such as summary, synopsis, and executive summary. It is placed at the beginning of the report, usually after the title page and the letter of transmittal (if applicable). As a baby is to the full grown, so is an abstract to the whole report. All the essential parts are fully represented.

The abstract assists the reader to understand the content of a report even before he has a chance to read the whole report. Very often, one reads the abstract in order to determine whether the work is relevant to one's study or not and whether the whole report should be read. There are three main components of an abstract; namely, the **introduction** or **background**, the **methodology** and the **results**.

The introduction is a brief statement of the background of the project. It is usually not longer than a few sentences. The methodology is a brief explanation of the procedure used for the study. The final part is a statement of the major results and the final conclusion. The writer may include applications of the results and contribution of the work to knowledge. Thus, indeed, an abstract is a capsular summary of the whole report.

The length of an abstract depends on the length of the original report. In journal articles, an abstract may be as short as 100 words, and as long as 250 words. It is customarily single-spaced.

In dissertations and theses, the lengths of abstracts range from about half a page to two pages. They are commonly double-spaced. Engineering reports (e.g. feasibility reports, design report, etc.) usually contain '*executive summary*' rather than *abstracts*. An '*executive summary*' or simply '*summary*' is a term very popular with executives. Very often, persons who have to take crucial decisions on a report, read only a summary. Therefore, it must be informative and brief. An example of an abstract is as follows:

### **Abstract\***

Small scale vegetable grower needs investment and cost guidelines on the different irrigation systems to evaluate the economics and profitability of growing their crops under these systems. This paper determines the growth, yield and economics of production of okra and amaranth under four irrigation methods: sprinkler, drip, furrow and basin. The experiment was conducted at the Teaching and Research Farm of Obafemi Awolowo University, Ile-Ife, Nigeria on a sandy loam soil during the dry season. The treatments were the four irrigation systems laid out in a completely randomized design with four replicates of each treatment. Plant heights and leaf area index were measured at different stages of plant growth and yield measured at maturity. The fixed and variable costs of all the methods were estimated using the results of field experiments and data collected from 50 survey farms and the State Agricultural Development Authority. Economic analysis of growing the crops under the different methods was then carried out.

Results indicated that drip irrigation and sprinkler gave significantly higher ( $P < 0.005$ ) yield than furrow and basin for both crops whose yields are not significantly different. However drip gave higher water use efficiency than sprinkler system for both crops, while water use efficiency of furrow was significantly higher than that of basin for okra. Partial budgeting shows that all the systems are profitable with basin having the least Benefit-Cost ratio and drip the highest. Economic analysis indicates that a minimum of 2½ and 3 years pay-back period would be needed to pay off the fixed assets for drip irrigation of amaranth and okra, respectively. It is recommended that drip irrigation should be used for growing of the crops especially where labour are not available or cheap.

**Keywords:** Irrigation systems; Yield; Economics; Benefit-cost ratio, Partial budgeting.

\*Okunade, D.A., Olanusi, O.A., and Adekalu, K.O. (2009). Growth, Yield and Economics of Okra and Amaranth Production Under Irrigation. *International Journal of Vegetable Science*, 15:28-43. Published by Taylor & Francis, Philadelphia.

It can be observed that the first two sentences of the abstract represents a brief background to the work; the next three or four sentences cover the method used (methodology) and the remaining portion summarizes the results.

**(g) Outlines** - An outline serves the purpose of guiding the writer of a report. If well prepared, it may assist in the preparation of the table of contents when the report is completed.

**Development of an outline** - Once the topic of a study has been chosen, developing an outline is a very important task. A method of doing this is to write down the topic on a piece of paper and then list all the items which one thinks about the subject as they flow from one's mind. Care should be exercised to write down the ideas as they come to mind without

bothering about their relevance to the subject or their logical sequence. The items would be sifted and rearranged later.

After listing all the items that can be thought about the subject, these items can be numbered consecutively for ease of reference. Then, the items should be thoroughly examined and grouped together as much as possible. Irrelevant items should be disregarded during grouping. Each group may be examined further and divided into subgroups as may be deemed fit. The outline can then be copied out in a logical sequence. The elements of each group should belong properly together and be given a suitable heading. It should be pointed out that the outline can be modified as the writing continues.

**Interrelationships of headings and sub-headings** - Outlining involves the division of a topic into headings and sub-headings. Numbers or letters or both are used for labeling the sub-headings. Outlines of short reports may require no numbering.

Three types of numbering in general use are as follows:

(a) *Capital Roman numerals with chapter headings:*

I, II, III,... (First level chapter headings)

A, B, C, ... (Second level chapter headings)

1,2,3, ... (Third level chapter headings)

a,b,c, ... (Fourth level chapter headings)

(b) *Capital letters with chapter headings*

A,B,C,... (First level chapter headings)

1,2,3,..... (Second level chapter headings)

a, b, c,..... (Third level chapter headings)

i, ii, iii,.... (Fourth level chapter headings)

*(c) Arabic numerals with chapter headings*

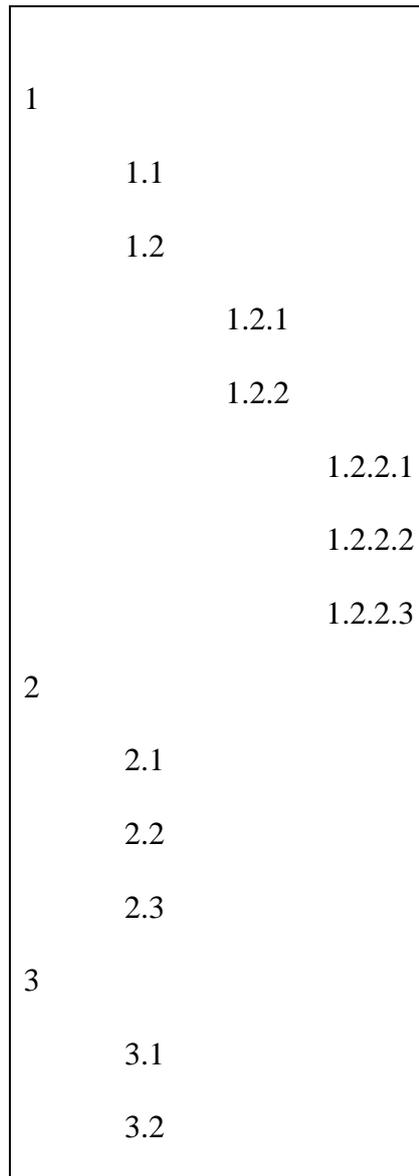
1, 2, 3, .... (First level chapter headings)

1.1, 1.2, 1.3, .. (Second level chapter headings)

1.1.1, 1.1.2, 1.1.3.... (Third level chapter headings)

1.1.1.1, 1.1.1.2.....1 (Fourth level chapter headings)

Type (c) is perhaps the most commonly used in technical report writing. The actual arrangement of type (c) may be as follows, for example:



Except in extremely long reports, subdivisions should not exceed the third level. Further subdivisions may be achieved by the use of paragraphs.

In writing an essay, a report, or even a letter, a good writer would first prepare an outline. No good report can be written without an outline.

## 2.7 Exercises

1. List *eight* (8) different types of reports and describe briefly the general coverage of any five of them.
2. Discuss concisely and briefly the important elements or sections of a report?
3. What is an abstract? Discuss the three main components of an abstract.
4. Distinguish between Environmental impact assessment (EIA) and Environmental audit (EA) reports.

### Reading List -

1. Ogedengbe, M.O., Akanbi, C.T., Oladepo, K.T. and Adewumi, I.K. (2005). Technical Report Writing. Macmillan Nig. Publishers Ltd, Lagos. Nigeria. 95pp.

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