PhD STUDY SUPPORT LITERATURE

1. Research Process

The complexity of today's technological world necessitates the importance of research for development of analytical skills, keen observation, critical reasoning and integrated thinking. In fact, the ever evolving and fast-growing technology is changing the world so fast that emphasis over latest available knowledge has emerged as the matter of prime importance.

Going forward, knowledge intensity will affect every human endeavor. And currency of this new emerging world order is excellence in research which is directly linked with technological and business world where competitive advantage plays vital roles. For this research and innovation becomes the matter of considerable significance.

Research is the systematic process of collecting and analysing the information to increase our understanding of the phenomenon under study (Balakumar, Inamdar, & Jagadeesh, 2013). The goal of research is to develop and buildan opinion on a topic. It is a synthesis of our own original perceptions, attitudes, ideas and experiences supported by information gained from other sources.

Research is, by and large, a self-regulating and self-policing process wherein researchers conduct and present their research without falsification and fabrication, giving credit to otherscholars for their ideas when and where such credit is due (Commision, 2020). Therefore, while maintaining high research quality is vital, it is equally important that research is conducted in a culture that supports honesty and integrity to ensure the highest standards of ethical practice and behaviour.

2. Elements of Research Process

Various elements and steps involved in research process are as under (Balakumar, Inamdar, & Jagadeesh, 2013):

Research Area Identification & Existing Literature Review	Gap Recognition & Topic Finalization	Research Planning* & Available Inputs*	Research Design Development* & Verification* Validation*	Output – Reports, Publications, Patents, etc.

Figure 1: Research Process

2.1. Research Area Identification and Literature Review

2.1.1. Research Area Identification

The research process begins with identification of a broad research area by the researcher (Kothari, 2004). This is generally the area of interest of the researcher in which he wants to carry out the research study.

The choice of research questions and rationale is a critical starting point. The creation ofnew knowledge and translation are important outcomes of research. The sound formulation ofthe research question requires:

1. Consultation with experts.

2. An understanding of relevant theories and the available data and records.

3. An understanding of the relevant literature.

2.1.2. Literature Review

Once an initial objective is identified, it is imperative that researchers are familiar with the state-of-art in their domain and undertake projects that meet their objectives, keeping in mind potential unintended negative consequence of the proposed activities. Describing the research questions and locating them properly in the existing literature are important aspects of literature review. A literature review involves searching and compiling the literature available on a specific topic (Snyder, 2019). A meaningful literature review, however, is

much more than a collection of summaries of papers or an annotated bibliography of research manuscripts. It involves using the ideas in the literature to ensure an understanding of earlier research, their methodological approach, and contributions. It also serves the important function of preventing the duplication of research and redundant publication. The essential steps in a literature review involve:

1. Framing research question in terms of the existing literature.

2. Consulting relevant databases and texts for the search.

3. Listing relevant keywords and phrases, as well as known key references.

4. Ensuring search results are easily retrievable and traceable.

5. Revising the original research question, if necessary.

2.2. Gap Recognition & Topic Finalization

A research gap or a literature gap refers to such unexplored or under explored areas that have scope for further research (Balakumar, Inamdar, & Jagadeesh, 2013). Research gaps can be identified by citation analysis, systematic reviews and in the introduction section of research articles and finally in the discussions and future research sections in research papers or journals which researchers have already published.

There are different techniques in various disciplines, but we can reduce most of them down to a few steps, which are:

- Identify key motivating issue/question.

- Identify key terms associated with this issue.

- Review the literature, searching for these key terms and identifying relevantpublications.

- Review the literature cited by the key publications which you located in the above step.

2.3. Research Planning and Available Inputs

Once the research questions have been clarified, contextualized and located within the existing literature, evidence must be obtained to support or refute the research claims. Typically, this evidence is presented through data. A research plan is a short document, which sets out initial thoughts on a research project in a logical and concise manner (McLean, 1988). It is a foundation document supported by evidence from literature review from which a detailed research proposal is developed. It is constructed in the following format:

- The research questions

- The hypotheses

- Aims and objectives

- Research design

2.4. Research Design, Development, Verification & Validation

2.4.1   Research Design & Development

A sound, systematic, and rigorous research practice depends upon the underlying ontological, epistemological, and methodological assumptions (Mackenzie & Knipe, 2006). Hence, the method used to systematically address research problems vary by discipline, the ontological and epistemological assumptions and traditions. These assumptions and the underlying logic define the various steps that are generally adopted by researchers. Research can be theoretical and empirical.

- Theoretical research is concerned with developing, exploring or testing the theories or ideas about how the world operates.

- Empirical research is based on observations and measurements of reality what we perceive of the world around us. The inferences that we make in research have probabilities associated with them.

Statistics is so dominant in research as it estimates probabilities in different situations. Research relies on empirical evidence and objective considerations for making probabilistic predictions.

2.4.2 Verification & Validation of Research

Robustness of the research results depends on thorough research execution, systematic documentation, and data quality. Careful collection of data is necessary not only for ensuring the quality of the results but also for maintaining records of collection methodology. These recordsare essential for judging data quality and for ensuring that future researchers can replicate the results.

Research design is made public for critical scrutiny and testing the conclusions through replication (Wahyuni, 2012). In this way, research methodology encourages a rigorous, impersonal mode of procedure dictated by the demands of logic and objective procedure. The purpose of research is to discover answers to questions through the application of scientific procedures. Each research study has its own specific purpose.

a. **<u>Verification:</u>** The evaluation of whether a research design complies with requirements,specifications, or any other imposed conditions. Prior to research development phase, verification procedures involve performing special tests to model or simulate a portion, or the entirety, of research, then performing a review or analysis of the modelling results. In the post-development phase, verification procedures involve regularly repeating tests devised specifically to ensure that the research output continues to meet the initial design requirements, specifications, and regulations as time progresses. It is a process that is used to evaluate whether a product, service, or system complies with regulations, specifications, or

conditions imposed at the start of a development phase. It is often an internal process.

b. **Validation:** The assurance that a research process follows the research objectives identified through literature review. It is a process of establishing evidence that provides a high degree of assurance that a research design accomplishes its intended outcomes. This often involves acceptance of fitness for purpose with reviewers. This is often an external process.

2.5. Research Output

Journals are the primary channel of scholarly communication for many disciplines. They provide a wide range of publishing opportunities for scholars at all career stages.There are many different types of article, for ex- review, original research, case study, methodological, theoretical, etc. Data publication and reporting is the process of preparing and disseminating research findings to the scientific community. Scholarly disciplines can only advance through dissemination and review of research findings at professional meetings and publications in discipline-related journals. The tacit assumption in publishing is one of trust between the author(s) and readers regarding the accuracy and truthfulness of any submission.

The practice of ensuring research integrity is relevant at all stages of research investigation, from early conceptualization, design, implementation, to analysis. This practice also extends to the stage of documenting and preparing results for publication. In this process, researchers may experience many more challenges to preserving research integrity (Hirsch, 2005).

3. Sample Design along-with Hypothesis Formulation & Testing

Additionally, in many cases, sample design and hypothesis formulation & testing play an important role for proper analysis and conclusions (Kothari, 2004). Details are as under:

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┌──────────────┐    ┌──────────────┐    ┌────────────────────┐
│ Formulate    │    │ Sample       │    │ Analyze data along │
│ Hypothesis   │──▶ │ Design & Data│──▶ │ with Hypothesis    │
│              │    │ Collection   │    │ Testing            │
└──────────────┘    └──────────────┘    └────────────────────┘
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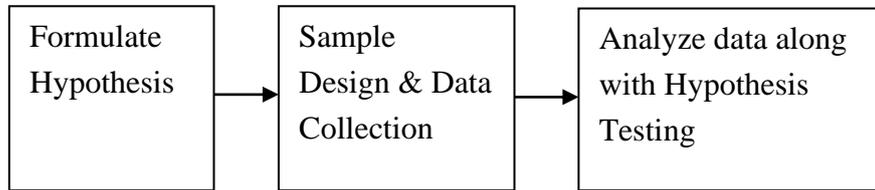
Figure 2: Research Process involving hypotheses formulation and other concepts

- **Formulation of Hypotheses:**

Hypothesis is tentative assumption made in order to draw out and test its logical or empirical consequences. It provides the focal point for research as it is very specific and limited to the piece of research in hand. Its role is to guide the researcher by delimiting thearea of research and to keep him on the right track for data analysis.

- **Sampling:**

It is the process of selecting units from a population of interest for generalizing the results back to the population from which they were chosen.The way of selecting a sample is popularly known as the sample design. It is a definite plan determined before any data are actually collected for obtaining a sample from a given population.

- **Data Collection:**

For ensuring adequacy and dependency in collected data, it is essential that research process is accomplished in a systematic manner and in time. The data collection can be made in various manners as per requirement.

- **Analysis of Data (Hypothesis Testing):**

In research process, the data analysis involves three major steps in the following order:

1. **Preparation of Data**: It consists organizing the data collected from research process for analysis.

2. **Description of Data**: It is the representation of data collected in research process using descriptive statistical measures and graphical analysis.

3. **Interpretation and Deduction of Data**: It is also called hypothesis testing in research process. Here, it is examined whether facts support the proposed hypotheses or they happen to be contrary. Various tests, such as Chi square test, t-test and F-test are utilised for this purpose depending upon the nature and objectives of research design. It results in either accepting the hypothesis or in rejecting it.

- **Preparation of Thesis/Report**:

   i)   Developing a good, effective and concise research report a crucial part of research process. The essential considerations taken into account are:

   1. For whom is the report intended?
   2. Specific research findings
   3. The Format - Structure of report

   ii) The elements of the research process typically addressed in a research paper are:

   1. Introduction
   2. Abstract
   3. Research Design
   4. Sampling Section
   5. Measurement Section
   6. Design & Procedures Section
   7. Results
   8. Conclusions & Reference Section

4. Review criteria for high-indexed journals

Research design is made public for critical scrutiny and testing the conclusions through replication. In this way, research methodology encourages a rigorous, impersonal mode of procedure dictated by the demands of logic and objective procedure. The purpose of research is to discover answers to questions through the application of scientific procedures. The review criteria examine the evidence that a research paper contains (Murthy & Iyer, 2013):

- **<u>Novelty</u>**: New knowledge that the research paper has contributed and how can it be applied elsewhere.

- **<u>Positioning</u>**: Arguments regarding why the research work is required in the light of prior published research and how it advances the state of art.

- **<u>Soundness of procedure</u>**: Details which demonstrate that the steps of the solution have been implemented systematically.

- **<u>Evidence of claims</u>**: Evidence such as data, analysis, examples and feasibility studies which show that the solution works as claimed.

- **<u>Coherence</u>**: Consistency between problem to be solved, solution approach, results, and claim.

5. Bibliography

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