

Research Design, Philosophy, and Quantitative Approaches in Scientific Research Methodology

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Abstract

Original Research Article

This paper provides a comprehensive review of existing literature on research design, philosophy, and quantitative approaches in scientific research methodology. It explores the theoretical foundations that influence researchers' choices when developing a research strategy, with particular emphasis on the alignment between research philosophy and methodological choices. By examining key philosophical paradigms such as positivism, interpretivism, and pragmatism, the paper highlights how these frameworks shape the selection of quantitative, qualitative, and mixed-methods research approaches. The Research Onion Model is utilized to demonstrate the sequential layers of research design, from philosophical stance to data collection strategy. Through a review of current research, this paper provides insights into the importance of selecting the appropriate methodology based on the research objectives, questions, and underlying theoretical perspectives. The findings suggest that understanding the interplay between philosophy and methodology is crucial for ensuring a coherent and effective research design. By synthesizing existing theoretical perspectives, this paper contributes to a deeper understanding of the methodological choices available for scientific research.

Keywords: Research Design, Research Philosophy, Quantitative Research, Research Paradigms, Positivism, Experimental Research, Non-Experimental Research, Scientific Methodology, Research Onion Model.

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INTRODUCTION

In scientific research, the design and strategy employed are crucial in ensuring the research questions are answered effectively and the objectives are met. A research strategy serves as a systematic approach, guiding researchers through the steps of data collection, analysis, and interpretation. It outlines the methods and techniques that are employed to achieve the research goals while navigating the complexities of the study. A well-defined research strategy not only ensures that the correct data is collected but also helps in drawing valid conclusions that contribute to knowledge advancement (Alharahsheh & Pius, 2020).

The concept of research methodology is foundational to any research, and the nested research design model introduced by Kagioglou *et al.*, (2000) offers a structured way of understanding how various elements of research design and strategy interrelate. This model highlights the significance of choosing an appropriate methodology to address the research questions and test hypotheses. Figure 1 below illustrates this model, highlighting the layered approach to research design.

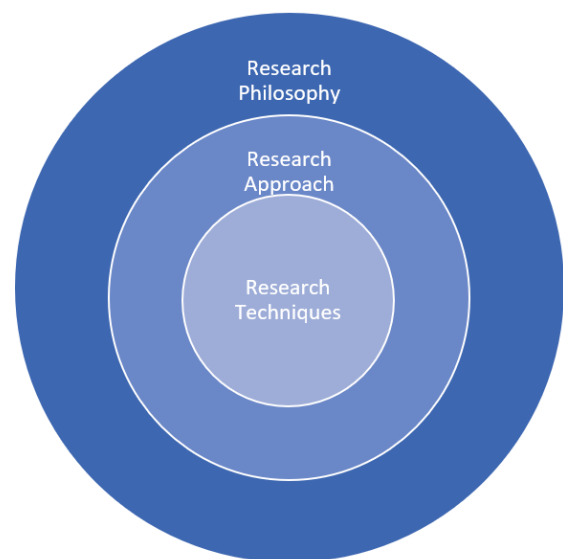


Figure 1: The Nested Research Design Model

A key decision in any research study is the choice of the data collection method, which primarily falls into quantitative, qualitative, or mixed methods

approaches (Alharahsheh & Pius, 2020). The selection of the appropriate strategy is influenced by various factors, including the research objectives, available resources, ethical considerations, and the nature of the research problem. Researchers typically outline their chosen approach in the methodology section, providing a roadmap for how they will address the research questions or test their hypotheses.

Research Objectives

This paper aims to provide an in-depth exploration of research design, philosophy, and quantitative approaches in scientific research methodology. Specifically, the objectives of this paper are to:

1. Examine the various research paradigms and their implications for study design.
2. Provide a detailed overview of the research onion framework and its application in selecting an appropriate quantitative research approach.
3. Explore key quantitative research methods, including experimental, non-experimental, survey, and correlational designs, to understand their role in scientific research.

By exploring these key aspects, this paper will contribute to a better understanding of how to design robust research strategies that align with the specific goals of scientific investigations.

Research Design and Strategy Overview

Research design serves as the blueprint for a study, detailing the methods, procedures, and strategies used to collect and analyze data in order to answer research questions or test hypotheses. It is a comprehensive framework that guides the researcher in systematically addressing the study's objectives while ensuring that the findings are valid, reliable, and meaningful. A well-designed research strategy is essential for navigating the complexities of the research process, allowing for the collection of relevant data and the drawing of accurate conclusions (Alharahsheh & Pius, 2020).

In research methodology, several approaches exist to collect data, primarily categorized as quantitative, qualitative, or mixed methods (Alharahsheh & Pius, 2020). The choice between these methods depends on the research objectives, the type of data required, and the underlying philosophy of the research. A researcher must critically evaluate these options to select the most appropriate method for addressing their

specific research questions. Factors such as available resources, ethical considerations, and the nature of the research phenomenon all play a role in determining the strategy to be employed.

Once the research strategy is determined, it is detailed in the methodology section of the research paper. This section provides an outline of the steps taken throughout the study, ensuring transparency and facilitating replication. Researchers must clearly explain the methodologies used and justify their choices in order to effectively communicate how the research was conducted and how the data was gathered and analyzed.

Research Philosophy

According to Saunders *et al.*, (2019), the research philosophy is a set of convictions and presumptions concerning the development of understanding. While this might sound complex, it mirrors precisely the process a researcher engages in when they commence research (Saunders *et al.*, 2019). As highlighted by Saunders *et al.*, (2016), the researcher should examine their own questions and beliefs to explore and understand the research philosophy.

Therefore, prior to determining a strategy for collecting data, it is essential for the researcher to establish a philosophical perspective that serves as the foundation for evaluating the data which is called 'paradigm'. According to Kivunja & Kuyini (2017), the term "paradigm" was initially introduced by the American philosopher Thomas Kuhn in 1962 to refer to a particular philosophical mode of thinking.

Research Paradigm

A research paradigm refers to a set of beliefs, assumptions, values, and practices that guide and inform the way research is conducted within a particular field or discipline (Lincoln *et al.*, 2011). "Worldview," used interchangeably with "paradigm," is defined as "a cognitive framework for comprehending and rationalizing the intricacies of the tangible world" (Kaushik & Walsh, 2019). It provides researchers with a framework for understanding the nature of reality, the way knowledge is produced, and the methods and techniques used to investigate and answer research questions. A paradigm includes a set of interconnected essential elements that collectively shape the framework for conducting research. These key components in a paradigm are epistemology, ontology, methodology and axiology (Kivunja & Kuyini, 2017). The relationship between these key elements of paradigm is shown in Figure 2.

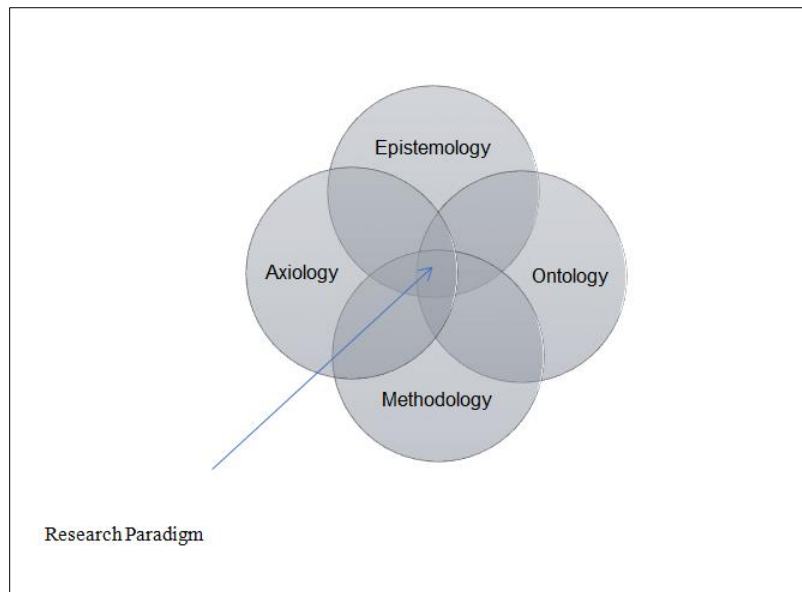


Figure 2: Key Elements of Paradigm

Epistemology

Epistemology, of a research paradigm, refers to the philosophical investigation of how knowledge is acquired, validated, and understood. It investigates into the fundamental questions about how researchers come to know what they claim to know and what constitutes valid knowledge. Epistemological considerations are paramount in shaping the methods, approaches, and processes researchers employ to investigate and make sense of phenomena (Rehman & Alharthi, 2016).

Epistemology guides researchers in determining the sources of knowledge, whether through empirical observation, intuition, personal experience, or social interactions. It addresses whether knowledge is objective and universal, or if it's contingent on subjective interpretations and contexts. According to Abu-Alhaija (2019), epistemology shapes the researcher's approach to data collection, the selection of appropriate methodologies, and the criteria used to evaluate the credibility and reliability of findings.

Ontology

The element Ontology within a research paradigm refers to the philosophical examination of the nature of reality, existence, and the fundamental essence of things. It entails exploring questions about what truly exists, the nature of being, and the underlying structures that shape our understanding of the world. Therefore, ontology serves as a critical element through which researchers interpret and approach their studies ((Kivunja & Kuyini, 2017). In essence, ontology in research paradigms shapes the researcher's philosophical orientation and sets the tone for their approach to understanding and contributing to the complexities of reality.

Methodology

In a research paradigm, Methodology element refers to the systematic approach or set of procedures and techniques that researchers use to gather, analyze, and interpret data in order to answer research questions or test hypotheses (Bibi *et al.*, 2022). It's a critical component of the research process because it guides how data will be collected, what tools and methods will be used, and how the findings will be analyzed and interpreted. Methodology essentially outlines the roadmap for conducting a research study. It is significantly shaped by the nature of the research problem, research question, and the intended objectives of the study (Bibi *et al.*, 2022).

Axiology

In research paradigms, Axiology refers to the philosophical consideration and study of values, ethics, and the role of personal beliefs in shaping the research process and its outcomes (Setiawan & Syamsuddin, 2022). It includes the examination of the values that researchers bring into their work, the ethical considerations in conducting research, and the potential impact of these values on the interpretation of findings.

Axiology is particularly important in qualitative and interpretive research paradigms, where the researcher's subjectivity and values can play a significant role in shaping the research process and the understanding of the studied phenomenon. However, it is relevant across various research approaches as well, when ethical considerations and value-related choices are present in all types of research (Maarouf, 2019). By acknowledging and addressing axiological considerations, researchers can enhance the ethical integrity of their work, promote transparency, and contribute to a more thoughtful interpretation of research findings (Killam, 2013).

Types of Paradigms

There are major three approaches of research paradigms that are positivism, interpretivism and pragmatism. Positivism seeks objective, empirical truths using quantitative methods, while interpretivism explores subjective meanings through qualitative

approaches, emphasizing context and cultural understanding (Junjie & Yingxin, 2022). The pragmatism paradigm focuses on resolving real-world practical issues through investigative methods (Allemang *et al.*, 2022). Figure 3 illustrates the major types of paradigms.

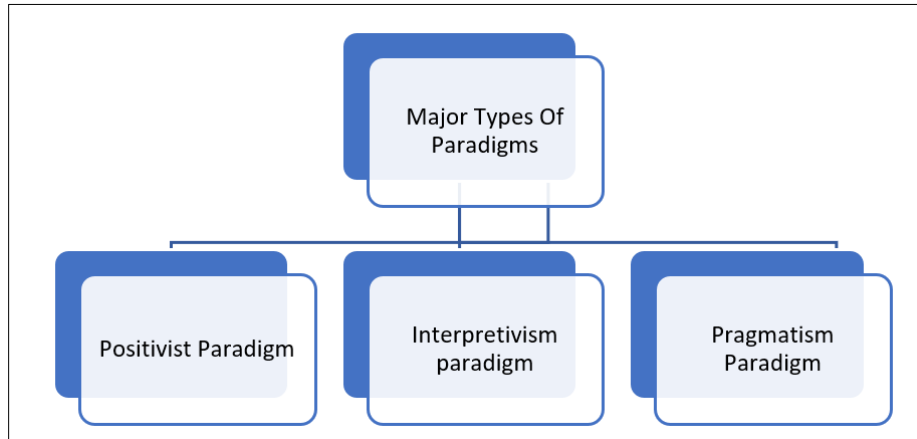


Figure 3: Major Types of Paradigms

Positivist Paradigm

The positivist paradigm is a philosophical and methodological approach that emphasizes the objective and empirical study of the world aiming to uncover universal truths through systematic observation, measurement, and analysis. Therefore, according to positivism paradigm, knowledge should be derived from observable facts and scientific principles, rather than relying on assumptions. Positivism focuses on pure data rather than human bias (Alharahsheh & Pius, 2020).

Positivist paradigm is mostly attached with quantitative research methods, such as surveys, experiments, and statistical analysis which are often favored to collect and analyze data objectively. Positivists value empirical evidence over theoretical speculation. They focus on building knowledge through systematic research (Bunmi, 2022). The positivist paradigm advocates for the use of the scientific method in various fields, including the natural sciences, social sciences, and even aspects of philosophy. It contends that the world operates according to regular patterns and laws, which can be understood through careful observation and experimentation. Positivists seek to eliminate biases and subjective interpretations, striving for objectivity (Junjie & Yingxin, 2022).

As cited by Bunmi (2022), positivist paradigm frequently faces criticism due to its inflexibility and failure to account for the complexities of human behavior. Consequently, it is frequently perceived as reductionist in its nature (Giddings & Grant, 2007).

Interpretivism paradigm

The interpretivism paradigm, which is also known as the interpretive paradigm or constructivist paradigm, is a philosophical and methodological

approach that linked to the qualitative research method or the mixed research method that collect both quantitative and qualitative data. If research problem needs deeper understanding and the available knowledge is limited, then interpretivism paradigm is the best approach for research design (Pabel *et al.*, 2021).

Researchers adopting this paradigm seek to uncover the underlying meanings, symbols, and interactions that give rise to human actions and behaviors. Unlike positivists, interpretivists are more interested in uncovering the richness and depth of individual experiences rather than seeking generalizable laws (Gunbayi, 2020).

Pragmatism Paradigm

The pragmatic paradigm in research is a philosophical and methodological approach that emphasizes practicality, real-world application, and the integration of theory and practice. It is rooted in the belief that research should be focused on addressing real-world problems, making a positive impact on society, and generating actionable insights (Allemang *et al.*, 2022). The pragmatic paradigm acknowledges that the effectiveness of knowledge is measured by its usefulness in solving practical problems rather than solely by its theoretical concepts (Saunders *et al.*, 2019).

An important aspect of the pragmatic paradigm is its emphasis on context. It recognizes that solutions that work well in one context might not be equally effective in another. Therefore, research conducted within this paradigm often involves close engagement with the intended users or beneficiaries of the research outcomes (Allemang *et al.*, 2022).

According to Saunders *et al.*, (2019), pragmatists commence research with the identification of a problem and seek to provide practical solutions that can guide future actions. The values of the researcher guide the introspective journey of inquiry, a process initiated by uncertainty and recognition of discrepancies, and culminating in the reaffirmation of conviction upon resolution of the identified problem. Pragmatists are more interested in practical outcome (Saunders *et al.*, 2019).

Researchers who adopt the pragmatic paradigm prioritize collaboration between academics, practitioners, and stakeholders. They value interdisciplinary approaches that draw on various fields to provide comprehensive solutions (Kelly & Cordeiro, 2020). Pragmatism encourages the integration of qualitative and quantitative methods to gather a holistic understanding of a problem and to develop solutions that are both empirically grounded and practically relevant.

Choosing Research Paradigm

Combining research paradigms involves blending the strengths of different approaches to gain a more comprehensive understanding of complex topics. It begins by selecting paradigms that complement each other, such as positivism and interpretivism. The process involves defining research goals, using relevant methods for data collection and analysis, and integrating findings. Transparency in explaining the rationale and ethical considerations is crucial. Ultimately, this approach enhances research quality by providing a holistic view of the subject. According to Junjie & Yingxin (2022), researchers need to assess particular issues and opt for the most suitable research approach based on their research objectives.

Research Onion Model

According to Saunders *et al.*, (2019), finding relationship between research philosophies and research paradigms can be confusing. However, Saunders *et al.*, (2019) introduced the Research Onion Model which is helpful in designing a research strategy. Figure 4 illustrates the Research Onion Model (Saunders *et al.*, 2019).

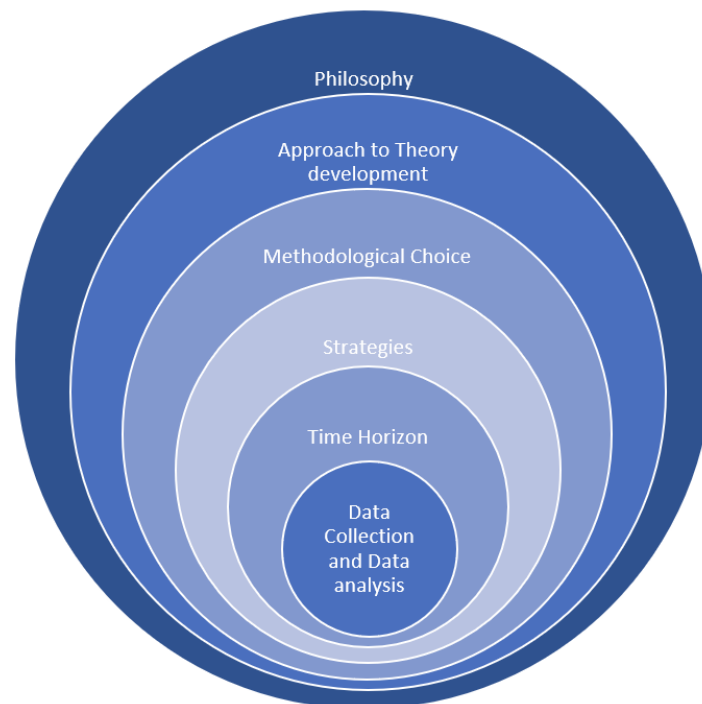


Figure 4: Research Onion Model

Research Approach

Mainly there are two research approaches although there are other approaches as well. The major research approaches are deductive approach and inductive approach. Below are the details and its suitability for different research methods.

The Deductive Research Approach

The deductive research approach is a systematic methodology used in empirical

investigations. Deduction entails moving from the general to the particular. It begins with the formulation of a general theory or hypothesis, often based on existing knowledge or literature (Zalaghi & Khazaei, 2016). Researchers then design specific research objectives and hypotheses that derive from this main theory. In this approach, data is collected through structured methods such as surveys, experiments, or observations, yielding quantitative information.

This collected data is subjected to rigorous statistical analysis to determine whether the observed results align with the predictions made by the initial theory. The ultimate goal is to either confirm or reject the hypothesis based on the empirical evidence gathered. If supported, the theory gains additional empirical validity. Conversely, if the data contradicts the hypothesis, it may lead to modifications or a re-evaluation of the original theory (Zalaghi & Khazaei, 2016).

The deductive approach aims to establish causal relationships and predict outcomes based on pre-existing theoretical frameworks. It provides a structured framework for hypothesis-driven research and contributes to the expansion and refinement of scientific knowledge. However, it is crucial to ensure that the chosen methods, sample, and analysis techniques align with the research objectives for meaningful and valid results (Kim, 2021). Figure 5 illustrates the deductive research approach.

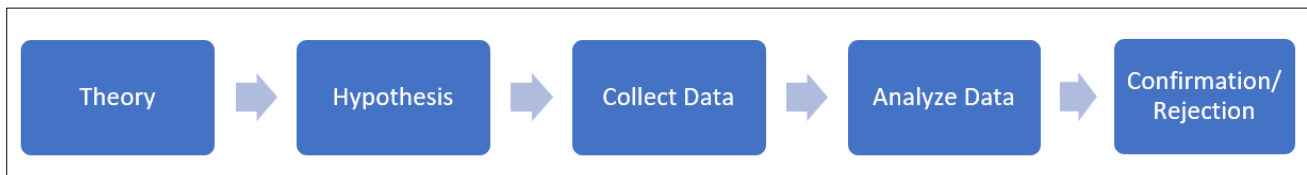


Figure 5: Deductive Research Approach

The Inductive Research Approach

The inductive research approach is a methodical strategy employed in empirical studies to generate theories or insights from specific observations and data. It involves moving from particular instances or cases to broader generalizations or theories (Kim, 2021). Unlike the deductive approach that starts with a theory and tests it through data analysis, inductive research begins with collecting and analyzing specific data to uncover patterns, themes, or trends.

Researchers gather qualitative data through methods such as interviews, observations, or content analysis. They then immerse themselves in the data, identifying recurring elements and emerging concepts.

Through careful analysis, researchers develop hypotheses or theories that explain the observed phenomena. These hypotheses are drawn from the ground up based on the data itself (Corley *et al.*, 2021).

Inductive research is often exploratory in nature and is useful when investigating novel or complex phenomena for which existing theories are lacking. It enables researchers to generate new insights and theories that can then be tested and refined through further research. However, the generalizations drawn from inductive research might not be as broadly applicable as those from deductive studies. Figure 6 illustrates the inductive research approach.

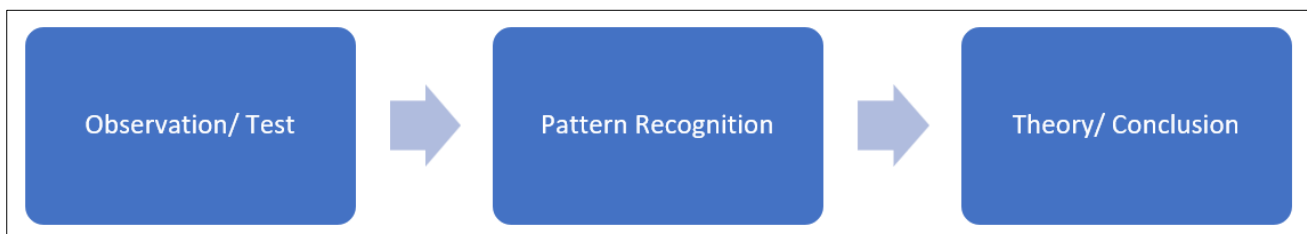


Figure 6: Inductive Research Approach

In summary, the inductive research approach involves collecting specific data and generating theories or hypotheses from the observed patterns. It is a bottom-up process that contributes to theory development and deepens understanding in areas where traditional theories might not apply.

Research Design Methodologies and Strategies

The research methodology is a systematic approach used to investigate and study of data that helps in identifying relevant facts and data for a study. According to Patel & Patel (2019), research methodology is a way utilized to systematically solve a problem including scientific studying. By using a proper research methodology, a researcher can analyse and

interpret data to achieve their research goals. There are several types of research methodologies available, each with its own set of techniques and approaches to conduct research and gather data. Researchers choose a specific research methodology based on their research objectives, the nature of the research questions, and the type of data needed, resources available, and the overall scope of the study (Mukherjee, 2019).

Basically, there are three categories of research methodology which are quantitative, qualitative and mixed method research. According to the research type, the researcher should decide his research strategy which helps him to achieve the research objectives (Asenahabi, 2019). According to Asenahabi (2019), these three main

research methodologies can be further classified into different methods as illustrated in Figure 7.

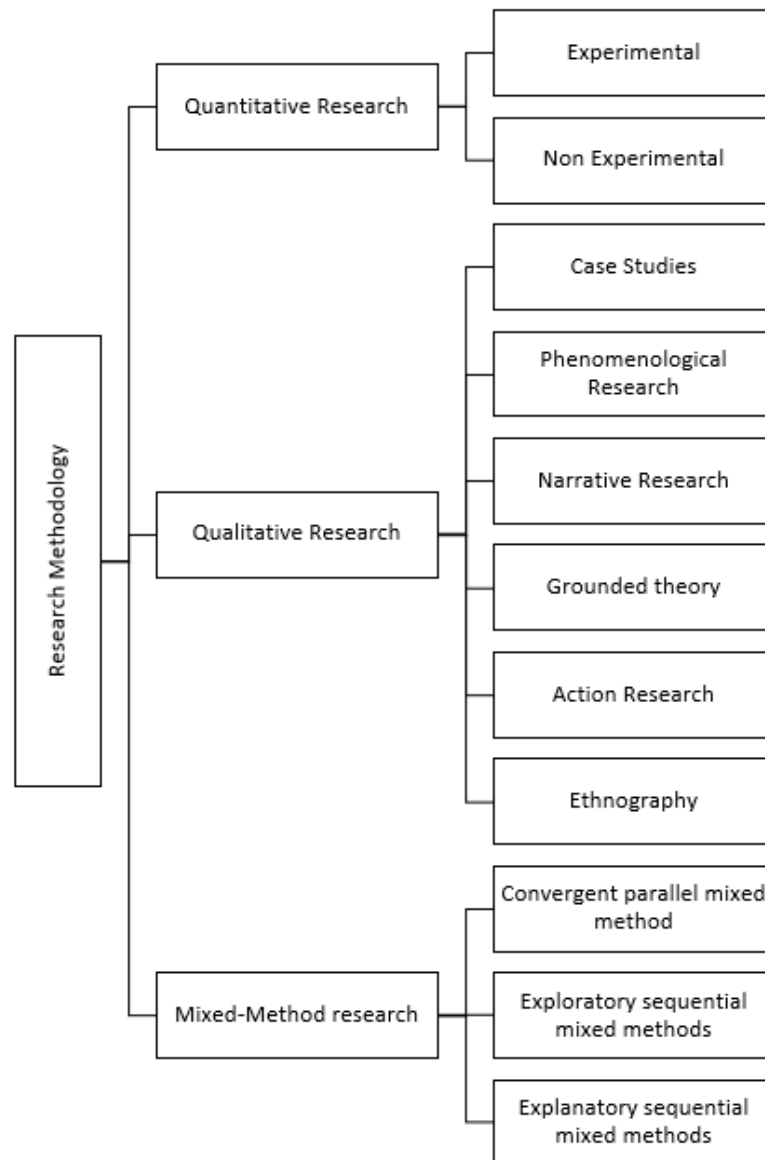


Figure 7: Types of Research Methodologies

While there are three main categories of research methodology, this study focuses on quantitative research approach in detail.

Quantitative Research

Quantitative research is a systematic empirical approach to research that focuses on collecting and analyzing numerical data to draw objective conclusions. Quantitative research makes generalizations about a population. This method is also considered as an analytical approach towards research (Asenahabi, 2019).

When quantitative research methodology is applied for research design, it requires more time and planning (Asenahabi, 2019). Further, this methodology

involves using structured and standardized methods to gather data, often through surveys, experiments, or the analysis of existing datasets. The primary goal of quantitative research is to quantify and measure relationships, patterns, and trends within a given population or sample. Therefore, quantitative research mainly rely on primary data such as data gathered from survey method and questionnaire method. Quantitative research often involves large sample sizes to increase the accuracy and generalizability of findings to the larger population (Patel & Patel, 2019). The quantitative research design methodology is of two types. Those are experimental research and non-experimental research design (Asenahabi, 2019). Figure 8 shows the different methods of quantitative research methodologies.

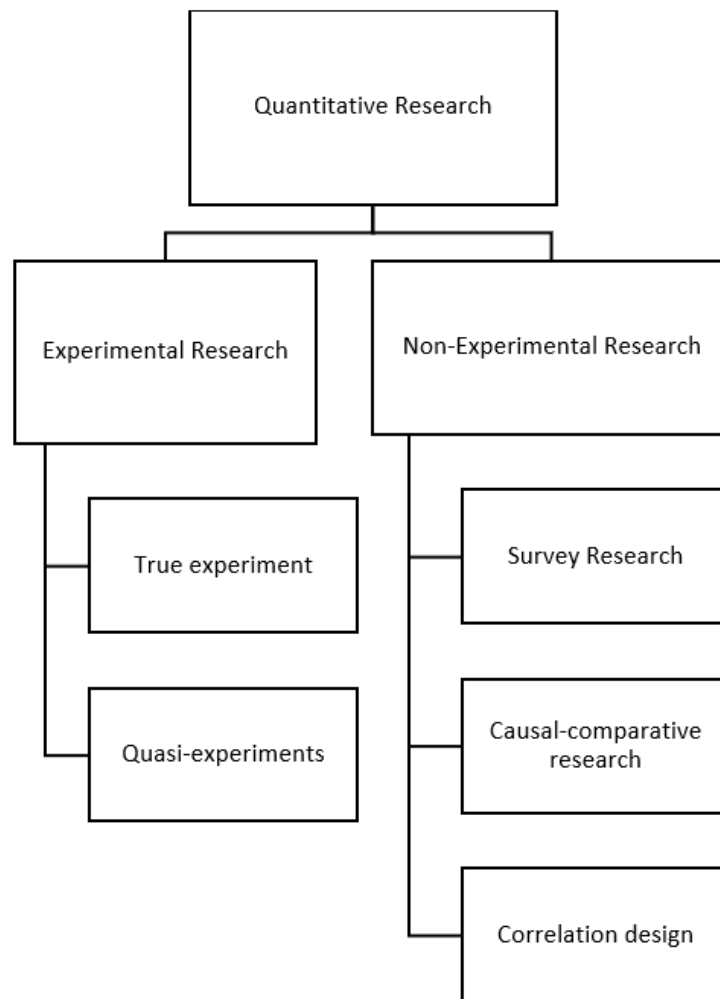


Figure 8: Types of Quantitative Research Methodologies

Experimental Research

Experimental research is a type of quantitative research design that involves the manipulation of one or more independent variables to observe their effects on a dependent variable (Asenahabi, 2019). The goal of experimental research is to establish cause-and-effect relationships between variables by carefully controlling and manipulating the conditions of the study. It is considered the most rigorous form of research for drawing causal inferences (Asenahabi, 2019). This design is best suited for controlled environments, such as laboratories, as it relies on random subject assignment and group allocation. Due to the necessity of random assignment, executing this design in real-world settings (non-laboratory) can be challenging (Pruthi *et al.*, 2021).

True Experiment Design

A true experimental research design utilizes statistical analysis to confirm or refute a researcher's hypothesis. It stands as one of the most precise and reliable forms of research, producing tangible and verifiable scientific proof. Moreover, among all the experimental designs, only a true experimental design has the capacity to establish a cause-effect relationship within a group (Dawes, 2010).

Quasi – Experimental Design

Quasi-Experimental design, also known as causal comparative design, aims to establish causal relationships between two or more variables. Quasi-experimental studies are formulated using already existing situations in real world. Therefore, this experiment method is widely used in educational settings (Li & Zhang, 2021).

A quasi-experimental design shares similarities with a true experimental design but differs in terms of how the control group is formed. In this research design, although, researchers manipulate an independent variable, they do not randomly assign participants to specific groups. According to Chiang *et al.*, (2015), Quasi-experimental research fails to completely eliminate the issue of confounding variables. Consequently, in terms of internal validity, quasi-experiments typically lie somewhere between correlational studies and true experiments (Chiang *et al.*, 2015).

Non-Experimental Research

Non-experimental research refers to studies that do not involve the manipulation of an independent

variable. Instead of actively altering the independent variable, researchers in non-experimental studies merely observe and measure variables as they naturally occur, whether in a controlled laboratory setting or the real world (Chiang *et al.*, 2015).

Further, non-experimental design refers to a quantitative research approach that abstains from conducting experiments during the data collection process. According to Novosel (2023), non-experimental research can be described as observational research, where investigators passively collect data without introducing any intervention to the study subjects or participants.

Non-experimental studies are valuable in advancing our understanding, and it is essential not to dismiss them solely based on their lower level of evidence. Indeed, certain situations may make it impractical, unfeasible, or unethical to carry out an experimental design (Novosel, 2023). It can be categorized into three groups: Survey design, Causal-comparative design, and Correlation design (Asenahabi, 2019).

Survey Research Design

This research approach offers a quantitative representation of attitudes, opinions, or trends within a population by examining a sample from that population. This is a means of gathering substantial data, often in a statistical format, from a considerable number of individuals within a relatively brief period. This is typically achieved through closed-ended questions (Asenahabi, 2019).

Essentially, survey researchers request their respondents to directly report their thoughts, emotions, and actions. Another crucial aspect is the focus on sampling. Survey researchers strongly favor large random samples as they offer the most precise estimations of the population's characteristics (Chiang *et al.*, 2015).

Surveys vary in length, ranging from short to lengthy, and can be administered through various methods such as in-person, telephone, mail, or online. While survey data is commonly analyzed using statistical methods, some questions are better suited for qualitative analysis (Chiang *et al.*, 2015).

The majority of survey research falls under the category of non-experimental. Its primary purpose is to describe individual variables. The survey method also serves to assess statistical associations between variables. However, it is worth noting that surveys can also be conducted as experimental studies (Chiang *et al.*, 2015).

Presently, surveys and survey experiments hold significant importance as data sources in various fields,

including psychology, sociology, political science, and behavioral economics. Survey analysis constitutes a substantial body of literature in statistics, and survey design has been subject to extensive research in the social sciences over the past decades (Kaufman, 2020).

The main benefit of survey studies is their ability to gather information from large groups of people with minimal effort and cost. Surveys offer researchers the opportunity to explore a broader range of behaviors and other phenomena compared to what can be observed in a typical naturalistic observation study (Asenahabi, 2019).

A well-designed survey design is challenging. Particularly it requires phrasing questions without bias and ensuring respondents can provide clear responses for every question. Consequently, significant time and effort should be devoted to constructing survey items carefully (Chiang *et al.*, 2015).

Causal-comparative/ ex-post facto research

Causal-comparative research, also known as ex-post facto research, is a research design that investigates relationships between independent and dependent variables after an action or event has taken place. The aim is to ascertain whether the independent variable influenced the outcome or dependent variable by comparing multiple groups of individuals. In this type of research, researchers seek to identify relationships among variables but do not have the ability to directly manipulate these variables (Strzelecki *et al.*, 2022).

Further, causal-comparative research designs function similarly to quasi-experiments, with the distinction that the effect has already taken place (ex-post facto). As the effect is already established, the researcher lacks the ability to directly manipulate the variables. Instead, they analyze the outcomes and conditions at the time. For instance, a causal-comparative study might examine the variance in test scores based on biological sex (Action Research for Science Teachers, 2020).

Correlation design

Correlational research is another non-experimental research type. In this method, the researcher measures two variables and evaluates the statistical relationship (correlation) between them without actively controlling extraneous variables (Chiang *et al.*, 2015).

Basic forms of correlation research are employed to establish whether a connection exists between two continuous variables. Continuous variables have a range from a minimum to a maximum value and can take any value within that range (Action Research for Science Teachers, 2020).

While correlation does not imply causation, it does indicate the presence of a relationship between the

variables. For instance, according to Action Research for Science Teachers (2020), in an action research project, one might investigate if using a web-based practice quiz site helps prepare students for tests. In this scenario, a correlation study could be conducted to examine if the number of practice problems a student answers correctly correlates with their final test score (Action Research for Science Teachers, 2020).

While correlational research can unveil robust associations that might be valuable in shaping intervention designs for causal testing in experimental studies and enabling the manipulation of independent variables, it does not consider other latent variables that could be causing or influencing the observed effect (Stefl-Mabry *et al.*, 2020).

Above are the different research methodologies that are used by researchers to design their researches.

Therefore, researchers need to understand the available methodologies and the research problem well before deciding on their research methodology.

Time Horizon

In research methodology, the term "time horizon" refers to the period over which a research study is conducted and the period which data is collected, analyzed, and interpreted. It represents the timeframe that researchers focus on when investigating a particular phenomenon, problem, or topic. The time horizon can vary widely based on the nature of the research question, the objectives of the study, and the available resources. According to Saunders *et al.*, (2019) and their introduced Research Onion Model, there are two time horizons. Those are namely, Cross-Sectional Time Horizon and Longitudinal Time Horizon (Saunders *et al.*, 2019). Figure 9 illustrates time horizons as introduced by Saunders *et al.*, (2019) in his Research Onion Model.

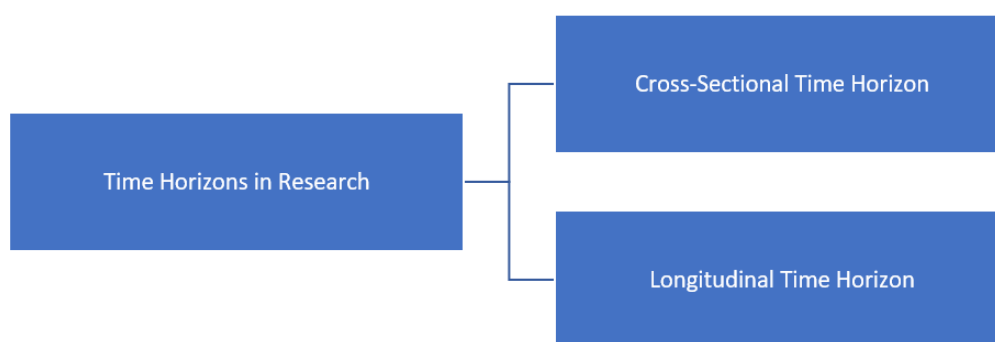


Figure 9: Time Horizons in Research

Cross-Sectional Time Horizon

According to Saunders *et al.*, (2019) and as cited by Aburas (2020), Cross-Sectional Time Horizon involves collecting data at a single point in time of a particular situation or phenomenon. Cross-sectional studies do not involve tracking changes or developments over time. They are useful for capturing variables and their relationships over a short period of time (Aburas, 2020).

Longitudinal Time Horizon

A longitudinal time horizon involves conducting research over an extended period, allowing researchers to observe changes, trends, and developments over time. Longitudinal studies involve collecting data from the same subjects or entities at multiple points in time. (Saunders *et al.*, 2019). This approach is useful for understanding patterns, causality, and dynamics that unfold over an extended period (Aburas, 2020).

Structured Research Strategy Development Using the Research Onion Model

Designing a robust research strategy requires a structured approach that ensures alignment between research objectives, philosophical foundations, and methodological choices. The Research Onion Model

introduced by Saunders *et al.*, (2019) provides a systematic framework for constructing a well-founded research design. This model guides researchers through multiple layers, from philosophical considerations to methodological choices and time horizons, ensuring a logical progression toward data collection and analysis. By following this structured approach, researchers can develop a coherent strategy that enhances the reliability and validity of their findings.

The Research Onion starts with the philosophical foundation of the research, progressing to more concrete layers such as the approach to theory development, the methodological choice, research strategy, and finally, the time horizon. This layered approach helps researchers ensure alignment between the research problem, the philosophical stance, and the chosen methods, contributing to a cohesive research design.

For researchers embarking on a new study, it is essential to begin by understanding the research philosophy that strengthens the work. Philosophical choices like positivism, interpretivism, or pragmatism shape the research design by influencing how knowledge is perceived and how data will be interpreted. The research philosophy impacts decisions about the overall

approach, be it qualitative, quantitative, or mixed methods. By choosing an appropriate research philosophy, researchers establish the foundational perspective from which the research problem will be approached.

Following the philosophical layer, the next step is to consider the research approach. Theories such as deductive or inductive reasoning provide guidance for theory development and hypothesis formulation. In a deductive approach, researchers typically test existing theories or hypotheses. However, in an inductive approach, they build theories from the data collected. The choice of approach should be driven by the research questions and objectives, whether the aim is to test a theory or generate new insights.

Next, it is important to evaluate the methodological choice. Quantitative methods, often used in positivist research, focus on measurable data and statistical analysis. Qualitative methods, typically aligned with interpretivist philosophy, emphasize understanding human experiences and social contexts. The mixed-methods approach, which combines both qualitative and quantitative data, is becoming increasingly popular for capturing a fuller picture of the research problem. Researchers must carefully assess which methodology aligns with their research questions and goals.

When selecting a research strategy, different options are available, depending on the study's objectives. Common strategies include case studies, surveys, experiments, and ethnography, each suited for different types of research problems. For example, experimental research is appropriate when testing cause-and-effect relationships, while case studies are ideal for in-depth exploration of a specific context or phenomenon.

Finally, researchers must consider the time horizon for the study. Cross-sectional studies are conducted at a single point in time, providing a snapshot of the phenomenon, while longitudinal studies extend over time, capturing changes and developments in the research subject.

In summary, the design of a research strategy for a new study should be grounded in a clear understanding of the underlying theories and philosophical frameworks. Researchers should carefully consider the layers of the Research Onion Model, ensuring that their methodological choices are logically aligned with the research problem, objectives, and the nature of the data they seek to collect. This thoughtful, step-by-step approach to research design will lead to more robust and meaningful research outcomes.

CONCLUSION

Quantitative research methods remain a cornerstone of scientific inquiry, providing structured, systematic approaches that ensure objectivity, reliability, and validity. This paper has examined various research paradigms and their influence on study design, emphasizing the role of positivism as the dominant philosophy guiding quantitative research. The Research Onion Model was highlighted as a practical framework for selecting research methodologies, illustrating the interplay between philosophical foundations, methodological choices, and data collection strategies.

By exploring key quantitative research methods, including experimental, non-experimental, survey, and correlational designs, this paper has demonstrated how these approaches facilitate the production of measurable, generalizable findings. A well-structured research methodology is essential not only for ensuring scientific rigor but also for enabling researchers to generate meaningful insights that contribute to their respective fields.

As research challenges evolve with advancements in technology, data science, and interdisciplinary studies, future studies should focus on refining and integrating these methodologies to address complex real-world problems. The adoption of hybrid methodologies, the application of AI in data analysis, and the ethical considerations of quantitative research will be critical areas for further exploration. By continuously adapting and improving research strategies, scholars can enhance the credibility and applicability of their findings, ensuring that quantitative research remains a vital tool for knowledge generation and evidence-based decision-making.

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