# Recent Trends of Quantitative Approaches In Different Sectors: A Concise Review


## Abstract:

The approaches and methods used in qualitative and quantitative research represent various research strategies and have diverse theoretical, epistemological, and ontological concerns. Every strategy will depend on how the researchers gather and analyze their data. It is important to use caution when doing research on problem-solving lessons in secondary scientific education to prevent bias in the collection and interpretation of data. Despite the fact that both methods are employed by academics, the quantitative technique is more popular because of its strengths and qualities. To measure actions, views, attitudes, and other characteristics and draw generalizations from a larger population, quantitative research is utilized. In order to express facts and identify trends in study, quantitative research uses quantifiable data. When conducting this kind of research, results are derived using statistical and mathematical tools. This review article focuses on the basic terminologies of quantitative research, its applications in various sectors and reasons why quantitative research approaches surpass qualitative research methods.


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## 1. Introduction:

Quantitative and qualitative research is the two major research strands in the social sciences. The amount of observations is where these two study traditions diverge most. In general, qualitative research is defined as having few observations (e.g., one, two, or three individuals or nations). Such research necessitates a close examination of the relevant examples. Contrarily, work involving a large number of observations—perhaps even 100,000—is typically referred to as quantitative research (J. Creswell, Fetters, Clark, & Morales, 2009; J. W. Creswell & Clark, 2017; Mark Petticrew et al., 2019). In quantitative research, researchers use statistics or numbers to quantify the world. Statistics in the twenty-first century include almost everywhere We come

across statistics in our daily lives in the form of betting odds, consumer preference surveys, weather predictions, and TV show approval ratings, to mention a few. Statistics are the mainstay of many scientific investigations in social and political science because they enable us to make sense of the world around us. As an illustration, we could use turnout rates to determine the proportion of voters who showed up for an election in the political sphere (Booth, Moore, et al., 2019; Cargo et al., 2018; Noyes et al., 2016).

Quantitative methods emphasize objective measurements and the statistical, mathematical, or numerical analysis of data collected through polls, questionnaires, and surveys, or by manipulating pre-existing statistical data using computational techniques. Quantitative research focuses on gathering numerical data and generalizing it across groups of people or to explain a particular phenomenon (De Savigny & Adam, 2009; C. G. Victora, J.-P. Habicht, & J. Bryce, 2004). Determine the relationship between one thing [an independent variable] and another [a dependent or outcome variable] within a population by undertaking a quantitative research study. There are two types of quantitative research designs: descriptive (subjects are often measured just once) and experimental (subjects are measured both before and after a treatment). An experimental study establishes causation; a descriptive analysis just establishes relationships between variables (Fletcher et al., 2016; Hammersley & Atkinson, 1992; C. G. Victora, J. P. Habicht, & J. Bryce, 2004). Quantitative research involves data, reasoning, and an impartial viewpoint. The focus of quantitative research is on precise, convergent thinking as opposed to divergent reasoning, which is the creation of several ideas concerning a research subject in an unplanned, unstructured way . Its primary attributes are (Dixon-Woods, 2011; Flemming, Booth, Garside, Tunçalp, & Noyes, 2019; Rehfuess et al., 2019):

- Often, organized research tools are used to acquire the data.
- Larger sample sizes that are typical of the population were used to generate the results.
- Given its high reliability, the research study can typically be replicated or redone.
- The researcher has a specific study question to which unbiased solutions are sought.
- Before data is collected, the study's various components are all carefully designed.
- Numbers and statistics make up data, which are frequently displayed in tables, charts, and other non-textual formats.

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- Project can be used to study causal linkages, anticipate future outcomes, or more broadly generalize concepts.
- To get numerical data, researchers utilize instruments like questionnaires or computer software.

### 1.1.The process of quantitative research:

The methodology of quantitative research is deductive. It is theory-driven; theory is where it all begins and finishes. Political science students must be familiar with the pertinent literatures before beginning any research projects. They need to be aware of the prevalent ideas and explanations for the phenomenon they want to examine and be able to spot disagreements, gaps in the evidence, and other issues. Then, using the current theory as a guide, they will develop some hypotheses that, ideally, will aim to settle some of the disagreements or close one or more knowledge gaps (Anderson et al., 2011; C. Carroll, Booth, Leaviss, & Rick, 2013; Kelly et al., 2017).

Quantitative research may also be used to evaluate previously held hypotheses against fresh quantitative evidence, define a theory's parameters or constraints, or specify the circumstances in which a theory is applicable (Kneale, Thomas, & Harris, 2015). Good research begins with a theoretically developed research question and hypothesis, regardless of its intended use. The research question should ideally address a politically significant and vital issue and have the potential to bring new theoretical insights to the body of literature (it should potentially add to, alter, change, or refute the existing theory). The independent and dependent variables should be identified in the hypothesis explicitly (Turley et al., 2013) (Booth, Noyes, et al., 2019; Chandler, Rycroft-Malone, Hawkes, & Noyes, 2016).

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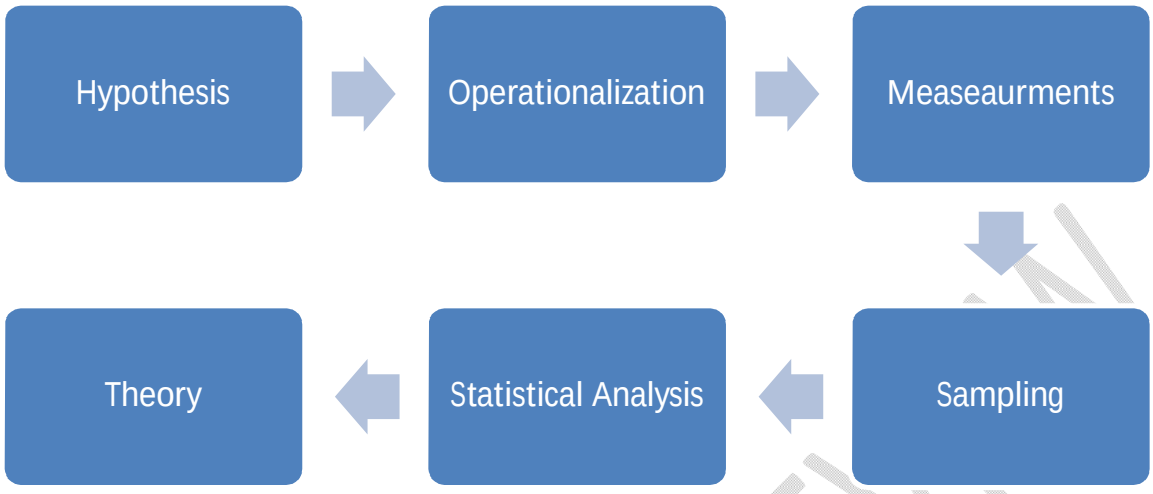


**Figure 1 Quantitative research process**

### 1.2.Methods of quantitative research:

- **Descriptive method:**

The "what" question is the main focus of this approach? It is used to characterize the factor under study's current position or situation. While utilizing this approach, researchers frequently start without a hypothesis. Instead, they create one after gathering the information. In this kind of research, variables are not changed, and the law of probability is not applied. This type of methodology is appropriate for survey research with huge data sets (Orlitzky, Louche, Gond, & Chapple, 2017).

- **Correlation method:**

This approach is used to examine the connections between variables that are measured and kept track of as research variables. This type of analysis is used to find patterns and trends in data. Variables in a correlation study are not changed. As a result, the findings are insufficient to determine the reasons behind the patterns and trends that were found. Correlation related or correlation predictive designs are both possible (Misangyi et al., 2016).

- **Experimental pedagogical inquiry:**

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The experimental approach investigates whether the variables under study are causally related. To determine how an independent variable affects one or more dependent variables, the researcher controls or modifies the independent variable. These studies are frequently conducted in the scientific disciplines of sociology, psychology, chemistry, and physics. Pre-experimental, quasi-experimental, and real experimental designs are examples of experimental class research. These designs frequently contain controls including random or non-random assignment, variable manipulation, and use of a control group (Noyes et al., 2019).

- **Comparative Analysis**

This approach emphasizes comparisons. Instead than forming groups specifically for the study, researchers examine existing ones. The focus is on how an independent variable affects a dependent variable, just like in experimental research. The distinction is that either there is no active manipulation variable, no control group, or no random selection. Ex post facto study designs using archived data are another type of comparative research that is possible (Noyes et al., 2019).

## 2. When to use Quantitative Research:

In addition to the circumstances where the aforementioned benefits are applicable, quantitative research is beneficial when you get information from a sizable number of different respondents. Also, it works well when your audience responds better to results presented as facts, graphs, charts, and statistics. Professionals in the social science fields, such as sociology, psychology, public health, and politics, frequently do quantitative research. Also, it is extensively employed in the disciplines of economics, marketing, and healthcare. When a study's goal is to evaluate an issue or provide a "what" or "how many" to a research question, researchers frequently use quantitative data. Understanding the link between an independent variable and one or more dependent variables in a population is the main aim of quantitative research investigations. Prior to selecting whether the quantitative method is the most appropriate strategy, researchers should assess their objectives as well as the assertions they wish to make while designing a study (Bonell et al., 2011; M. Petticrew et al., 2005).

## 3. Advances Of Quantitative Approaches In Different Sectors:

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### 3.1.QUANTITATIVE METHODS IN DECISION MAKING:

The field that focuses on using Information Technology (IT) for informed decision-making is known as Decision Science, Quantitative Techniques (QT), and Operations Research (OR). Quantitative procedures are statistical and programming methods that aid in decision-making, particularly in the business and industrial sectors. Considerations for QT include the usage of numbers, symbols, and other mathematical expressions as well as other features. QT essentially serves to improve judgment and intuition. Instead of offering recommendations for actions, quantitative methodologies examine planning variables and alternatives as they become available (Y. H. Choi et al., 2010; Heesterbeek et al., 2015; Menzies et al., 2016). The following are the main functions of quantitative technique (Jacobsen & Walensky, 2016):

- It offers a resource for analytical science.
- It provides answers to a range of business issues.
- It enables efficient resource allocation.
- It helps reduce waiting times and service fees.
- The management can use it to decide how to buy and when to buy anything.
- It aids in lowering the overall processing time required to complete a set of tasks.

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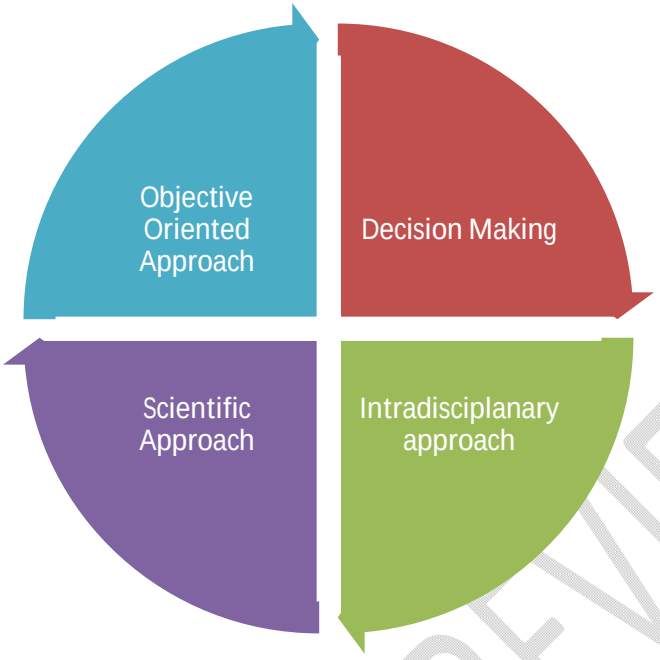


**Figure 2 Characteristics of Quantitative approach**

### 3.2.How Quantitative Methods Can Be Used By Decision Makers To Direct Outbreak Responses:

Staffing, logistics, choosing public health interventions, informing professionals and the public, planning future response needs, creating strategic and tactical priorities, and determining financial needs are all within the control of decision makers. To quickly synthesize data from various experts across numerous disciplines, fill in data gaps, and translate epidemiological analysis into a practical set of decisions for disease prevention, decision-makers must quickly synthesize data from these experts. For certain response phases, such as inquiry, scale-up, and control, analytical methodologies might be specified. Among these strategies are enhanced applications of quantitative methods to produce insightful epidemiological descriptions of outbreaks, thorough investigations of causal agents and risk factors, tools to assess response needs, choosing and monitoring the best interventions or combinations of interventions, and forecasting for response planning. Decision-making can be enhanced by using quantitative methods and data science (L. N. Carroll et al., 2014; Han & Drake, 2016; Meltzer et al., 2014; Smith et al., 2015).

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The many various facets of dealing with data that quantitative techniques encompass include data management, visualization, statistical analysis, modeling, machine learning (ML), and geospatial analysis. By enabling decision-makers to make the most use of the data that is currently available, the use of quantitative techniques to decision-making for outbreak responses offers the potential to overcome many of the drawbacks outlined above. Making decisions more formally facilitates communication to interested parties and the general public as well as the participation of many stakeholders (Arias et al., 2016; Eyler, 2001; Oakeson, Wagner, Mendenhall, Rohrwasser, & Atkinson-Dunn, 2017; Thompson, Morgan, & Jalava, 2019).

### 3.3.Emergence Of Quantitative Methods In Supply Chain:

Supply chains (SC) are faced with a variety of events that could disrupt SC operational activities and imperil effective and efficient performance in today's global, more turbulent and dynamic surroundings. Events that result from natural disasters like hurricanes, earthquakes, or floods or from man-made threats like terrorist attacks or labor strikes are considered disruption risks (Christou, 2011). Events with low likelihood but high impact are often referred to as disruption risks. These events are unpredictable in their type, scale, and character, making them difficult to identify, assess, and forecast accurately. They may also have short- or long-term negative impacts (Blackhurst, Dunn, & Craighead, 2011; Bode & Macdonald, 2017; Brandon-Jones, Squire, Autry, & Petersen; Brusset & Teller, 2017).

Simply defined, the goal of quantitative supply chain optimization, also known as quantitative supply chain, is to maximize human intelligence while utilizing the capabilities of contemporary computing resources. It is a comprehensive perspective on supply chains. Yet, this viewpoint is not exhaustive. It doesn't claim to be the final answer to supply chain problems, but rather one of many complimentary ones that can almost always be employed to make things better (Cardoso, Barbosa-Póvoa, Relvas, & Novais, 2015; C. Chen, 2016; D. Chen, Liu, Luo, Webber, & Chen, 2016).

Quantitative supply chain enables your business to raise productivity, decrease excess stocks and write-offs, increase service quality, and cut operational costs and buy prices. the list is endless. The difficulties in the supply chain change drastically depending on the circumstances. Quantitative Supply Chain seeks to deal with the ensuing complexity while embracing this

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diversity. Quantitative Supply Chain, however, could seem a little perplexing to supply chain professionals who are used to more traditional methods of supply chain optimization (T. M. Choi & Lambert, 2017).

### 3.4.Studying Socio-Environmental Conflicts Quantitatively:

The social sciences' most recent game-changer, the use and analysis of greater data, is only now being applied to the social scientific research of socio-environmental problems. The overwhelming bulk of case study research and extensive fieldwork have been used to explore societal conflicts associated with resource mega-projects in the literature. The use of quantifiable data generated from a variety of sources, such as remote (satellite) sensing, academic databases, NGOs, and social media users, presents excellent chances to supplement or reinforce these assessments in this regard (Hilbert, 2016; King, Keohane, & Verba, 2021; Mann, 2018).

Larger data, then, is information that can be quantified or quantifiable from a variety of sources, can be gathered in huge quantities, and needs to be subjected to quantitative analysis. The idea of "bigger data" enables us to understand that, in the social sciences, there is still a lot of valuable data that needs to be processed (extracted, quantified, and organised) by researchers and that, in some cases, combining this data with other sources, some of which are actually "big," like remote sensing data, can give us a really helpful advantage over issues. Between tiny data (case studies) and big data, bigger data can be thought of as a middle category of data (Lieberson, 1991; Lijphart, 1971; Mahoney, 2010).

The usage of geo-referential pegs across several sets of data is a natural technique to arrange various sources of data due to the localized nature of mining and other resource conflicts. It is important to emphasize the variety of this larger body of data, which also includes surveys, remote (GIS) sensing, social media accounts, structured information from businesses and governments, and textual data that needs to be deciphered and transcribed (from media accounts of conflict, to activist websites, and environmental impact assessments) (Amengual, 2018; Steinberg, 2019). A methodological opportunity to address selection and subjective bias issues brought on by the selection of instances based on the dependent variable and the selection of cases with extreme values is provided by the use of larger datasets. All researchers should be focused on data triangulation in order to get conclusions that are very confidently valid and

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generalizable. So, the emergence of greater data presents a fantastic chance to investigate novel facets of socio-environmental conflict, where the sources and applications of this data are only constrained by our creative thinking (CCSRC, 2009; Imai, Gardner, & Weinberger, 2017).

### 3.5.Advancement Of Quantitative Approach In Health Department:

Leaders of health care organizations must comprehend the quantitative processes that help transform data into information as they use data increasingly frequently in decision-making. Quantitative Approaches in Health Care Management details numerous issues and offers answers, offering significant insights into the various quantitative methodologies (AGES, 2017). The quantitative approach to management challenges necessitates the definition, analysis, and solution of decision problems in a deliberate, logical, methodical, and scientific manner, based on data, facts, and logic rather than mere intuition or rule-of-thumbs. PERT/CPM, Linear Programming, EOQ, ABC analysis, forecasting approaches, Lean tools like JIT, 5S, and Poke Yoke, Six Sigma quality management, to name a few, are some of the crucial quantitative techniques used in the healthcare industry (Fukuda-Parr, 2016; Martinez & Ebenhack, 2008). These methods and technologies have been effectively used for many years by manufacturing firms. Leading hospitals and healthcare organizations have recently started using the same tools (Bhardwaj, Joshi, Khosla, & Dubash, 2019; ICSU, 2017; Sachs, Schmidt-Traub, Kroll, Durand-Delacre, & Teksoz, 2017; Schmidt-Traub, Kroll, Teksoz, Durand-Delacre, & Sachs, 2017).

Making judgments on which initiatives to fund requires a thorough understanding of the effects of health and care interventions and policies. Using experimental methods enables the production of data with a high level of internal validity using "gold-standard" techniques like randomized controlled trials. The results, however, might not be generalizable due to feature lowered externality validity (McCollum et al., 2018; Nerini et al., 2018; Nilsson, Griggs, & Visbeck, 2016). Administrative, survey, and other types of 'observational' data are used in observational quantitative methods such as matching, synthetic control, and instrumental variables to obtain results that are generally applicable (Bhatia & Angelou, 2015; Fao, 2015).

These techniques have been evolving in the literature and are better able to handle fundamental issues like selection bias, which enhances internal validity. A variety of quantitative techniques, both experimental and observational, are available to evaluators. Perhaps a combination of these

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methods is best for assessing complex initiatives (Burton, Albur, Eberl, & Cuff, 2019; Cho et al., 2020; Meskó, Drobni, Bényei, Gergely, & Győrffy, 2017; Panch, Szolovits, & Atun, 2018; Yang, Wang, Byrne, Schneider, & Yang, 2019).

## 4. Quantitative Vs Qualitative Research; Some Evidences Some Facts:

Epistemological, ontological, and ethical debates about the use of qualitative approaches, particularly in epidemiology, have paralleled the rise in use of these techniques in public health1. In this paper, we examine some of these arguments, provide a typology of qualitative research applications, and, using two examples, provide a novel interpretation of the applications of qualitative research in social epidemiology. We contend that qualitative research has frequently served as a "whistle blower" throughout the history of public health and related population health professions. As a result, less rigorous, less expensive, and more widely accepted quantitative research has been unable to identify social causes affecting health (such as racism). As a result, qualitative research can reveal mechanisms that were previously overlooked or disregarded (Arruda, García, & del Lama, 2017; Baadi, Sabaoui, & Tekiout, 2020; Bollati, Smiraglia, & Pelfini, 2013).

The reliance on comprehensive accounts of interpersonal encounters without connecting them to social structure, as in Ervin Goffman's social psychology of everyday interactions, is one of the most prevalent criticisms levelled at qualitative research2. That is to say, ontological individualism is a problem in qualitative research. However, in modern public health, the majority of qualitative investigations attempt to connect more general social structures with naturalistic findings (Brilha, 2016; Bruschi & Cendrero, 2009; Cocean & Cocean, 2017).

There are still some concerns about the effectiveness of the technique, despite the benefit of using a qualitative research approach for investigating problem-solving. Because it is more unbiased, rapid, focused, and acceptable, quantitative research is recommended over qualitative research. But when a researcher is unsure of what to expect, they turn to qualitative research. It is employed to clarify the issue or create a solution (Coratza & Giusti, 2005).

More scientifically, a significant amount of data is acquired and then statistically examined. If other researchers did the analysis on the data, they would always arrive to the same results, which virtually eliminates bias (Erhartič, 2010).

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Control-sensitive: The researcher is farther away from the experiment and has more control over the data collection process. This technique gives one an outside perspective (Fassoulas, Mouriki, Dimitriou-Nikolakis, & Iliopoulos, 2012).

Less biased/objective: The research is removed from the data and aspires for objectivity, i.e. without bias. The researcher has established specific study questions that they are looking for unbiased responses to (García-Cortés, Vegas, Carcavilla, & Díaz-Martínez, 2019).

- Focused: Research is used to test a theory and finally confirm or deny it. The design of the study is decided before it starts.
- Focuses on larger sample sizes: The findings are based on larger, representative samples that represent the population. To obtain results in customer insight that are statistically valid, a large sample size is used. Given its high reliability, the research study can typically be replicated or redone. Received data are presented as numbers and statistics, frequently in the form of tables, charts, figures, or other non-textual representations. Project can be used to study causal linkages, anticipate future outcomes, or more broadly generalize concepts. If the selection procedure is well-designed and the sample is large enough, the results can be generalized.

## 5. Scope Of Quantitative Techniques:

### 5.1. Industry:

From the purchasing of raw materials through the delivery of finished goods, industrial management deals with a variety of issues. The management's ultimate goal is to fully comprehend the strategies for maximizing profitability. Hence, the operations research team must consider different alternative techniques to create things and earn returns in each scenario in order to make decisions that are supported by science (Shakeel et al., 2019).

In order to improve the outcomes, the operations research study should also recommend potential changes to the general structure, such as the installation of a new machine or the introduction of automation, etc. Applying operations research to a variety of activities has greatly benefited several sectors. Operations research, for instance, can be applied in the areas of production and manufacturing, blending and product mix, inventory management, demand forecasting, sales and

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purchases, repair and maintenance tasks, scheduling and sequencing planning, as well as project scheduling and control (Shakeel et al., 2019).

### 5.2. Economics:

Both emerging and developed economies can use OR. Nonetheless, there is a lot of room to grow an operations research approach to planning in developing economies. The fundamental concept is to organize the planning to achieve optimum growth per capital income in the shortest amount of time while taking into account the national objectives and constraints. Several nations in Asia and Africa struggle with poverty and hunger as their main issues. Hence, using an operations research method, statisticians, economists, technicians, administrators, politicians, and agriculture professionals can collaborate to tackle this problem (Basu & Meltzer, 2010).

### 5.3. Agriculture:

There is a lot of potential for operations research in the agricultural sector. Food is in short supply as a result of population growth. For many nations, it might be difficult to allocate land in the best possible way for different crops in accordance with climate factors. Also, each growing nation struggles with how to distribute water from various water sources in an efficient manner. There is a lot of room for scientific investigation in these areas of concern (Basu & Meltzer, 2010; Scholtz, de Klerk, & de Beer, 2020).

### 5.4. Organizations:

Any organization, no matter how big or little, can effectively use operations research. Using quantitative methods, organizations' operational productivity has increased. Operations research methods can be used to reduce costs and increase benefits of choices. A department business might have trouble, for instance, hiring more salespeople or getting a second van.

### 5.5. Business:

Operations research has immediate benefits for both businesses and society. Hospitals, clinics, etc., as examples. Methods from operations research can be immediately applied to resolve administrative issues, including reducing the amount of time patients have to wait outside (Scholtz et al., 2020).

Using simulation techniques can also be advantageous for the transportation industry. These techniques can aid in regulating train arrival and departure times. The notion of queues can be used to reduce traffic and passenger wait times (Colubri et al., 2016).

Employers in L.I.C. are increasingly using these techniques. It aids in determining the premium costs for different policies. Its application has greatly benefited sectors like petroleum, paper, chemical, metal processing, aerospace, rubber, mining, and textile (Van Kerkhove, Bento, Mills, Ferguson, & Donnelly, 2015).

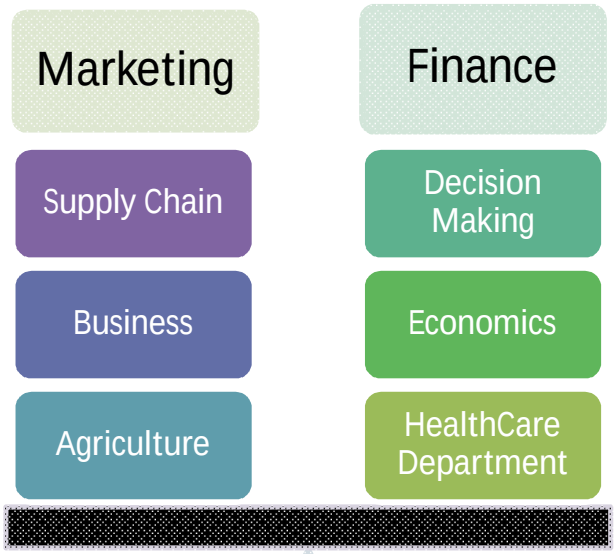


**Figure 3 Applications Of quantitative Research**

## 6. Present Scenario Of QR:

In QR, representation and correspondence are frequently used. The research in this story represents real-world phenomena using theories, hypotheses, models, equations, samples, data, or parameter estimates. They can then be true, valid, or unbiased by correlating to their real-world counterparts, such as when observed data match the variables they are intended to assess or parameter estimates match population correlations or causal effects. In the main business ethics research fields of psychology, sociology, economics, statistics, and analytic philosophy,

this narrative contributes to a number of epistemologies. The story does aid in the organization of QR, but it also leads to two issues that we will now discuss: an ethic of probabilistic inference and a superficial comprehension of QR (Jeanes, 2016; Misangyi et al., 2016; Nayak, 2016; Orlitzky et al., 2017).

### 6.1. Advanced Data Analytic Techniques:

While there is a growing need to analyze trends in huge datasets, big data analytics has drawn considerable interest from both academia and business to solve social issues. Data gathering has increased dramatically as a result of recent advancements in sensor networks, cyber-physical systems, and the Internet of Things (IoT), including data from social media, smart cities, agriculture, finance, education, and more (Hariri, Fredericks, & Bowers, 2019; Iafrate, 2014).

Yet, because of noise, incompleteness, and inconsistency, the data gathered from sensors, social media, financial records, etc., is intrinsically questionable. Advanced analytical approaches are needed for the examination of such enormous amounts of data in order to efficiently assess and/or anticipate future courses of action with high precision. Data's intrinsic uncertainty grows along with its volume, diversity, and speed, which makes the subsequent analytics process and its conclusions less reliable. Artificial intelligence approaches, such as machine learning, natural language processing, and computational intelligence, produce outcomes in big data analytics that are more precise, swifter, more scalable when compared to traditional data methodologies and platforms (Maugis, 2018; Pouyanfar, Yang, Chen, Shyu, & Iyengar, 2018)

## Conclusions:

A qualitative approach that is based on the philosophy of phenomenology and a quantitative approach that corresponds to the positivist school of thought is the two methodologies that are frequently utilized in social research. The two proponents of this technique occasionally disagree with one another, especially when it comes to how well they convey facts on social problems and how trustworthy they are to do so. Quantitative research aims to produce knowledge and foster comprehension of the social world. Social scientists, including communication scholars, employ quantitative research to investigate phenomena or events that have an impact on people. Social scientists are interested in examining people. A sample population is a particular group of people that can be studied using quantitative methods. Quantitative research uses scientific inquiry to

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address questions about the sample population using data that are observed or measured. In this review all the advancements of quantitative research in different sectors is focused in detail. Further research is needed to find the actual worth of these methods in different daily life problems and social as well as economic problems.

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