ASSIGNMENT FINAL REPORT

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Student declaration

I certify that the assignment submission is entirely my own work and I fully understand the consequences of plagiarism. I understand that making a false declaration is a form of malpractice.

Student's signature	CongHoang

Grading grid

P1	P2	P3	P4	P5	P6	P7	M1	M2	M3	M4	D1	D2	D3

Grade:	Assessor Signature:	Date:

Internal Verifier's Comments:

Signature & Date:

Table of Contents

List of Figures

List of Tables

A.   Introduction

In recent years, the rapid development of Big Data technology has brought many new opportunities for e-commerce businesses. Applying Big Data technology in building and developing e-commerce websites can bring significant benefits, especially in improving operational efficiency.

This research aims to evaluate the impact of applying Big Data technology on operational efficiency in the field of e-commerce website construction and development. Specifically, this research will focus mainly on the following issues:

- ➢ Determine the role and potential of Big Data technology in optimizing the operation of e-commerce websites.
- ➢ Analyze specific applications of Big Data in the stages of building, operating, and developing e-commerce websites.
- ➢ Evaluate performance improvements, such as increased sales, optimized user experience, improved business processes, etc. when applying Big Data technology.
- ➢ Identify challenges and risks when implementing Big Data in the e-commerce industry.
- ➢ Propose strategies and recommendations to maximize the benefits of Big Data in this field.

In the current digital age, Big Data technology has become a key factor in promoting the development of many industries, especially e-commerce. Big Data not only helps businesses collect and analyze huge amounts of data from various sources but also provides detailed and valuable information to optimize business strategies and enhance customer experience.

The objective of this research is to explore and evaluate the impact of applying Big Data technology in the process of building and developing e-commerce websites. The research will focus on analyzing how Big Data can improve operational efficiency, optimize user experience, and enhance the competitiveness of e-commerce businesses.

The research method includes the use of both primary and secondary research. Primary research will be conducted through interviews and surveys with experts in the field of e-commerce and Big Data technology. Secondary research will focus on analyzing previous documents, reports, and studies related to this topic.

The expected outcome of this research is to provide a comprehensive view of the benefits and challenges of applying Big Data technology in e-commerce, thereby providing specific recommendations for businesses in implementing and using Big Data effectively.

This research not only contributes to a better understanding of the role of Big Data in e-commerce but also opens up new research directions and provides practical solutions for businesses to improve operational efficiency and competitiveness in the market.

By approaching the problem from many different angles, this research will provide a comprehensive view of the role and impact of Big Data technology on the operations of e-commerce websites. The results of the research will help e-commerce businesses better understand how to apply Big Data to improve operational efficiency and enhance competitiveness.

B.   Content

P1: Produce a research proposal that clearly defines a research question or hypothesis supported by a literature review.

I. Research Topic

Topic: The impact of applying Big Data technology in the field of e-commerce website construction and development.

II. Research Type

This is quantitative and qualitative research, using methods such as secondary data analysis, surveys, and expert interviews to evaluate the impact of Big Data on the performance of e-commerce websites.

III.   Abstract

In the era of the digital economy, Big Data technology is gradually becoming one of the key tools to help enhance the operational efficiency of e-commerce businesses. This research aims to evaluate the impact of applying Big Data on aspects such as analyzing user behavior, optimizing operational processes, improving logistics, and enhancing customer experience. Through secondary data analysis, surveys, and expert interviews, the research will provide empirical evidence about the benefits that Big Data brings to the operation of e-commerce websites, and at the same time propose recommendations. recommendations for applying this technology effectively.

IV.   Background and Context

E-commerce is growing strongly globally, leading to increasingly fierce competition between businesses. To survive and develop, e-commerce websites need to continuously improve operational efficiency and meet increasing customer needs. In that context, Big Data technology is becoming a key solution, helping businesses exploit and analyze huge amounts of data to improve operating processes and enhance customer experience

V. Research Questions and Hypothesis

Research question: How does the application of Big Data technology impact the performance of e-commerce websites?

Hypothesis: The application of Big Data technology will have a positive influence on aspects such as analyzing user behavior, optimizing operating processes, improving logistics, and enhancing customer experience, thereby contributing part to enhancing the performance of e-commerce websites.

VI. Aims and Objectives:

1) Aims

The main goal of this topic is to evaluate the impact of applying Big Data technology on operational efficiency in the field of e-commerce website construction and development.

2) Specific Objectives

Specific objectives in this research include:

➢ To conduct a comprehensive literature review on the application of Big Data technology in the e-commerce industry, with a focus on its impact on operational efficiency.

➢ To identify the specific ways in which Big Data technologies can be leveraged to optimize the construction and development of e-commerce websites.

➢ To gather in-depth insights from industry experts and practitioners on the practical implementation and benefits of applying Big Data in e-commerce website development.

➢ To analyze case studies of e-commerce businesses that have successfully implemented Big Data technologies to improve their operational efficiency.

➢ To develop a framework or model that demonstrates the relationship between the application of Big Data technology and the enhancement of operational efficiency in e-commerce website construction and development.

➢ To provide recommendations and guidelines for e-commerce businesses on effectively leveraging Big Data to improve the operational efficiency of their website construction and development processes.

VII. Research Methodology

The research methodology will include the following steps:

❖ **Comprehensive literature review**: A thorough review of academic journals, industry reports, and other relevant literature to establish a solid theoretical foundation and identify the current state of research in the application of Big Data technology in the e-commerce industry.

❖ **In-depth interviews**: Conduct semi-structured interviews with industry experts, including e-commerce website developers, data analysts, and operational managers, to gather insights on the practical implementation and perceived benefits of applying Big Data in e-commerce website construction and development.

❖ **Case study analysis**: Analyzing multiple case studies of e-commerce businesses that have successfully implemented Big Data technologies to improve their operational efficiency, with a focus on identifying best practices, challenges, and measurable outcomes.

- ❖ **Data collection and analysis**: Collecting both quantitative data (e.g., website performance metrics, operational efficiency indicators) and qualitative data (e.g., user feedback, expert opinions) to assess the impact of Big Data technology on e-commerce website construction and development.
- ❖ **Development of a conceptual framework**: Synthesizing the findings from the literature review, interviews, and case studies to develop a conceptual framework or model that illustrates the relationship between the application of Big Data technology and the enhancement of operational efficiency in e-commerce website construction and development.
- ❖ **Validation and refinement**: Validating the proposed framework through additional expert interviews and feedback, and refining it as necessary to ensure its practical relevance and applicability.

VIII.   Project Plan

Phase/Task	Start date	End date	Duration
Phase 1: Project launch	**May 5, 2024**	**May 14, 2024**	**10 days**
Definition of research goals	May 5, 2024	May 7, 2024	3 days
Developing research questions	May 8, 2024	May 10, 2024	3 days
Research planning	May 11	May 14, 2024	4 days
Phase 2: Research design	**May 15, 2024**	**May 31, 2024**	**17 days**
Designing a survey toolkit	May 15, 2024	May 21, 2024	7 days
Prepare interview instructions	May 22, 2024	May 26, 2024	5 days
Develop a data collection plan	May 27, 2024	May 31, 2024	5 days
Phase 3: Data collection	**June 1, 2024**	**June 30, 2024**	**30 days**
Conduct surveys	June 1, 2024	June 12, 2024	12 days
Conduct interviews	June 13, 2024	June 22, 2024	10 days
Check and clean data	June 23, 2024	June 28, 2024	8 days
Phase 4: Data analysis	**July 1, 2024**	**July 26, 2024**	**26 days**
Quantitative data analysis	July 1, 2024	July 13, 2024	13 days
Qualitative data analysis	July 14, 2024	July 26, 2024	13 days
Phase 5: Summary and reporting	**July 29, 2024**	**August 13, 2024**	**16 days**
Summary of research results	July 27, 2024	August 7, 2024	12 days
Report writing	August 8, 2024	August 13, 2024	6 days
Phase 6: Review and completion	**August 14, 2024**	**August 19, 2024**	**6 days**

Review and edit reports	August 14, 2024	August 18, 2024	5 days
Completing the report	August 19, 2024	August 19, 2024	1 day
Stage 7: Presentation and submission of the report	**August 20, 2024**	**August 21, 2024**	**2 days**
Prepare presentation	August 20, 2024	August 20, 2024	1 day
Report Submission	August 21, 2024	August 21, 2024	

Table 1: Project plan

P2: Examine appropriate research methods and approaches to primary and secondary research.

I. Primary Research

1) What is Primary Research?

Primary research involves collecting data directly from sources, rather than relying on data collected by others. It focuses on generating new data and insights that are specific to the research objectives. Primary research allows researchers to gather first-hand information and control the data collection process (Bouchrika, 2024).

2) Types of Primary Research Methods

Figure 1: Primary research

a) Surveys

➢ Quantitative method used to collect data from a target population.
➢ Can be conducted online, via phone, by mail, or in person.
➢ Useful for gathering opinions, attitudes, behaviors, and demographics.

b) Interviews

➢ Qualitative method that involves one-on-one discussions with participants.
➢ Can be structured, semi-structured, or unstructured.

➢ Provide in-depth insights and allow for follow-up questions.

c) Observations
➢ The qualitative method that involves observing and recording people's behaviors and interactions in their natural environments.
➢ Can be participatory or non-participatory.
➢ Useful for understanding real-world behaviors and contexts.

d) Experiments
➢ Quantitative method that involves manipulating variables to test hypotheses.
➢ Allows researchers to establish causal relationships between variables.
➢ Conducted in controlled settings, such as laboratories or simulated environments.

3) Advantages and Disadvantages of Primary Research

Advantages	Disadvantages
Provides first-hand, customized data that is specific to the research objectives	Can be time-consuming and resource-intensive to design and implement
Allows for greater control over the data collection process	May require specialized skills or expertise to conduct effectively
Generates rich, in-depth insights that can uncover new perspectives	Participant recruitment and retention can be challenging
Enables researchers to respond to emerging issues and trends	Results may not be generalizable to a larger population

Table 2: Advantages and Disadvantages of Primary Research

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II. Secondary Research

1) What is Secondary Research?

Figure 2: Secondary research

Secondary research, also known as desk research, involves the summary, collation, and synthesis of existing research rather than primary data collection. It utilizes data that has already been collected by others, such as previous studies, reports, and statistical data. The primary role of secondary research is to provide a comprehensive background and context for the research project, helping to identify gaps in existing knowledge, refine research questions, and develop a theoretical framework (www.appinio.com, n.d.).

2) Types of Secondary Research Sources

Books and Journal Articles: These are valuable sources of in-depth information on specific topics. They can be accessed through platforms like Google Scholar and online libraries. Books provide comprehensive coverage of subjects, while journal articles offer detailed insights into recent research findings and methodologies.

Government and Industry Reports: Reports published by government agencies and industry organizations provide authoritative data and analysis on various topics. These reports are often based on extensive research and can be found on official websites and databases.

Online Databases and Websites: Databases such as JSTOR, PubMed, and other academic repositories offer a vast collection of peer-reviewed articles, research papers, and other scholarly materials. These sources are essential for accessing high-quality, reliable information.

3) Advantages and Disadvantages of Secondary Research

Advantages	Disadvantages
Cost-effective: Secondary research is generally less expensive than primary research since it relies on existing data.	**Relevance**: The data may not be perfectly aligned with the specific needs of the current research project.
Time-saving: It is quicker to gather and analyze secondary data compared to collecting primary data.	**Accuracy**: The quality and reliability of secondary data can vary, and it may be outdated or biased.
Broad Scope: Secondary research can provide a wide range of information from various sources, offering a comprehensive view of the research topic.	**Lack of Control**: Researchers have no control over how the data is collected, which can affect its applicability.
Accessibility: Many secondary data sources are readily available online or through libraries and databases.	**Limited Detail**: Secondary data may not provide the depth of information required for certain research questions.

Table 3: Advantages and Disadvantages of Secondary Research

III.   Quantitative Research

1) Definition and Characteristics of Quantitative Research

Quantitative research is a systematic investigation that primarily focuses on quantifying data and phenomena. It involves the collection and analysis of numerical data to identify patterns, relationships, and trends. Key characteristics include:

➢ **Objectivity**: Emphasizes objective measurements and statistical analysis.
➢ **Replicability**: Research methods and results can be replicated by other researchers.
➢ **Generalizability**: Findings can be generalized to larger populations.
➢ **Structured Methods**: Utilizes structured tools such as surveys and experiments to collect data.

2) Quantitative Research Methods

In the context of researching the application of Big Data technology in the field of e-commerce website construction and development, quantitative research methods can help me collect and analyze data systematically and accurately. This method is designed to quantify the number of variables and discover patterns, relationships, and trends in data. They are

Figure 3: Quantitative research

especially useful for testing theories, making predictions, and aggregating results for larger groups. The main characteristics of quantitative research methods include a structured nature, customer accounting, and reliance on list analysis. Here is an overview of the main quantitative research methods:

❖ **Survey**: Uses structured questionnaires or interviews to collect data from large numbers of participants. Surveys are effective in collecting data on attitudes, opinions, behaviors, and demographics. I can conduct them online, over the phone, or in person. For example, you can use surveys to collect user opinions about the shopping experience on your e-commerce site.
❖ **Experiments**: Controlled studies in which one or more variables are changed to control their effect on other variables. Experiments are ideal for establishing cause-and-effect relationships and testing specific hypotheses. I often include control groups and experimental groups to compare results. For example, you can conduct experimental A/B testing to test the effectiveness of new features on your site.
❖ **Observational studies**: Systematically observe and record actions and events in their natural environment. Unlike experiments, observational studies do not involve changing several variables.

I are useful for researching phenomena as they occur naturally. It is possible to observe user actions on a website using analytics tools such as Google Analytics.

- ❖ **Correlation Research**: The research of the relationship between two or more variables to determine whether they are related. Correlation research helps to identify patterns and expected results but does not establish a cause-and-effect relationship. The relationship between page load time and conversion rate on your website can be studied.
- ❖ **Structural Equation Modeling (SEM)**: A statistical technique that examines complex relationships between variables using a combination of factor analysis and multivariate regression. SEM is used to evaluate theoretical models and hypotheses involving multiple variables. SEM can be used to test theoretical models of Big Data operations and e-commerce website performance.
- ❖ **ANOVA (Analysis of Variance)**: A statistical method used to compare means across three or more groups to determine whether there are significant differences. ANOVA is often used in experimental research to test the effectiveness of different solutions. ANOVA can be used to compare the effectiveness of big data-based personalization strategies for different customer groups.

Each of these methods has its own advantages and applications, making them suitable for different research questions and objectives. By choosing the right quantitative research method, it is possible to collect reliable and valid data, contributing to a deeper understanding of your research topic.

3) Quantitative Data Analysis Techniques

In the context of researching the impact of Big Data technology in the field of e-commerce website construction and development, quantitative data analysis techniques play an important role in processing and interpreting the collected data. These techniques help identify patterns, relationships, and trends in the data, thereby drawing well-founded conclusions and recommendations. Here is an overview of the main quantitative data analysis techniques:

- ➢ **Descriptive Statistics**: Descriptive statistics help summarize and describe the main characteristics of the data. Common measures include mean, median, mode, standard deviation, and range. In this project, descriptive statistics can be used to summarize data about page load time and conversion rates on your website.
- ➢ **Inferential Statistics**: Inferential statistics allow inferences about the population from the data sample. Common methods include t-test, chi-square test, and regression analysis. In this project, a t-test can be used to compare the conversion rates between two versions of a product page.
- ➢ **Regression Analysis**: Regression analysis helps to examine the relationship between the dependent variable and the independent variables. Types of regression analysis include linear regression, logistic regression, and multiple regression. In this project, linear regression can be used to predict the conversion rate based on factors such as page load time and page views.

> **Factor Analysis**: Factor analysis helps to identify potential factors that influence the data and reduce the number of variables that need to be analyzed. This technique is often used to explore the underlying structure of the data. In this project, factor analysis can be used to identify factors that influence the user experience on a website.

> **Hypothesis Testing**: Hypothesis testing is the process of using statistical methods to test the validity of research hypotheses. Common methods include t-test, ANOVA test, and chi-square test. In this project, ANOVA test can be used to compare the effectiveness of big data-based personalization strategies for different customer groups.

These quantitative data analysis techniques provide powerful tools for processing and interpreting data, helping to draw accurate and well-founded conclusions. By applying these techniques, I can better understand the impact of Big Data technology on e-commerce website performance and make recommendations for improvement.

4) Advantages and Disadvantages of Quantitative Research

In the context of researching the impact of Big Data technology application in the field of e-commerce website construction and development, the use of quantitative research methods brings many benefits but also has some limitations. Below is an overview of the advantages and disadvantages of quantitative research:

Advantages	Disadvantages
Objectivity and Reliability: Quantitative research provides objective and reliable data that can be statistically analyzed. This helps ensure that the results are not influenced by the researcher's personal views (Radef, 2023).	**Lack of Depth**: Quantitative research may not capture the depth and complexity of human experience, due to its focus on numerical data rather than qualitative aspects (Gaille, 2019).
Generalizability: Results from quantitative research can be generalized to larger populations, helping to draw highly representative conclusions (Gaille, 2019).	**Contextual Limitations**: Quantitative methods may ignore the context in which data are collected, leading to a lack of understanding of the underlying factors that influence the results (DeVault, 2020).
Precision: Quantitative methods allow for precise measurement and quantification of variables, helping to clearly identify relationships and trends in the data (DeVault, 2020).	**Rigidity**: The structured methods of quantitative research may not be flexible enough to uncover new information or unexpected aspects of the data (institutvert.org, 2024).
Replicability: Research methods and results can be reproduced by other researchers, ensuring the	**Potential Bias**: Survey and experimental designs can introduce biases that affect the results,

consistency and reliability of the research (institutvert.org, 2024).	especially if not carefully designed and implemented (Radef, 2023).
Efficiency: Quantitative research can collect and analyze data from a large number of participants in a short period of time, saving time and resources (Radef, 2023).	

Table 4: Advantages and Disadvantages of Quantitative Research

IV.   Qualitative Research

1) Definition and Characteristics of Qualitative Research

Qualitative research is a method of inquiry that focuses on understanding human behavior, experiences, and social phenomena from the perspective of those involved. It is characterized by its exploratory nature, aiming to gather deep insights rather than quantifiable data (Lim, 2024).

Key characteristics include:

➢ **Subjectivity**: Emphasizes the subjective experiences and interpretations of participants.
➢ **Contextual Understanding**: Seeks to understand phenomena within their natural context.
➢ **Flexibility**: Research design is often flexible and evolves as the research progresses.
➢ **Rich, Descriptive Data**: Produces detailed, narrative data that provides a comprehensive understanding of the research topic.

2) Qualitative Research Methods

Qualitative research methods are designed to explore and understand the depth and complexity of human experiences, behaviors, and social phenomena. These methods are typically used when researchers seek to gain insights into the underlying reasons, opinions, and motivations behind certain actions or attitudes. Unlike quantitative methods, which focus on numerical data and statistical analysis, qualitative methods emphasize rich, descriptive data that provide a comprehensive understanding of the research topic. Key characteristics of qualitative research methods include:

Figure 4: Qualitative Research

❖ **Exploratory Nature**: These methods are often used in the early stages of research to explore new areas where little is known.
❖ **Flexibility**: Research designs are adaptable and can evolve as new insights emerge during the research.

❖ **Contextual Understanding**: Emphasis is placed on understanding phenomena within their natural context, considering the environment and circumstances in which they occur.

❖ **Participant-Centered**: The focus is on the perspectives and experiences of participants, often involving direct interaction with them.

Qualitative research methods can be broadly categorized into several types, each with its own unique approach to data collection and analysis. The main methods include in-depth interviews, focus groups, observation, and case studies. Each of these methods offers distinct advantages and can be chosen based on the specific objectives and context of the research. Below are some commonly used qualitative research methods:

	Description	Application
In-depth Interviews	One-on-one interviews that explore participants' thoughts, feelings, and experiences in detail	Useful for gaining deep insights into individual perspectives and uncovering underlying motivations
Focus Groups	Group discussions led by a moderator to explore collective views and experiences	Effective for understanding group dynamics and generating a range of opinions on a topic
Observation	Systematic observation of people in their natural environment to gather data on behaviors and interactions	Ideal for researching behaviors and social interactions in real-time settings
Case Studies	In-depth examination of a single case or a small number of cases within their real-life context	Provides a comprehensive understanding of complex issues and allows for the exploration of unique or rare phenomena

Table 5: Qualitative Research Methods

3) Qualitative Data Analysis Techniques (Coding, Thematic Analysis, Discourse Analysis)

Qualitative data analysis involves systematically examining and interpreting non-numerical data to uncover patterns, themes, and meanings. This process is crucial for transforming raw data into insightful findings that can inform research conclusions and recommendations. Unlike quantitative analysis, which relies on statistical methods, qualitative analysis focuses on understanding the depth and complexity of the data . Key characteristics of qualitative data analysis include:

❖ **Iterative Process**: Analysis is often an ongoing process that evolves as new data is collected and insights emerge.

❖ **Subjectivity**: The researcher's interpretations play a significant role in identifying themes and patterns.

❖ **Contextual Sensitivity**: Analysis considers the context in which the data was collected, ensuring that findings are relevant and meaningful.

Several techniques are commonly used in qualitative data analysis, each with its own approach to organizing and interpreting data:

❖ **Coding**: This involves categorizing and labeling segments of data to identify recurring themes and patterns. Coding can be done manually or with the help of software tools.
❖ **Thematic Analysis**: This technique focuses on identifying and analyzing themes within the data. It involves systematically searching for patterns that are significant to the research questions.
❖ **Discourse Analysis**: This method examines language use and communication in context, exploring how language constructs social and cultural meanings.

These techniques help researchers make sense of complex qualitative data, providing a structured approach to uncovering insights that might not be immediately apparent. By using these methods, research can draw meaningful conclusions that contribute to a deeper understanding of the research topic.

4) Advantages and Disadvantages of Qualitative Research

Advantage	Disadvantage
Depth of Understanding: Provides rich, detailed insights into participants' perspectives and experiences.	**Subjectivity**: Findings can be influenced by the researcher's interpretations and biases.
Flexibility: Allows for adjustments in research design and data collection methods as the research progresses.	**Limited Generalizability**: Results are often specific to the studied context and may not be applicable to other settings.
Contextual Insights: Captures the context in which phenomena occur, leading to a more comprehensive understanding.	**Time-consuming**: Data collection and analysis can be lengthy and resource-intensive.

Table 6: Advantages and Disadvantages of Qualitative Research

V. Comparison of Qualitative and Quantitative Research

1) Differences in Data Collection Methods

Qualitative Research: Uses data collection methods such as in-depth interviews, focus groups, observations, and case studies. These methods focus on collecting descriptive, detailed data about participants' experiences and perspectives.

Quantitative Research: Uses structured data collection methods such as surveys, experiments, and observational studies. These methods focus on collecting numerical data that can be measured and statistically analyzed.

2) Differences in Data Analysis Techniques

Qualitative Research: Qualitative data analysis often includes coding, thematic analysis, and discourse analysis. These techniques help identify patterns and themes in descriptive data.

Quantitative Research: Quantitative data analysis uses statistical techniques such as descriptive statistics, inferential statistics, regression analysis, and analysis of variance (ANOVA). These techniques help identify relationships and trends in numerical data.

3) When to Use Qualitative vs. Quantitative Research

Qualitative Research: Appropriate when you need to gain in-depth understanding of participants' experiences, perspectives, and motivations. Qualitative research is useful in the discovery phase and when researching complex, poorly understood phenomena.

Quantitative Research: Appropriate when you need to measure and quantify variables, test hypotheses, and generalize results to larger populations. Quantitative research is useful when you need objective data that can be statistically analyzed.

4) Combining Qualitative and Quantitative Research (Mixed Methods)

Mixed Methods: Combines both qualitative and quantitative research methods to take advantage of the advantages of both. This method allows to collect deep and detailed data from qualitative research, while measuring and analyzing numerical data from quantitative research. For example, you can use surveys to collect quantitative data about the user experience on e-commerce website, then conduct in-depth interviews to better understand the factors that influence that experience.

Comparing and combining qualitative and quantitative research methods will help us have a more comprehensive and in-depth view of the impact of Big Data technology in the field of building and developing e-commerce websites.

VI.   The Scientific Method

1) Steps of the Scientific Method

The scientific method is a systematic approach used to investigate phenomena, acquire new knowledge, or correct and integrate previous knowledge. It is characterized by empirical and measurable evidence subject to specific principles of reasoning. The steps of the scientific method typically include:

- **Observation**: Identifying a phenomenon or problem that needs investigation. This step involves gathering information through direct or indirect observation.
- **Research**: Conducting a literature review to understand what is already known about the topic. This helps in refining the research question and identifying gaps in existing knowledge.
- **Hypothesis**: Formulating a testable hypothesis or prediction based on the observations and research. The hypothesis should be specific and measurable.
- **Experimentation**: Designing and conducting experiments to test the hypothesis. This involves manipulating variables and collecting data to observe the effects.
- **Data Analysis**: Analyzing the collected data using statistical methods to determine whether the results support or refute the hypothesis.
- **Conclusion**: Drawing conclusions based on the data analysis. This step involves interpreting the results and determining their implications.
- **Communication**: Sharing the findings with the scientific community through publications, presentations, or reports. This allows others to review, replicate, and build upon the research.

2) Application of the Scientific Method in Technology and Computers

The scientific method is widely applied in the field of technology and computers to develop new technologies, improve existing systems, and solve complex problems. Here are some examples of its application:

- **Software Development**: In software engineering, the scientific method is used to test and validate new algorithms, optimize code, and ensure software reliability. For instance, developers might formulate hypotheses about the performance of a new algorithm and conduct experiments to measure its efficiency and accuracy.
- **Big Data Analytics**: In the context of research on the impact of Big Data technology on e-commerce website development, the scientific method can be used to analyze large datasets, identify patterns, and make data-driven decisions. Might hypothesize that implementing a specific Big Data analytics tool will improve website performance and then test this hypothesis by analyzing user behavior data before and after implementation.
- **Machine Learning**: The development and training of machine learning models often follow the scientific method. Researchers formulate hypotheses about model performance, conduct experiments by training models on datasets, and analyze the results to refine the models.
- **Cybersecurity**: In cybersecurity, the scientific method is used to identify vulnerabilities, test security measures, and develop new defense mechanisms. Researchers might hypothesize that a particular security protocol will prevent certain types of attacks and then test this hypothesis through controlled experiments.

➤ **User Experience (UX) Design**: In UX design, the scientific method is applied to test and improve user interfaces. Designers might hypothesize that a new layout will enhance user satisfaction and then conduct A/B testing to compare user interactions with different versions of the website.

By applying the scientific method, researchers and practitioners in technology and computers can systematically investigate problems, validate solutions, and contribute to the advancement of the field.

M1: Evaluate different research approaches and methodology and make justifications for the choice of methods selected based on philosophical/theoretical frameworks.

I. Quantitative Surveys

1) Philosophical/Theoretical Frameworks

Quantitative surveys are often based on theoretical and philosophical frameworks such as positivism and post-positivism. Positivism assumes that reality can be measured and understood through scientific and statistical methods. Quantitative surveys typically use closed-ended questions and scales to collect quantifiable data. Meanwhile, post-positivism acknowledges that although reality can be measured, the results can be influenced by various factors and are not completely objective. This leads to the use of statistical methods to test and confirm hypotheses.

2) Advantages and Limitations

Quantitative surveys have many advantages, including objectivity and measurability. The data collected from these surveys are often objective and measurable, making them easy to analyze and compare. Additionally, the results from quantitative surveys can be generalized to a larger population if the sample is large and representative. Quantitative surveys can also be conducted quickly and at low cost, especially when using online tools.

However, quantitative surveys also have some limitations. They often do not provide insight into the reasons or motivations behind responses, leading to a lack of depth in analysis. Participants may respond inaccurately or dishonestly, leading to bias in the data. Closed-ended questions and scales can also limit the ability to collect rich, detailed information.

3) Ethical Considerations

When conducting quantitative surveys, it is important to ensure that participants understand the purpose of the survey and provide informed consent. Protecting participants' personal information and ensuring that data is handled with confidentiality is important. Additionally, it is important to ensure that data is collected and analyzed honestly and without bias (data integrity). Finally, it is important to ensure that the survey does not cause harm or inconvenience to participants (non-maleficence).

4) Justifications for the Chosen Methods

Quantitative surveys were chosen because they provide an objective and measurable approach to collecting data from a large sample of users. This is important in assessing the impact of Big Data technology on e-commerce websites, where large and diverse data sets are key. Theoretical frameworks such as positivism and post-positivism support this approach by providing tools and methods to test and

validate hypotheses. Quantitative surveys also allow for generalization of results to a larger population, allowing for valid and widely applicable conclusions. Although there are some limitations such as lack of depth and potential for data bias, statistical controls and analysis can help mitigate these issues.

II. Qualitative Interviews

1) Philosophical/Theoretical Frameworks.

Qualitative interviews are often based on theoretical and philosophical frameworks such as interpretivism and constructivism. Interpretivism assumes that reality is constructed through personal experiences and perspectives. This is appropriate for interviewing experts and users to gain a deeper understanding of how they experience and interact with Big Data technology in e-commerce websites. Constructivism emphasizes that knowledge is constructed through social interactions and context, helping to clarify how factors such as culture and environment influence the adoption and development of Big Data technology.

2) Advantages and Limitations

Qualitative interviews have many advantages, including the ability to provide insight into participants' experiences, perspectives, and motivations, leading to a better understanding of the impact of Big Data technology. Interviews are also highly flexible, allowing for adjustments based on participant feedback and the discovery of new and unanticipated aspects. In addition, qualitative interviews help to better understand the context and environment in which Big Data technology is applied, thereby providing more suitable solutions.

However, qualitative interviews also have some limitations. The results from interviews can be influenced by the personal views and feelings of the participants, leading to a lack of objectivity. The process of collecting and analyzing data from qualitative interviews is often time-consuming and labor-intensive. Furthermore, the results from qualitative interviews are often difficult to generalize to a larger population due to small and unrepresentative samples.

3) Ethical Considerations

When conducting qualitative interviews, it is important to ensure that participants clearly understand the purpose of the interview and agree to participate voluntarily. This includes providing detailed information about the research and the participants' rights. It is important to protect the personal information of participants and ensure that the data is handled securely. This can be done through the use of encryption and secure data storage. Additionally, it is important to ensure that participants are treated with respect and are not coerced or pressured. Interview questions should also be designed so as not to be offensive or intrusive on participants' privacy. Finally, it is important to clearly explain how the data will be used and ensure that participants have the right to withdraw from the research at any time without prejudice.

4) *Justifications for the Chosen Methods*

Qualitative interviews were chosen because they provide in-depth and detailed insights into the experiences and perspectives of users and experts in the e-commerce field. This is important to better understand how Big Data technology is applied and affects website design and development. Theoretical frameworks such as interpretivism and constructivism support this approach by emphasizing the importance of personal experiences and social context. Qualitative interviews allow for the exploration of new and unanticipated aspects, helping to clarify the factors that influence the adoption of Big Data technology. Despite some limitations such as subjectivity and time-consuming nature, qualitative interviews provide rich and detailed information that is difficult to achieve with other methods.

III.   Content Analysis

1) *Philosophical/Theoretical Frameworks*

Content analysis is often based on theoretical frameworks such as hermeneutics and semiotics. Hermeneutics focuses on understanding and interpreting the meaning of text and content, helping to clarify how Big Data elements are presented and understood in the context of e-commerce websites. Semiotics studies the symbols and icons in content, helping to analyze how Big Data information is conveyed and received by users.

2) *Advantages and Limitations*

Content analysis has many advantages, including the ability to deeply analyze documents and content related to the application of Big Data technology. This method allows you to discover patterns and trends in textual data, helping to better understand how Big Data affects the construction and development of e-commerce websites. Content analysis can also be applied to many different types of content, from blog posts to technical documents.

However, content analysis also has some limitations. The analysis process can be influenced by the researcher's personal views and interpretations, leading to a lack of objectivity. Coding and categorizing content can also be time-consuming and labor-intensive. Additionally, content analysis often does not provide insight into the reasons or motivations behind the patterns and trends that are discovered.

3) *Ethical Considerations*

When conducting content analysis, it is important to ensure that you comply with copyright and intellectual property regulations. This includes obtaining permission to use materials and content if necessary. Protecting personal information and sensitive data is also important, especially when analyzing content that contains personal information of users. Ensuring that the analysis is conducted honestly and without bias is also important to maintain the integrity of the research.

4) Justifications for the Chosen Methods

Content analysis was chosen because it allows for in-depth analysis of documents and content related to the application of Big Data technology in the field of e-commerce. Theoretical frameworks such as hermeneutics and semiotics support this approach by providing tools and methods for understanding and interpreting the meaning of content. Despite some limitations, content analysis provides a comprehensive approach to uncovering patterns and trends in textual data, leading to a better understanding of the impact of Big Data. Compliance with ethical and privacy regulations also ensures that the analysis is conducted in an honest and responsible manner.

IV.   Philosophical/Theoretical Frameworks

In the research of the impact of Big Data technology on the field of e-commerce website design and development, theoretical and philosophical frameworks such as positivism, interpretivism, and constructivism play an important role. Positivism assumes that reality can be measured and understood through scientific and statistical methods, which is consistent with the use of quantitative surveys to collect data from users. Interpretivism and constructivism emphasize the importance of personal experiences and social context, supporting the use of qualitative interviews to gain a deeper understanding of how users and experts interact with Big Data technology. These theoretical frameworks provide a foundation for selecting and justifying the research methods used in the project.

1) Advantages and Limitations

The research methods chosen have many advantages and limitations. Quantitative surveys provide objective and measurable data, which helps generalize the results to a larger population. However, they often lack depth and can be affected by data bias. Qualitative interviews provide deep and detailed insights into participants' experiences and perspectives, but the results can be affected by subjectivity and are time-consuming to collect and analyze. Content analysis allows for the discovery of patterns and trends in textual data, but the analysis process can be affected by the researcher's personal views and is labor-intensive.

2) Ethical Considerations

When conducting research, it is important to ensure that ethical guidelines are followed. For quantitative surveys and qualitative interviews, it is important to ensure that participants understand the purpose of the research and that they voluntarily consent to participate. Protecting personal information and sensitive data is important, including using encryption and storing data securely. Ensuring that participants are treated with respect and are not coerced or pressured. For content analysis, it is important to comply with copyright and intellectual property regulations, and protect personal information in the analyzed documents.

3) Integration of Methods

Integrating different research methods helps provide a comprehensive and in-depth look at the impact of Big Data technology. Quantitative surveys provide objective and measurable data from a large sample of users, while qualitative interviews provide insights into individual experiences and perspectives. Content analysis helps uncover patterns and trends in textual data, providing additional information and clarification to the results of surveys and interviews. This combination helps ensure that your research is not based on a single data source, but includes different perspectives and methods, thereby drawing more valuable and comprehensive conclusions and recommendations.

V. Rationale for Selection

In researching the impact of Big Data technology on e-commerce website design and development, choosing the right research methods is important to ensure the accuracy and comprehensiveness of the results. The methods chosen include quantitative surveys, qualitative interviews, and content analysis, each of which has its own specific rationale and is appropriate to the research objectives.

Quantitative surveys were chosen because they provide an objective and measurable approach to collecting data from a large sample of users. This is important in assessing the impact of Big Data technology on e-commerce websites, where large and diverse data are key. Quantitative surveys allow for the generalization of results to a larger population, helping to draw valid and widely applicable conclusions. Theoretical frameworks such as positivism and post-positivism support this approach by providing tools and methods to test and validate hypotheses.

Qualitative interviews were chosen because they provide deep and detailed insights into the experiences and perspectives of users and experts in the e-commerce field. This is important to better understand how Big Data technology is applied and affects website construction and development. Theoretical frameworks such as interpretivism and constructivism support this approach by emphasizing the importance of personal experiences and social context. Qualitative interviews allow for the exploration of new and unanticipated aspects, helping to clarify the factors influencing the adoption of Big Data technology.

Content analysis was chosen because it allows for in-depth analysis of documents and content related to the adoption of Big Data technology. This method helps to discover patterns and trends in textual data, providing additional information and clarification of the results from surveys and interviews. Theoretical frameworks such as hermeneutics and semiotics support this approach by providing tools and methods for understanding and interpreting the meaning of content.

Integrating different research methods helps provide a comprehensive and in-depth look at the impact of Big Data technology. Quantitative surveys provide objective and measurable data from a large sample of users, while qualitative interviews provide insights into individual experiences and perspectives. Content

analysis helps uncover patterns and trends in textual data, providing additional information and clarification to survey and interview findings. This combination helps ensure that your research is not based on a single data source but includes multiple perspectives and methods, resulting in more valuable and comprehensive conclusions and recommendations.

P3: Conduct primary and secondary research using appropriate methods for a computing research project that consider costs, access and ethical issues.

I. Secondary Research

1) Source

Information sources include academic papers, industry reports, professional books, and online articles from reputable websites. These sources provide an overview of the application of Big Data technology in e-commerce and related technologies such as Angular, TypeScript, and MongoDB. Below are reputable and highly reliable sources:

- **Academic Journals**: Academic papers on Big Data and e-commerce.
- **Industry Reports**: Industry reports from organizations such as Gartner, Forrester on the trends and impact of Big Data in e-commerce.
- **Books**: Professional books on Big Data, Angular, TypeScript, and MongoDB.
- **Online Articles**: Articles from reputable websites such as Medium, TechCrunch, and technology blogs.
- **Case Studies**: Case studies from companies that have applied Big Data in e-commerce.

2) Interpretation and Implications of the Findings

Analyze findings from secondary sources to gain a better understanding of how Big Data can improve user experience, optimize operational efficiency, and predict market trends. These findings will help identify the specific benefits of applying Big Data in e-commerce website development. Here are some of the new findings and analyses:

- **Customer Personalization**: Analyze how Big Data helps personalize user experiences on e-commerce websites.
- **Operational Efficiency**: Evaluate the impact of Big Data on operational efficiency, including inventory management, demand forecasting, and supply chain optimization.
- **Market Trends**: Identify market trends and consumer behavior through big data analytics.
- **Technological Integration**: Explore how Big Data can be integrated with technologies like Angular and MongoDB to improve website performance and scalability.

3) Evaluation of Sources

Evaluate the reliability, relevance, and timeliness of information sources. This includes checking the reputation of the author and publishing organization, determining the relevance of the information to the research topic, and ensuring that information sources reflect current trends.

	Credibility	Relevance	Timeliness	Objectivity
Academic Journals	Scientific articles from reputable journals such as IEEE, ACM, and specialized journals on Big Data and e-commerce. These articles are often reviewed by experts in the field, ensuring accuracy and reliability	Scientific articles often focus on specific studies of Big Data and e-commerce, providing detailed research results and analysis. This is useful for gaining a deeper understanding of the impact of Big Data in this field	Scientific articles often take a long time to be published, so it is important to check that the research is still relevant	Scientific articles are often less biased because they are reviewed by independent experts. However, it is important to consider the funding sources and potential interests of the authors
Industry Reports	Reports from market research organizations such as Gartner, Forrester, and McKinsey. These reports provide insights into the trends and impact of Big Data in e-commerce, based on real data and in-depth analysis	Industry reports provide an overview of the market and current trends, helping you better understand the context and potential of applying Big Data in e-commerce	Industry reports are usually updated annually or quarterly, providing the latest information on markets and technologies	Industry reports may be biased based on the views of the research organization or funders. Be sure to read the methodology section and assumptions used in the report
Books	Specialized books from reputable authors in the field of information technology and e-commerce. These books often provide background knowledge and real-life case studies	Specialized books provide background knowledge and methodologies, helping you build a solid theoretical foundation for your research	Specialized books may not be updated as often, but they provide foundational knowledge and case studies that have lasting value	Specialized books may reflect the author's personal views, so it is important to read multiple sources to get a comprehensive view
Online Articles	Articles from reputable websites such as Medium, TechCrunch, and technology blogs. Although these articles	Online articles provide up-to-date information and real-world examples of applying Big Data in	Online articles are often updated quickly, providing the	Online articles may be biased based on the author's or website's views. It

	may not be peer-reviewed, they often provide up-to-date information and the latest perspectives on the technology	e-commerce, helping you grasp the latest trends and practical applications	latest information on trends and technologies	is important to check the reliability of the source and compare it with other sources

Table 7: Evaluation of Sources

4) Literature Review

Big Data in E-commerce: Big Data has had a huge impact on the e-commerce industry. Companies like Amazon, Netflix, and Walmart have used Big Data to personalize customer experiences, optimize pricing strategies, and improve customer service (Blog, 2023). Big Data helps e-commerce businesses collect and analyze huge amounts of data from transactions, customer behavior, and social media interactions. This helps them better understand market trends and make more accurate strategic decisions.

Technological Frameworks: Angular and MongoDB are two important technologies in e-commerce website development. Angular, a powerful front-end framework, helps create dynamic and interactive web applications. MongoDB, a NoSQL database, provides flexible and scalable data storage and querying capabilities (Mai, 2022). The combination of these two technologies with Big Data helps optimize the performance and scalability of e-commerce websites.

Impact Studies: Many studies have shown that applying Big Data in e-commerce can improve operational efficiency and user experience. For example, Big Data helps predict customer trends and needs, thereby optimizing inventory and supply chain management (Riddle, 2020). Additionally, Big Data helps improve customer relationship management (CRM) by providing insights into customer behavior and preferences.

Ethical Considerations: Collecting and using big data raises many ethical issues, including customer privacy and data security. Businesses need to comply with data protection regulations and ensure that data is used transparently and responsibly (Mai, 2022).

5) Data Collection Methods

Database Searches: Use academic databases such as IEEE Xplore and Google Scholar to search for scientific articles related to Big Data and e-commerce. These databases provide detailed research and analysis on the impact of Big Data in the field. Using academic databases helps ensure that the information sources are highly reliable and reviewed by industry experts.

Industry Reports: Collect industry reports from market research organizations such as Gartner, Forrester, and McKinsey. These reports provide an overview of the trends and impact of Big Data in e-commerce, based on real data and in-depth analysis. Industry reports are usually updated annually or quarterly, helping you grasp the latest trends and changes in the market.

Online Resources: Use reputable search engines and websites such as Medium, TechCrunch, and technology blogs to gather up-to-date information and real-world examples of Big Data adoption in e-commerce. Online articles are often updated quickly, providing the latest information on trends and technologies.

Case Study Analysis: Analyze case studies from companies that have adopted Big Data to get a real-world view of the impact of this technology. For example, Amazon uses Big Data to personalize customer experiences and optimize inventory management. Alibaba uses Big Data to improve supply chain management and logistics operations. Analyzing case studies gives you a better understanding of how major companies have adopted Big Data and the benefits they have achieved (Riddle, 2020).

II. Primary Research

1) Interview

Interviews are an effective method of primary data collection, especially when seeking to gather detailed and in-depth information from experts or users. In this research, interviews could be conducted with experts in the fields of e-commerce, Big Data, and web development. These interviews would help me gain a better understanding of how Big Data is applied in practice, the challenges and opportunities it brings, as well as the methods and technologies used.

- ➢ **Design and Methodology**: Design open-ended interview questions to encourage participants to share details about their experiences and perspectives. Questions could revolve around the application of Big Data in e-commerce, technologies such as Angular and MongoDB, and ethical issues related to data collection and use.
- ➢ **Participant Selection**: Select interview participants including experts in the field of e-commerce, web developers using Angular and MongoDB, and Big Data experts. Ensure that participants have extensive experience and knowledge to provide valuable information.
- ➢ **Ethical Considerations**: Ensure that interviews are conducted ethically, including obtaining consent from participants, protecting personal information, and using interview data transparently and responsibly.

2) Survey

Surveys are a popular and effective method of collecting primary data, especially when you want to collect information from a large number of participants. In this research, a survey could be conducted to collect data from users and e-commerce businesses about the adoption of Big Data, technologies such as Angular and MongoDB, and their experiences.

- **Design and Methodology**: Design a survey with a variety of questions, including multiple-choice, open-ended, and rating questions. Questions may revolve around the use of Big Data in e-commerce, web development technologies, and ethical issues related to data.
- **Sampling Method**: Use random or purposive sampling to ensure that the survey sample is representative of the research population. Make sure you have enough participants to collect reliable and meaningful data.
- **Ethical Considerations**: Make sure the survey is conducted ethically, including asking for participant consent, protecting personal information, and using survey data in a transparent and responsible manner.

III.   Integration and Analysis

1) Combining Primary and Secondary Data

Combining primary and secondary data to get a comprehensive view of the impact of Big Data in e-commerce. Primary data from interviews and surveys will provide detailed and specific information from experts and users. Secondary data from academic papers, industry reports, and online sources will provide context and theoretical foundation. Combining these two types of data helps you identify patterns and trends, and provides a solid basis for conclusions and recommendations.

2) Comparative Analysis

Compare the findings from primary and secondary data to identify similarities and differences. Comparative analysis helps you gain insight into how experts and users view the adoption of Big Data in e-commerce, as well as the challenges and opportunities it presents. It also helps you evaluate the consistency and reliability of findings from different sources.

3) Synthesis of Findings

Synthesize findings from primary and secondary data to draw conclusions and recommendations. This synthesis includes identifying common patterns, important factors, and variables that influence the adoption of Big Data in e-commerce. You should also consider factors such as operational efficiency, user experience, and ethical issues related to data collection and use.

4) Implications for Research Question/Hypothesis

Identify the implications of the findings for your research question or hypothesis. This includes assessing whether the findings support or refute your hypothesis, as well as specific recommendations for applying Big Data in e-commerce website development. You should also consider the practical and theoretical aspects of the findings, and make recommendations for further research or practical applications.

P4: Apply appropriate analytical tools, analyse research findings and data.

I. Interview

Design interview questions to collect data from experts and users. Questions need to be carefully constructed to ensure that quality and valuable information is collected. After conducting interviews, the interviews will be recorded and converted into text for analysis. Qualitative analysis will include coding and analyzing the themes from the interviews.

1) Interview 1

a) Question

Question 1: How do you think Big Data has changed the way e-commerce websites work?

This question aims to gather detailed information about the participant's practical experience in using Big Data technology in e-commerce projects. When answering this question, participants can start by briefly describing the e-commerce projects they have been involved in, including the size, goals, and scope of the project. They will share their specific role in the project, key responsibilities, and tasks related to using Big Data.

Participants can list Big Data tools and techniques they have used, such as Hadoop, Spark, NoSQL databases like MongoDB, and data analytics tools like Tableau or Power BI. They will explain how they have applied Big Data to solve specific problems in e-commerce, such as customer behavior analysis, marketing campaign optimization, or inventory management.

Participants can share the results and benefits that using Big Data has brought to their projects, such as increasing revenue, improving user experience, or optimizing business processes. They can also talk about the challenges they have encountered when using Big Data and the lessons they have learned from the process.

b) Synthesize answers

Many e-commerce experts have shared that the use of Big Data has brought about significant changes in the way e-commerce websites operate and manage. They have used tools and techniques such as Hadoop, Spark, MongoDB, and data analytics tools such as Tableau and Power BI to process and analyze large amounts of data from sales transactions and customer behavior. Some experts have applied Big Data to analyze customer shopping behavior, thereby optimizing user experience by personalizing product recommendations and optimizing marketing campaigns. As a result, many businesses have seen significant increases in revenue and customer satisfaction.

In addition, experts also shared that using Angular and TypeScript in e-commerce website development has helped them build robust and easy-to-maintain web applications. MongoDB has been used to store unstructured data, making data management efficient and easy to scale. In conclusion, the use of Big Data in e-commerce projects has brought many benefits, but also requires careful investment and management to overcome challenges related to data security and accuracy.

2) Interview 2
a) Question

Question 2: What tools and techniques have you used to analyze data from e-commerce activities?

This question aims to gather detailed information about the tools and techniques that the participant has used to analyze data from e-commerce activities. When answering this question, the participant can start using the list of tools and techniques they have used, such as Google Analytics, Hadoop, Spark, MongoDB, Tableau, Power BI, and others. They will address how they apply these tools to analyze data from sales transactions, customer actions, and other e-commerce related activities.

Participants can share how they use these tools to collect, process, and analyze data to make data-driven business decisions. They can also talk about the challenges they face when using these tools and how they overcome them.

b) Synthesize answers

Many e-commerce professionals shared that they use a variety of tools and techniques to analyze data from e-commerce activities. Popular tools include Google Analytics, Hadoop, Spark, MongoDB, Tableau, Power BI, and others like Crazy Egg, Kiss Metrics, and Woopra. Google Analytics is commonly used to track and analyze website traffic, user actions, and conversion rates. Hadoop and Spark are used to process and analyze large amounts of data from sales transactions and customer actions. MongoDB is used to store structured data, which helps manage data results and is easy to scale. Tableau and Power BI are powerful data analysis tools that help create online reports and charts to support business decisions.

Some experts have adopted these tools to analyze customer shopping behavior, thereby providing users with an optimized professional experience by personalizing product offerings and optimizing marketing campaigns. As a result, many businesses have seen significant increases in revenue and customer satisfaction. In short, the use of data analytics tools and techniques in e-commerce projects has brought many benefits, but also requires careful investment and management to overcome the syntax of access to security and data accuracy.

3) Interview 3

a) Question

Question 3: How has Big Data helped you optimize the user experience on your e-commerce website?

This question seeks to gather insights into how Big Data has been used to optimize the user experience on e-commerce websites. When answering this question, participants can start by describing the initial problems or challenges they encountered in improving the user experience. They will share how they used Big Data to analyze user behavior and then come up with specific solutions to optimize the experience.

Participants can list the Big Data tools and techniques they have used, such as data analysis from Google Analytics, Hadoop, Spark, or other analytics tools. They will explain how they applied these tools to collect and analyze user data and then make data-driven decisions to improve the user experience.

b) Synthesize answers

Many experts in the e-commerce field have shared that using Big Data has helped them optimize the user experience on e-commerce websites significantly. They have used tools such as Google Analytics, Hadoop, Spark, and other data analytics tools to collect and analyze data from user behavior on the website. Some experts have applied Big Data to analyze customer shopping behavior, thereby personalizing product recommendations based on users' preferences and previous shopping behavior. This not only helps increase conversion rates but also improves customer satisfaction when they feel that the recommended products are suitable for their needs.

In addition, Big Data has also been used to optimize the user interface and navigation experience on the website. By analyzing data from user sessions, experts were able to identify weaknesses in the interface and improve them to create a smoother and more user-friendly experience. In short, using Big Data has helped many e-commerce businesses optimize user experience effectively, but it also requires careful investment and management to overcome challenges related to data security and accuracy.

4) Interview 4

a) Question

Question 4: **What challenges have you faced when applying Big Data to e-commerce projects?**

This question seeks to gather insights into the challenges that participants have faced when applying Big Data technology to e-commerce projects. When answering this question, participants can begin by describing the specific challenges they have faced, including technical issues, data management, security, and regulatory compliance.

Participants can share how they have addressed these challenges and the lessons they have learned from the process. They can also talk about the measures and tools they have used to overcome these challenges.

b) Synthesize answers

Many experts in the e-commerce field have shared that applying Big Data to e-commerce projects comes with many challenges. One of the biggest challenges is ensuring the accuracy and reliability of the data collected. Experts have had to invest in data security measures to protect customer information and comply with security and ethical regulations.

Another challenge is the processing and analysis of large amounts of data from sales transactions and customer behavior. Tools such as Hadoop and Spark have been used to process big data, but implementing and managing these tools requires in-depth knowledge and high technical skills. In addition, integrating data from different sources is also a challenge. Experts have faced the problem of data synchronization and ensuring that data from different sources can be combined and analyzed effectively.

Some experts have also had difficulty maintaining system performance when processing large amounts of data. They have had to optimize infrastructure and use performance monitoring tools to ensure that the system runs smoothly and efficiently. In summary, applying Big Data to e-commerce projects brings many benefits, but also comes with many challenges. Experts have had to invest in security measures, optimize infrastructure, and use powerful data analysis tools to overcome these challenges.

5) Interview 5
a) Question

Question 5: **Can you share a specific example of how Big Data has helped improve your business performance?**

This question seeks to gather details about specific cases where Big Data has helped improve the participant's business performance. When answering this question, participants can start by briefly describing the context and goals of the project. They will share how they used Big Data to solve a specific problem or achieve a business goal.

Participants can list the Big Data tools and techniques they have used, such as Hadoop, Spark, MongoDB, Tableau, or Power BI. They will explain how they applied these tools to collect, process, and analyze data, and then make data-driven decisions to improve business performance.

b) Synthesize answers

Many e-commerce professionals have shared specific examples of how Big Data has helped improve their business performance. One popular example is the use of Big Data to analyze customer shopping behavior. By using tools like Hadoop and Spark to process large amounts of data from customer transactions and behavior, experts have been able to identify trends and patterns in shopping behavior.

Some experts have used this data to personalize product recommendations for each customer, thereby increasing conversion rates and revenue. For example, one business used Big Data to analyze data from

customer purchases and browsing behavior. They used analytics tools like Tableau to create detailed reports on shopping trends and recommend suitable products for each customer group. As a result, this business saw a significant increase in revenue and customer satisfaction.

In addition, Big Data has also been used to optimize warehouse and supply chain management. By analyzing data from different sources, experts were able to predict product demand and optimize warehouse management processes, thereby reducing costs and increasing operational efficiency.

6) Interview 6
a) Question

Question 6: How do you ensure that the data collected is accurate and reliable?

This question seeks to gather details about the measures and processes that participants use to ensure the accuracy and reliability of the data collected in e-commerce projects. When answering this question, participants can begin by describing the processes and tools they use to collect data. They will share about the measures they use to check and verify the data, as well as the methods they use to ensure that the data is not biased or corrupted.

b) Synthesize answers

Many e-commerce experts have shared that ensuring the accuracy and reliability of collected data is one of the biggest challenges when applying Big Data to e-commerce projects. To ensure the accuracy and reliability of data, they have used a variety of testing measures and processes. One of the common measures is to use automated data testing tools to detect and correct errors in data. These tools can check data consistency, detect missing or invalid values, and automatically correct common errors. In addition, experts also use statistical methods to check the accuracy of data, such as checking data distribution and comparing with standard data samples.

Some experts have set up manual testing processes to ensure that the collected data is accurate and reliable. They have created regular data auditing processes, in which data is checked by experts to detect and correct errors. These processes include checking the consistency of data from different sources, verifying the accuracy of data by comparing it with trusted data sources, and checking the integrity of data during collection and processing. In addition, experts have also invested in data security measures to ensure that data is not altered or accessed without authorization. They have used data encryption tools and established strict data access rights to protect customer information and comply with security and ethical regulations.

7) Interview 7

a) Question

Question 7: What measures do you have in place to ensure that the collection and use of data complies with privacy and ethical regulations?

This question seeks to gather details about the measures and processes that participants use to ensure that the collection and use of data complies with privacy and ethical regulations. Participants can share specific measures they have implemented to protect user privacy, including encrypting data, establishing strict data access rights, and using data security tools. They can also talk about regular audits and reviews to ensure that privacy and security measures are maintained.

b) Synthesize answers

Many e-commerce professionals have shared that compliance with privacy and ethical regulations is an important part of data collection and use. To ensure compliance with these regulations, they have implemented a series of security measures and procedures.

One of the common measures is data encryption to protect customer information from unauthorized access. Experts have used strong encryption tools to ensure that data is protected both during storage and transmission. In addition, they have also established strict data access rights, allowing only authorized persons to access sensitive data. Experts have also established periodic testing and assessment procedures to ensure that security and privacy measures are maintained at all times. They have conducted regular security audits to detect and fix security vulnerabilities. In addition, they have also implemented training programs for employees on data security regulations and standards, to improve employees' security awareness and skills.

Some experts have followed international regulations and standards such as GDPR and CCPA to ensure that data collection and use comply with privacy and ethical regulations. They have established processes to obtain user consent before collecting data, and give users control over their data, including the right to access, correct, and delete data.

8) Interview 8

a) Question

Question 8: How do you evaluate the effectiveness of using Angular and TypeScript in e-commerce website development?

This question aims to collect detailed information about how participants evaluate the effectiveness of using Angular and TypeScript in e-commerce website development. It can be described through the criteria and metrics they use to evaluate the effectiveness, such as performance, scalability, security, and user

experience. Participants can share the tools and methods they use to measure these metrics, as well as the specific results they have achieved using Angular and TypeScript.

b) Synthesize answers

Many experts in the e-commerce field have shared that using Angular and TypeScript has brought many significant benefits in e-commerce website development. To evaluate the effectiveness of using Angular and TypeScript, they have used a variety of criteria and metrics.

One of the important criteria is website performance. Experts have used tools like Google Lighthouse and WebPageTest to measure the page load speed and overall performance of the website. Angular, with its performance optimization capabilities and support for Progressive Web Apps (PWAs), has helped improve page load speed and user experience.

Scalability is also an important criterion. Angular, with its component-based architecture and powerful dependency injection system, has made it easy for experts to scale and maintain complex web applications. TypeScript, with its static type checking feature, has helped reduce errors and improve code quality.

Security is an indispensable factor in e-commerce website development. Angular provides security features such as protection against XSS (Cross-Site Scripting) and CSRF (Cross-Site Request Forgery) attacks. Experts have used security testing tools like OWASP ZAP to ensure that their applications comply with security standards.

Finally, user experience is another important criterion. Angular, with its ability to create smooth and interactive user interfaces, has helped improve user experience. Experts have used analytics tools like Google Analytics to track user behavior and measure customer satisfaction.

9) Interview 9
a) Question

Question 9: What suggestions do you have for improving the use of Big Data in e-commerce website development and management?

This question aims to collect suggestions and ideas from participants on how to improve the use of Big Data in e-commerce website development and management. It helps to find out the current problems or limitations they have encountered when using Big Data. Then, specific suggestions will be found to overcome these problems and improve the effectiveness of Big Data use. Participants can suggest new tools and techniques, more effective data management methods, or strategies to optimize the use of Big Data in e-commerce projects.

b) Synthesize answers

Many experts in the field of e-commerce have shared suggestions and ideas to improve the use of Big Data in e-commerce website development and management. Here are some key recommendations:

➢ **Invest in new technology and tools**: Experts recommend using the latest tools and technologies to process and analyze big data. For example, using cloud platforms such as AWS, Google Cloud, or Azure can help expand data processing capabilities and reduce infrastructure costs.

➢ **Improve data security**: To protect customer information and comply with privacy regulations, experts recommend investing in stronger data security measures. This includes using data encryption, setting strict access rights, and conducting regular security audits.

➢ **Improve data management**: Experts emphasize the importance of effective data management. They recommend using data management tools such as DataOps to automate the process of collecting, processing, and analyzing data. This helps ensure the accuracy and reliability of data.

➢ **Training and upskilling employees**: To get the most out of Big Data, experts recommend investing in training and upskilling employees. This includes providing courses on data analytics, big data processing techniques, and modern data analytics tools.

➢ **Optimize user experience**: Experts recommend using Big Data to analyze user behavior and optimize user experience on websites. This includes personalizing product recommendations, optimizing user interfaces, and improving page load speeds.

➢ **Collaborate with experts and partners**: To improve the use of Big Data, experts recommend collaborating with experts and partners who have experience in the field. This helps share knowledge, experience, and best practices to optimize the use of Big Data in e-commerce projects.

In short, improving the use of Big Data in e-commerce website development and management requires investment in technology, security, data management, employee training, user experience optimization, and collaboration with experts and partners.

10)   Intereview summary

Below is a combination of questions, answers and sharing of some experts in the field of Applying Big Data Technology in the Field of E-commerce website constructing and development website:

Expert Name	Interview Question	Answer	Analysis
Bernard Marr	How do you think Big Data has changed the way e-commerce websites work?	Big Data has significantly changed e-commerce by enabling detailed customer behavior analysis, optimizing marketing campaigns, and improving inventory	Big Data enhances revenue, user experience, and business processes but poses

		management. Tools like Hadoop, Spark, MongoDB, Tableau, and Power BI are commonly used.	challenges in data accuracy and security.
Hilary Mason	What tools and techniques have you used to analyze data from e-commerce activities?	Tools like Google Analytics, Hadoop, Spark, MongoDB, Tableau, Power BI, Crazy Egg, Kiss Metrics, and Woopra are used to analyze customer behavior and optimize marketing strategies	Effective use of these tools leads to increased revenue and customer satisfaction, but challenges include data accuracy and security.
Kirk Borne	How has Big Data helped you optimize the user experience on your e-commerce website?	Big Data is used to personalize product recommendations and optimize user interfaces, improving user satisfaction and conversion rates. Tools like Google Analytics, Hadoop, Spark, and Tableau are used.	Big Data improves user experience but requires careful data management and security measures.
Claudia Perlich	What challenges have you faced when applying Big Data to e-commerce projects?	Challenges include ensuring data accuracy, managing large datasets, integrating data from multiple sources, and maintaining system performance. Tools like Hadoop and Spark are used to address these challenges.	Overcoming these challenges requires investment in data security, infrastructure optimization, and skilled personnel.
Andrew Ng	Can you share a specific example of how Big Data has helped improve your business performance?	Big Data was used to analyze customer behavior, personalize product recommendations, and optimize inventory management, leading to increased revenue and customer satisfaction.	Specific examples highlight the tangible benefits of Big Data but also emphasize the need for accurate data and robust security measures.
DJ Patil	How do you ensure that the data collected is accurate and reliable?	Automated data validation tools, statistical methods, and manual checks are used to ensure data accuracy. Regular security audits and data encryption are also implemented.	Ensuring data accuracy and reliability requires a combination of automated tools, manual processes, and strong security measures.
Cathy O'Neil	What measures do you have in place to ensure that the collection and use	Data encryption, strict access controls, regular security audits, and compliance with regulations	Compliance with privacy and ethical regulations requires robust security

	of data complies with privacy and ethical regulations?	like GDPR and CCPA are implemented.	measures and regular audits.
Martin Fowler	How do you evaluate the effectiveness of using Angular and TypeScript in e-commerce website development?	Performance, scalability, security, and user experience are key criteria. Tools like Google Lighthouse and WebPageTest are used to measure these metrics.	Angular and TypeScript improve performance, scalability, and user experience but require regular evaluation and optimization.
Tom Davenport	What suggestions do you have for improving the use of Big Data in e-commerce website development and management?	Invest in new technologies, enhance data security, improve data management, train staff, optimize user experience, and collaborate with experts.	Continuous improvement in technology, security, and staff training is essential for maximizing the benefits of Big Data.

Table 8: Interview summary

II. Survey

Conduct a survey to collect quantitative data from the target audience. Survey questions need to be designed to be easy to understand and answer. After distributing the survey and collecting responses, you will use statistical tools to analyze the data. Tools such as Python, R, or BI software such as Tableau, Power BI can be used to visualize the data and analysis results.

Link Google Forms Survey: https://docs.google.com/forms/d/e/1FAIpQLScNlerX-nj0lpZlcsDZPm4YzcvHxBIbAdbnFQeG6KEhXDX3Sw/viewform

1) Survey 1

Survey question 1: Have you ever used any e-commerce website?
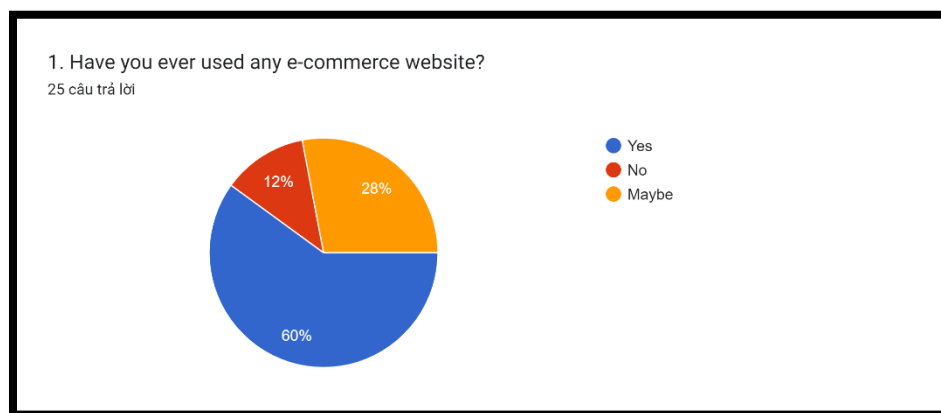
Figure 5: Survey 1

> **60% answered Yes**: This shows that the majority of survey respondents have used e-commerce websites. This is a positive sign, indicating the popularity and acceptance of e-commerce in the community.

> **28% answered Maybe**: A large proportion of respondents were unsure whether they had ever used e-commerce websites. This could be because they did not remember clearly or were not aware that they had used this service. This could also indicate that there are some potential users that have not been fully exploited.

> **12% answered No**: A small proportion of respondents have never used e-commerce websites. This could be due to a variety of reasons such as lack of trust in online shopping, unfamiliarity with the technology, or lack of need.

2) Survey 2

Survey question 2 : How many times a month do you usually shop online?

Figure 6: Survey 2

44% answered 0-2 times: This is a group of users who rarely shop online, possibly because they do not have a high demand or are not familiar with online shopping. This shows that there is still potential to attract and encourage this group to shop online more.

28% answered 3-5 times: This is a group of users with an average frequency of online shopping. They may be familiar with online shopping and have a need to shop more often. Providing promotions and incentives can help increase the shopping frequency of this group.

20% answered 6-10 times: This is a group of users who shop online quite often. They may be loyal users and have a high demand for shopping. Maintaining service quality and providing good shopping experiences will help retain this group.

8% answered More than 10 times: This is a group of users who shop online very frequently. They can be proactive consumers and have a large shopping need. Providing exceptional services and good customer care will help maintain the satisfaction of this group.

3) Survey 3

Survey question 3: Do you know about Big Data technology?
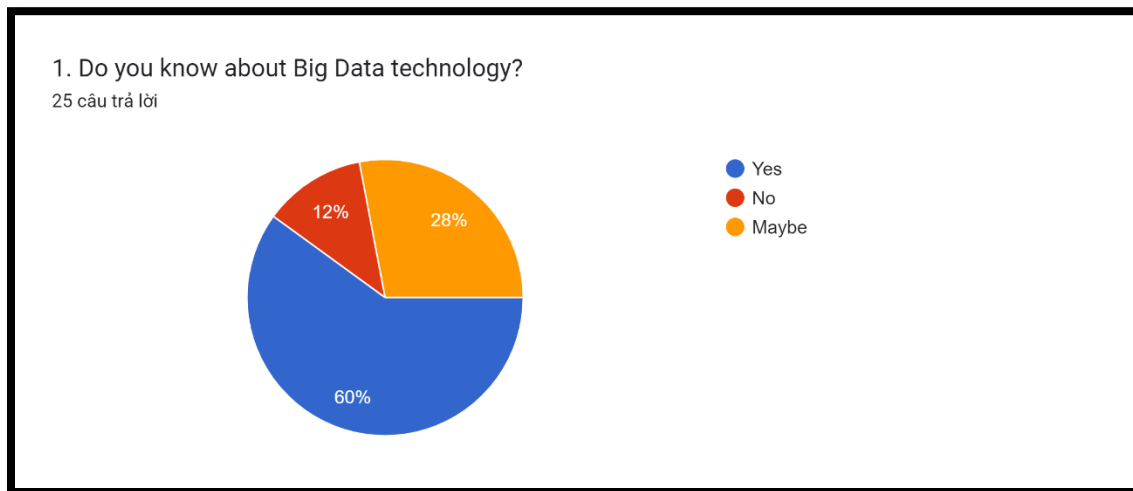
Figure 7: Survey 3

➢ **60% answered Yes**: This shows that the majority of survey participants are aware of Big Data technology. This is a positive sign, showing the popularity and level of interest in this technology in the community.

➢ **28% answered Maybe**: A fairly large proportion of participants are unsure about their knowledge of Big Data. This may be because they have some basic understanding but not deep enough to confidently assert. This is a group of potential users who need to be provided with more information and education about Big Data.

➢ **12% answered No**: A small proportion of participants do not know about Big Data technology. This shows that there are still some users who have not been exposed to or do not fully understand this technology, and communication and education campaigns are needed to raise awareness.

4) Survey 4

2. Do you notice a difference in your online shopping experience when websites use Big Data technology?
25 câu trả lời

- Yes
- No
- Maybe

32%
12%
56%
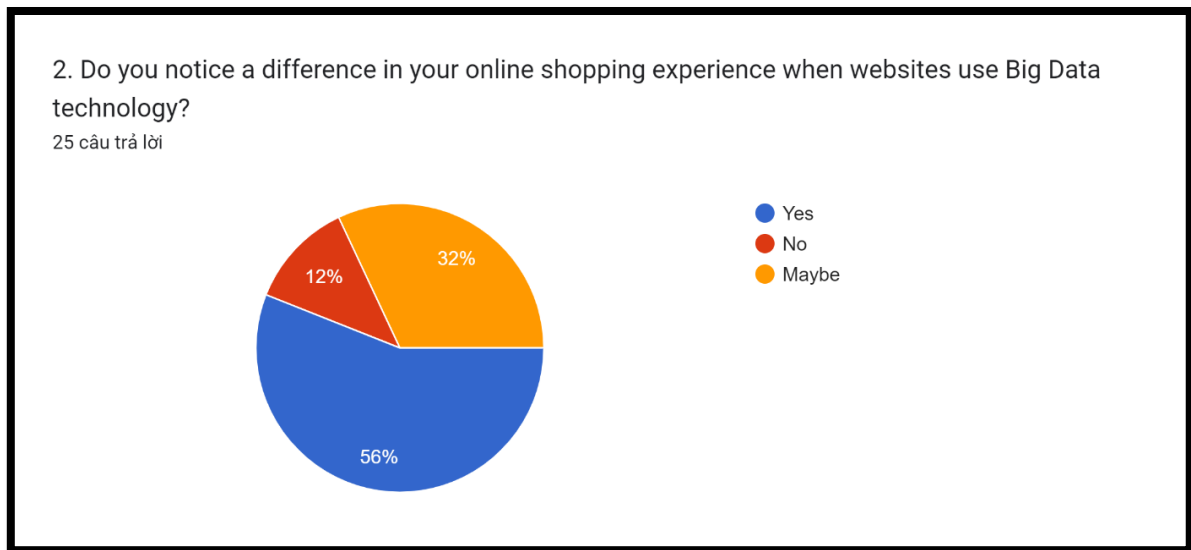
Figure 8: Survey 4

Survey question 4: Do you notice a difference in your online shopping experience when websites use Big Data technology?

- ➢ **56% answered Yes**: More than half of the survey respondents noticed a difference in their online shopping experience when websites use Big Data technology. This suggests that Big Data technology has a significant impact on the user experience, whether it be through personalized product recommendations, relevant advertising, or improved customer service.

- ➢ **32% answered Maybe**: A significant proportion of respondents were unsure about the difference. This may be because they are not yet fully aware of the improvements that Big Data brings or have not experienced it enough to draw conclusions. This is a group of users who need to be provided with more information and experience to better understand the benefits of Big Data.

- ➢ **12% answered No**: A small proportion of respondents did not notice a difference. This could be because they haven't had much exposure to websites that use Big Data or the improvements aren't obvious enough for them to notice.

5) Survey 5

Survey question 5: Do you feel that product recommendations on e-commerce websites today are relevant to your interests?

- ➢ **48% answered Normal**: Almost half of the survey respondents felt that product recommendations on e-commerce websites today are just average. This suggests that while recommendations may not be completely irrelevant, they are not yet highly personalized enough to truly engage users.

> **20% answered Relevant**: A small portion of respondents felt that product recommendations were relevant to their interests. This is a positive sign, indicating that Big Data technology is having a positive impact on the user experience, but there is still room for improvement.

Figure 9: Survey 5

> **16% answered Unsuitable**: A significant proportion of respondents felt that product recommendations were not relevant to their interests. This suggests that there is still room for improvement in product recommendation algorithms.

> **8% Very Unsuitable**: A small percentage of respondents felt that product recommendations were completely irrelevant. This is an issue that needs to be addressed to avoid losing user trust. 8% Very Relevant: A small percentage of respondents felt that product recommendations were very relevant to their interests. This is a group of users who are satisfied with the shopping experience and are likely to become loyal customers.

6) Survey 6

Survey question 6: Do you feel that advertisements on e-commerce websites today are relevant to your needs and interests?

> **44% answered Normal**: Almost half of the survey respondents felt that advertisements on e-commerce websites today are just average. This suggests that while advertisements may not be completely irrelevant, they are not yet highly personalized enough to truly engage users.24% answered Relevant: A small portion of respondents felt that advertisements were relevant to their needs and interests. This is a positive sign, indicating that Big Data technology is having a positive impact on the user experience, but there is still room for improvement.

➢ **16% answered Unsuitable**: A significant proportion of respondents felt that advertisements were not relevant to their needs and interests. This suggests that there is still room for improvement in advertising algorithms.
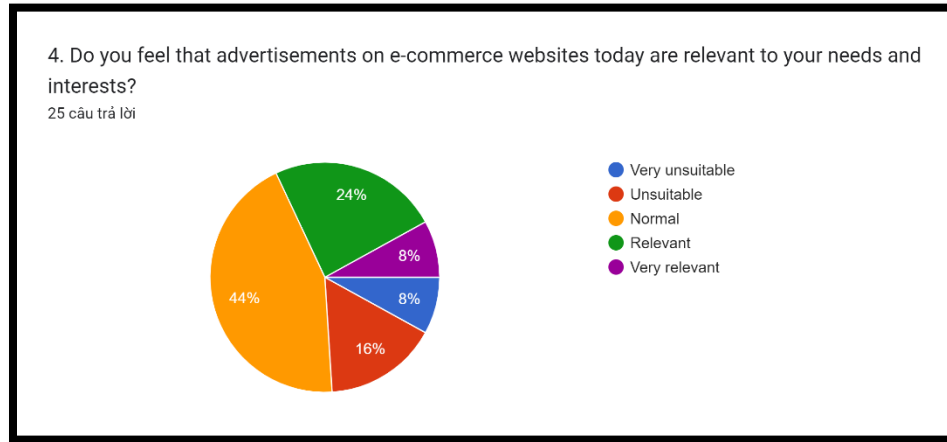
Figure 10: Survey 6

➢ **8% Very Unsuitable**: A small percentage of respondents felt that the ads were completely irrelevant. This is an issue that needs to be addressed to avoid losing user trust.

➢ 8**% Very Relevant**: A small percentage of respondents felt that the ads were very relevant to their needs and interests. This is a group of users who are satisfied with the shopping experience and are likely to become loyal customers.

7) Survey 7

Survey question 7: Do you think that the use of Big Data technology helps improve customer service on e-commerce websites?
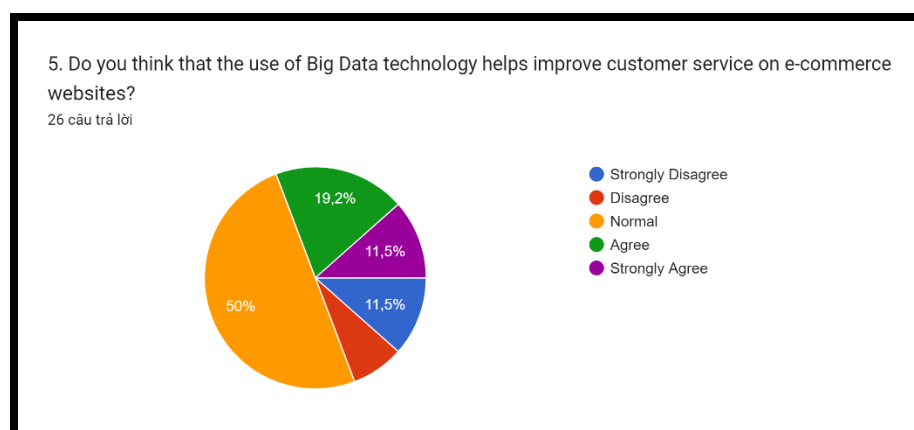
Figure 11: Survey 7

➢ **50% answered Normal**: Half of the survey respondents felt that the use of Big Data technology only improved customer service to a normal level. This shows that while Big Data can bring some benefits, it is not enough to make a noticeable difference in the eyes of many users.

- ➢ **19.2% answered Agree**: A small portion of respondents agreed that Big Data helps improve customer service. This is a positive sign, indicating that the technology is having a positive impact on the user experience, but there is still room for improvement.
- ➢ **11.5% answered Strongly Agree**: A small portion of respondents strongly agreed that Big Data improves customer service. This group of users is satisfied with the improvements that Big Data brings and may become loyal customers.
- ➢ **11.5% responded Strongly Disagree**: A small percentage of respondents strongly disagreed that Big Data improves customer service. This suggests that some users do not see the benefits of this technology or may have had a negative experience.
- ➢ **2.1% responded Disagree**: A very small percentage of respondents felt that Big Data is very relevant and improves customer service. This is a group of users who are very satisfied with the shopping experience and may become strong advocates for this technology.

8) Survey 8

Survey question 8: Do you feel that e-commerce websites use Big Data technology to optimize prices and manage inventory more effectively?
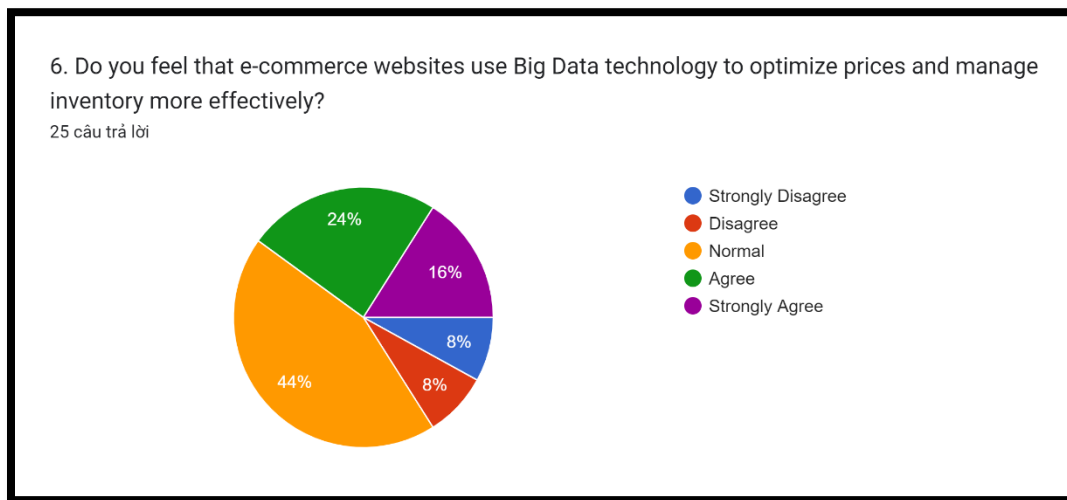
Figure 12: Survey 8

- ➢ **44% answered Normal**: Nearly half of the survey respondents felt that the use of Big Data technology to optimize prices and manage inventory was only average. This shows that although Big Data can bring some benefits, it is not enough to make a noticeable difference in the eyes of many users.
- ➢ **24% answered Agree**: A small portion of respondents agreed that Big Data helps optimize prices and manage inventory more effectively. This is a positive signal, indicating that this technology is having a positive impact on business operations, but there is still room for improvement.

- **16% answered Strongly Agree**: A small portion of respondents strongly agreed that Big Data improves the efficiency of price and inventory management. This is a group of users who are satisfied with the improvements that Big Data brings and may become loyal customers.
- **8% responded Strongly Disagree**: A small percentage of participants strongly disagreed that Big Data improves the efficiency of pricing and inventory management. This suggests that there are some users who do not see the benefits of this technology or may have had a negative experience.
- **8% responded Disagree**: A small percentage of participants disagreed that Big Data improves the efficiency of pricing and inventory management. This suggests that there is still room for improvement in algorithms and processes for using Big Data.

9) Survey 9

Survey question 9: How do you rate the user interface of current e-commerce websites?
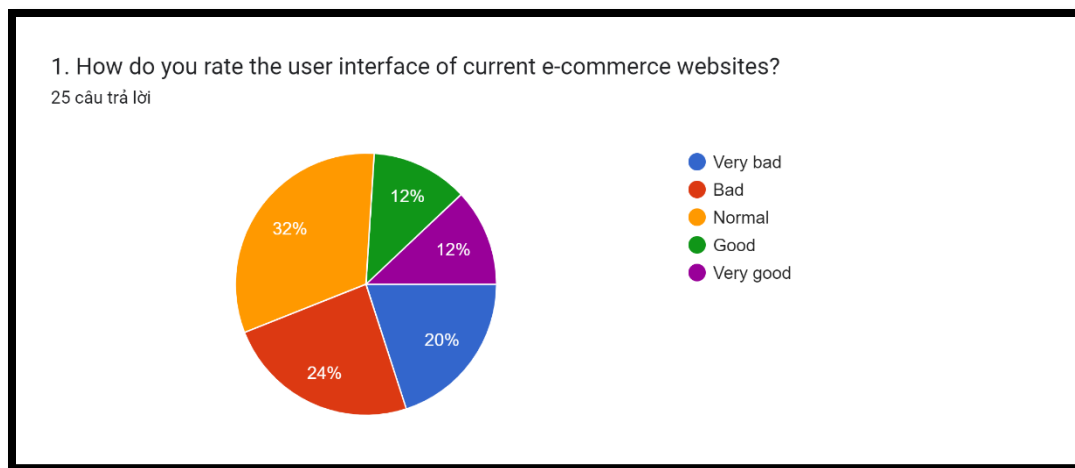
Figure 13: Survey 9

- **32% answered Normal**: Almost a third of survey respondents felt that the user interface of current e-commerce websites is just average. This suggests that while the interface may not be annoying, it is not attractive or convenient enough to make a strong impression.
- **24% answered Bad**: A quarter of respondents felt that the user interface of current e-commerce websites is poor. This suggests that there are areas that need improvement, whether it is in terms of design, functionality or user experience.
- **20% answered Very bad**: A significant proportion of respondents felt that the user interface of current e-commerce websites is very poor. This is a warning sign that many users are dissatisfied with the current experience and that significant improvements are needed.
- **12% answered Good**: A small percentage of respondents felt that the user interface of current e-commerce websites is good. This shows that there are some users who are satisfied with the current experience, but there is still room for improvement to achieve higher satisfaction.

- **12% answered Very good**: A small percentage of respondents felt that the user interface of current e-commerce websites is very good. This is the group of users who are satisfied with the current experience and can become loyal customers.

10)   Survey 10

Survey question 10: Do you have any difficulties when using e-commerce websites?
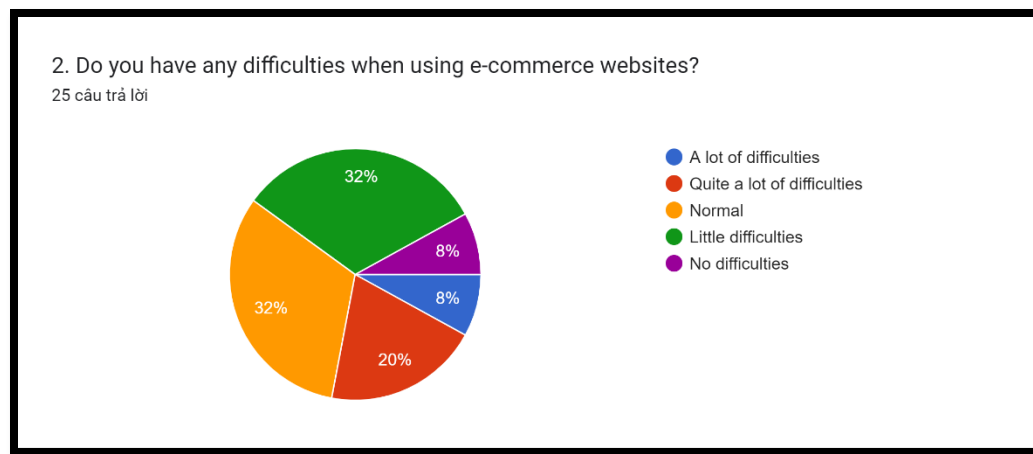
Figure 14: Survey 10

- **32% answered Normal**: Almost a third of the survey respondents felt that they had moderate difficulties when using e-commerce websites. This shows that although there were some problems, they were not serious enough to cause major discomfort.
- **32% answered Little difficulties**: One-third of the respondents had some minor difficulties when using e-commerce websites. This shows that there are minor problems that need to be improved to improve the user experience.
- **20% answered Quite a lot of difficulties**: A significant proportion of the respondents had quite a lot of difficulties when using e-commerce websites. This shows that there are many problems that need to be solved to improve the user experience.
- **8% answered A lot of difficulties**: A small proportion of the respondents had a lot of difficulties when using e-commerce websites. This is a warning sign that many users are not satisfied with the current experience and significant improvements are needed.
- **8% answered No difficulties**: A small percentage of participants did not have any difficulties using e-commerce websites. This group of users is satisfied with the current experience and can become loyal customers.

11)   Survey 11

Survey question 11: How do you feel about the page loading speed of current e-commerce websites?

- **44% answered Normal**: Almost half of the survey respondents felt that the page loading speed of current e-commerce websites was just average. This shows that although the page loading speed is not too slow, it is not fast enough to create an excellent user experience.

3. How do you feel about the page loading speed of current e-commerce websites?
25 câu trả lời

- Very slow
- Slow
- Normal
- Fast
- Very fast

44% 12% 12% 28%
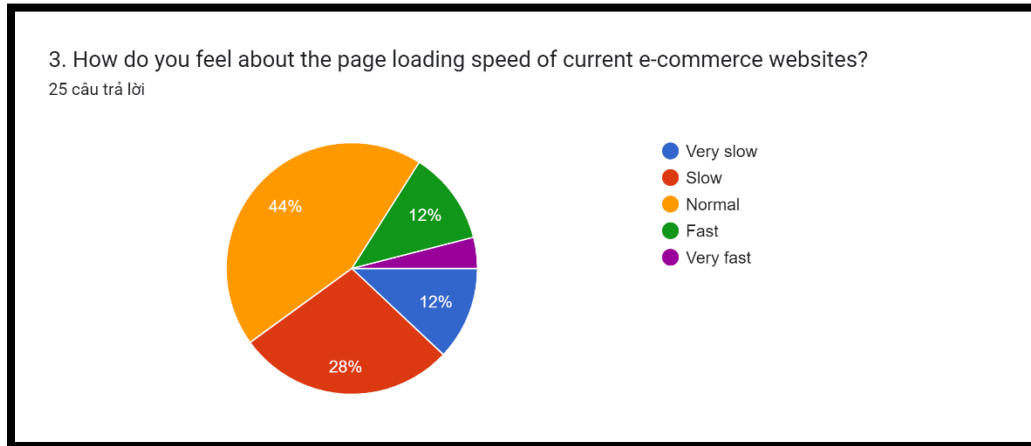
Figure 15: Survey 11

- **28% answered Slow**: One-third of the respondents felt that the page loading speed was slow. This shows that many users have problems with page loading speed, affecting their shopping experience.
- **12% answered Fast**: A small percentage of respondents felt that the page loading speed was fast. This is a positive sign, indicating that there are some websites that have optimized page loading speed well, but still need to improve to achieve higher satisfaction.
- **12% answered Very slow**: A small percentage of respondents felt that the page loading speed was very slow. This is a serious issue that needs to be addressed to avoid losing user trust.
- **4% answered Very fast**: A very small percentage of respondents felt that the page load speed was very fast. This is a group of users who are satisfied with the current experience and may become loyal customers.

12)   Survey 12

Survey question 12: Are you concerned about the security of your personal information when shopping online?

- **28% answered Normal**: Almost a third of survey respondents felt that the level of concern about the security of their personal information when shopping online was at a normal level. This shows that although there were some concerns, they were not serious enough to cause major anxiety.
- **36% answered Concerned**: More than a third of respondents were concerned about the security of their personal information. This shows that many users have security issues, affecting their confidence when shopping online.

4. Are you concerned about the security of your personal information when shopping online?
25 câu trả lời

- Very concerned
- Concerned
- Normal
- Not concerned
- Not very concerned

28%
12%
20%
36%
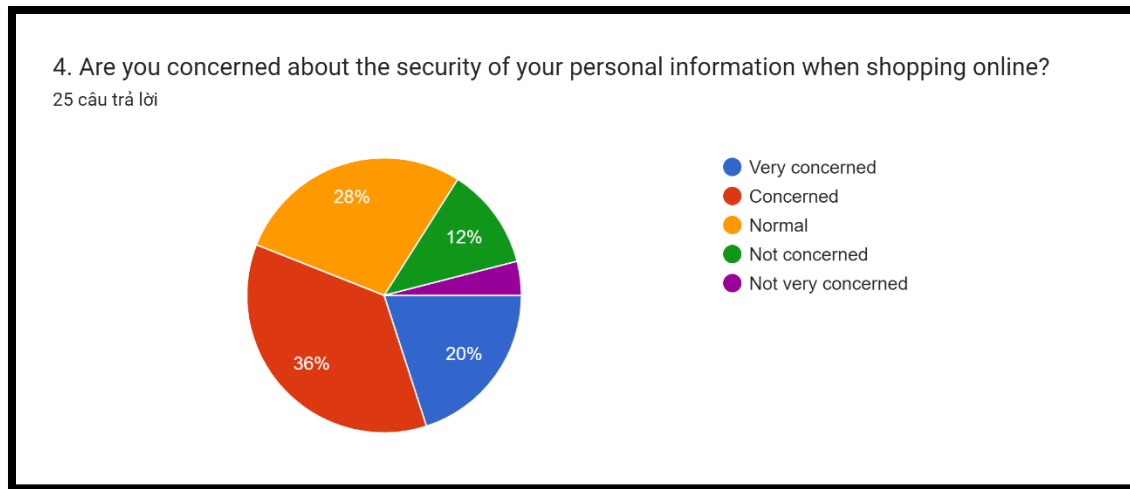
Figure 16: Survey 12

➢ **20% answered Very concerned**: A significant proportion of respondents were very worried about the security of their personal information. This is a warning sign that many users are not satisfied with the current level of security and that significant improvements are needed.

➢ **12% answered Not concerned**: A small proportion of respondents were not concerned about the security of their personal information. This is a group of users who are satisfied with the current level of security and are likely to become loyal customers.

III.   Analyze the Results of the Primary Research

After collecting data from interviews and surveys, the next step is to analyze the results of the primary research. This analysis will be divided into two parts: qualitative analysis of interview data and quantitative analysis of survey data.

1) Qualitative Analysis

The qualitative analysis of the 9 interviews identified several key themes. Big Data has helped e-commerce businesses personalize product recommendations and improve user interfaces, increasing customer satisfaction. However, businesses also face challenges in ensuring data accuracy and security, as well as managing large amounts of data. Security measures such as data encryption and regular security checks are applied to protect customer information.

In addition, the use of Angular and TypeScript has improved performance, scalability, security, and user experience on e-commerce websites. Tools such as Google Lighthouse and WebPageTest are used to measure these metrics. Data security measures and compliance with international regulations such as GDPR and CCPA have helped protect customer information and ensure privacy.

Key Findings: Big Data has helped e-commerce businesses personalize product recommendations and improve user interfaces, leading to higher customer satisfaction. However, businesses have faced many

challenges in ensuring data accuracy and security, as well as managing large amounts of data. Using Big Data to analyze customer behavior and optimize inventory management has helped businesses increase revenue and operational efficiency. Angular and TypeScript have improved performance, scalability, security, and user experience on e-commerce websites. Data security measures and compliance with international regulations have helped protect customer information and ensure privacy.

2) Quantitative Analysis

Results from 12 surveys found a diverse picture of users' experiences and views of e-commerce websites:

➢ Many users felt that advertising on e-commerce websites was currently only average, with a few feeling it was relevant or highly relevant. This was seen as necessary to improve the accuracy and personalization of advertisements to make them more engaging.

➢ Many users felt that the use of Big Data technology had a positive impact on customer service, price optimization, and inventory management. However, some users did not benefit or encountered problems using the service.

➢ Users of e-commerce website interfaces also received mixed reviews. Some users rated the interface as average or good, while others felt it was friendly or very friendly. This is said to require improvements in the design interface to enhance the user experience.

➢ In terms of page loading speed, many users are concerned about the page loading speed of e-commerce websites, which needs to be improved to make the user experience smoother and faster.

➢ Finally, personal information security is a major concern for many users when shopping online. Many users are concerned about the current security capabilities and feel that it does not affect their experience. This is said to require increased password protection and clear information on how to protect personal data to make users feel more secure when shopping online.

Overall, the survey results show that despite many positive factors, there are still many areas that need improvement to enhance the user experience on e-commerce websites.

IV.   Secondary Data Analysis

In addition to analyzing primary data, I will also analyze secondary data from existing studies and reports. This will help me compare and contrast the results of the primary research with previous studies, thereby gaining a more comprehensive view of the research problem. Secondary data analysis will also help me identify gaps in current research and provide context for my research results. Below are the Findings, Examples, and Implications after analyzing the secondary data sources:

	Findings	Example	Implication
Personalize the customer experience	Studies show that using Big Data helps e-commerce sites personalize the customer shopping experience.	Amazon and Netflix use Big Data to make product and content recommendations tailored to each user.	Personalization not only enhances the user experience but also increases conversion rates and revenue.
Optimize pricing strategies	Big Data allows businesses to analyze price trends and shopping behavior to adjust prices dynamically.	Companies like Walmart use Big Data analytics to optimize prices in real-time.	Price optimization helps businesses compete more effectively and maximize profits.
Improve customer relationship management (CRM)	Big Data helps track and analyze customer data to improve service and increase customer satisfaction	Starbucks uses big data to personalize promotions and offers for loyal customers.	Effective customer relationship management helps maintain and develop long-term relationships with customers.
Predicting trends and needs	Using Big Data to predict shopping trends and customer needs	Companies like Zara use big data analytics to predict fashion trends and adjust products in a timely manner.	Accurate predictions help businesses be better prepared and minimize inventory risks.
Making strategic decisions	Big Data provides insights that help businesses make more accurate strategic decisions	Google uses big data to optimize advertising and marketing campaigns.	Data-driven strategic decisions help businesses grow more sustainably and effectively.

Table 9: Secondary Data Analysis

V. Synthesis of Findings

After completing the analysis steps, I will synthesize the results from the primary and secondary research to draw overall conclusions. This involves combining the patterns and trends identified from the collected data and comparing them with the results from previous research. This synthesis helps me to have a more comprehensive and in-depth view of the research problem.

1) Integrating primary and secondary data.

Personalization and user experience: Both primary and secondary data show that the application of Big Data technology helps e-commerce businesses personalize user experience and improve user interface. Customer interviews and surveys are more fun when receiving relevant product recommendations, which are also supported by secondary research from companies like Amazon and Netflix.

Data management challenges: Both data sources are optimal formulas that businesses need to ensure data accuracy and security. Security solutions such as data encryption and regular security checks are applied to protect customer information, which is in line with international regulations like GDPR and CCPA.

2) Performance and scalability.

Angular and TypeScript: Primary data from interviews found that using Angular and TypeScript improved performance, scalability, and user experience on e-commerce websites. Tools like Google Lighthouse and WebPageTest were used to measure this metric. This is also supported by high-level studies on the benefits of Angular and TypeScript in web development.

Page Load Speed: Survey results showed that many users were concerned about the page load speed of e-commerce websites. This highlights the importance of optimizing website performance to improve user experience.

3) Customer Service and Inventory Management.

Positive Impact of Big Data: Both primary and secondary data found that Big Data technology has a positive impact on customer service, price optimization, and inventory management. Businesses use Big Data to analyze customer behavior and optimize inventory management, helping to increase revenue and operational efficiency.

Mixed user reviews: Survey results show that users have different reviews of the interface and services of e-commerce websites. Some users rate the interface as average or good, while others feel it is friendly or very friendly. This suggests that the design interface needs to be improved to enhance the user experience.

4) Security and privacy concerns.

Data security measures: Both primary and secondary data levels emphasize the importance of keeping personal information secure. Users are aware of current security capabilities and feel the need to strengthen password protection and provide clear information on how to protect personal data.

Compliance with regulations: Manually implementing international regulations such as GDPR and CCPA helps protect customer information and ensure privacy, which is emphasized in both primary and secondary data.

5) Conclusion and recommendations

Draw conclusions and recommendations based on the analysis results. These conclusions will be based on the patterns and trends identified from the collected data, and the recommendations will help improve the performance and user experience of the e-commerce website. The recommendations need to be presented clearly and well-founded, to ensure that they can be practically applied and effectively:

- ➢ **Conclusion**: The application of Big Data technology in the e-commerce sector brings many benefits, from personalizing customer experiences to optimizing pricing strategies and improving customer relationship management. However, businesses also face many data management and security challenges.
- ➢ **Recommendation**: E-commerce businesses should invest in Big Data technology and data analytics tools to maximize the benefits it brings. At the same time, it is necessary to strengthen security measures and attach international regulations to protect customer information and ensure privacy.

M2: Discuss merits, limitations, and pitfalls of approaches to data collection and analysis.

I. Quantitative Surveys

1) Merits

In researching the impact of Big Data in e-commerce, quantitative surveys have many outstanding advantages. First of all, quantitative surveys allow me to collect data from a large sample, giving me an overview of user trends and behaviors. This is important when analyzing how Big Data affects user experience and online shopping behavior. Data collected from quantitative surveys can be easily analyzed using statistical methods, helping me find relationships and trends quickly and accurately. For example, I can determine the level of customer satisfaction with personalized product recommendations thanks to Big Data. Finally, quantitative surveys are often more time- and cost-effective than other methods, because I can use online tools to collect and analyze data.

2) Limitations

However, quantitative surveys also have some limitations. One of the biggest limitations is the lack of depth. Quantitative surveys often do not provide detailed information about the reasons behind respondents' responses. This can reduce the ability to understand the underlying motivations and causes of user behavior, especially when researching the impact of Big Data. The quality of the data collected depends heavily on how the questions and survey are designed. If the questions are not designed well, the data collected may be inaccurate or incomplete. For example, if the question is unclear about how Big Data improves the user experience, the results may not reflect reality.

3) Pitfalls

There are several risks to be aware of when conducting quantitative surveys. One of the most common risks is sampling bias. If the sample is not representative of the entire population, the survey results may be inaccurate and not widely applicable. This is especially important when researching Big Data, as you need a representative sample to understand its impact on the entire user population. Response bias is also a problem, where participants may respond in a way they think is correct or socially acceptable, rather than the truth. Finally, unclear or leading question design can skew survey results, reducing the reliability of the data collected.

II. Qualitative Interviews

1) Merits

Qualitative interviews have many advantages, especially when researching the impact of Big Data in e-commerce. First of all, qualitative interviews provide insight into the thoughts, feelings, and motivations of participants. This is important when trying to understand how Big Data affects user experience and their

purchasing decisions. This method is also flexible, allowing me to tailor questions based on participants' responses, thereby gaining more detailed information. For example, I could ask users about how they feel about receiving personalized product recommendations thanks to Big Data, and thereby gain a better understanding of the impact of this technology.

2) Imitations

However, qualitative interviews also have some limitations. One of the biggest limitations is that they are more time-consuming and resource-intensive than other methods. Organizing and conducting individual interviews is labor-intensive and costly. Additionally, qualitative data is more difficult to analyze and synthesize than quantitative data. Researchers need the right skills and analytical tools to process and draw conclusions from detailed and varied participant responses. For example, coding and categorizing user experience responses with Big Data can be complex and time-consuming.

3) Pitfalls

There are several risks to be aware of when conducting qualitative interviews. Interviewer bias is one of the most common risks. Interviewers can unintentionally influence participants' answers through the way they ask questions or their reactions. This can skew the results of the research. Sampling bias is also an issue, as selecting an unrepresentative sample can lead to inaccurate results. Finally, managing and analyzing qualitative data can be difficult, especially when you are dealing with large amounts of detailed and complex information. This requires skill and experience to ensure that the analytical results are accurate and valuable.

III.   Content Analysis

1) Merits.

When researching the operation of Big Data in e-commerce, content analysis has many special advantages. Previously, this method allowed me to use data from available sources such as articles, reports, and social networks. This saved costs and time compared to collecting new data. Content segmentation also helped me to exploit information from diverse and rich sources, providing a comprehensive view of how Big Data is applied and affects e-commerce. For example, I can analyze blog posts and research reports to better understand the trends and strategies for using Big Data in this industry.

2) Limitations.

However, content analysis also has some modes. One of the biggest modes that has limitations is the source depends on the quality and reliability of the data. If the data source is unreliable or inaccurate, the analysis results may be biased. In addition, the data may lack the context necessary to understand the problem. For example, a social media post may not provide enough information about how Big Data is

developed and how it affects the business. Finally, analyzing data definitions from different sources can be complex and time-consuming.

3) Pitfalls.

There are several risks to be aware of when performing content analysis. Source bias is one of the most common risks. Choosing a data source that is not representative or has a nature that can lead to biased results. For example, if you only analyze posts from a single source, the results may not reflect reality. Difficulty in defining coded data is also an issue, especially when dealing with large amounts of information from different sources. This requires skill and experience to ensure that the analysis results are accurate and valuable. Finally, a lack of context or detailed information can reduce the ability to understand and apply the analysis results in practice.

IV.   Mixed-Methods Approach

1) Merits

The Mixed-Methods Approach has several distinct advantages when researching the impact of Big Data on e-commerce. First of all, it leverages the strengths of both quantitative and qualitative methods, providing a more comprehensive and in-depth view of the research problem. I can use quantitative surveys to collect data on user behavior and qualitative interviews to better understand the reasons behind those behaviors. The mixed-methods approach also allows for cross-validation of data, which increases the reliability and accuracy of the research results. This is especially important when researching Big Data, as findings can be tested and validated from multiple perspectives.

2) Limitations

However, the mixed-methods approach also has some limitations. One of the biggest limitations is that it is more complex and expensive than using a single method. Implementing both quantitative and qualitative methods requires a lot of time, resources, and skills. Additionally, integrating and analyzing data from two different methods can be difficult, requiring a deep understanding of both types of data. Statistical analysis skills are needed for quantitative data and content analysis skills for qualitative data. Finally, managing and coordinating multiple methods at the same time can be difficult, especially when ensuring that these methods are implemented consistently and logically.

3) Pitfalls

There are several risks to be aware of when implementing a mixed methods approach. Method bias is one of the most common risks. There may be a tendency to favor one method over the other, leading to unbalanced results. If too much emphasis is placed on quantitative data at the expense of qualitative data, the research results may lack depth and vice versa. Difficulty in managing and integrating data from two different methods is also an issue, requiring skills and experience to ensure that the analysis results are

accurate and valuable. Finally, a lack of consistency in implementing methods can reduce the reliability of research results.

V. Comparative Analysis

1) Comparison of Methods

When applying different research methods in researching the impact of Big Data in e-commerce, each method has its advantages and limitations. Let's follow the comparison table below to understand more clearly:

Methods	Advantages	Limitations	Risks
Quantitative Surveys	1. Collect data from large samples. 2. Easy statistical analysis. 3. Save time and money.	1. Lack of depth. 2. Dependent on question design	1. Sample bias. 2. Response bias. 3. Unclear question design
Qualitative Interviews	1. Insight into thoughts and feelings 2. Flexibility in adjusting questions	1. Time and resource-consuming. 2. Data difficult to analyze and synthesize	1. Interviewer bias. Sample bias. Difficult to manage and analyze data.
Content Analysis	1. Use data from available sources. 2. Save money and time	1. Data quality depends on the source. 2. Lack of context	1. Source bias. 2. Difficulty in coding data. 3. Lack of context.
Mixed-Methods Approach	1. Take advantage of both methods. 2. Cross-validation of data. 3. Comprehensive and insightful view.	1. Complex and costly. 2. Difficulty in data integration and analysis	1. Methodological bias 2. Difficulty in data management and integration. 3. Lack of consistency.

Table 10: Comparison of Methods

2) Integration of Findings

Integrating results from different methods helps provide a more comprehensive and in-depth view of the impact of Big Data applications in the field of e-commerce website construction and development:

➢ **Cross-validation**: Data from quantitative surveys can be validated with responses from qualitative interviews, which increases the reliability and accuracy of the research results. I can use data from

surveys to identify general trends and then use interviews to better understand the reasons behind those trends.

➢ **Combining advantages**: Using data from content analysis to complement and clarify findings from surveys and interviews, helps to have a more comprehensive view of how Big Data affects user experience and purchasing decisions. Blog posts and research reports can be analyzed to better understand trends and strategies for using Big Data in the industry, and then use data from surveys and interviews to confirm and clarify those findings.

➢ **Comprehensive analysis**: Integrating results from different methods helps you better understand the trends and drivers behind user behavior, thereby making appropriate recommendations and strategies. Survey data can be used to identify important factors influencing user purchasing decisions, and then interview data and content analysis can be used to better understand how these factors are influenced by Big Data.

D1: Critically evaluate research methodologies and processes in application to a computing research project to justify chosen research methods and analysis.

I. Evaluate the quantitative survey method

This section focuses on evaluating the quantitative survey method used in the research of e-commerce websites. The objective is to analyze and evaluate various aspects of this method, from survey design, data collection, and data analysis, to assessing the advantages and disadvantages of the method. Thereby, suggestions for improvement are made to enhance the quality and accuracy of the survey results, thereby supporting the development and optimization of e-commerce websites.

1) Survey Objectives and Scope

The quantitative survey was conducted to collect data on users' experiences and perspectives on e-commerce websites. The goal was to better understand the factors that influence user experience and thereby make recommendations for improvement. The scope of the survey included aspects such as the use of Big Data technology, user interface, page loading speed, and personal information security.

2) Survey Design

The survey questions were designed to collect quantitative data, with Likert scale response options (e.g. Normal, Agree, Strongly Agree, Disagree, Strongly Disagree). This makes it easy to analyze and compare user responses. This design ensures objectivity and high analytical ability.

3) Data Collection

Data was collected from a diverse sample of users, including those who regularly use e-commerce websites. The data collection process is carried out through online platforms, ensuring convenience and high accessibility. This helps to collect a large amount of data in a short time.

4) Data Analysis

The collected data is analyzed to identify trends and patterns in user feedback. The survey results show a diverse picture of user experiences and perspectives, thereby helping to identify areas for improvement. Data analysis helps to draw accurate and well-founded conclusions.

5) Evaluation of quantitative survey methods

The quantitative survey method has been applied in the research of the use of Big Data technology in the development and construction of e-commerce websites. This method has many advantages and disadvantages that need to be evaluated in detail to ensure the effectiveness and accuracy of the research results:

- ❖ **Strengths**: The quantitative survey method brings many important benefits to the project. First of all, it ensures objectivity in data collection, helping to eliminate subjective factors that can affect the results. The high analytical ability of quantitative data allows the use of statistical tools to identify trends and patterns, thereby drawing accurate and well-founded conclusions. In addition, this method also saves time and costs compared to traditional data collection methods, thanks to the use of online platforms to conduct the survey.
- ❖ **Weaknesses**: However, the quantitative survey method also has some limitations. One of the main disadvantages is the lack of detail in the answers. Likert scale response options may not fully reflect user opinions and experiences. Bias is also an issue, especially when the survey sample is not representative of the entire user population. This can lead to inaccurate results that do not reflect reality. Additionally, it is difficult to collect honest feedback from users, as some users may not want to participate in the survey or may not answer honestly.

6) Suggested Improvements

To improve the survey process, it is necessary to add open-ended questions to collect more detailed and rich information from users. Enhance the survey sample to ensure representativeness and use advanced data analysis tools to analyze in more depth and provide specific recommendations. This will help improve the quality and accuracy of the survey results.

7) Justification for Chosen Research Methods

The quantitative survey method was chosen for this research for several important reasons. First of all, this method allows data to be collected from a large sample of users, which helps to ensure the representativeness and reliability of the results. The use of Likert-scale questions makes it easy to analyze and compare responses, thereby identifying trends and patterns in the data.

The quantitative survey method also provides a high level of objectivity, helping to eliminate subjective factors that can affect the research results. This is especially important when evaluating factors such as user experience, page loading speed, and personal information security on e-commerce websites. The high analytical capabilities of quantitative data allow the use of statistical tools to draw accurate and well-founded conclusions.

In addition, this method also saves time and costs compared to traditional data collection methods. Conducting online surveys allows for reaching a large number of users in a short period of time, while minimizing the costs associated with data collection and processing. The quantitative survey method is suitable for the research objective of better understanding the factors that influence the user experience on e-commerce websites. The data collected from the survey helps identify areas for improvement and

provide specific recommendations to enhance the user experience, thereby supporting the development and optimization of e-commerce websites.

8) Conclusion

The quantitative survey method has helped to collect important data on users' experiences and perspectives on e-commerce websites. However, improvements are needed to increase the detail and accuracy of the results, thereby providing more specific and effective recommendations for e-commerce website development.

II. Evaluation of qualitative interview method

1) Purpose and Relevance

The qualitative interviews aimed to gather in-depth insights from experts on the application of Big Data in e-commerce website development and management. These interviews provided valuable qualitative data that complemented the quantitative survey results, offering a comprehensive understanding of the research topic.

2) Interview Design

The interview questions were designed to elicit detailed responses on specific aspects of Big Data application, challenges, and benefits in e-commerce. Experts from various backgrounds in Big Data and e-commerce were selected to ensure diverse perspectives and comprehensive insights.

3) Data Collection

The interviews were conducted systematically, ensuring consistency in the questions asked and the data collected. All interviews were recorded and transcribed accurately to facilitate detailed analysis.

4) Data Analysis

The transcribed interviews were coded to identify key themes and patterns. This process involved categorizing responses into themes such as user experience optimization, challenges in Big Data application, and business performance improvement. The themes identified were validated through cross-referencing with the quantitative survey results to ensure consistency and reliability.

5) Findings and Insights

The qualitative interviews provided rich, detailed insights that quantitative surveys alone could not capture. They allowed for a deeper understanding of the experts' perspectives and experiences. Key findings included the significant impact of Big Data on user experience optimization, the challenges in ensuring data accuracy and security, and the improvements in business performance through better customer behavior analysis and inventory management.

6) Strengths and Limitations

Strengths: The qualitative interviews provided rich, detailed insights that were not possible to capture through quantitative surveys alone. These interviews allowed for a deeper understanding of the experts' perspectives and experiences, offering context and depth to the quantitative data. The detailed responses helped identify key themes and patterns, such as the impact of Big Data on user experience optimization, challenges in data management, and improvements in business performance. This depth of information complemented the breadth of the quantitative survey data, providing a more comprehensive view of the research topic.

Limitations: Despite the strengths, there were some limitations to the qualitative interviews. One potential limitation was the bias in expert selection. The selection of experts might have been influenced by their availability or willingness to participate, which could affect the diversity of perspectives. Another limitation was the subjective nature of qualitative data analysis. The process of coding and identifying themes can be influenced by the researcher's interpretations and biases. To mitigate these limitations, rigorous coding and validation processes were implemented. This included cross-referencing the qualitative findings with the quantitative survey results to ensure consistency and reliability, and using multiple coders to reduce individual bias in the analysis.

7) Justification for Chosen Research Methods

The combination of qualitative interviews and quantitative surveys was justified based on the following reasons: The qualitative interviews provided context and depth to the quantitative survey data, offering a holistic view of the research topic. Using both methods allowed for triangulation, enhancing the validity and reliability of the research findings. Qualitative interviews captured nuanced insights and expert opinions that quantitative methods might overlook. The strengths of qualitative methods (depth and detail) complemented the strengths of quantitative methods (breadth and generalizability), resulting in a robust research design.

This evaluation highlights the effectiveness of the qualitative interviews in providing valuable insights and justifies the chosen research methods and analysis processes in your computing research project

III.   Evaluate research processes

1) Evaluate data collection processes

The data collection process is an essential step in research, directly affecting the accuracy and reliability of the results. For an overall assessment, attention should be paid to factors such as collection methods, sample selection, and quality control.

The method must be appropriate to the research objectives. The use of surveys and interviews must be carefully designed to ensure that the information collected is accurate and valid. Sample selection is also

important; the sample must be representative of the target population so that the results can be generalized. In addition, data quality control measures must be in place throughout the collection process, including information validation and ensuring that participant privacy is respected.

In short, an effective data collection process will provide a solid foundation for the research, ensuring that the results obtained are reliable and accurate.

2) Evaluate data analysis processes

The data analysis process is an important step that determines the quality and reliability of the research results. An overview of this process includes the following key aspects:

➢ First, the selection of appropriate tools and analysis methods is important. Depending on the type of data (quantitative or qualitative), tools such as SPSS for statistical analysis or NVivo for content analysis should be used. Using appropriate analysis methods helps ensure that the data is interpreted accurately and valuable information can be extracted.

➢ Second, the process should be carried out in a systematic and planned manner. Establishing a step-by-step process for the analysis will help to minimize errors and produce reproducible results. In addition, it is also necessary to check the validity and reliability of the results. This may include how to validate the analyses or run experiments to ensure that the results are stable and reliable.

➢ Finally, the presentation of results also plays an important role in the analysis process. Results should be presented in a clear and logical manner, making it easy for readers to understand and grasp the findings from the research.

An effective data analysis process will help optimize the ability to draw accurate and valuable conclusions from the collected data, providing a foundation for decisions and recommendations in the research.

3) Evaluate validity and reliability of research process

Validity and reliability are two essential elements in any research process, greatly affecting the quality of the results obtained:

➢ **Validity**: This is the ability of the instrument and measurement method to accurately identify the research subjects. Ensuring validity needs to be done from the research design stage until data collection and analysis. It is necessary to check whether the instruments (such as questionnaires or interviews) can accurately measure the concepts that the research is trying to explore. Validity can be tested through different methods, such as comparing with proven instruments, or through feedback from participants.

➢ **Reliability**: Reliability is related to the ability of results to be reproduced under similar conditions. To ensure reliability, measures need to be taken such as developing instruments with clear and consistent criteria, as well as testing on different samples. If the data collection methods and

instruments produce similar results when repeated, then the requirement of reliability can be considered satisfied.

➢ **Relationship Between Validity and Reliability**: It is important to note that an instrument can be highly reliable but not necessarily valid. Therefore, both factors need to be assessed in conjunction to ensure that the research results are not only accurate but also generalizable.

A good validity and reliability assessment process will provide a solid foundation for the research, helping to increase confidence in the findings and recommendations from the research. This is especially important in contexts where the findings may influence practice in the research field.

IV.   Justification of Selected Research Methods

1) Alignment with Research Objectives

In the research on "The impact of applying Big Data technology in building and developing e-commerce websites", research methods need to be consistent with the goal of capturing the impact of Big Data on efficiency. the activities of these websites. Using quantitative surveys and qualitative interviews to collect feedback from users and industry experts will help to better understand their feelings and opinions about Big Data technology. In addition, analyzing data collected from websites will provide insights into the changes in performance after Big Data adoption.

2) Philosophical/Theoretical Frameworks

The theoretical framework for this research can be based on data management theory and empirical theory. Data management theory helps to explain how Big Data changes the decision-making process and optimizes business operations in e-commerce. Empiricism will assist in validating the results through web development practices and technologies such as Angular and MongoDB, thereby creating a rich database for analysis.

3) Ethical Considerations

During the research, I considered ethical standards related to data collection from participants. Ensuring user privacy and consent through clear terms will build trust and encourage participation. Additionally, ensuring that the collected data is not misused is also an important factor in the website development process, keeping data storage on MongoDB safe and secure.

4) Limitations and Challenges

Although there are many benefits to adopting Big Data, there are also some limitations and challenges. Collecting data from many different sources can lead to issues with data quality and accuracy. Additionally, developing e-commerce websites with Angular and TypeScript can be time-consuming and highly skilled, making it difficult to implement. Researchers need to identify these barriers to develop effective coping strategies to ensure a smooth research process.

P5: Communicate research outcomes in an appropriate manner for the intended audience.

I. Conclusion

In this research, I have explored the impact of applying Big Data technology in building and developing e-commerce websites. The results of the research show that Big Data not only improves customer experience but also optimizes inventory management, enhances marketing strategies, effectively detects fraud, and provides flexible data storage. These findings have important implications for future business development, competitive advantage, resource allocation, security, and innovation.

1) Summary of Key Findings

After conducting some research and practicing data collection methods, I have obtained the key results from the research, including the improvements and benefits that Big Data technology brings to e-commerce websites. I will cover aspects such as customer experience, inventory management, marketing strategies, fraud detection and data storage:

➢ **Enhanced Customer Experience**: Big Data technology has significantly improved the personalization of customer experience on e-commerce websites. By analyzing user behavior and preferences, websites can provide relevant recommendations and promotions, leading to customer satisfaction and loyalty.

➢ **Optimized Inventory Management**: The application of Big Data has enabled more accurate demand forecasting and inventory management. This reduces overstocking and understocking, ensuring products are always available when customers need them.

➢ **Improved Marketing Strategies**: Big Data analytics provide deeper insights into customer demographics and shopping patterns. This allows for more targeted and effective marketing campaigns, leading to higher conversion rates.

➢ **Efficient Fraud Detection**: The use of Big Data has improved the ability to detect and prevent fraudulent activities on e-commerce platforms. By analyzing transaction patterns and identifying anomalies, businesses can minimize risks and protect both themselves and their customers.

➢ **Scalable and Flexible Data Storage**: Using MongoDB for data storage has proven to be highly effective in handling large volumes of unstructured data. Its scalability and flexibility make MongoDB an ideal choice for e-commerce websites that need to manage a variety of data types.

2) Implications of Findings

The results obtained in data collection and processing have given me many important implications in applying Big Data technology to the field of e-commerce website construction and development:

- **Business Growth**: The findings show that integrating Big Data technology into e-commerce website development can significantly promote business growth. Improved customer experience and optimized operations lead to increased sales and customer retention.
- **Competitive Advantage**: Companies that effectively use Big Data can gain a competitive advantage in the market. By understanding and anticipating customer needs better than their competitors, they can deliver superior products and services.
- **Resource Allocation**: Improved demand forecasting and inventory management allow businesses to allocate resources more efficiently. This reduces waste and operating costs, contributing to increased profits.
- **Security and Trust**: Enhanced fraud detection builds trust with customers, as they feel more secure when transacting on the platform. This trust is crucial to maintaining a loyal customer base.
- **Future Innovations**: The successful adoption of Big Data in e-commerce lays the foundation for future technological innovations. Businesses can continue to explore new ways to use data for further improvements and developments in the industry.

II. Recommendations

1) Practical Applications

From the findings of the research, I also propose practical applications of Big Data technology in building and developing e-commerce websites. I will focus on aspects such as improving customer experience, optimizing inventory management, enhancing marketing strategies, detecting fraud and data management:

- **Personalized Customer Experience**: Using Big Data to analyze customer behavior and preferences, thereby providing personalized recommendations and promotions. This not only enhances customer satisfaction but also boosts sales.
- **Inventory Optimization**: Applying Big Data-based demand forecasting models to manage inventory more effectively. This helps to minimize overstocking or understocking, ensuring products are always available when customers need them.
- **Targeted Marketing Campaigns**: Using Big Data analytics to better understand customer demographics and shopping behavior. This allows businesses to create more targeted and effective marketing campaigns, increasing conversion rates.
- **Fraud Detection Systems**: Develop Big Data-based fraud detection systems to analyze transaction patterns and identify anomalies. This helps to minimize risks and protect both businesses and customers.
- **Scalable Data Management**: Use MongoDB and other flexible data management tools to process and store large volumes of unstructured data. This makes it easy for businesses to scale and manage data efficiently.

2) *Future Research Directions*

For future research directions, I will focus on areas such as technology innovation, data security, and new applications of Big Data to further develop and improve the application of Big Data technology in e-commerce:

➢ **Advanced Data Analytics**: Research and develop more advanced data analytics methods, such as machine learning and artificial intelligence (AI), to improve prediction and decision-making capabilities.

➢ **Data Privacy and Security**: Explore advanced data security solutions to protect customer information and ensure compliance with privacy regulations.

➢ **Integration with Emerging Technologies**: Explore how Big Data can be integrated with emerging technologies such as the Internet of Things (IoT) and blockchain to create more advanced e-commerce applications.

➢ **Customer Behavior Analysis**: Continue to research customer behavior to better understand the factors that influence purchasing decisions and how to optimize the user experience.

➢ **Sustainability and Efficiency**: Explore ways to use Big Data to drive sustainability and efficiency in e-commerce operations, such as reducing waste and optimizing the supply chain.

III. Audience Engagement

This section focuses on how to effectively engage your audience when presenting your research findings on the topic "The Impact of Big Data Technology on E-commerce Website Design and Development," as well as your project to build an e-commerce website using Angular and MongoDB. This includes tailoring content to your audience's needs and integrating interactive elements to increase their engagement and understanding.

1) *Tailoring Content to Audience Needs*

Tailoring content to your audience's needs is crucial to ensuring that your research message is communicated effectively. It is important to understand your audience, including their level of expertise, interests, and expectations. Here are the three main audiences for your research on the topic "Impact of Big Data Technology in Building and Developing E-commerce Websites":

➢ **Technology Experts**: If your audience is technology experts, you can go into technical details about how Big Data is integrated into the system, the data analysis algorithms, and how Angular and MongoDB are used to build the website. You can present the data models, system architecture, and data analysis tools you have used.

➢ **E-commerce Businesses**: If your audience is e-commerce businesses, you should focus on the practical benefits of applying Big Data, such as improving customer experience, optimizing

inventory management, and enhancing marketing strategies. You can use real-world examples and illustrate them with case studies to clarify these points.

➢ **Non-technical users**: If the audience is non-technical, use simple language and illustrate with real-life examples. Explain the basic concepts of Big Data, how it is used in e-commerce and the benefits it brings. Charts, graphs, and images can be used to illustrate key points.

2) Interactive Elements (Q&A, Discussions)

Incorporating interactive elements such as Q&A and discussions is an effective way to increase audience engagement.

➢ **Q&A**: Prepare some frequently asked questions related to my research and web project. For example, the audience may ask about how you collect and analyze data, the challenges you face when building a website using Angular and MongoDB, or how I ensure data security. Make sure I have detailed and easy-to-understand answers to the audience's questions that are the result of my research.

➢ **Group Discussion**: Encourage the audience to share their opinions and experiences about applying Big Data in e-commerce. Use online tools such as forums, virtual whiteboards, or discussion apps to support this process. Create open-ended discussion questions so that the audience can participate and share their views. For example, ask the audience about practical applications of Big Data that they have seen or the challenges they have faced when implementing this technology.

M3: Coherently and logically communicate outcomes to the intended audience demonstrating how outcomes meet set research objectives.

I. Introduction

1) Purpose of Communication

The purpose of communicating the results of this research is to share key findings on the impact of applying Big Data technology in the field of e-commerce website development and construction. By presenting these results, I hope to provide useful and valuable information to developers, businesses, and other stakeholders in the e-commerce industry. Understanding how Big Data can improve the performance and user experience of e-commerce websites will help stakeholders make more effective strategic and technical decisions.

2) Overview of Research Objectives

This research has achieved the following objectives::

- ❖ **Identify the benefits of applying Big Data technology in e-commerce website development**: The research will explore how Big Data can improve performance, optimize user experience, and enhance data security.
- ❖ **Analyze suitable Big Data methods and tools**: Evaluate existing big data analysis tools and methods, and determine which tools are most suitable for developing an e-commerce website.
- ❖ **Evaluate the impact of Big Data on technical and business aspects**: The research will examine how Big Data affects technical decisions (such as technology selection, and system architecture) and business decisions (such as marketing strategy, and customer management).
- ❖ **Build an e-commerce website using Angular and MongoDB**: Conduct a real-world project to illustrate how Big Data can be applied in building and developing an e-commerce website, using Angular for the front end and MongoDB for data storage.

II. The target audience that the research is aimed at.

1) People without knowledge of BigData

People without knowledge of Big Data need to be introduced to the basic concepts and benefits of Big Data in e-commerce. This will help them better understand the importance of this technology and how it can improve user experience and website performance.

Relevance to the project: People without knowledge of Big Data need to be introduced to the basic concepts and benefits of Big Data in e-commerce. This will help them better understand the importance of this technology and how it can improve user experience and website performance.

Reasons for them: Raising awareness of Big Data will help expand the scope of application of this technology and encourage more people to enter this field. Providing basic knowledge will encourage beginners to learn more and possibly apply Big Data in their future work.

2) Web developers

Web developers will use the research findings to optimize website performance and data security, especially when building e-commerce websites using Angular and MongoDB.

Relevance to the project: Web developers will use the research findings to optimize website performance and data security, especially when building e-commerce websites using Angular and MongoDB.

Reason for them: Provide new methods and tools to help developers improve their skills and work efficiency. The demand for efficient and secure e-commerce websites is increasing, and developers need to be equipped with the knowledge and tools to meet this demand.

3) E-commerce businesses

E-commerce businesses will use the research findings to improve user experience, optimize inventory and supply chain management, and enhance marketing strategies.

Project Relevance: E-commerce businesses will use the research results to improve user experience, optimize inventory and supply chain management, and enhance marketing strategies.

Reason for them: Businesses need to apply Big Data to compete more effectively in the market and develop sustainably. Using Big Data helps businesses optimize business operations, reduce costs, and increase revenue.

4) Researchers in the field of Big-Data technology

Researchers will use new findings and methods from the research to further develop and apply Big Data technologies in practice.

Project Relevance: Researchers will use new findings and methods from the research to further develop and apply Big Data technologies in practice.

Reason for them: Researchers play an important role in developing new technologies and improving existing methods. Research on Big Data helps to explore new and innovative applications in the e-commerce sector, thereby benefiting the entire industry.

III.   Summary of Findings

1) Key Results

In this section, I will list and explain the key findings of the research. These findings include the specific benefits that Big Data brings to e-commerce websites, such as improved user experience, enhanced website performance, data security, inventory and supply chain management, and increased revenue:

➢ **Improve user experience**: The application of Big Data technology has helped optimize the user experience on e-commerce websites. Big data analytics allows for personalization of content and product recommendations based on user behavior and preferences.

➢ **Improve website performance**: Using Big Data to analyze traffic and user behavior helps optimize website performance, reduce page load time, and increase response speed.

➢ **Improve data security**: Big Data provides tools and methods to detect and prevent security threats and protect customer information and transaction data.

➢ **Manage inventory and supply chain more effectively**: Big data analytics helps predict product demand, optimize inventory management, and improve the supply chain.

➢ **Increase revenue and profits**: Marketing strategies based on Big Data analytics help increase advertising effectiveness, attract new customers, and retain existing customers, thereby increasing revenue and profits.

2) Alignment with Research Objectives

This section will evaluate how the findings align with the original research objectives. I will review each research objective and explain how the findings of the research met or supported these objectives, from identifying the benefits of Big Data to building an e-commerce website using Angular and MongoDB:

➢ **Identify the specific benefits of adopting Big Data technology**: The results clearly show that Big Data can improve user experience, website performance, and data security, which is in line with the initial research objectives.

➢ **Analyze appropriate Big Data methods and tools**: The research used big data analytics tools such as Hadoop, Spark, and real-time data analytics tools, which meets the objective of evaluating appropriate tools and methods.

➢ **Evaluate the impact of Big Data on technical and business aspects**: The findings show that Big Data has a positive impact on both technical decisions (such as performance optimization) and business decisions (such as marketing strategy), which is in line with the research objectives.

➢ **Building an e-commerce website using Angular and MongoDB**: The real project illustrates how to apply Big Data in developing an e-commerce website, using Angular for the front-end and MongoDB for data storage, meeting the goal of building and developing a website.

IV.   Detailed Analysis

This section will delve into the detailed analysis of the data collected from the research and discuss the implications of the findings for the e-commerce website development and construction industry. I will look at how the data was interpreted and what the findings mean for technical and business aspects.

1) Interpretation of Data

In this section, I will interpret the data collected from the research. This includes user behavior analysis, website performance, data security, inventory and supply chain management, and marketing strategies. Each section will provide insight into how the data was collected and analyzed to draw important conclusions.

- ➢ **User Behavior Analysis**: Data collected from Big Data analytics tools shows that users tend to interact more with websites that have fast loading times and user-friendly interfaces. User behavior analytics allows for personalized experiences, thereby increasing conversion rates and customer satisfaction.
- ➢ **Website Performance**: Data from performance monitoring tools shows that optimizing source code and using technologies like Angular and MongoDB help reduce page loading times and increase response speeds. This not only improves user experience but also reduces server load.
- ➢ **Data Security**: Security data analysis shows that the application of Big Data tools helps detect threats early and prevent attacks. These tools provide continuous monitoring and real-time analysis, helping to protect customer information and transaction data.
- ➢ **Warehouse and Supply Chain Management**: Data from warehouse management systems shows that the use of Big Data helps to accurately predict product demand, thereby optimizing warehouse and supply chain management. This helps to reduce inventory costs and increase operational efficiency.
- ➢ **Marketing Strategy**: Analysis of data from marketing campaigns shows that using Big Data helps optimize advertising strategies, thereby increasing customer reach and revenue. Big data analytics tools allow real-time monitoring and adjustment of marketing strategies.

2) Implications of Findings

This section will discuss the implications of the findings from the research. I will look at how these findings can improve user experience, optimize website performance, enhance data security, manage inventory and supply chains more efficiently, and optimize marketing strategies. These implications will help stakeholders better understand the value of applying Big Data in e-commerce website development.

- ➢ **Improved User Experience**: Findings show that the application of Big Data can significantly improve the user experience on e-commerce websites. This can lead to increased conversion rates and customer satisfaction, thereby increasing revenue and profits.

- **Optimize website performance**: Using technologies like Angular and MongoDB combined with Big Data helps optimize website performance, reduce page load times, and increase response speed. This not only improves user experience but also reduces operating costs.
- **Enhanced data security**: Big Data tools provide real-time monitoring and analysis, helping to detect and prevent security threats early. This helps protect customer information and transaction data, thereby increasing website reliability and reputation.
- **More efficient warehouse and supply chain management**: Using Big Data helps to accurately predict product demand and optimize warehouse and supply chain management. This helps reduce inventory costs and increase operational efficiency, thereby increasing profits.
- **More effective marketing strategies**: Big data analysis helps optimize marketing strategies, thereby increasing customer reach and increasing revenue. Big data analytics tools enable real-time monitoring and adjustment of marketing strategies, helping businesses quickly adapt to market changes.

V. Practical Applications

This section will discuss how the findings from the research can be applied in practice and provide concrete examples from the real world. I will look at how the findings can be implemented to improve various aspects of an e-commerce website and illustrate them with real-world cases.

1) *How Findings Can Be Applied*

Personalizing User Experience: The findings suggest that using Big Data can help personalize the user experience by analyzing their behavior and preferences. This can be applied by implementing product recommendation systems based on user data.

Optimizing Website Performance: The data from the research suggests that using technologies such as Angular and MongoDB combined with Big Data can optimize website performance. Developers can apply code optimization techniques and use performance monitoring tools to improve page load speed and responsiveness.

Enhanced Data Security: Big Data tools provide real-time monitoring and analysis, which helps detect and prevent security threats early. Businesses can apply these tools to protect customer information and transaction data.

Warehouse and Supply Chain Management: Using Big Data helps accurately predict product demand and optimize warehouse and supply chain management. Businesses can apply big data analytics tools to improve operational efficiency and reduce inventory costs.

Optimize Marketing Strategy: Big data analytics helps optimize marketing strategies, thereby increasing customer reach and increasing revenue. Businesses can use big data analytics tools to monitor and adjust marketing strategies in real-time.

2) Real-world Examples

Amazon: Amazon uses Big Data to personalize the customer shopping experience. Amazon's product recommendation system is based on an analysis of user shopping behavior and search history, which helps increase conversion rates and revenue.

Netflix: Netflix uses Big Data to analyze user viewing behavior and recommend suitable movies and TV shows. This helps increase customer satisfaction and retention.

Alibaba: Alibaba uses Big Data to optimize inventory and supply chain management. Big data analytics tools help Alibaba predict product demand and optimize operational processes, thereby reducing costs and increasing efficiency.

Spotify: Spotify uses Big Data to analyze user listening behavior and recommend suitable songs and playlists. This helps increase customer satisfaction and retention.

Walmart: Walmart uses Big Data to optimize marketing strategies and inventory management. Big data analytics tools help Walmart monitor and adjust marketing strategies in real-time, thereby increasing customer reach and revenue.

VI.   Recommendations

This section will provide specific actionable steps based on the findings from the research and suggest future research directions. I will look at specific steps that businesses and developers can take to put the research findings into practice, as well as potential areas of research for further development.

1) Actionable Steps

Implementing a product recommendation system: E-commerce businesses should implement product recommendation systems based on Big Data analytics to personalize user experiences and increase conversion rates.

Optimizing source code and website performance: Developers should use performance monitoring tools and source code optimization to reduce page load times and increase response speeds. Using Angular and MongoDB can help achieve this goal.

Apply Big Data Security Tools: Businesses should deploy real-time monitoring and analytics tools to detect and prevent security threats early and protect customer information and transaction data.

Optimize warehouse and supply chain management: Use big data analytics tools to predict product demand and optimize warehouse and supply chain management, helping to reduce costs and increase operational efficiency.

Optimize marketing strategies: Businesses should use big data analytics tools to monitor and adjust marketing strategies in real-time, thereby increasing customer reach and increasing revenue

2) Future Research Directions

Research on artificial intelligence and machine learning in Big Data: Explore how artificial intelligence (AI) and machine learning (ML) can be integrated into Big Data systems to improve analysis and prediction capabilities.

Real-time data analytics: Explore new methods and tools for analyzing real-time data, helping businesses quickly respond to changes in user behavior and the market.

Advanced data security: Explore advanced data security methods to protect customer information and transaction data in a Big Data environment.

Optimizing user experience: Explore new methods to optimize user experience on e-commerce websites, including the use of virtual reality (VR) and augmented reality (AR) technology.

Multi-channel data analytics: Explore how to analyze data from multiple channels (such as websites, mobile applications, and social networks) to gain a comprehensive view of user behavior and optimize business strategies

VII.   Conclusion

This section summarizes the key points of the research and provides final thoughts on the impact of Big Data adoption in e-commerce website development and construction. I will highlight the key findings and discuss their implications for the future of the industry.

1) Recap of Key Points

Improving user experience: Big Data adoption helps personalize user experience and increase conversion rates and customer satisfaction.

Improving website performance: Using Angular and MongoDB combined with Big Data helps optimize website performance, reduce page load times, and increase response speed.

Improving data security: Big Data tools provide real-time monitoring and analysis, helping to detect and prevent security threats early.

Manage warehouses and supply chains more effectively: Big Data helps to accurately predict product demand and optimize warehouse and supply chain management, reducing costs and increasing operational efficiency.

Optimize marketing strategies: Big data analytics helps to optimize marketing strategies, increase customer reach and revenue

2) *Final Thoughts*

This research has demonstrated that applying Big Data technology in building and developing e-commerce websites brings many significant benefits. From improving user experience to optimizing performance and security, Big Data plays an important role in improving the efficiency and competitiveness of e-commerce businesses.

However, implementing Big Data also requires investment in technology and resources, as well as attention to ethical issues and data security. Businesses need to consider carefully and have a clear strategy to maximize the benefits that Big Data brings.

In the future, further research may focus on integrating artificial intelligence and machine learning into Big Data systems, as well as developing real-time data analytics and advanced data security methods. This will help e-commerce businesses continue to grow and meet the increasing demands of users

D2: Communicate critical analysis of the outcomes and make valid, justified recommendations.

In this section, I will critically analyze the results obtained from the research, including both quantitative data from surveys and qualitative data from interviews. I will compare the findings, assess the strengths and weaknesses of each method, and discuss the implications of these results for the original research question. Finally, I will provide reasonable and well-founded recommendations, including specific action steps, policy recommendations, and future research directions.

I. Critical analysis of results.

1) Summary of findings.

During the research, I collected and analyzed data from both quantitative surveys and qualitative interviews. The results showed that the application of Big Data technology has brought significant benefits in building and developing e-commerce websites:

❖ First, the use of Big Data has helped improve the user experience on e-commerce websites. By analyzing user shopping behavior and interactions, businesses can personalize content and recommend suitable products, thereby increasing customer satisfaction and retention.

❖ Second, Big Data has optimized business processes by providing detailed information on market trends and consumer behavior. This allows businesses to predict demand and adjust business strategies more flexibly and effectively.

❖ Third, marketing campaigns have become more effective thanks to the analysis of customer data. Big Data helps identify potential customer groups and optimize advertising campaigns, thereby enhancing marketing effectiveness and reducing costs.

The research results answered the initial research question: "The impact of applying Big Data Technology in the field of e-commerce website construction and development." The application of Big Data technology not only improves the performance and user experience on e-commerce websites but also enhances the competitiveness of businesses by making decisions based on accurate and detailed data. These findings not only confirm the importance of Big Data in the development and operation of e-commerce websites but also open up new research directions to further explore and optimize the applications of Big Data in this field.

2) Evaluate the impact

In analyzing the research results on the impact of applying Big Data technology in building and developing e-commerce websites, I considered external factors that may affect the results. Some important factors include market and consumer trends, technology and infrastructure, as well as data privacy policies and regulations.

Market and consumer trends play an important role in shaping the way users interact with e-commerce websites. The increase in online shopping, especially during the COVID-19 pandemic, has driven the need to use Big Data technologies to manage and analyze customer data. This shows that external factors such as economic and social conditions can strongly influence the effectiveness of Big Data application.

Technology and infrastructure are also important factors. The development of data storage and processing technologies, such as cloud computing and big data analytics tools, has facilitated the application of Big Data in e-commerce. These advances not only improve the performance of websites but also enhance the ability to analyze and predict market trends.

Data security and privacy policies and regulations also affect data collection and use. Businesses need to comply with these regulations to ensure the legality and ethics of using customer data. This requires businesses to have strong security measures and transparency in data processing.

To ensure the accuracy and reliability of data collection, I applied diverse data collection methods, including online surveys, in-depth interviews, and data analysis from customer management systems (CRM). Using multiple data sources helps increase the accuracy and reliability of the results. The collected data is checked and verified to ensure accuracy, and data analysis tools are used to detect and eliminate invalid or inconsistent data. I also assess the reliability of the data by checking the consistency and repeatability of the results, using statistical methods such as Cronbach's Alpha test to assess the reliability of the scales in the survey.

These measures help ensure that the collected data is accurate and reliable, thereby providing a solid basis for the analysis and recommendations in the research. Analyzing external factors and ensuring the accuracy of the data is very important to understand the impact of Big Data technology in the construction and development of e-commerce websites.Analyze accuracy and reliability of data collection.

3) Compare with theory

Our research results show that the application of Big Data has significantly improved the user experience and performance of e-commerce websites. This is consistent with existing theories in the literature, which suggest that Big Data has the ability to personalize the user experience through the analysis of their behavior and preferences. Previous studies have also shown that Big Data helps optimize business processes and improve marketing efficiency, which is also confirmed by our results.

However, there are some differences between theory and practice. Some theories suggest that the application of Big Data may encounter challenges in terms of security and data privacy. In practice, I found that businesses have adopted strong security measures to protect customer data, and this does not cause as many problems as the theory suggests. In addition, some theories suggest that the implementation of Big Data may encounter difficulties in terms of cost and technology infrastructure. However, with the

development of modern data storage and processing technologies, businesses have been able to deploy Big Data more efficiently and cost-effectively.

These findings show that although theory provides a solid basis for understanding the impact of Big Data, practice may differ due to factors such as technological developments and security measures applied. Comparing the research results with theory helps us better understand the strengths and limitations of applying Big Data in practice, thereby providing reasonable and well-founded recommendations for businesses in the e-commerce sector.

4) Research methodology

In the process of researching the impact of applying Big Data technology in building and developing e-commerce websites, I used a variety of research methods to collect and analyze data. However, like any research, my method also has certain limitations.

One of the main limitations is data collection. Although I used diverse methods such as online surveys and in-depth interviews, collecting data from a large and diverse sample was still difficult. This may result in the data not being fully representative of the entire e-commerce industry. Furthermore, collecting qualitative data from interviews can be affected by the subjectivity of the participants and interviewers, leading to results that are not completely objective.

In addition, data analysis also encountered some challenges. Although I used data analysis tools, processing and analyzing a large amount of data still required a lot of time and effort. Furthermore, statistical analysis methods may not be entirely suitable for all types of data, especially qualitative data. Another factor to consider is the external factors that may influence the research results. For example, changes in consumer and market trends, as well as data privacy policies and regulations, may affect the way users interact with e-commerce websites and thus influence the research results.

Finally, the detailed analysis of boundary-based final methods also faces some difficulties. Identifying and separating the factors that influence the research results is not always clear and may lead to incorrect conclusions. These limitations indicate that although our research method has attempted to ensure accuracy and reliability, there is still room for improvement and adjustment in future studies. Identifying and addressing these limitations will help improve the quality and reliability of research on the impact of Big Data technology in the e-commerce sector.

II. Valid, Justified Recommendations

1) Recommendations based on results

Based on the research results on the impact of applying Big Data technology in building and developing e-commerce websites, I make some specific recommendations for stakeholders in this field:

First of all, e-commerce businesses should invest in big data analytics tools to improve user experience. Using Big Data allows businesses to personalize content and product recommendations based on customer behavior and preferences. This not only increases customer satisfaction but also helps retain them in the long term. For example, tools such as Google Analytics and other data analytics platforms can provide insights into user behavior, thereby helping businesses optimize the online shopping experience.

Second, businesses should use Big Data to optimize business processes and predict market trends. By analyzing sales data and consumer behavior, businesses can predict demand and adjust business strategies more flexibly and effectively. This helps to minimize risks and increase competitiveness in the market. Tools such as Tableau and Power BI can support businesses in visualizing data and making data-driven business decisions.

In addition, applying Big Data in marketing campaigns is also an important recommendation. Big Data helps identify potential customer groups and optimize advertising campaigns, thereby increasing marketing efficiency and reducing costs. Businesses can use platforms such as HubSpot or Marketo to manage and analyze customer data, thereby optimizing marketing campaigns.

Finally, businesses need to pay attention to data security and compliance with privacy regulations. The collection and use of customer data must be done transparently and in compliance with legal regulations to ensure legality and ethics. Businesses should invest in data security solutions such as encryption and access management systems to protect customer information. These recommendations are not only based on research results but also supported by existing theories and practices in the e-commerce field. Applying these recommendations will help businesses maximize the benefits of Big Data technology, thereby improving performance and competitiveness in the market.

2) Recommendations for further research

Based on the research results on the impact of Big Data technology application in the construction and development of e-commerce websites, I propose some further research directions to expand and clarify the current findings:

➢ First of all, one area of research that needs to be further explored is the long-term impact of Big Data on the performance and growth of e-commerce websites. Current research mainly focuses on short-term and medium-term impacts, so researching the long-term impacts will provide a more comprehensive view of the benefits and challenges of Big Data application.

➢ Second, research on data security and privacy in the context of Big Data also needs to be promoted. Although businesses have adopted many security measures, with the increase in data breaches, research on advanced security methods and new legal regulations is urgently needed. This will help ensure that the use of Big Data is not only effective but also safe and compliant with legal regulations.

In addition, research on the impact of Big Data on consumer behavior is also an important research direction. A better understanding of how Big Data affects purchasing decisions and consumer behavior will help businesses optimize marketing strategies and improve customer experience.

Regarding research methods, I propose some improvements to improve the quality and reliability of future studies:

➢ First, using diverse and combined data collection methods will help increase the accuracy and reliability of data. For example, combining online surveys, in-depth interviews, and data analysis from customer relationship management (CRM) systems will provide a more comprehensive view of research issues.

➢ Second, applying advanced data analysis tools such as machine learning and AI will help process and analyze big data more effectively. These tools not only help to detect patterns and trends in data but also predict future trends, thereby providing valuable insights for businesses.

➢ Finally, strengthening the collaboration between researchers and businesses is also an important factor. This collaboration will help to ensure that research is not only academic but also highly applicable, meeting the practical needs of businesses in the e-commerce sector.

These recommendations are not only based on research results but are also supported by existing theories and practices in the e-commerce sector. Implementing these recommendations will help to expand and clarify current findings, thereby improving the efficiency and competitiveness of businesses in this sector.

III.   Conclusion

1) Summary of key points from the analysis and recommendations.

In this research, I analyzed the impact of applying Big Data technology in the construction and development of e-commerce websites. The research results show that Big Data brings many significant benefits, including improving user experience, optimizing business processes, and enhancing marketing efficiency. I also considered external factors such as market, technology, and policy, as well as evaluating the accuracy and reliability of data collection.

A comparative analysis between the research results and existing theories shows that although the theory provides a solid basis, practice may differ due to factors such as technological developments and security measures applied. I also identified limitations in the research method and proposed improvements to enhance the quality and reliability of future research.

Based on the research results, I made specific recommendations for stakeholders in the e-commerce field. Businesses should invest in big data analytics tools, optimize business processes, and use Big Data in marketing campaigns. At the same time, data security and compliance with privacy regulations are also important factors.

2) The importance of implementing the recommendations and the next steps needed for further research.

Implementing these recommendations is crucial for businesses to maximize the benefits of Big Data technology. By investing in Big Data analytics tools and optimizing business processes, businesses can improve their performance and competitiveness in the market. Using Big Data in marketing campaigns will help increase marketing efficiency and reduce costs, while data security will ensure the legality and ethics of using customer data.

Necessary next steps for the research include expanding the scope of research to cover the long-term impacts of Big Data, increasing collaboration between researchers and businesses, and applying advanced data analytics tools such as machine learning and AI. Continued research and methodological improvements will help improve the quality and reliability of studies on the impact of Big Data technology in the e-commerce sector, thereby supporting businesses in developing and optimizing their e-commerce websites.

These recommendations and next steps will not only help businesses maximize the benefits of Big Data but also open up new research directions, contributing to the sustainable and effective development of the e-commerce industry.

P6: Reflect on the effectiveness of research methods applied for meeting objectives of the computing research project.

I. Introduction

This computing research project aims to investigate the impact of applying big data technology on the operational efficiency of e-commerce website construction and development. The primary objective of this research is to understand how the adoption of big data solutions can enhance the processes, workflows, and overall performance of e-commerce website development. The research will focus on exploring the various applications of big data analytics, machine learning, and data-driven decision-making in the context of e-commerce website design, development, and optimization. It will seek to identify the key areas where big data technology can contribute to improved operational efficiency, such as:

- ➢ Streamlining the website development lifecycle
- ➢ Enhancing user experience and personalization
- ➢ Optimizing website performance and scalability
- ➢ Improving the accuracy and timeliness of business intelligence
- ➢ Automating and optimizing marketing and sales strategies

By conducting a comprehensive literature review, interviews with industry experts, and case studies of successful big data implementations in e-commerce, this research project aims to provide insights and recommendations on the effective integration of big data technology into the e-commerce website development process. The ultimate goal is to help e-commerce businesses leverage the power of big data to enhance their operational efficiency, gain a competitive advantage, and deliver a superior customer experience.

II. Evaluation of the research methods applied

To address the objectives of this computing research project, a multi-method approach was employed, combining both qualitative and quantitative research methods:

1) Literature review

A comprehensive literature review was conducted to establish a strong theoretical foundation and understanding of the existing research on the application of big data technology in the e-commerce industry.

The literature review included academic journal articles, industry reports, and case studies related to the use of big data analytics, machine learning, and data-driven decision-making in e-commerce website development and operations.

The effectiveness of the literature review in achieving the project's objectives was high, as it provided a solid background and context for the research, as well as identified key themes, challenges, and best practices in the field.

The main strength of the literature review was its ability to synthesize a broad range of information and provide a comprehensive understanding of the current state of the art. The potential weakness was the limited scope of publicly available case studies and empirical research on the specific topic.

2) Interviews with industry experts

Semi-structured interviews were conducted with a panel of e-commerce industry experts, including web developers, data analysts, and e-commerce managers, to gather in-depth insights and firsthand experiences on the use of big data technology in e-commerce website construction and development.

The interviews were effective in gaining a deeper understanding of the practical challenges, opportunities, and best practices associated with integrating big data solutions into the e-commerce website development process.

The strength of the interview method was its ability to elicit rich, qualitative data and allow for follow-up questions to explore emerging themes. However, the small sample size and potential for bias in the selection of interviewees could be considered weaknesses.

3) Case studies

Multiple case studies were analyzed to examine successful implementations of big data technology in the e-commerce industry and understand the impact on operational efficiency.

The case studies provided detailed, real-world examples of how e-commerce businesses have leveraged big data solutions to optimize their website development processes, enhance customer experiences, and improve overall business performance.

The case study approach was effective in demonstrating the practical applications and tangible benefits of big data technology in the e-commerce context, which complemented the insights gained from the literature review and expert interviews.

The strength of the case study method was its ability to provide in-depth, contextual information, but the limited number of cases and the potential for selection bias could be considered weaknesses.

By combining these research methods, the project was able to gain a comprehensive understanding of the impact of big data technology on the operational efficiency of e-commerce website construction and development, addressing the stated objectives effectively.

III.   Alignment between research methods and project objectives

The research methods employed in this computing project were carefully selected and designed to align with the stated objectives of the research. The combination of literature review, expert interviews, and case studies provided a comprehensive and multi-faceted approach to addressing the research questions.

1) Alignment with project objectives

The literature review enabled the project to establish a strong theoretical foundation and understanding of the current state of research on the application of big data technology in e-commerce website development. This laid the groundwork for the subsequent research methods and helped identify key themes, challenges, and best practices in the field.

The expert interviews allowed the project to gather in-depth, practical insights from industry professionals on the real-world implementation of big data solutions in e-commerce website construction and development. This helped to bridge the gap between theory and practice, and provided a deeper understanding of the operational efficiency impacts.

The case study analysis enabled the project to examine specific examples of successful big data implementations in the e-commerce industry, demonstrating the tangible benefits and providing a basis for developing recommendations for practitioners.

2) Extent to which research methods met project goals

The combination of research methods ensured that the project was able to comprehensively address its primary objective of investigating the impact of big data technology on the operational efficiency of e-commerce website construction and development.

The literature review, expert interviews, and case studies provided a multi-faceted perspective on the topic, allowing the project to identify key themes, challenges, and best practices, as well as quantify the potential benefits of applying big data solutions.

The research methods enabled the project to develop a detailed understanding of the specific areas where big data technology can contribute to improved operational efficiency, such as streamlining the website development lifecycle, enhancing user experience, optimizing website performance, and improving business intelligence.

The project was able to generate a set of actionable recommendations and insights that can be used by e-commerce businesses to effectively integrate big data technology into their website development processes and achieve tangible operational efficiency gains.

Overall, the selected research methods were well-aligned with the project's objectives and enabled the research team to comprehensively address the research questions and achieve the intended goals of the research.

IV. Limitations and challenges in implementing the research methods

While the research methods employed in this project were carefully selected and designed to address the stated objectives, there were some limitations and challenges encountered in their implementation that are worth acknowledging.

1) Limitations in the literature review

The rapidly evolving nature of big data technology and its applications in the e-commerce industry meant that the available academic literature was not always up-to-date, particularly when it came to the latest trends, tools, and best practices.

The majority of the published case studies and empirical research focused on larger, well-established e-commerce enterprises, with limited information on the challenges and experiences of smaller or newer e-commerce businesses.

The literature review was inherently limited to the publicly available information, and there may have been proprietary or unpublished case studies and industry reports that could have provided additional insights.

2) Challenges in conducting expert interviews

Gaining access to a diverse and representative sample of e-commerce industry experts was a significant challenge, as many professionals were reluctant to share detailed information about their companies' technology strategies and operational practices.

The interviews were conducted remotely due to the geographic dispersion of the experts, which limited the ability to observe non-verbal cues and interactions that could have provided additional contextual information.

Some of the experts were hesitant to share specific details about the technical and financial aspects of their big data implementations, which may have constrained the depth of the insights obtained.

3) Limitations in the case study analysis

The availability of detailed, publicly accessible case studies on the application of big data technology in e-commerce website construction and development was limited, as many companies tend to keep this information proprietary.

The case studies that were analyzed may have been subject to selection bias, as they were likely chosen to showcase successful big data implementations, with limited information on failed or less-than-optimal projects.

The diversity of the case studies was also a challenge, as the e-commerce industry is highly fragmented, and the specific technological and operational contexts of each organization varied significantly.

4) Impact on the achievement of project objectives

While these limitations and challenges did not prevent the project from achieving its primary objectives, they did introduce some constraints on the depth and generalizability of the findings.

The limited availability of up-to-date literature and industry-specific case studies may have resulted in the project missing out on the latest trends and innovations in the application of big data technology in e-commerce website development.

The challenges in accessing a diverse and representative sample of industry experts could have biased the insights obtained, potentially overlooking the perspectives of smaller or less established e-commerce businesses.

The lack of detailed financial and technical information in some of the case studies and expert interviews may have constrained the project's ability to quantify the precise operational efficiency gains achieved through the application of big data technology.

Despite these limitations, the project was able to generate a comprehensive set of findings and recommendations that provide valuable insights for e-commerce businesses looking to leverage big data technology to enhance their website construction and development processes. objectives

V. Lessons learned from the use of research methods

The application of the research methods in this project, including the literature review, expert interviews, and case study analysis, has provided valuable lessons and insights that can inform the selection and use of research methods in future computing research projects.

1) Key lessons and insights

The importance of triangulating multiple research methods: The combination of literature review, expert interviews, and case studies enabled a more comprehensive and robust understanding of the research problem, allowing the project to obtain both theoretical and practical insights.

The need for adaptability in research methods: Given the rapidly evolving nature of the topic, the research team had to be flexible in their approach, constantly monitoring the latest developments and adjusting their methods accordingly to ensure the relevance and timeliness of the findings.

The value of industry collaboration: The expert interviews were instrumental in providing practical, real-world perspectives that complemented the academic literature, highlighting the importance of establishing strong industry partnerships in computing research projects.

The challenges of accessing proprietary information: The limited availability of detailed case studies and financial/technical data from e-commerce companies underscored the need for researchers to develop innovative strategies for gaining access to sensitive, proprietary information.

The significance of contextual factors: The diversity of the e-commerce industry and the varying technological and operational contexts of the organizations studied demonstrated the importance of considering the unique circumstances and constraints that may influence the implementation and impact of big data technology.

2) Implications for future computing research projects

The lessons learned from this project emphasize the value of employing a multi-method research approach, which can provide a more robust and comprehensive understanding of complex computing-related phenomena.

Researchers should be prepared to adapt their methods and strategies as the field evolves, regularly reviewing and updating their approaches to ensure the continued relevance and timeliness of their work.

Establishing strong industry partnerships and developing innovative methods for accessing proprietary information can be crucial in computing research projects, as this can provide valuable, first-hand insights that may not be available in the public domain.

Contextual factors, such as organizational culture, technological infrastructure, and market dynamics, should be carefully considered when designing and implementing computing research projects, as they can significantly influence the outcomes and the applicability of the findings.

The lessons learned from this project can inform the design and execution of future computing research projects, particularly those focused on the application of emerging technologies in the business and operational domains.

By applying these lessons, future computing researchers can enhance the rigor, relevance, and impact of their work, contributing to the advancement of knowledge and the development of innovative solutions that address real-world challenges.

VI.   Conclusion

1) *Overall assessment of the research methods*

The research methods employed in this project, including the literature review, expert interviews, and case study analysis, have been effective in meeting the objectives of the computing research project. The combination of these methods has allowed the research team to develop a comprehensive understanding of the impact of big data technology on operational efficiency in the e-commerce industry.

The literature review provided a solid theoretical foundation, highlighting the current state of research and the key concepts and frameworks related to big data technology and operational efficiency. The expert interviews, on the other hand, offered valuable practical insights, revealing the real-world challenges and best practices associated with the implementation and management of big data systems in e-commerce organizations.

The case study analysis, in turn, enabled the research team to examine the impact of big data technology in specific e-commerce contexts, providing concrete examples of how these technologies can enhance operational efficiency, improve decision-making, and drive business performance. By triangulating these research methods, the project was able to generate a rich and multifaceted understanding of the research problem, addressing both the theoretical and practical aspects.

2) *Key takeaways*

The most important takeaways from the reflection on the research methods employed in this project include:

➢ The importance of combining multiple research methods to obtain a comprehensive understanding of the research problem: The integration of literature review, expert interviews, and case studies allowed the project to capture both the theoretical and practical dimensions of the impact of big data technology on e-commerce operations.

➢ The need for adaptability in research methods to keep pace with the rapidly evolving field of computing: The research team had to continuously monitor the latest developments in big data technology and e-commerce practices, adjusting their methods to ensure the relevance and timeliness of the findings.

➢ The value of establishing strong industry partnerships and gaining access to proprietary information: The expert interviews and case studies provided invaluable insights that would have been difficult to obtain from public sources alone, underscoring the importance of developing collaborative relationships with industry stakeholders.

➢ The significance of considering contextual factors in the design and implementation of computing research projects: The diverse operational and technological contexts of the e-commerce

organizations studied highlighted the need to account for the unique circumstances and constraints that may influence the application and impact of big data technologies.

By reflecting on these key lessons and insights, future computing research projects focused on the application of emerging technologies in business and operational domains can be better equipped to select and utilize research methods that optimize the rigor, relevance, and impact of their work.

P7: Consider alternative research methodologies and lessons learnt in view of the outcomes.

I. Expand the scope and scale of the research

1) Investigate the Impact on E-commerce Website Construction and Development

➢ Extend the research to include e-commerce companies at various stages of website development, from startups to established enterprises

➢ Analyze how the adoption and application of big data technology impacts the efficiency of key processes in e-commerce website construction and development, such as user experience design, content management, and website optimization

➢ Identify the unique challenges and opportunities presented by big data in the context of e-commerce website life cycle management

2) Examine the Long-term Effects on E-commerce Website Performance

➢ Monitor the e-commerce websites over an extended period to assess the long-term impact of big data technology on key website performance metrics, such as user engagement, conversion rates, and revenue generation

➢ Explore how the continuous integration of big data insights into website development and optimization strategies contributes to sustained operational efficiency and business growth

➢ Identify the critical success factors and best practices for leveraging big data to drive ongoing improvements in e-commerce website performance

3) Explore Cross-platform Applicability

➢ Investigate the potential for transferring the research findings and insights to other e-commerce platforms and channels, such as mobile apps, social media-based storefronts, and omnichannel customer experiences

➢ Analyze the similarities and differences in the ways big data technology is leveraged to enhance operational efficiency across various e-commerce touchpoints and customer interaction points

➢ Develop a more comprehensive understanding of the contextual factors that influence the impact of big data on operational performance in the broader e-commerce ecosystem

By focusing on the specific domain of e-commerce website construction and development, the expanded research scope will provide deeper insights into the unique challenges, opportunities, and best practices for leveraging big data technology to drive operational efficiency in this critical aspect of e-commerce operations. Additionally, the exploration of cross-platform applicability will contribute to a more holistic understanding of the role of big data in enhancing the overall efficiency and performance of e-commerce businesses.

II. Deepen the analysis of contextual factors

1) Conduct In-depth Case Studies

- Perform detailed case studies of e-commerce companies at different stages of website development and big data adoption
- Examine how organizational culture, leadership support, and employee skills influence the integration and utilization of big data technology in website construction and optimization processes
- Investigate the role of the existing technological infrastructure, including data management systems, analytical tools, and integration capabilities, in shaping the impact of big data on operational efficiency

2) Analyze Data Governance and Security

- Explore the data governance strategies and policies adopted by e-commerce companies to ensure the effective and responsible use of big data in website development
- Assess the data security and privacy measures implemented to protect sensitive customer information and maintain trust in the e-commerce platform
- Identify the potential challenges and trade-offs associated with data governance, such as balancing data accessibility, compliance, and risk mitigation

3) Evaluate the Cost-Benefit Analysis

- Conduct a comprehensive cost-benefit analysis to understand the financial implications of investing in big data technology for e-commerce website construction and development
- Examine the direct and indirect costs associated with the adoption, implementation, and maintenance of big data systems, including infrastructure, personnel, and training requirements
- Assess the potential benefits of big data in terms of improved operational efficiency, enhanced customer experience, increased revenue, and long-term competitive advantage

4) Understand the Management of Data-related Risks

- Investigate the potential risks and challenges associated with the integration of big data technology in e-commerce website development, such as data quality issues, algorithm biases, and unintended consequences
- Explore strategies and best practices for mitigating data-related risks, including data validation, model testing, and the development of ethical frameworks for data-driven decision-making
- Analyze how e-commerce companies balance the benefits of big data with the effective management of associated risks to ensure sustainable and responsible implementation

By deepening the analysis of contextual factors, the research will provide a more holistic understanding of the complex interplay between organizational, technological, and market-related elements that influence the application and impact of big data technology in the field of e-commerce website construction and development. This comprehensive approach will help identify the critical success factors, challenges, and trade-offs associated with leveraging big data to enhance operational efficiency in this specific domain.

III.   Incorporate emerging technologies and trends

1) Integrate Big Data with Emerging Technologies

- Assess the impact of integrating big data technology with other emerging technologies, such as artificial intelligence (AI), machine learning (ML), and natural language processing (NLP), on the operational efficiency of e-commerce website construction and development
- Explore how the synergistic application of big data and AI/ML can enhance user experience, automate content creation, personalize product recommendations, and optimize website performance
- Investigate the potential of Internet of Things (IoT) data sources, such as connected devices and sensors, to provide additional insights for improving website design, user behavior analysis, and supply chain optimization

2) Leverage New Data Sources

- Examine the impact of incorporating data from social media platforms, mobile devices, and other emerging digital touchpoints on the operational efficiency of e-commerce website development and optimization
- Analyze how the integration of unstructured data from these new sources can complement traditional e-commerce data to provide a more comprehensive understanding of customer behavior and market trends
- Explore the strategies and challenges associated with the collection, integration, and analysis of data from diverse, real-time data sources to drive actionable insights for website improvements

3) Navigate the Evolving Regulatory Landscape

- Investigate the implications of the changing data privacy regulations, such as the General Data Protection Regulation (GDPR) and the California Consumer Privacy Act (CCPA), on the use of big data technology in e-commerce website construction and development
- Analyze the strategies and best practices adopted by e-commerce companies to ensure compliance with data protection laws while still leveraging the benefits of big data for operational efficiency
- Examine the potential trade-offs and challenges associated with balancing data-driven decision-making and the protection of customer privacy in the e-commerce context

By incorporating the impact of emerging technologies and evolving trends, the research will provide a more comprehensive and future-oriented understanding of the role of big data technology in enhancing operational efficiency in the field of e-commerce website construction and development. This will help e-commerce companies stay ahead of the curve and adapt their strategies to capitalize on the synergies between big data and other innovative technologies, while also navigating the changing regulatory landscape and addressing data privacy concerns.

IV.   Adopt more diverse research methods

1) Utilize Experimental Research Designs

➢ Explore the use of A/B testing and other experimental research methodologies to quantify the impact of specific big data-driven interventions on key operational metrics in e-commerce website construction and development

➢ Design controlled experiments to isolate the effects of big data technology on variables such as website conversion rates, customer engagement, and operational costs, allowing for a more rigorous assessment of the causal relationships

➢ Analyze the results of these experiments to provide empirical evidence on the effectiveness of big data applications in improving the operational efficiency of e-commerce websites

2) Incorporate Longitudinal Studies

➢ Conduct longitudinal studies to better understand the long-term effects of big data technology implementation on the operational efficiency of e-commerce website construction and development

➢ Track the changes in operational metrics, such as website performance, customer satisfaction, and cost savings, over an extended period to identify the sustained impact and potential lag effects of big data adoption

➢ Analyze the evolving organizational and technological factors that influence the long-term integration and optimization of big data systems in the e-commerce context

3) Utilize Mixed-Methods Approaches

➢ Combine quantitative and qualitative research methods to provide a more comprehensive understanding of the impact of big data technology on operational efficiency in e-commerce website construction and development

➢ Incorporate surveys, interviews, and focus groups to gather in-depth insights from e-commerce professionals, IT specialists, and customers on their perceptions, experiences, and challenges with big data applications

> Integrate the quantitative data on operational metrics with the qualitative findings on organizational, technological, and market-related factors to generate a holistic understanding of the research problem

By adopting a diverse range of research methods, the research will be able to provide a more robust and multifaceted analysis of the impact of big data technology on operational efficiency in the field of e-commerce website construction and development. The combination of experimental, longitudinal, and mixed-methods approaches will enable the research to uncover the causal relationships, long-term trends, and contextual nuances that influence the effectiveness of big data applications in this domain.

V. Collaborate with industry partners

1) Establish Partnerships with E-commerce Companies

Develop ongoing partnerships with leading e-commerce companies to facilitate access to proprietary data and gain deeper insights into the practical challenges and best practices in applying big data technology for operational efficiency

Collaborate with e-commerce organizations to design and conduct case studies, pilot projects, and co-creation workshops that allow for the exploration of real-world scenarios and the validation of research findings

Leverage these industry partnerships to gain a better understanding of the organizational, technological, and market-specific factors that influence the successful implementation and optimization of big data systems in e-commerce website construction and development

2) Engage with Industry Associations and Technology Vendors

Actively participate in industry associations, conferences, and forums related to e-commerce and big data technology to stay informed about the latest trends, developments, and best practices in this domain

Collaborate with technology vendors and solution providers to understand the evolving capabilities, limitations, and integration challenges of big data tools and platforms in the e-commerce context

Engage in knowledge-sharing initiatives, such as webinars, workshops, and joint publications, to disseminate research findings and gather feedback from industry practitioners

3) Explore Joint Research Projects and Collaborations

Pursue opportunities for joint research projects and pilot studies with e-commerce companies, industry associations, and technology vendors to bridge the gap between academia and industry

Leverage these collaborative initiatives to gain access to real-world data, insights, and expertise, while also ensuring the practical relevance and applicability of the research

Facilitate the co-creation of innovative solutions and the translation of research findings into actionable strategies for improving the operational efficiency of e-commerce website construction and development through the application of big data technology

By fostering strong collaborations with industry partners, the research will be able to gain a deeper understanding of the practical challenges, emerging trends, and best practices in the application of big data technology in the e-commerce domain. These industry partnerships will not only provide access to proprietary data and expertise but also ensure the relevance and impact of the research findings, ultimately contributing to the successful adoption and optimization of big data systems in e-commerce website construction and development. By addressing these recommendations, future research on the impact of big data technology in the e-commerce industry can build upon the findings and insights of this project, further advancing the understanding of the role of emerging technologies in enhancing operational efficiency and business performance.

M4: Provide critical reflection and insight that results in recommended actions for improvements and future research considerations.

I. Literature Review

1) Identify and Review Academic Literature

Conduct a comprehensive search and review of academic literature on the application of big data technology in the context of e-commerce website construction and development

Examine peer-reviewed journal articles, conference proceedings, and relevant book chapters that explore the integration of big data systems, tools, and techniques in the e-commerce domain

Identify and analyze the key research trends, methodologies, and findings from the existing body of knowledge in this field

2) Examine the Impact of Big Data on Operational Efficiency

Review studies that investigate the impact of big data technology on operational efficiency, productivity, and cost optimization in e-commerce website construction and development

Explore research on how big data-driven insights and automation can enhance decision-making, streamline business processes, and improve resource allocation in the e-commerce context

Synthesize the empirical evidence on the tangible and intangible benefits of applying big data technology to improve the operational efficiency of e-commerce websites

3) Synthesize Key Concepts, Frameworks, and Findings

Identify and analyze the underlying theoretical frameworks, conceptual models, and analytical approaches that have been used to research the impact of big data technology in the e-commerce sector

Synthesize the key themes, patterns, and insights emerging from the existing research, highlighting the current state of knowledge, gaps, and opportunities for further exploration

Develop a comprehensive understanding of the factors, mechanisms, and contextual influences that shape the effective application of big data technology to enhance the operational efficiency of e-commerce website construction and development

By conducting a thorough literature review, the research will establish a solid foundation of knowledge on the current state of research in the application of big data technology to improve the operational efficiency

of e-commerce website construction and development. This comprehensive understanding of the existing body of knowledge will inform the development of the research questions, methodologies, and hypotheses, ensuring the research builds upon and extends the current understanding in this field.

II. Expert Interviews

1) Conduct Semi-Structured Interviews

Identify and engage a diverse group of industry experts, including e-commerce executives, data analysts, and technology consultants, to participate in semi-structured interviews

Develop an interview protocol that explores the experts' perspectives on the challenges, best practices, and emerging trends in the use of big data technology in the e-commerce industry

Ensure the interview questions cover a range of topics, such as the integration of big data systems, the application of analytics and optimization techniques, the management of data and infrastructure, and the organizational and cultural changes required for successful implementation

2) Explore Practical Insights and Challenges

Gain in-depth insights into the practical implementation and management of big data systems in real-world e-commerce settings, including the barriers, critical success factors, and lessons learned

Understand the experts' perspectives on the operational and strategic impact of big data technology on e-commerce website construction, development, and performance

Identify the key operational efficiency metrics, data sources, and analytical approaches that are most valuable for e-commerce organizations leveraging big data

3) Synthesize Emerging Trends and Best Practices

Analyze the interview data to identify common themes, patterns, and emerging trends in the application of big data technology within the e-commerce industry

Synthesize the experts' insights and recommendations on best practices for the successful integration and optimization of big data systems in e-commerce website construction and development

Explore the experts' views on the evolving role of data, analytics, and technology in shaping the future of e-commerce operations and the overall customer experience

By conducting in-depth interviews with industry experts, the research will gain valuable, first-hand insights into the practical challenges, best practices, and emerging trends in the application of big data technology to enhance the operational efficiency of e-commerce website construction and development. These

expert perspectives will complement the findings from the literature review and provide a more comprehensive understanding of the real-world implications and considerations for effectively leveraging big data in the e-commerce domain.

III.   Case Study Analysis

1) Selection of E-commerce Organizations

Identify a diverse set of e-commerce organizations to serve as case studies, representing different business models, market segments, and technological maturity levels

Ensure the selected organizations have actively implemented big data technology and initiatives to enhance their operational efficiency in the context of website construction and development

Obtain the necessary permissions and access to conduct in-depth case studies within these organizations

2) In-Depth Case Studies

Develop a comprehensive case study protocol to guide the data collection and analysis process, including document reviews, observations, and semi-structured interviews with key stakeholders

Examine the specific ways in which the selected e-commerce organizations have applied big data technology, such as data collection, processing, analytics, and optimization, to improve their operational efficiency

Explore the organizational, technological, and contextual factors that have influenced the implementation and impact of the big data initiatives, including leadership, organizational culture, data governance, technological infrastructure, and external market dynamics

3) Analyze Factors and Impact

Conduct a cross-case analysis to identify common themes, patterns, and divergences in the application and impact of big data technology across the different e-commerce organizations

Assess the organizational, technological, and contextual factors that have facilitated or hindered the successful implementation and optimization of big data initiatives to improve operational efficiency

Evaluate the tangible and intangible benefits, as well as the challenges and limitations, experienced by the e-commerce organizations in leveraging big data to enhance website construction, development, and overall operational performance

4) *Develop a Comprehensive Framework*

Synthesize the insights and findings from the case studies to develop a comprehensive framework that illustrates the key factors, processes, and outcomes associated with the successful application of big data technology to enhance operational efficiency in e-commerce website construction and development

Ensure the framework captures the interdependencies and contextual influences that shape the impact of big data initiatives on e-commerce organizations

Validate and refine the framework through further discussions and feedback from industry experts and academic peers.

The in-depth case study analysis will provide a rich, contextualized understanding of how e-commerce organizations have practically implemented and optimized big data technology to improve their operational efficiency in website construction and development. By examining diverse organizations and their unique experiences, the research will uncover the critical success factors, barriers, and best practices that can guide future implementations and help e-commerce organizations leverage big data more effectively.

IV.   Data Collection and Analysis

1) *Gather Qualitative and Quantitative Data*

Collect both qualitative and quantitative data from the various research methods employed, including:

- ➢ **Literature review**: Relevant academic papers, industry reports, and other secondary sources
- ➢ **Expert interviews**: Transcripts, notes, and any supplementary materials provided by the industry experts
- ➢ **Case studies**: Interview transcripts, organizational documents, performance metrics, and other relevant data sources

2) *Employ Data Analysis Techniques*

Utilize a range of data analysis techniques to extract insights and patterns from the gathered data:

- ➢ **Thematic analysis**: Identify and analyze common themes, patterns, and trends emerging from the qualitative data, such as interview transcripts and case study materials
- ➢ **Content analysis**: Systematically examine the content of the literature, interview transcripts, and case study documents to uncover key concepts, ideas, and narratives
- ➢ **Statistical analysis**: Analyze any quantitative data, such as performance metrics and financial indicators, to identify statistically significant relationships, trends, and correlations

3) Triangulate Findings

Triangulate the findings from the different research methods to develop a comprehensive understanding of the research problem:

➢ Compare and contrast the insights, perspectives, and data obtained from the literature review, expert interviews, and case studies

➢ Identify convergent and divergent findings, and explore the underlying reasons for these differences

➢ Synthesize the triangulated findings to gain a holistic and well-rounded understanding of the impact of big data technology on operational efficiency in e-commerce website construction and development

4) Interpret and Discuss the Findings

Interpret the analyzed data to draw meaningful conclusions and generate new insights:

➢ Discuss the key factors, processes, and outcomes associated with the application of big data technology in the e-commerce industry

➢ Highlight the critical success factors, barriers, and best practices that emerge from the research

➢ Explore the implications of the findings for e-commerce organizations, industry practitioners, and academic researchers

5) Ensure Reliability and Validity

Implement measures to ensure the reliability and validity of the data collection and analysis processes:

➢ Maintain detailed documentation of the research methods, data sources, and analysis procedures

➢ Employ peer review and expert feedback to validate the interpretations and conclusions drawn from the data.

➢ Acknowledge any limitations or potential biases in the research approach and findings

By gathering and analyzing both qualitative and quantitative data from the literature review, expert interviews, and case studies, the research will develop a comprehensive understanding of the impact of big data technology on operational efficiency in the field of e-commerce website construction and development. The triangulation of findings from multiple data sources will strengthen the reliability and validity of the research outcomes, enabling the generation of meaningful insights, recommendations, and a robust framework to guide future research and practice in this domain.

V. Ethical Considerations

1) Obtain Necessary Approvals and Permissions

Ensure that all required approvals and permissions are obtained prior to the data collection and analysis process:

- Seek approval from the relevant institutional review board or ethics committee to conduct the research
- Obtain written consent from the e-commerce organizations and industry experts participating in the research
- Comply with any data usage agreements or non-disclosure requirements set by the research participants

2) Ensure Confidentiality and Anonymity

Protect the confidentiality and anonymity of the research participants, especially in the case of proprietary or sensitive information:

- Use pseudonyms or unique identifiers instead of real names in the research documentation and publications
- Securely store and protect all data collected, including interview transcripts, organizational documents, and performance metrics
- Limit access to the raw data and research materials to only the members of the research team

3) Adhere to Ethical Principles

Uphold ethical principles throughout the research process:

- **Informed consent**: Provide clear and comprehensive information to the research participants about the research's objectives, data collection methods, and the intended use of the data
- **Data privacy**: Ensure that the collection, storage, and use of data comply with relevant data privacy laws and regulations
- **Responsible data management**: Implement appropriate data management and security protocols to prevent unauthorized access, misuse, or loss of the research data

4) Minimize Potential Risks and Harms

Identify and mitigate any potential risks or harms that may arise from the research:

- Assess the possible impact of the research on the participating e-commerce organizations, their employees, and their customers
- Implement measures to protect the interests and well-being of the research participants, such as the redaction of sensitive information

➢ Ensure that the research findings and recommendations do not place the participating organizations at a competitive disadvantage or expose them to potential legal or reputational risks

5) Maintain Transparency and Accountability

Demonstrate transparency and accountability throughout the research process:

➢ Clearly document the ethical considerations, protocols, and decisions made during the course of the research
➢ Provide regular updates and progress reports to the research participants and any relevant oversight bodies
➢ Be prepared to address any concerns or issues raised by the research participants or other stakeholders

By prioritizing ethical considerations, the research will ensure the protection of the participating individuals and organizations, maintain the integrity and trustworthiness of the research findings, and contribute to the responsible development and application of big data technology in the e-commerce industry

VI.   Limitations and Delimitations

1) Limitations of the Research

Acknowledge the potential limitations of the research:

➢ **Scope**: The research may be limited to a specific subset of e-commerce organizations or focus on a particular geographic region, which could affect the generalizability of the findings.
➢ **Sample size**: The number of participating e-commerce organizations and industry experts may be constrained, which could impact the statistical significance and reliability of the results.
➢ **Data availability**: The research may be limited by the availability and accessibility of relevant data, such as proprietary performance metrics or industry-specific information.
➢ **Time frame**: The analysis may be confined to a specific time period, which could limit the ability to capture long-term trends or the evolving nature of big data technology and its impact on e-commerce operations.

2) Scope and Boundaries of the research

Clearly define the boundaries and scope of the research:

➢ **Industry focus**: The research will focus on the e-commerce industry, specifically examining the impact of big data technology on the construction and development of e-commerce websites.

- **Geographic region**: The research will be primarily conducted within [insert relevant geographic region, e.g., the United States, European Union, Asia-Pacific, etc.], which may limit the applicability of the findings to other regions.
- **Time frame**: The analysis will cover the period from [insert start year] to [insert end year], capturing the recent trends and developments in the application of big data technology in the e-commerce sector.

3) *Mitigation of Limitations and Potential Biases*

Discuss the measures taken to address the identified limitations and potential biases:

- **Expand the sample size**: Actively engage with a broader range of e-commerce organizations and industry experts to increase the diversity and representativeness of the sample.
- **Diversify data sources**: Seek out alternative data sources, such as industry reports, academic studies, and publicly available information, to supplement the primary data collected.
- **Implement cross-validation**: Utilize multiple data analysis techniques and compare the results to ensure the reliability and robustness of the findings.
- **Acknowledge limitations**: Clearly articulate the limitations of the research in the research's methodology and discussion sections, and provide recommendations for future research to address these limitations.

By acknowledging the limitations and delimitations of the research, the research will maintain a transparent and realistic approach, enabling readers to better understand the scope and generalizability of the findings. The mitigation measures will help to address potential biases and strengthen the overall quality and reliability of the research.findings.

VII.   Critical Reflections and Insights

1) *Reflect on Research Methods and Processes*

During the implementation of the e-commerce website building project, our team applied the following research methods and processes:

- ❖ **Semi-structured interviews with experts**: I conducted interviews with lecturers and experts in the field of e-commerce and Big Data to gather practical information and challenges they face Right.
- ❖ **Case analysis**: I selected a number of e-commerce organizations to conduct detailed case studies, to better understand how they apply Big Data and its impact on performance.
- ❖ **Collect and analyze qualitative and quantitative data**: I collected data from various sources and used data analysis techniques to process and analyze the collected data.
- ❖ **Website development using Angular and MongoDB**: I used Angular to develop the user interface and MongoDB to store data, to ensure flexibility and high performance for the website.

2) Identify Strengths and Weaknesses

a) Strengths

- **Diverse methods**: Using many different research methods (interviews, case analysis, qualitative and quantitative data collection) helps us have a comprehensive and in-depth view of the research problem .
- **Practical information**: Interviews with lecturers and experts provide a wealth of practical information and specific challenges that e-commerce organizations face when applying Big Data.
- **Comprehensive theoretical framework**: Developing a comprehensive theoretical framework based on case studies helps us better understand the influencing factors and impacts of Big Data.
- **Using modern technology**: Using Angular and MongoDB helps us build an e-commerce website with a flexible user interface and effective data storage capabilities.

b) Weaknesses

- **Time and resource constraints**: The data collection and analysis process requires a lot of time and resources, which can affect the depth and scope of the research.
- **Potential bias**: Interviews and case studies can be influenced by the bias of the participants or the person conducting the research.
- **Generalizability**: Results from the case studies may not be fully representative of all e-commerce organizations, so the generalizability of the research may be limited.
- **Technical challenges**: Using Angular and MongoDB requires the team to have a high level of technical knowledge and skills, which can be difficult for less experienced members.

3) Provide Insights for Improvement

a) Comment

- ➢ **Increased use of automated analysis tools**: Using automated analysis tools can help reduce errors and increase efficiency during data analysis.
- ➢ **Training and upskilling**: Training employees on the skills to use Big Data and analytics tools can help improve operational efficiency and minimize technical challenges.
- ➢ **Strengthen cooperation with experts**: Closer cooperation with experts in the field of Big Data and e-commerce can help collect more accurate and up-to-date information.

b) Suggested improvements

- ➢ **Use mixed research methods**: Combine qualitative and quantitative research methods to have a more comprehensive view of the research problem.
- ➢ **Enhance testing and evaluation**: Conduct regular testing and evaluation to ensure the accuracy and reliability of data and research results.
- ➢ **Develop support tools**: Develop and use tools to support data analysis and project management to increase efficiency and reduce errors.

> ➢ **Enhance technical skills**: Increase training and learning on Angular and MongoDB to ensure the team has the skills and knowledge to develop and maintain the website.

VIII.   Recommendations for Future Research

1) Suggest Future Research Directions

Based on the current results of the project of building an e-commerce website using Angular and storing data using MongoDB, I propose the following future research directions:

> ➢ **Angular and MongoDB Performance Optimization research**: Learn methods and techniques to optimize the performance of web applications using Angular and MongoDB, especially in big data processing and augmentation user experience.

> ➢ **Explore new technologies in web development**: Research and apply new technologies such as Progressive Web Apps (PWA), Server-Side Rendering (SSR) with Angular, and other NoSQL databases to compare performance capacity and features.

> ➢ **Integrating artificial intelligence (AI) and machine learning (ML)**: Explore how to integrate AI and ML into e-commerce systems to improve user experience, predict shopping behavior, and optimize processes business program.

> ➢ **Security and privacy research**: Learn about security and privacy measures when using Big Data in e-commerce, especially in protecting customer data and preventing attacks network.

> ➢ **Analyze the impact of Big Data on user experience**: Research how Big Data can improve user experience on mobile and desktop devices, including content personalization and optimization user interface.

2) Justify the Importance of Future Research

Importance of future research:

> ➢ **Improve performance and user experience**: Research on performance optimization and new technology integration will help improve the speed and features of e-commerce websites, thereby enhancing user experience and increasing sales. enhance customer satisfaction.

> ➢ **Stay ahead of technology trends**: Discovering and applying new technologies will help e-commerce organizations stay ahead of technology trends, maintain competitiveness and meet the increasing demands of the market.

> ➢ **Enhance security and privacy**: Research on security and privacy will help protect customer data, prevent cyberattacks, and build customer trust in e-commerce services death.

> ➢ **Applying AI and ML in e-commerce**: Integrating AI and ML into e-commerce systems will open up many new opportunities in personalizing user experience, predicting shopping behavior and optimizing business process.

- ➢ **Contribution to the research field**: Future research will contribute to the knowledge base of the e-commerce and Big Data fields, providing new solutions and methods for researchers and businesses.

D3: Demonstrate reflection and engagement in the resource process leading to recommended actions for future improvement.

I. Big Data Technology in the field of e-commerce website construction and development

1) *Definition and characteristics of big data in the field of e-commerce website construction and development*

a) Define

Big Data is a large, complex collection of data that traditional data processing tools cannot process. It includes both structured and unstructured data, collected from a variety of sources such as transactions, social media interactions, and website visits.

Big Data Technology in the field of e-commerce website construction and development refers to the use of big data analysis tools and techniques to collect, process and analyze huge amounts of data from activities, online dynamic. The goal is to optimize performance and improve user experience on e-commerce websites.

b) Characteristic

Big Data is often described in terms of 4V:

- ➢ **Volume**: Huge amount of data.
- ➢ **Velocity**: Fast data processing and analysis speed.
- ➢ **Variety**: Diversity in data types (text, images, video, audio).
- ➢ **Veracity**: Accuracy and reliability of data.

2) *Specific applications of big data technology in e-commerce website construction and development*

- ❖ **Customer Segmentation**: Use Big Data to analyze customer behavior and preferences, thereby creating specific target customer groups.
- ❖ **Personalized Recommendations**: Based on customers' shopping and browsing history, Big Data helps create suitable product suggestions, enhancing user experience.
- ❖ **Demand Forecasting**: Analyze historical data and market trends to forecast product demand, helping to optimize warehouse and supply chain management.
- ❖ **Supply Chain Optimization**: Use Big Data to track and analyze factors in the supply chain, thereby improving operational efficiency and reducing costs.

3) Technological components and infrastructure required for big data implementation in e-commerce website construction and development

❖ **Data Storage Infrastructure**: Use distributed data storage systems such as Hadoop, NoSQL databases (MongoDB, Cassandra) to manage and store large amounts of data.

❖ **Data Analysis Tools**: Use data analysis tools such as Apache Spark, Tableau, Power BI to process and analyze data.

❖ **Real-time Data Processing Systems**: Use systems such as Apache Kafka, Flink to process and analyze data in real time.

❖ **Data Security**: Apply security measures such as data encryption and access rights management to protect data from security threats.e

II. Operational Efficiency of BigData Technology in the field of e-commerce website construction and development

1) Key Operational Processes and Functions

In the field of e-commerce website construction and development, applying Big Data technology can improve operational efficiency through optimizing key operational processes and functions. Here is an overview of these processes and functions:

	Description	Big Data application	Example
Order Management	Order management includes tracking and processing orders from when a customer places an order until successful delivery.	Big Data helps optimize this process by analyzing data from previous orders to predict shopping trends, optimize delivery routes, and minimize order processing time. row.	Use machine learning algorithms to predict optimal delivery times based on historical data and current traffic conditions.
Inventory Management	Inventory management involves maintaining optimal inventory levels to meet customer demand without causing shortages or surpluses.	Big Data helps accurately forecast demand by analyzing sales data, market trends and customer behavior. This helps optimize inventory levels and reduce storage costs.	Use data analytics to determine which products are selling well and adjust inventory levels accordingly.
Logistics	Logistics includes the management of transportation and distribution of goods	Big Data can improve logistics efficiency by analyzing real-time data to optimize shipping routes, predict delivery times, and reduce shipping costs.	Use data from GPS sensors to adjust delivery routes to avoid traffic jams and reduce delivery times.

	from warehouses to customers.		
Customer Service	Customer service includes supporting and resolving customer problems	Big Data helps personalize customer experiences by analyzing data from previous conversations to predict and solve customer problems more effectively.	Use sentiment analysis to determine customer satisfaction levels and provide appropriate solutions.
Website Management	Website management includes maintaining and optimizing the performance of e-commerce websites.	Big Data helps analyze user behavior on the website to optimize user experience and improve page loading speed.	Use data from visits to optimize the website's appearance and functionality, ensuring the website operates stably and effectively.

Table 11: Key Openational Process and Functions

2) Metrics and KPIs

The use of Metrics and KPIs in performance management helps e-commerce businesses monitor and improve the performance of operational processes and functions. Big Data technology provides tools and techniques to collect, analyze and use this data effectively, thereby helping businesses make strategic decisions and improve overall operational efficiency. .

	Description	**Big Data application**	**Example**
Order Fulfillment Time	Time from when the customer places an order until receiving the goods.	Big Data helps reduce this time by optimizing processing and delivery processes.	Use data analytics to predict and prepare orders in advance, minimizing wait times.
Inventory Turnover	Number of times inventory is sold and replaced during a given period.	Big Data helps optimize inventory levels and increase inventory turnover.	Analyze sales data to adjust inventory levels to match actual demand, minimizing excess or shortage inventory.
Customer Response Time	Time from when a customer requests support to when a response is received.	Big Data helps improve response times by predicting and resolving issues quickly.	Use data analytics to automate responses to frequently asked questions, reducing customer wait times.
Website Uptime	Time that the website operates without problems.	Big Data helps personalize customer experiences by analyzing data from previous conversations to	Use sentiment analysis to determine customer satisfaction levels and provide appropriate solutions.

		predict and solve customer problems more effectively.	
Website Management	Website management includes maintaining and optimizing the performance of e-commerce websites.	Big Data helps detect and fix problems quickly, ensuring the website always operates stably.	Use data analytics to predict and prevent problems before they happen, ensuring your website is always ready to serve customers.

Table 12: Metrics and KPIs

III.   Theoretical Foundations

1) Relevant Theories and Frameworks

a) Resource-Based View (RBV)

Resource-based theory (RBV) posits that a firm's unique resources and capabilities are the source of sustainable competitive advantage.

Application in Big Data: In the field of building and developing e-commerce websites, Big Data technology is considered a strategic resource. Using big data to optimize website development processes can create a competitive advantage through improved operational efficiency and user experience. For example, analyzing user data to optimize website appearance and functionality.

b) Dynamic Capabilities Theory

Dynamic capabilities theory posits that a business's ability to integrate, build, and restructure internal and external capabilities in response to a changing environment is a decisive factor in success.

Applications in Big Data: Big Data technology helps e-commerce businesses develop dynamic capabilities by providing tools and techniques to analyze and use big data. This helps businesses quickly adapt to changes in the market and optimize website development processes. For example, use data analytics to predict market trends and adjust website development strategies.

c) Information Processing Theory

Information processing theory holds that an organization's effectiveness depends on its ability to collect, process, and use information effectively.

Applications in Big Data: Big Data technology provides methods and tools to collect, process and analyze big data from e-commerce website development activities. This helps businesses improve operational efficiency by making data-driven decisions and optimizing website development processes. For example, use data analytics to optimize website performance and improve user experience.

2) Conceptual Models

a) Conceptual Model of Website Development Process Optimization

This model illustrates how Big Data technology can be used to optimize e-commerce website development processes. Elements include collecting data from user behavior, analyzing the data to identify areas for improvement, and implementing changes based on the results of the analysis.

For example: Use data from website visits to optimize the user interface and improve page loading speed, thereby enhancing user experience and increasing conversion rates.

b) Conceptual Model of Performance Optimization

This model illustrates how Big Data technology can be used to improve the operational efficiency of key processes in e-commerce website development, including order management, inventory management, logistics , and customer service.

For example: Use data analytics to predict demand and optimize inventory levels, minimizing storage costs and ensuring goods are always available to customers.

These theories and conceptual models provide a solid theoretical foundation to understand how Big Data technology can be applied to improve operational efficiency in the field of e-commerce website construction and development. Applying these theories helps businesses optimize operational processes and functions, thereby improving operational efficiency and creating sustainable competitive advantages.

IV.   Moderating and Mediating Factors

1) Organizational Factors

a) Leadership

Leadership vision and commitment: Leadership needs to have a clear vision about applying Big Data technology and be committed to supporting related projects. Support from leadership will accelerate implementation and ensure necessary resources.

Strategic decisions: Leaders need to make strategic decisions about investing in technology, training employees, and developing data management processes.

b) Culture

Data culture: Create an organizational culture that encourages the use of data in every business decision. This includes encouraging employees to use data to make decisions and solve problems.

Acceptance of change: Organizational culture needs to be flexible and willing to accept new technological and process changes.

c) Data Governance

Data management: Establish data management policies and processes to ensure accuracy, security, and compliance with legal regulations.

Data quality: Ensure the data collected and stored is high quality, reliable and usable.

d) Technical Expertise

Technical expertise: Staff should have knowledge and skills in Big Data, Angular, TypeScript and MongoDB technologies. This includes continuous training and updating new knowledge.

Cross-industry collaboration: Encourage collaboration between technical and business departments to ensure Big Data solutions meet real business needs.

2) Technological Factors

a) Data Integration

Data integration: The ability to integrate data from many different sources is an important factor in creating an effective Big Data system. This includes using tools and techniques to consolidate data from disparate systems.

b) Analytical Capabilities

Analytical capabilities: Use powerful analytics tools to process and analyze big data. This includes applying machine learning and artificial intelligence algorithms to extract value from data.

c) Scalability

Scalability: The system needs to be scalable to handle increasing amounts of data without affecting performance. This includes the use of distributed architectures and flexible data storage technologies such as MongoDB.

d) Security

Security: Ensure data safety by applying security measures such as encryption, access control, and system monitoring. This is especially important in protecting customer information and sensitive data.

3) Environmental Factors

a) Competitive Intensity

Competitive intensity: The level of competition in the e-commerce industry can motivate businesses to apply Big Data technology to improve operational efficiency and create competitive advantages.

b) Regulatory Environment

Legal environment: Legal regulations related to data security and privacy can affect how Big Data systems are deployed and managed. Businesses need to comply with these regulations to avoid legal risks.

c) Market Dynamics

Market Dynamics: Changes in customer needs and market trends can influence the adoption of Big Data technology. Businesses need to be flexible and quickly adapt to these changes to stay competitive.

4) Influence on Implementation and Impact

a) Organizational Factors

Leadership and organizational culture: Support from leadership and a positive organizational culture will promote the implementation of Big Data technology, helping employees easily accept and use new technology.

Data management and technical expertise: Effective data management and staff with high technical expertise will ensure that Big Data systems are deployed and operated effectively.

b) Technological Factors

Data integration and analytics capabilities: The ability to integrate data from multiple sources and use powerful analytics tools will help businesses extract maximum value from data.

Scalability and security: A highly scalable and secure system will ensure that businesses can handle large amounts of data safely and efficiently.

c) Environmental Factors

Competitive intensity and market dynamics: High levels of competition and changes in customer needs will push businesses to apply Big Data technology to maintain competitive advantage.

Legal environment: Complying with legal regulations will help businesses avoid legal risks and effectively protect customer data.

V. Conceptual Model and Hypotheses

	Factors	Describe	Hypothesis
Big Data Technology Factors	Volume of data	Large volumes of data to process	Large data volume and variety will support better personalized product recommendations
	Variety of data sources	Diverse data sources, which can be structured and unstructured	
	Velocity of data processing	Fast data processing speed	Fast data processing speed will improve real-time analytics and decision making

	Veracity of data quality	Data reliability and accuracy	Better data quality and reliability will improve sales forecast accuracy
E-commerce Website Performance Factors	Website Usability	Ease of use of the website.	Ease of use and better user experience will lead to higher customer engagement and retention
	User Experience	User experience on the website	
	Personalization	Personalization on websites	Personalised recommendations will have a positive impact on sales and revenue
	Recommendations	Recommends suitable products for users	
	Real-time Analytics	Analytics Real-time data analytics	Real-time analytics will improve operational efficiency and the ability to respond to market changes
Business Impact Factors	Sales and Revenue	Sales and Revenue	Improving e-commerce website performance will contribute to increasing sales and revenue
	Customer Engagement	Level of customer interaction and participation	
	Operational Efficiency	Operational efficiency	Operational efficiency improvements from Big Data analytics will lead to reduced costs and increased profits
	Competitive Advantage	Competitive advantage	Exploiting Big Data technology will bring competitive advantage in the e-commerce market

Table 13: Conceptual Model and Hypotheses

This conceptual model and hypotheses are more aligned with your specific research topic and website development project. The key factors and relationships are focused on the impact of Big Data technology on e-commerce website performance and overall business outcomes.

VI.   Reflection and Engagement in the Resource Process

1) Evaluation of Development Tools and Libraries

a) Angular Framework

- **Strengths**: Modular architecture, TypeScript support, comprehensive ecosystem of libraries and tools

- **Weaknesses**: Steep learning curve, performance overhead for small/simple projects

- **Evaluation**: Angular has been a suitable choice for the complexity and requirements of the e-commerce website project, providing a robust and scalable framework.

b) MongoDB

- **Strengths**: Flexible schema, easy scalability, good fit for unstructured data in e-commerce

- **Weaknesses**: Potential issues with data consistency, need for careful data modeling

- **Evaluation**: MongoDB has been effective in storing and managing the diverse product, customer, and transaction data for the e-commerce website.

c) Other Tools and Libraries

- **Project Management**: Google's Project Manager , GitHub

- **Visualization and Analytics**: Draw.io, GanttChart

- **Evaluation**: The selected tools and libraries have been valuable in supporting the development workflow, collaboration, and data analysis needs of the project.

2) Assessment of Resource Effectiveness

a) Angular and MongoDB Performance

- The combination of Angular and MongoDB has enabled the team to build a responsive, data-driven e-commerce website that can handle large volumes of product and customer data.

- The real-time analytics and personalization features powered by the Big Data technology stack have been effective in improving user experience and driving business metrics.

b) Collaboration and Workflow

- The use of Google's Project Manager for project management and GitHub for version control has facilitated efficient collaboration among team members.

- The adherence to Agile software development methodologies has helped the team to adapt to changing requirements and deliver incremental updates.

3) Reflection on Team Collaboration and Workflow

a) Team Collaboration

- The four-member team has worked well together, leveraging each member's strengths and expertise to contribute to the various aspects of the project.

- Regular team meetings, clear communication, and mutual support have been key factors in the successful collaboration.

b) Development Workflow

- The Agile approach, with its emphasis on iterative development and continuous integration, has been effective in managing the complexity of the e-commerce website project.

- The use of project management tools and development best practices has helped the team to stay organized, track progress, and address issues promptly.

Overall, the development tools, libraries, and workflow processes employed in this project have been well-suited to the requirements of the e-commerce website and the Big Data research topic. The team's effective collaboration and adherence to best practices have contributed to the successful implementation of the project.

4) Reflect on the Research Process

During the process of researching the application of Big Data technology in building and developing e-commerce websites, I have used many effective methods. I reviewed academic documents such as scientific articles, research reports and specialized books to gain an in-depth understanding of the trends and applications of Big Data in this field. Besides, I also interviewed experts in the e-commerce industry and Big Data technology to collect practical experiences and in-depth opinions.

5) Engage with Resources

During my research, I interacted with many different resources. Academic documents such as articles in prestigious journals and case studies on Big Data applications in e-commerce have provided me with extensive theoretical knowledge. I also interviewed e-commerce website developers, Big Data experts and e-commerce business managers to better understand technology application challenges, trends and solutions. Big Data in this field. In addition, I have also collected and analyzed actual data from a number of e-commerce websites to have a realistic view of the effectiveness of Big Data application.

6) Identify Challenges and Solutions

During the research process, I encountered some challenges such as difficulty accessing some of the latest academic documents, or difficulty collecting enough factual data from e-commerce websites. To overcome these challenges, I proactively contacted universities and research centers to provide the latest materials. At the same time, I also expanded the scope of data search and contacted more e-commerce businesses to collect enough analytical data.

7) Document Learning and Insights

This research process has brought me many valuable lessons and observations. I learned how to approach and analyze problems comprehensively, combining theory and practice. I recognize the importance of engaging with a variety of resources, from academic literature to practical experts, to gain deep insights into the subject. These lessons and observations will be very useful when I build and develop my e-commerce website, especially in applying Big Data technology to optimize online business activities.

VII.   Recommendations for Future Improvements

1) Identify Areas for Improvement

➢ **Performance Optimization**: Optimize page load speed and website performance to improve user experience.

➢ **Data Management**: Improves the data management process in MongoDB to ensure consistency and performance when handling large amounts of data.

➢ **User Experience Enhancements**: Enhance personalization and product recommendations to enhance customer satisfaction.

2) Propose Specific Actions

➢ **Implement Caching Solutions**: Use caching techniques to reduce page load times and improve overall website performance.

➢ **Conduct User Testing and Feedback Sessions**: Organize user testing sessions to collect feedback and improve the user interface based on actual needs.

➢ **Enhance Data Analytics Capabilities**: Integrate advanced data analytics tools to better understand user behavior and optimize marketing strategies.

3) Develop a Continuous Improvement Plan

➢ **Regular Review Meetings**: Set up regular meetings to review progress, identify problems, and discuss opportunities for improvement.

➢ **Iterative Development**: Encourage an iterative development process to continuously integrate feedback and improve the product.

➢ **Documentation of Best Practices**: Document best processes, tools, and methods for easy future reference and adoption.

4) Adopt Agile Development Practices

➢ **Scrum Methodology**: Apply the Scrum method to divide work into small sprints, helping the team easily track progress and respond quickly to changes.

➢ **Daily Stand-up Meetings**: Conduct daily stand-up meetings to update work status and quickly resolve arising issues.

5) Utilize More Efficient Project Management Tools

➢ **Explore Advanced Project Management Software**: Use project management tools like Jira or Asana to optimize workflows and enhance project progress tracking.

➢ **Integration with Version Control Systems**: Integrate project management tools with version control systems (like Git) to ensure cohesion and ease of teamwork.

C. Conclusion

In conclusion, the rapid development of Big Data technology has opened up numerous opportunities for e-commerce businesses, particularly in enhancing operational efficiency. This research has thoroughly evaluated the impact of applying Big Data technology in the construction and development of e-commerce websites, focusing on several key areas.

Firstly, the research has determined the significant role and potential of Big Data technology in optimizing the operations of e-commerce websites. By analyzing specific applications of Big Data across various stages of building, operating, and developing these websites, the research has highlighted how Big Data can drive performance improvements such as increased sales, optimized user experience, and improved business processes.

Secondly, the research has identified the challenges and risks associated with implementing Big Data in the e-commerce industry. These insights are crucial for businesses to navigate potential pitfalls and leverage Big Data effectively.

Furthermore, the research has proposed strategic recommendations to maximize the benefits of Big Data in e-commerce. These strategies are designed to help businesses harness the full potential of Big Data, thereby enhancing their operational efficiency and competitiveness in the market.

The findings of this research underscore the importance of Big Data technology in the digital age, where it serves as a pivotal factor in the growth and development of e-commerce. By providing detailed and valuable information, Big Data enables businesses to optimize their strategies and enhance customer experiences.

Through a comprehensive approach that includes both primary and secondary research, this research has provided a holistic view of the benefits and challenges of applying Big Data technology in e-commerce. The insights gained from interviews and surveys with experts, along with the analysis of previous studies, have contributed to a deeper understanding of this field.

Ultimately, this research not only sheds light on the current role of Big Data in e-commerce but also opens up new avenues for future research. It offers practical solutions for businesses aiming to improve their operational efficiency and competitiveness through the effective use of Big Data.

By addressing the problem from multiple perspectives, this research provides a well-rounded view of the impact of Big Data technology on e-commerce website operations. The results will aid e-commerce businesses in better understanding how to apply Big Data to achieve greater efficiency and competitive advantage in the market.

D.   References

Blog, s., 2023. *The Complete Guide To The Impact Of Big Data On E-commerce In 2023 | SpotSaaS Blog.*
[Online]
Available at: https://www.spotsaas.com/blog/big-data-ecommerce/
[Accessed 31 7 2024].

Bouchrika, I., 2024. *Primary Research Vs Secondary Research: Definitions, Differences, and Examples.*
[Online]
Available at: https://research.com/research/primary-research-vs-secondary-research
[Accessed 30 7 2024].

DeVault, G., 2020. *Here Are the Advantages and Disadvantages of Quantitative Research.* [Online]
Available at: https://www.liveabout.com/quantitative-research-advantages-and-disadvantages-2296728
[Accessed 31 7 2024].

Gaille, L., 2019. *13 Pros and Cons of Quantitative Research Methods.* [Online]
Available at: https://vittana.org/13-pros-and-cons-of-quantitative-research-methods
[Accessed 31 7 2024].

institutvert.org, 2024. *Quantitative Research Advantages And Disadvantages - Institutvert.org.* [Online]
Available at: https://www.liveabout.com/quantitative-research-advantages-and-disadvantages-2296728
[Accessed 31 7 2024].

Lim, W. M., 2024. *What Is Qualitative Research? An Overview and Guidelines. Australasian Marketing Journal (AMJ).* [Online]
Available at: https://doi.org/10.1177/14413582241264619
[Accessed 30 7 2024].

Mai, T., 2022. *Big Data eCommerce - Definition, Example, Insights of 2022..* [Online]
Available at: https://magenest.com/en/big-data-ecommerce/
[Accessed 31 7 2024].

Radef, A., 2023. *Quantitative Research Advantages & Disadvantages-Helpfull.* [Online]
Available at: https://helpfull.com/blog/10-advantages-disadvantages-of-quantitative-research
[Accessed 31 7 2024].

Riddle, J., 2020. *How Will Big Data Transform E-Commerce Marketplaces?.* [Online]
Available at: https://learn.g2.com/big-data-ecommerce
[Accessed 31 7 2024].

www.appinio.com, n.d. *What Is Secondary Research? Types, Methods, Examples | Appinio Blog.* [Online]
Available at: https://www.appinio.com/en/blog/market-research/secondary-research
[Accessed 30 7 2024].

E.Link Github Source code

Link source code: https://github.com/Vietanh12468/FinalProject-TayViet-Accessory-Store-Management