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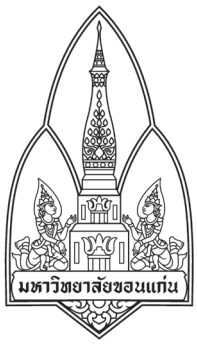
FIRST EDITION

# Structural Equation Modeling in Business Research

## A Practical Approach for Business Research Using Amos

Chavis Ketkaew • Phaninee Naruetharadhol •
Nathatenee Gebsombut • Sasichakorn Wongsaichia • Wutthiya Srisathan

Khon Kaen University
International College

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Chavis Ketkaew

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# Preface: About it book

This instructional textbook was designed to assist students who use Structural Equation Modelling (SEM). It was written specifically for college students majoring in business at Khon Kaen University's International College to familiarize them with the Structural Equation Modelling (SEM) as applied to business. The text was written informally to be user-friendly and easy to understand, and it is filled with explanations and examples.

I would like to acknowledge that several students from previous semesters proposed changes and improvements, caught errors, and helped make this textbook more valuable practical learning tool.

Asst. Prof. Chavis Ketkaew

***STRUCTURE OF THE BOOK***

Chapter 1: Fundamentals of Business Research

Chapter 2: The Structural Equation Modelling in Business Research Process

Chapter 3: Data and Data Collection

Chapter 4: Measurement Model Assessment

Chapter 5: Structural Equation Model Assessment

Chapter 6: Communication the Structural Equation Model Results

Chapter 7: Advanced Action I: Multigroup Analysis

Chapter 8: Advanced Action II: Second-order Analysis

## About the Authors

Chavis Ketkaew

- Chavis Ketkaew is an assistant professor of management at the International College, Khon Kaen University, Thailand. He is the author of this book. His research interests include business management, behavioural economics, consumer research, market research, and business models.

Phaninee Naruetharadhol

- Phaninee Naruetharadhol is an assistant professor of management and the director of the Center for Sustainable Innovation at the International College, Khon Kaen University, Thailand. Her research interests involve organizational behavior and innovation management.

Nathatenee Gebsombut

- Nathatenee Gebsombut is a lecturer at the International College, Khon Kaen University (KKUIC). Her research interests include customer relationship management, e-business management, and technology adopt.

Sasichakorn Wongsaichia

- Sasichakorn Wongsaichia is a lecturer at the Center for Sustainable Innovation and Society, managed by the International College, Khon Kaen University, Thailand. Her research interests include customer behavior, qualitative research, and sustainability.

Wutthiya Srisathan

- Wutthiya Srisathan is a lecturer at the Center for Sustainable Innovation and Society, managed by the International College, Khon Kaen University, Thailand. His research interests involve open innovation, inferential statistics, finance, and eco-innovation.

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# CHAPTER 1
# Fundamentals of Business Research

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## Learning Objectives

After studying this chapter, you should be able to:

**LO1** To understand the purpose and distinct focus of business and management research.

**LO2** To identify the stages of the research process that must be completed.

**LO3** To determine the various types of research studies conducted in business.

# 1.1 INTRODUCTION

This book is intended to assist researchers in completing their research projects, regardless of whether they are undergraduate or postgraduate business and management students or managers. It prepares an easy-to-follow guide for research while also emphasizing the truths of conducting study and the more ordinary difficulties. Furthermore, the book is intended to guide the research process and equip researchers with the mandatory comprehensions and expertise to conduct research from the initial stages of brainstorming a study matter to communicating the program statement. Finally, it will serve as a guide or instruction for researchers on how to conduct their study.

After reading the book, researchers will become acquainted with various research philosophies and approaches to reasoning, and multiple strategies, techniques, and procedures for tackling the research project. Equally important, they will understand that there is no single most acceptable method for conducting all studies. Instead, they will be aware of the choices they will face and how those choices will affect what they can learn. This will enable researchers to make informed decisions about the appropriate research philosophy, reasoning perspectives, policies, methods, and practices for their specific research project and justify them. In choosing and implementing these systems and procedures, researchers will also recognize the value that practical application of information technology can add to the study.

Researchers will unavoidably scrutinize various publications and reports during the study. Many of these will correspondently use the terms "research method" and "research methodology," with methodology being a more detailed term for the same concept.. The book has a more specific usage of these terms in its book. The period "methods" are used throughout the book to refer to the techniques and strategies used to gather and analyse statistics. As a result, the book covers questionnaires, examinations, discussions, and quantitative (statistical) and qualitative (non-statistical) analysis approaches, which researchers have probably deduced from the subject, the book's primary core.

By contrast, the term methodology mentions the theory governing the conduct of the study. It believes that researchers must have a basic understanding of it to make informed choices about the survey. It discusses a variety of philosophical assumptions that can be used to conduct research and their implications for the method or methods used.

# 1.2 BUSINESS AND MANAGEMENT RESEARCH

Business research is the process of finding out everything there is to know about a business and using that information to increase sales and profits. This study enables businesses to determine which product or service is the most profitable or in high demand. Simply put, it gathers information or knowledge for professional or commercial purposes to evaluate a business's potential and goals. In addition, business research contributes to designing tactics, which are specific, time-bound operations that carry out a strategy. Furthermore, business

research can be utilized to assist a manager in determining which of various techniques is most likely to succeed in executing the desired method (Zikmund et al., 2012).

As a result, international business and marketing research necessitate the application of methodological approaches capable of coping with the field's changing nature and complexity and the consequent expansive theoretical agenda. When researchers choose an analytical approach, they must carefully consider the purpose of the research, the theory behind it, and the available empirical evidence.

In books about research methods, research process models demonstrate the importance of two interconnected parts (Bell et al., 2022). The first part involves measuring the conceptual variables of a theory in the real world, while the second part involves using these measures to test for links between the abstract variables anticipated by the theory. Historically, a common approach to management research has been to separate these two components. For instance, a researcher may conduct exploratory component analysis to ensure that the measures accurately reflect the underlying variables before generating scales for linear or logistic regression to identify significant predictors consistent with the theory. In this approach, the model and analysis that link the measures to their hypothesized underlying constructs, and the model and analysis that evaluate the relationships between the underlying constructs are separate. Consequently, the structural equation modeling (SEM) approach has been widely used in business and management research to validate the relationships between each indicator and variable.

## 1.3 STEP IN RESEARCH PROCESS

The research process is a series of scientific stages used to conduct research. The *seven-step* research process is an essential component of a research proposal, as shown in **Figure 1**, which outlines the commitment required to carry out a research project. Each step in the process is dependent on the preceding one. The procedure starts with identifying the research problem and proceeds consecutively through subsequent phases. Generally, researchers follows seven steps when conducting research. To begin the research process, a research proposal is required, which serves as an approval for the research project, regardless of whether it can be performed. Therefore, when writing a research proposal, it is crucial to accurately convey your research's goals and specific objectives.

### STEP 1: IDENTIFY AND DEFINE THE RESEARCH PROBLEM

The research process begins with the identification of a problem or the formulation of a research topic. The research problem can arise from anything the agency perceives as a problem, a need for knowledge or information, or a desire to identify a national recreation trend. However, the research issue arises due to a continuous phenomenon or concern.

According to academic literature, theory, or experience, a research problem requires in-depth analysis and investigation to better understand and address an issue or subject. In several social disciplines, the research problem is frequently phrased as a question. A research

problem does *not* indicate how to achieve something, make a broad or imprecise assertion, and pose a value judgment.

**SCENARIO:**

A company wants to introduce a new product to the market but is unsure of its potential demand and acceptance. It is necessary to determine the target market's preferences and willingness to purchase the new product.

**SOLUTION:**

The research problem is defined as the need to investigate the consumers' perception, attitude, and behavior towards the new product, as well as the competition, pricing strategy, and marketing mix elements that affect its success. The researcher will then proceed to develop research questions and objectives to guide the study, such as "What are the key features and benefits that consumers are looking for in the new product?" and "What are the most effective marketing channels and messages to promote the new product to the target market?"


***Figure 1*** *Steps in business research process*

## STEP 2: CONDUCT A LITERATURE REVIEW

After identifying and defining the research problem, the next stage reviews the current literature. Next, the researcher must gain further knowledge about the subject under investigation, and to accomplish this, a literature review must be conducted on the study's topic. This step helps establish a foundational understanding of the problem area and informs the researcher about previous investigations, methods, and results in the problem area.

**SOLUTION:**

In the case of a company wanting to introduce a new product to the market, Step 2: Conduct a literature review would involve conducting a thorough review of existing literature on the target market's preferences, behaviors, and attitudes towards similar products. This step would help the researcher gain a better understanding of the market and identify any gaps in the existing knowledge. Additionally, the literature review could inform the researcher about previous investigations, methods, and results related to product development, pricing strategy, and marketing channels. The insights gained from the literature review would then be used to refine the research questions and hypotheses for the subsequent stages of the research process.

**Why Is a Hypothesis Necessary?**

1. Hypotheses contribute to the validation of scientific activities.
2. Researchers can ascertain whether their hypothesis is correct or not through testing.
3. Hypotheses serve as a guide for researchers in the pursuit of new knowledge.
4. A well-formulated hypothesis enables savings of time and resources.
5. Hypotheses enable researchers to collect and utilize pertinent data.
6. A well-formulated hypothesis can lead to an illuminating conclusion.
7. Hypotheses assist in focusing on specific concerns and direct investigations into the subjects that need to be explored.
8. Hypotheses aid in the data collection process.
9. A well-supported hypothesis adds to the validation and strengthening of a theory.

***Figure 2*** | *The need for hypotheses*

## STEP 3: CONSTRUCT A HYPOTHESIS

A hypothesis is a statement or assumption made by a researcher or scientist to explain a phenomenon or predict a relationship between variables. It is an initial proposed explanation that is based on limited evidence and requires further investigation and testing to confirm or reject its validity. In business research, a hypothesis is used to explain a phenomenon or forecast a relationship. A hypothesis must comply with four evaluation criteria. Firstly, it must specify an anticipated relationship between variables. Secondly, A hypothesis should be testable and falsifiable, meaning that it can be subjected to empirical testing and potentially proven false or supported by data. Thirdly, it must be consistent with the current body of

knowledge. Finally, it should be stated as straightforwardly and concisely as possible. In research, Hypotheses serve as guides for research and are an essential component of the scientific method. **Figure 2** illustrates the need for hypotheses. A hypothesis must be a definite, testable, and predictable assertion guided by theory and prior evidence. Various ways of expressing a hypothesis can be employed during the research process.

## COMMON TYPES OF HYPOTHESES

Various statistical methods are often used to evaluate hypotheses. This type of analysis requires two types of hypotheses: **null hypotheses ($H_0$)** and **alternative hypotheses ($H_1$ or $H_a$)**.

In statistical hypothesis testing, a null hypothesis **($H_0$)** is a statement that suggests there is no significant difference or relationship between variables being studied. It assumes that any observed differences or relationships are due to chance or random sampling error. The null hypothesis is often used as a baseline or default position that is compared to an alternative hypothesis ($H_1$), which suggests that there is a significant difference or relationship between the variables being studied.

The alternative hypothesis **($H_1$ or $H_a$)** is a statement that contradicts the null hypothesis and is usually what researchers are interested in demonstrating. It is formulated to test a specific hypothesis or research question and provides evidence that there is a real relationship or effect between the variables. In general, the alternative hypothesis predicts a difference or relationship between variables that cannot be explained by chance or sampling error. The alternative hypothesis can be one-tailed, where it predicts a specific direction of the relationship or difference, or two-tailed, where it predicts that there is a difference or relationship between variables but does not specify the direction of the effect.

| | |
|---|---|
| **Null hypothesis** | **Scenario 1:** If seeing this advertisement has no impact on how much people desire the product, and if they view the advertisement twice as much, they will not buy the product any more than people who have not seen an advertisement.<br><br>**Scenario 2:** There is no difference in student performance between those who use Facebook to learn English and those who do not. As a result, there is no distinction between the two student groups. |
| **Alternative hypothesis** | **Scenario 1:** If seeing this advertisement increases people's desire for the product and they watch it twice or more, they are more likely to buy the product than those who have not seen it.<br><br>**Scenario 2:** There is a distinction between pupils who use Facebook to improve their English proficiency and those who do not. Thus, a distinction exists between the two groups of students. |

According to the null hypothesis, the dependent variable will not change because of any changes made to the independent variable. It states that the independent variable will not affect the dependent variable in any way. On the other hand, the experimental hypothesis, also known as the alternative hypothesis, may predict the change that the independent variable will bring about in the dependent variable.

For instance, let us consider a hypothetical group of scientists and business practitioners who want to investigate whether viewing a particular advertisement increases consumers' likelihood of purchasing a specific commodity. Their two hypotheses would be:

## HYPOTHESIS TESTING

To compare the researcher's assumptions based on their understanding of the situation with empirical reality, the hypotheses should be tested. In other words, how do our expectations match up with empirical reality? The process can be described as follows:

1. Determine the type of hypothesis to test.
2. Calculate the sample size for the population under investigation.
3. Collect your data.
4. Decide on the level of significance $(\alpha)$.
5. Compare the p-value with the level of significance to determine whether to reject or accept the null hypothesis.
6. Summarize the results.

It is evident that the research question and hypothesis are the backbone of any thesis writing process. These two components determine the success or failure of a study. Without well-defined research questions and hypotheses, it is impossible to develop a clear research objective, purpose, or problem. Therefore, it is crucial to write both the research question and hypothesis carefully. The hypothesis should be clear, relevant to the study, tested in the field, verifiable, and most importantly, feasible. If it lacks any of these attributes, the results may be unsatisfactory.

## ERRORS IN HYPOTHESIS TESTING

While hypothesis testing can be useful, there is a risk in interpreting the results. incorrectly There are two types of mistakes or errors that may occur when evaluating the findings. First, the data collection is examined, and then a decision on the null hypothesis is made. Either the data provided rejects it, or the researchers fail to reject it. However, our conclusions about an experiment may not always reflect reality, and mistakes may occur in the analysis **Type I** and **Type II errors** are the two categories of errors in hypothesis testing.

- Type I Error: This occurs when you reject a true null hypothesis.
- Type II Error: This occurs when you accept a false null hypothesis.

When testing a hypothesis, there are two possible outcomes: *correct* and *incorrect*. The illustration below (**Figure 3**) summarizes both these errors.

Even when the conclusion is correct, we can still make errors in judgment when testing a hypothesis. This occurs for the following reasons:

1. Your study road map is ineffective.
2. Your population or sampling is insufficient or inappropriate.
3. Your statistical analysis and methodology are dubious.
4. Your conclusion is incorrect.

What are the implications of both errors? Let's consider the following example. Suppose a business researcher wants to determine the effectiveness of new software application. They test it on a sample population and carry out follow-up tests.

**Type I Error** The first type of error might occur if the null hypothesis is rejected while it is true. This indicates that business researchers preferred the alternative explanation. The other possibility was that the software application was effective even when it wasn't. As a result, the researcher exaggerated the platform's efficacy.

**Type II Error** The second error might occur if the null hypothesis is not rejected when it should be. This suggests that the software application was effective, but the business researcher did not believe it was. As a result, resources were wasted, and the project was abandoned.

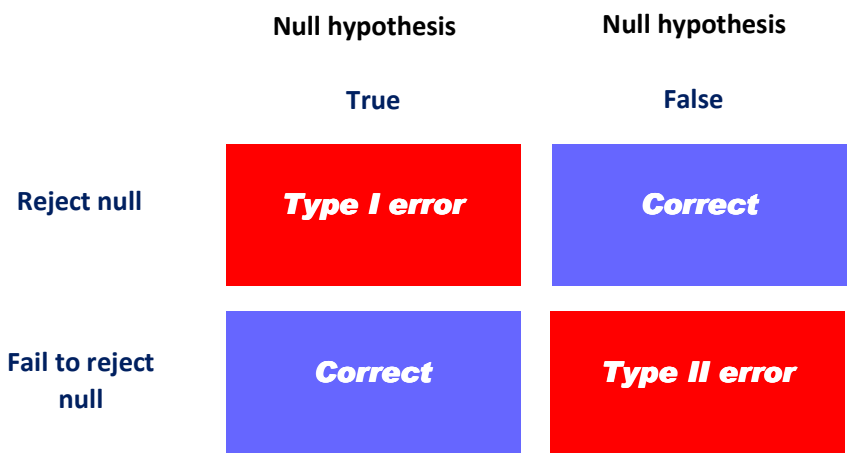


***Figure 3*** | *Errors in hypothesis testing*

## STEP 4: DESIGN THE RESEARCH

Afterward, the researcher must determine a research design. The research design establishes how study materials will be gathered. Depending on the research objectives, one or more research methods, such as an experiment, survey, or interview, may be used. A survey may be appropriate in certain research circumstances, while interviews, case studies, or observation may be preferred in other instances. Essentially, research design elucidates "how" to do