

Teaching guidelines

Research Decisions Unlocked - A Practical Introduction to Multi-Criteria Decision Models

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Material information

This teaching material introduces Multiple Criteria Decision-Making (MCDM) methods as a family of research approaches designed to address complex, interdisciplinary decision-making problems. Developed primarily for PhD students and advanced master students, the material begins by explaining why contemporary decision-making challenges are becoming increasingly difficult to study, highlighting characteristics such as multiple criteria, uncertainty, conflicting objectives, data intensity, and interdisciplinary contexts. It then presents the distinction between quantitative and qualitative methods and discusses the growing need for approaches that integrate both perspectives.

To demonstrate how decision-making problems can be translated into research designs, the material employs a practical example related to foreign direct investment location attractiveness and the influence of geopolitical-related factors on managerial decision-making. Through this example, students learn how a broad research question can be operationalized into a structured decision-making problem suitable for scientific investigation. The material further introduces MCDM methods as a response to the key challenges of decision-making research and discusses their growing popularity across disciplines.

A particular focus is placed on DEMATEL (Decision-Making Trial and Evaluation Laboratory), presented as an example of an MCDM method capable of identifying and visualizing cause-and-effect relationships among interrelated factors. Rather than concentrating on mathematical calculations, the material emphasizes methodological design and practical implementation. Students are guided through the three major stages of a DEMATEL study: factor identification and data collection, analytical processing, and result modeling. Particular attention is given to questionnaire design, expert selection, data collection strategies, and software solutions such as MATLAB, R, Super Decisions, and Excel-based tools.

The resource also explains how DEMATEL outputs can be interpreted, including the identification of driving and dependent factors, the strength of interactions, direct and indirect influences, and feedback loops within complex systems. By focusing on the practical application of the method, the material helps learners understand how DEMATEL can support rigorous analysis of decision-making phenomena in a variety of contexts.

While designed primarily for doctoral-level courses in research methodology, management science, international business, and decision analysis, the material can also serve as supplementary content for master's programs in business analytics, sustainability, public policy, and operations management.

Learning objectives and outcomes

This teaching material focuses on how Multiple Criteria Decision-Making (MCDM) methods can support the analysis of complex decision-making problems, moving beyond traditional quantitative-versus-qualitative distinctions to provide structured approaches for evaluating multiple, often interrelated criteria. Its core objective is to help students understand the role of MCDM methods in contemporary research, including problem formulation, factor identification, data collection, analysis, and modeling, while critically assessing their advantages, limitations, and applicability across different research contexts.

Learning outcomes are categorized as follows:

Knowledge

- The student is able to explain the characteristics of complex decision-making problems and their implications for research design.
- The student understands the role of Multiple Criteria Decision-Making (MCDM) methods in addressing problems involving multiple and conflicting criteria.
- The student understands how cause-and-effect relationships can be analyzed within decision-making systems.

Skills

- The student is able to formulate a research problem as a decision-making problem suitable for MCDM analysis.
- The student is able to design a data collection process for DEMATEL, including questionnaire development and expert selection.
- The student can interpret DEMATEL outputs, including cause-and-effect relationships, driving factors, and dependent factors.

Social Competences

- The student can participate in discussions on methodological choices in decision-making research.
- The student appreciates the value of interdisciplinary perspectives in solving complex decision-making problems.

Overview

The provided teaching materials—comprising a PowerPoint presentation and a video lecture—are designed to support doctoral-level instruction on Multiple Criteria Decision-Making (MCDM) methods, with a particular focus on the DEMATEL

(Decision-Making Trial and Evaluation Laboratory) technique. Both materials follow an identical structure, allowing instructors to deliver content either during live sessions or through asynchronous learning formats.

The lecture begins by discussing the growing complexity of contemporary decision-making problems, emphasizing characteristics such as uncertainty, conflicting objectives, multiple criteria, interdisciplinarity, and data intensity. It then introduces the traditional distinction between quantitative and qualitative research methods, highlighting the increasing need for approaches that combine the strengths of both perspectives. This discussion serves as a foundation for understanding the role of MCDM methods in modern research.

To illustrate the process of transforming a broad phenomenon into a researchable decision-making problem, the lecture uses an example concerning the influence of geopolitical-related factors on the perception of FDI-location attractiveness. Students are guided through the process of refining a research question, operationalizing concepts, identifying decision-makers, and defining the factors that shape investment decisions. This example demonstrates how the formulation of a research problem influences methodological choices.

The core section introduces MCDM methods as a family of techniques designed to address complex decision contexts involving multiple and often conflicting criteria. The lecture discusses the growing popularity of MCDM approaches across disciplines, including engineering, mathematics, management, social sciences, and environmental studies, emphasizing their interdisciplinary character. Particular attention is then given to DEMATEL, explaining how the method can be used to identify and model cause-and-effect relationships among interrelated factors.

The lecture subsequently walks students through the main stages of a DEMATEL study: factor identification and data collection, analysis, and modeling. Practical guidance is provided on literature-based factor selection, questionnaire design, expert involvement, alternative data collection approaches, and software solutions such as MATLAB, R, Super Decisions, and Excel-based tools. Rather than focusing on mathematical calculations, the material emphasizes research design decisions and methodological considerations.

The session concludes by demonstrating how DEMATEL results can be interpreted. Students learn how to identify driving and dependent factors, assess the strength of relationships, analyze direct and indirect interactions, and detect feedback loops within complex systems. Through this discussion, the lecture highlights how DEMATEL can help researchers better understand the structure and dynamics of decision-making phenomena.

Pre-lecture preparation

To get the most out of this lecture, students should refresh key concepts in strategic To get the most out of this lecture, students should refresh key concepts related to quantitative and qualitative research methods, as these form the foundation for understanding the methodological position of MCDM techniques. In particular, students should review the main characteristics, strengths, and limitations of both approaches, including the role of numerical data, statistical analysis, expert judgment, and subjective assessments in research.

Suggested usage

The provided teaching materials can be used both in traditional classroom settings and as asynchronous learning resources, allowing students to engage with the content at their own pace. The combination of a presentation and a recorded lecture gives instructors flexibility in how the material is incorporated into research methodology courses.

The material is best used as an introductory module to a broader series of seminars on research methods and decision-making analysis. It provides students with a conceptual understanding of MCDM methods and DEMATEL before they engage with more advanced methodological topics or software-based applications.

Depending on the course structure, the content can be delivered during a single lecture session as an overview of MCDM techniques or spread across multiple classes. In the latter case, individual stages of the DEMATEL process can be supplemented with practical exercises involving research question formulation, factor identification, questionnaire design, expert evaluation, and result interpretation.

Because the lecture focuses on methodological design rather than mathematical calculations, it serves as an effective foundation for later hands-on workshops and case-study discussions. This flexibility makes the material suitable for doctoral courses in research methodology, management science, decision analysis, and related disciplines where students are expected to critically evaluate and select appropriate research methods.

Engagement activities

This lecture can be supplemented with a range of interactive activities designed to enhance student engagement and deepen understanding of the topic. These activities are flexible and can be used either before the lecture to activate prior knowledge, or after to reinforce key concepts and encourage critical thinking. They are suitable for both live and asynchronous teaching formats.

Activity	Description
From a broad problem to a decision-making problem	<p>Objective: Enable students to learn how to transform a broad research topic into a precise and operationalizable decision-making research question.</p> <p>Activity: Students are provided with several broad topics, such as "the impact of geopolitics on business" or "sustainability in international trade." Working individually or in small groups, they reformulate these topics into specific decision-making problems by identifying decision-makers, decisions, and influencing factors. Students then present their revised research questions and explain why they are more suitable for MCDM analysis. The exercise concludes with a discussion on operationalization and research design.</p>
Identifying factors and designing a DEMATEL questionnaire	<p>Objective: To understand the factor identification stage and the principles of DEMATEL data collection.</p> <p>Activity: Using a selected decision-making problem, students conduct a brief literature search and create a preliminary list of factors that may influence the decision under investigation. They then design a two-part DEMATEL questionnaire, including factor significance assessment and interdependency evaluation using a Likert scale. Students compare their questionnaires and discuss the advantages and disadvantages of different data collection approaches, including single-stage versus multi-stage studies and individual versus group assessments.</p>
Interpreting a DEMATEL cause-and-effect map	<p>Objective: To develop the ability to interpret DEMATEL results and draw managerial or research implications.</p> <p>Activity: Students receive a completed DEMATEL graph or influence map generated from a real or hypothetical study. They identify driving factors, dependent factors, direct and indirect relationships, and potential feedback loops. Based on their findings, students prepare a short interpretation explaining how the decision-making system functions and which factors should receive the greatest managerial attention. The exercise concludes with a discussion on how DEMATEL results can support evidence-based decision-making.</p>

Post-lecture activities

Depending on the depth at which DEMATEL was discussed during the lecture, a natural follow-up activity is to explore the mathematical foundations of the method. Students can examine how expert evaluations are transformed into matrices, how the normalization process works, and how prominence and relation indicators are calculated. This deeper understanding helps students better interpret DEMATEL results and critically assess the assumptions behind the method.

Another valuable activity is to compare DEMATEL with other MCDM methods and investigate how different techniques contribute to our understanding of decision-making problems. The MCDM family is extensive, and each method was developed to address a particular analytical need. For example, AHP (Analytic Hierarchy Process) focuses on determining the relative importance of criteria through pairwise

comparisons, while ANP (Analytic Network Process) extends this approach by accounting for interdependencies among factors. TOPSIS aims to rank alternatives according to their distance from an ideal solution, whereas VIKOR helps identify compromise solutions in situations with conflicting objectives.

Students may also explore methods such as Interpretive Structural Modeling (ISM), which is used to uncover hierarchical relationships among factors, PROMETHEE, which supports ranking alternatives through preference-based comparisons, and ELECTRE, which helps eliminate less desirable alternatives through outranking procedures. Comparing these approaches allows students to appreciate that no single MCDM method is universally superior; rather, each provides a different perspective on the decision-making process.

As a final activity, students can apply one or several of these methods to a decision-making problem related to their own research interests and reflect on how the choice of method influences the type of insights generated. This exercise reinforces the importance of aligning methodological choices with research objectives and problem characteristics.
