Investigating the State of Teaching Multiple Attribute Decision-Making (MADM) Techniques Within Higher Education: A Case Study of Engineering Disciplines at the University of Manchester

Amirhossein Balali

PhD candidate, The University of Manchester

The University of Manchester

TIIKM ICEDU

THE 10TH INTERNATIONAL CONFERENCE ON EDUCATION 2024

"BRIDGING THE GAP BETWEEN RESEARCH AND PRACTICE IN EDUCATION: FOSTERING CREATIVITY, NEW CURRICULUM, AND ENTREPRENEURIAL SKILLS FOR LEARNERS AND EDUCATORS."

Introduction

- Decision-making is one of the key skills which is highly valued by employers.

- Contemporary decision-making problems often involve multiple criteria.

- Multiple Attribute Decision-Making (MADM) techniques are required to be taught to students.

- MADM is required for both industry and academia.
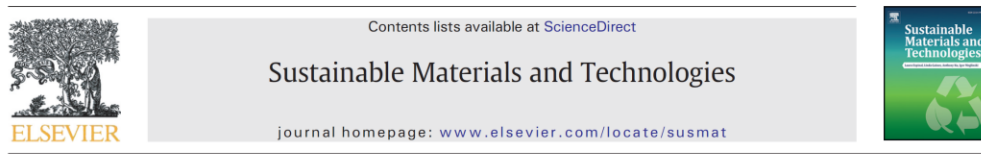
Introduction

- MADM is a sub-discipline of operations research that explicitly evaluates multiple conflicting criteria in decision making (both in daily life and in settings such as project management, business, government and medicine).

- Used since 1970 to structure and resolve decision-making problems.

Introduction

- Examples of using MADM for solving real-life problems

Sustainable Materials and Technologies 26 (2020) e00213

Contents lists available at ScienceDirect

Sustainable Materials and Technologies

journal homepage: www.elsevier.com/locate/susmat

Identification and selection of building façade's smart materials according to sustainable development goals

Amirhossein Balali, Alireza Valipour *

Operations Research Perspectives 10 (2023) 100263

Contents lists available at ScienceDirect

Operations Research Perspectives

journal homepage: www.elsevier.com/locate/orp

Analysing the impact of COVID-19 pandemic on the psychological health of people using fuzzy MCDM methods

Shafi Ahmad [a], Sarfaraz Masood [b,*], Noor Zaman Khan [c], Irfan Anjum Badruddin [d], Ompal [e], Ali Ahmadian [f,g,h], Zahid A. Khan [a], Amil Hayat Khan [i]

Reliability Engineering and System Safety 208 (2021) 107442

Contents lists available at ScienceDirect

Reliability Engineering and System Safety

journal homepage: www.elsevier.com/locate/ress

Ranking effective risks on human resources threats in natural gas supply projects using ANP-COPRAS method: Case study of Shiraz

Amirhossein Balali [a], Alireza Valipour [a,*], Rodger Edwards [b], Robert Moehler [c]

Sustainable Energy Technologies and Assessments 53 (2022) 102488

Contents lists available at ScienceDirect

Sustainable Energy Technologies and Assessments

journal homepage: www.elsevier.com/locate/seta

The novel augmented Fermatean MCDM perspectives for identifying the optimal renewable energy power plant location
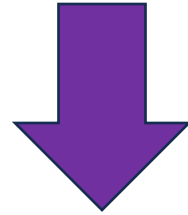
Samayan Narayanamoorthy [a], Thirumalai Nallasivan Parthasarathy [a], Subramaniam Pragathi [a], Ponnan Shanmugam [b], Dumitru Baleanu [c,d,e,*], Ali Ahmadian [f,g], Daekook Kang [h,**]
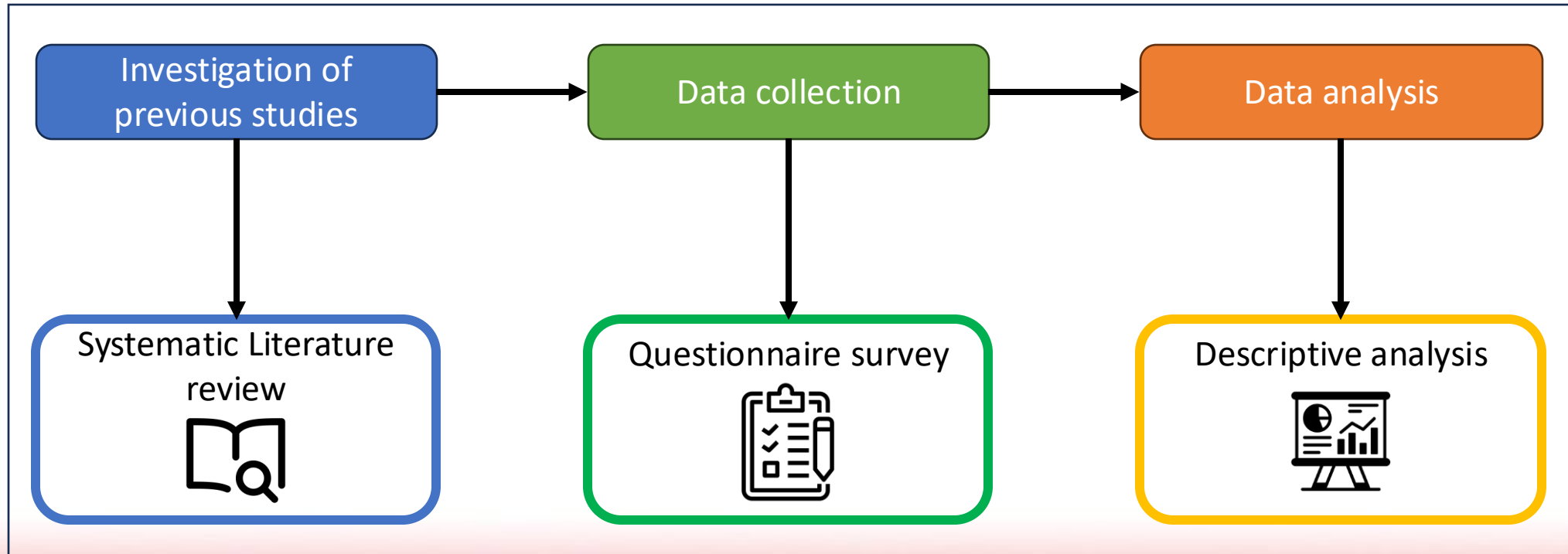
Introduction

- Considering the importance of teaching MADM techniques to students, the state of teaching such techniques is yet to be investigated.

- Aim: Investigating the state of teaching MADM techniques within higher education

- Case study: Engineering disciplines at the University of Manchester

Methodology

Methodology

Investigation of previous studies

Item	Description
Keywords	Multiple Criteria Decision Making OR Multi-Criteria Decision Making OR Multi-Criteria Decision-Making OR MCDM OR Multiple Criteria Decision Making OR Multi-Criteria Decision Analysis OR Multi-Criteria Decision-Analysis OR MCDA AND Higher Education OR universit* OR bachelor* OR undergraduate* AND teach*
Inclusion criteria	Written in English, focus on MADM, available in full text
Publication type	Journal articles, conference articles, conference proceedings, articles in press, book chapters, dissertations
Time window	Unrestricted

The University of Manchester

THE 10TH INTERNATIONAL CONFERENCE ON
EDUCATION 2024
"BRIDGING THE GAP BETWEEN RESEARCH AND PRACTICE IN EDUCATION: FOSTERING CREATIVITY, NEW CURRICULUM, AND ENTREPRENEURIAL SKILLS FOR LEARNERS AND EDUCATORS."

TIIKM ICEDU

Methodology
Questionnaire survey

Developing questionnaire

✓ Designed in two sections.

✓ Asked the respondents whether they teach MADM techniques within the units they are coordinating and the reason(s) for doing so.

Selection of respondents

✓ Coordinates of the engineering units in which the usage of MADM techniques is relevant were considered.

✓ 26 unit coordinators within 5 disciplines, including Mechanical Engineering, Civil Engineering, Aerospace Engineering, Chemical Engineering, and Electrical and Electronic Engineering, were identified.

✓ Coordinators were contacted via email.

Results and discussion
SLR

- **Three** studies were identified through the SLR

  - ✓ Two studies focused the evaluation of teacher using MADM techniques

  - ✓ One study focused on renewable energy selection as a part of a module
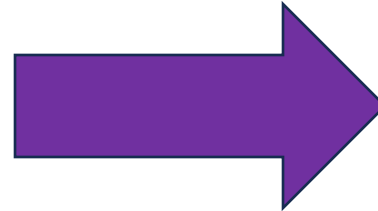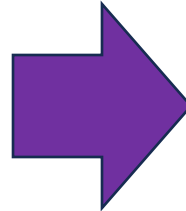
- **Three** techniques were used including

  - ✓ Analytic Hierarchy Process (AHP)

  - ✓ Analytic Network Process (ANP)

  - ✓ VIekriterijumsko KOmpromisno Rangiranje (VIKOR)
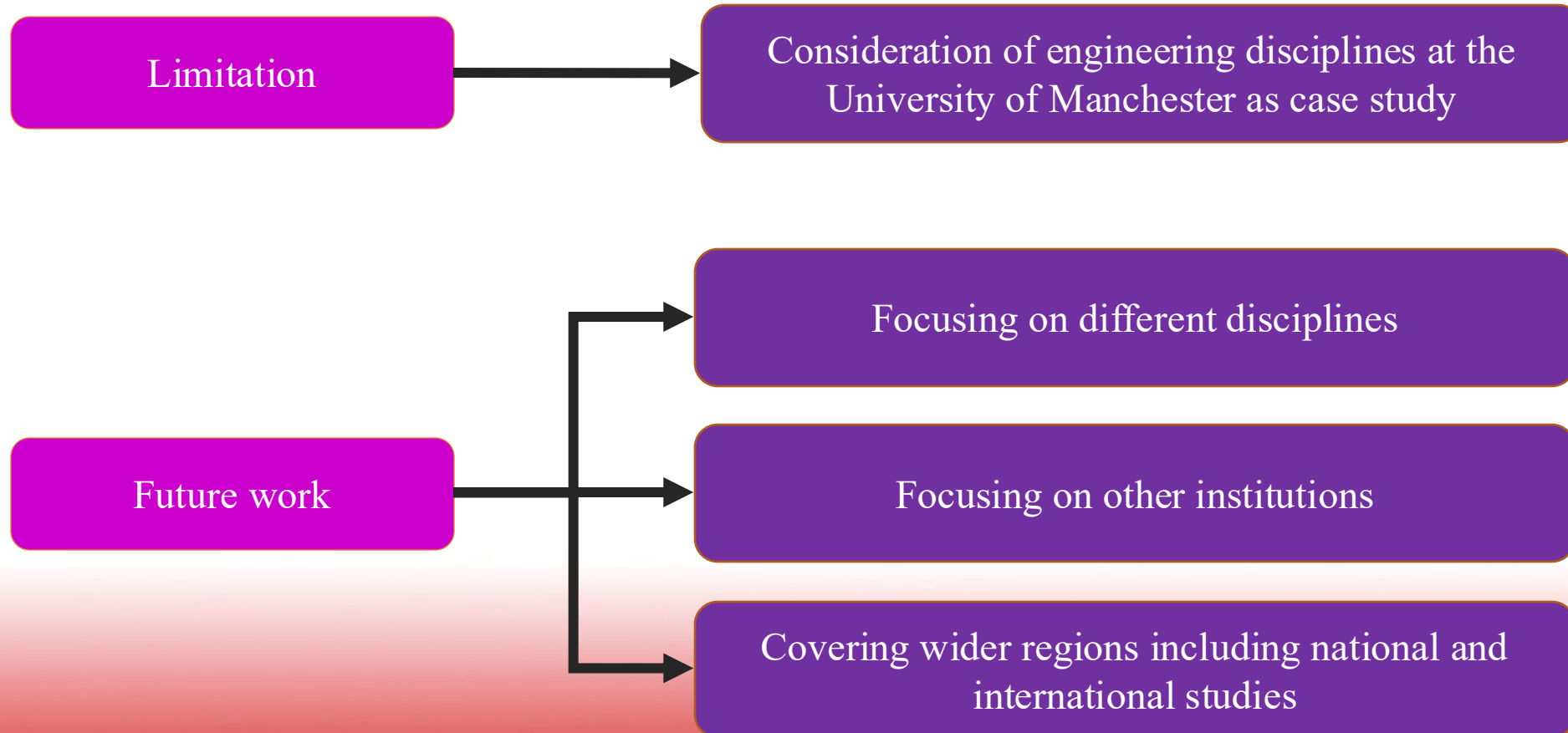
Results and discussion

Preliminary analysis

- Survey is still open.

- 66 percent of the coordinators did not teach MADM techniques.

- 34 percent of the coordinators teach MADM techniques, including AHP and ANP.

- Insufficient understanding of the coordinators about the relevance of MADM techniques with the Intended Learning Outcomes (ILOs) of the units was mentioned as the reason why such techniques are not taught. This necessitates the introduction of MADM techniques to academics and therefore increase such understanding.

- Focusing on famous, however old, MADM techniques implies the necessity of focusing more on novel MADM techniques in which many of the shortcomings of old MADM techniques are solved.

Limitation and future work

Limitation → Consideration of engineering disciplines at the University of Manchester as case study

Future work → Focusing on different disciplines

Focusing on other institutions

Covering wider regions including national and international studies