

# Multi-criteria decision-making in civil engineering – A PROMETHEE way

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# Summary

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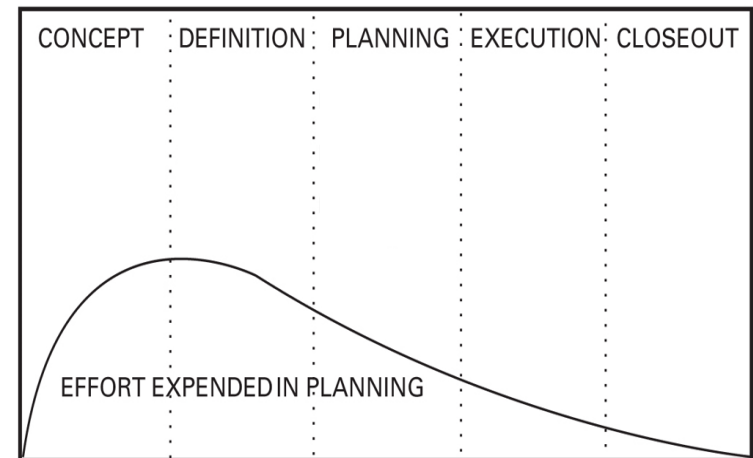
- Introduction
- Research background
- Methodology
- Results and discussion
- Conclusions

# Introduction

- Planning – the most important phase of decision-making process in civil engineering
- Quality decision-making based on stakeholders' collaboration is crucial in civil engineering project's early stages.

- Challenging for several reasons:

- Specific conditions of construction industry
- Investors' desires and attitudes
- Influence of various socio-economic and environment aspects




# Goals and objectives

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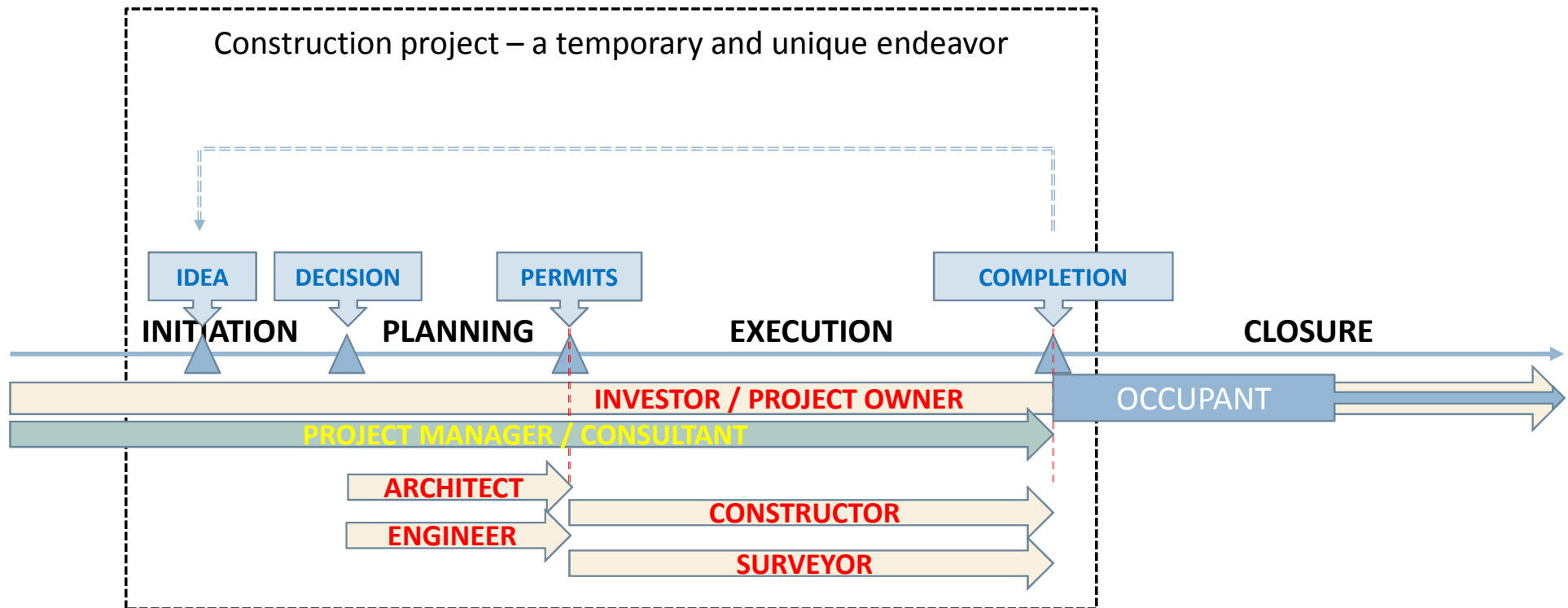
- The main objectives are:
  - To identify papers published in journals (indexed in Scopus and WoS) that use PROMETHEE method for solving various problems in civil engineering, construction industry, and construction project management
  - To create distribution of identified papers across the years
  - To create distribution of identified papers across the research areas
  - To create distribution of identified papers across the published journals
- The main goal is:
  - To identify problems that are mostly solved with PROMETHEE method
  - To identify future challenges and research opportunities

# Research background

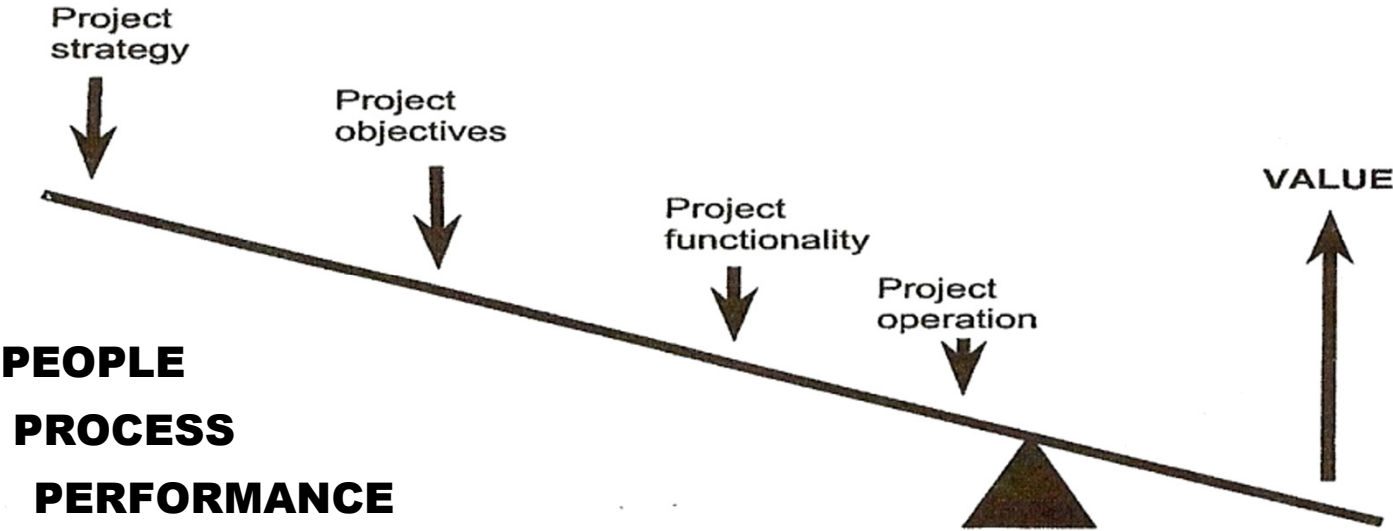
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- In general, Civil engineering sub-disciplines are:
  - Hidrotechnical Engineering, Geotechnical Engineering, Traffic and Transportation, Structural Engineering, and Construction Management
  
- According to **PMI (2013)**, project management involves **10 managerial fields**  
(Time, Cost, Quality, Procurement, Scope,  
Human resources, Communications, Integration, Risk, Stakeholder)
  
- Decisions drive projects!  **Critical success factor**

# Construction Project Life-Cycle



# Achieving value in construction projects



Source: Kelly, J., Male, S., Graham, D. (2004)

# Research background

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- Grimble and Wellard (1997):

„**Stakeholders** are any group of people, organized or not organized, who share a common interest or stake in a particular issue or system.”

- **Involving stakeholders in the decision-making process**

(Alvarez-Carillo 2010, Jajac 2009, Leyva-Lopez 2010, Macharis et al. 2004, Macharis et al. 2010, Macharis et al. 2012, Marović 2013, etc.)

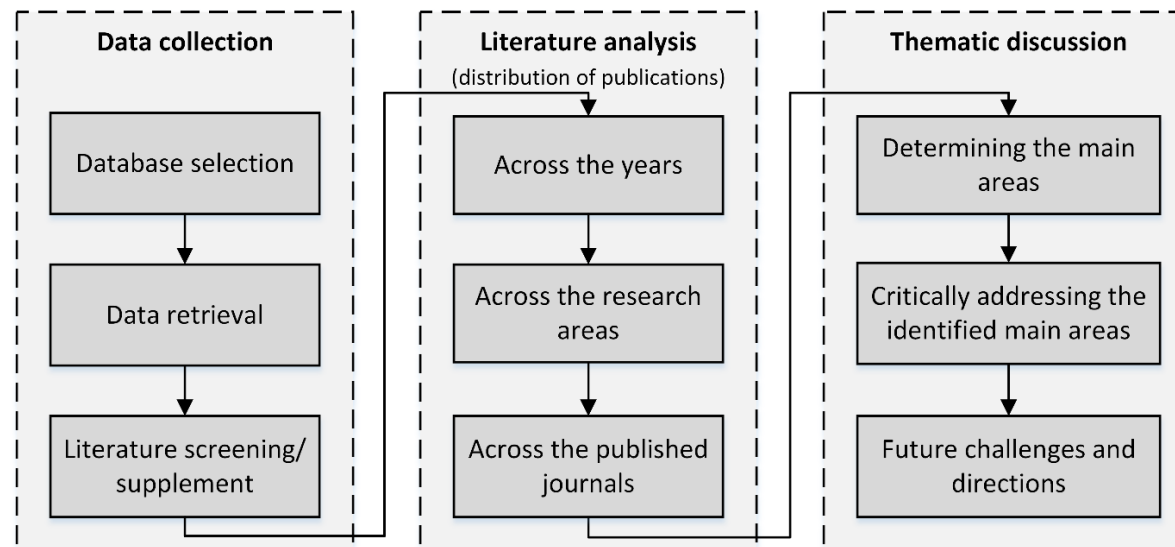
- **Application of multi-criteria methods to planning and management in the field of civil engineering**

(Jajac et al. 2009, Jajac et al. 2012, Jajac et al. 2013, Marović 2013, Marović et al. 2014, Marović et al. 2015, Marović and Hanak, 2017, Jajac et al. 2019)



# Methodology

- **Databases:** Scopus and Web of Science (WoS)
- **Search:**
  - “Title/Abstract/Keywords” field with keywords PROMETHEE, civil engineering, construction industry, construction project management and their syntax derivatives
  - Only journal papers published from 2000 to 03/2020

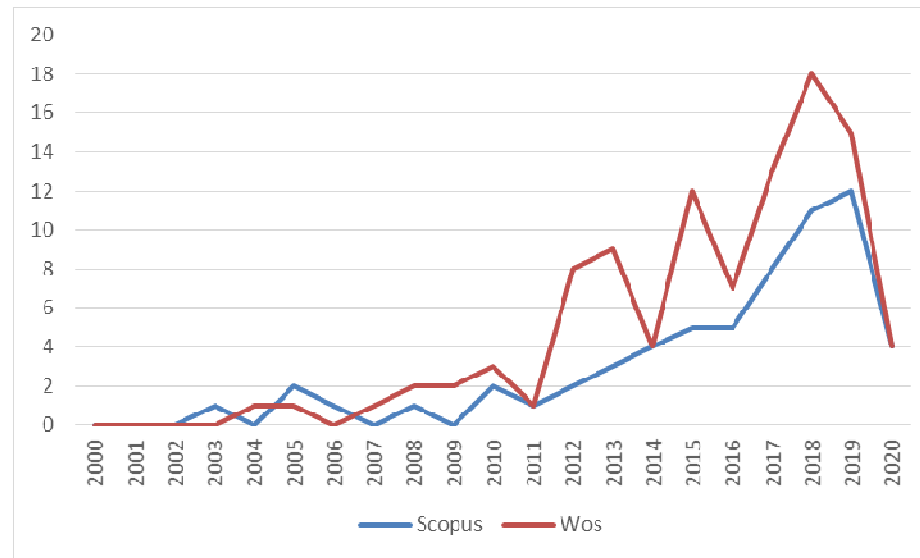


The systematic literature review workflow

# Results and discussion

- PROMETHEE AND

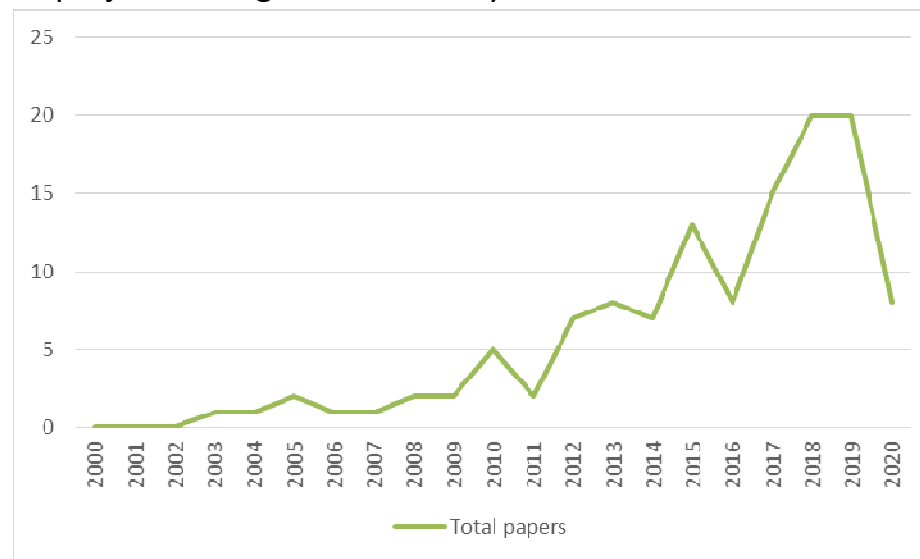
- Civil engineering.....Scopus = 17 papers; WoS = 11 papers
- Construction industry.....Scopus = 244 papers; WoS = 228 papers
- Construction project management..... Scopus = 26 papers; WoS = 17 papers



The distribution of PROMETHEE published papers in Scopus and WoS across the years

## Results and discussion

- During the screening, both sets were checked in order to filter duplicates and off-topic ones
- Such resulted into the total of 123 papers
  - Civil engineering & Construction industry & Construction project management
    - Hidrotechnical Engineering, Geotechnical Eng., Traffic and Transportation, Structural Eng., Construction Management
    - Phases of construction project throughout the life-cycle

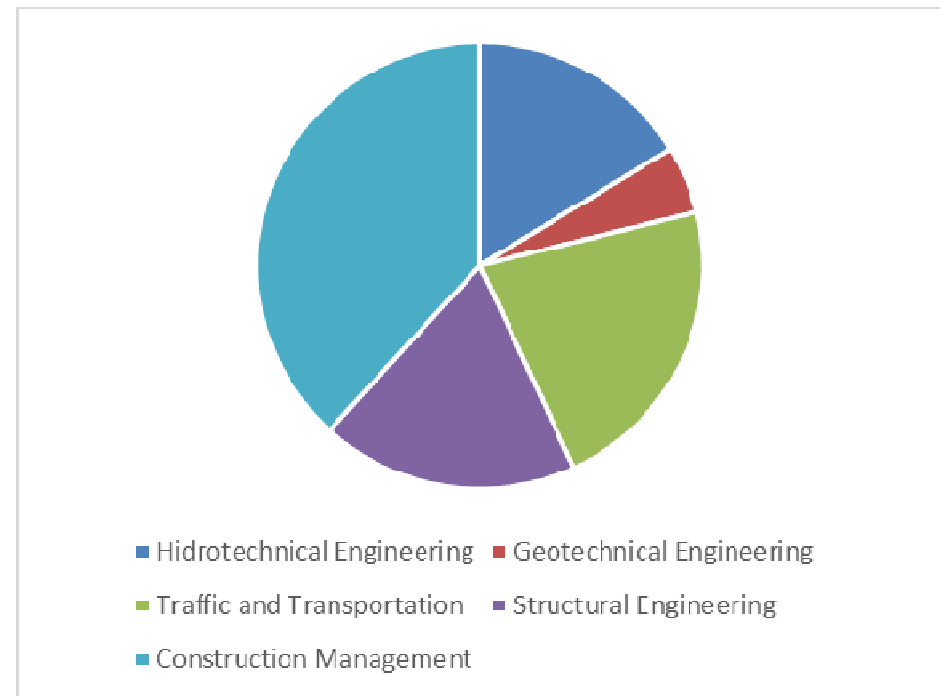


The distribution of PROMETHEE published papers in Scopus and WoS across the years

# Results and discussion

## Civil Engineering

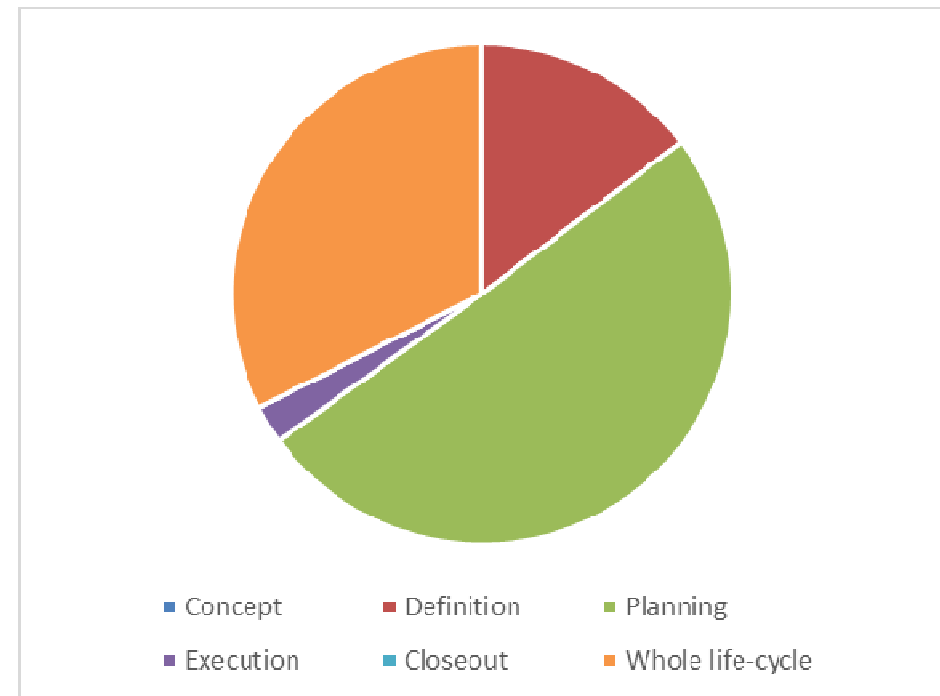
- Hidrotechnical Engineering 20
- Geotechnical Engineering 6
- Traffic and Transportation 27
- Structural Engineering 23
- Construction Management 47



# Results and discussion

## Project life-cycle

- Concept phase 0
- Definition phase 18
- Planning phase 62
- Execution phase 3
- Closeout phase 0
- Whole life-cycle 40



## Results and discussion

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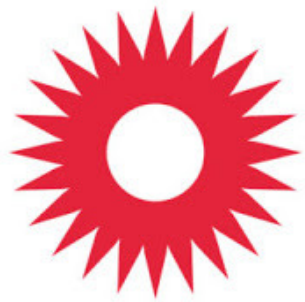
- Croatian Operational Research Review (8)
- Sustainability (7)
- Water Resources Management (4)
- Journal of Cleaner Production (3)
- Expert Systems with Applications (3)
- Transportation Research Part D: Transport and Environment (3)
- Water (3)
- ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering (2)
- Asian Journal of Shipping and Logistics (2)
- Journal of Advanced Transportation (2)
- Journal of Civil Engineering and Management (2)
- Journal of Environmental Management (2)
- Journal of Management in Engineering (2)
- Tehnicki Vjesnik (2)
- Transport Policy (2)

# Conclusions

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- In short:
  - Various problems that occur in the sub-discipline Construction Management are frequently solved with PROMETHEE
  - Mostly, PROMETHEE is used in Planning phase of construction projects and as a part of whole decision support frameworks
  - As it is used for solving problems regarding construction management, traffic and transportation, and water issues, the journals aim either for method development and/or applications of the method in specific surroundings/problems
  - Almost all papers deal with improving the surroundings in more sustainable way
- This paper provides a useful reference for researchers and practitioners interested in the application of PROMETHEE as a tool for decision-making in civil engineering

# Greetings from



**RIJEKA  
2020**

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