

Human Resource Allocation: A Systematic Literature Survey

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Motivation

——why we need human resource allocation

- Organizations need to run their business effectively and efficiently.
- Human resource: one of the most important assets/resources of a company.
- Effective human resource allocation
 - reduces cost
 - saves time
 - improves the overall performance of the company
- Right person executes the right task at the right time

Research question

——what do we want to know

- RQs:
 - What are the **recent trends** in human resource allocation?
 - What **algorithms** have been proposed and what **techniques** have been developed recently?
 - What **improvements** do these approaches offer? (in terms of **cost**, **time**, ...)

Select primary studies

- Search terms:
- IEEE: ((human resource OR task OR staff) AND (allocation OR assignment OR scheduling OR optimization OR planning) AND (“process mining” OR “business processes”))
- ACM: recordAbstract:(human resource staff task) AND (allocation assignment scheduling optimization planning) AND (“business processes” “process mining”)



Start

| Search in databases

536

| after reading title and abstract

10

| 19 conf papers forward & backward search

29

| exclusion due to low quality/relevance

19

Review protocol

——how we conduct the review

- Inclusion/exclusion criteria:
 - IN1 The study proposes an approach supporting human resource allocation and was published within the last 2 years.
 - EX1 The study primarily focus on material/vehicle resource allocation
 - EX2 The study does not include any of the following aspects in human resource allocation strategy:
 - A real-life experiment of the approach with detailed documentation
 - A artificial simulation of the approach with detailed documentation
 - Pseudo code/math model of the allocation algorithm
- Abandoned criterion:
 - Control flow graph

Review protocol

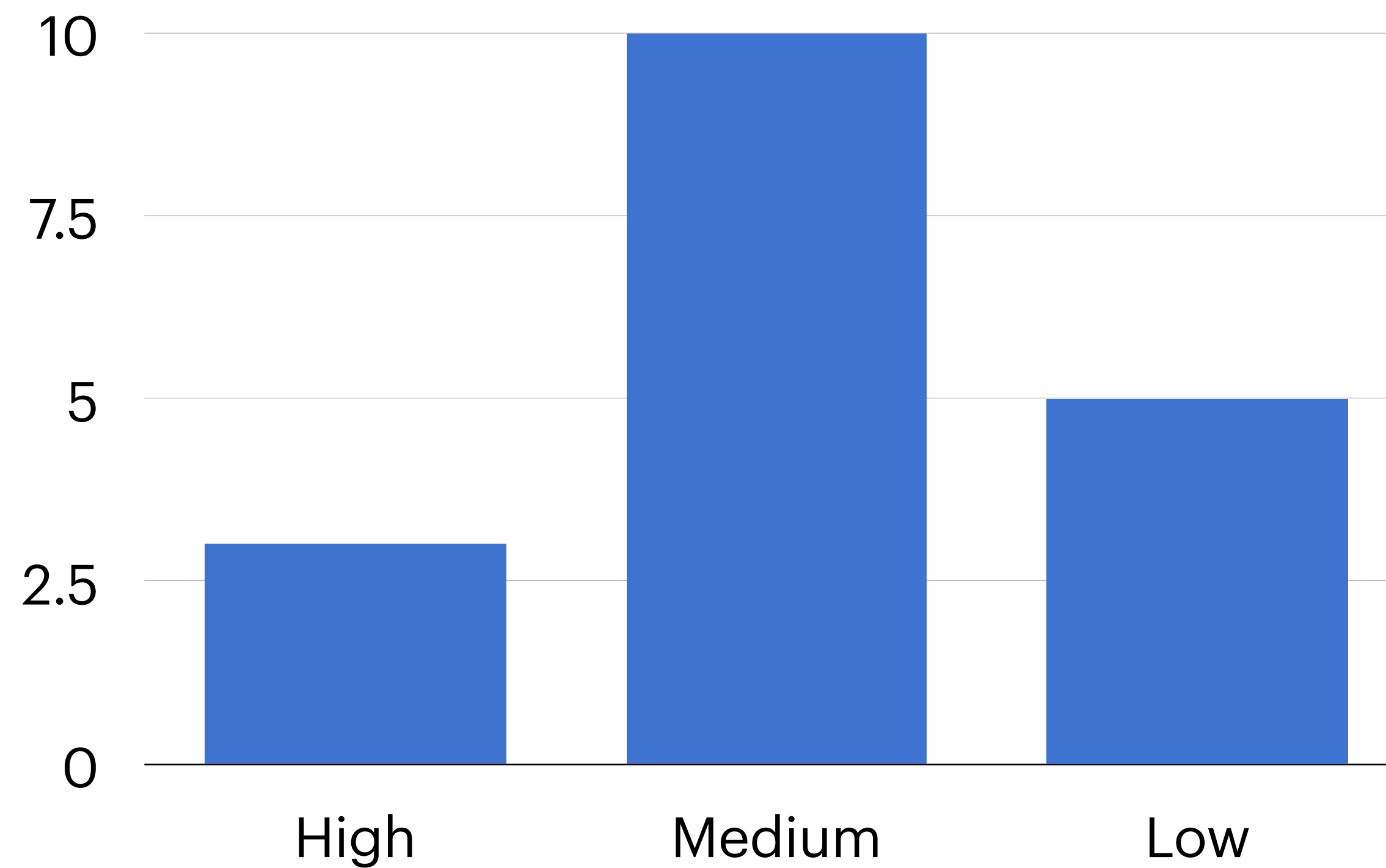
——how we conduct the review

- Data extraction and synthesis strategy :
 - Country, Year
 - Improvement: expressed in percentage or other form
 - The concrete techniques/approaches used
 - Application domain: general situation vs. Specific scenario
 - Maturity level

Assess study quality

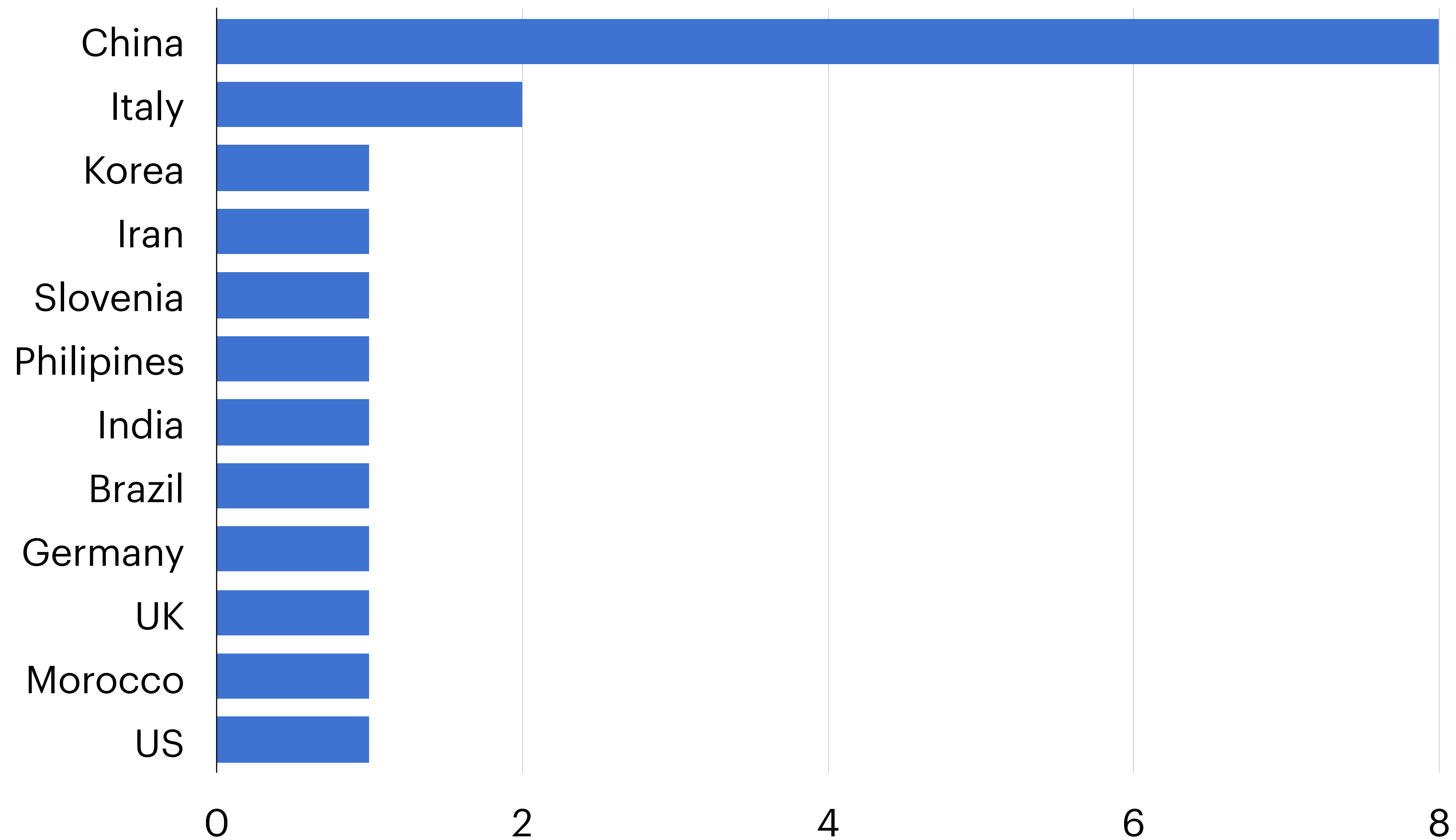
- Study quality metric:
 - High: comprehensive documentation experiment/simulation and improvement statistics
 - Medium: computer simulation is conducted and at least descriptive improvement is discussed
 - Low: Only algorithm/method or only pure math model is presented

Assess study quality



Extract and synthesise data

Number of publications by country

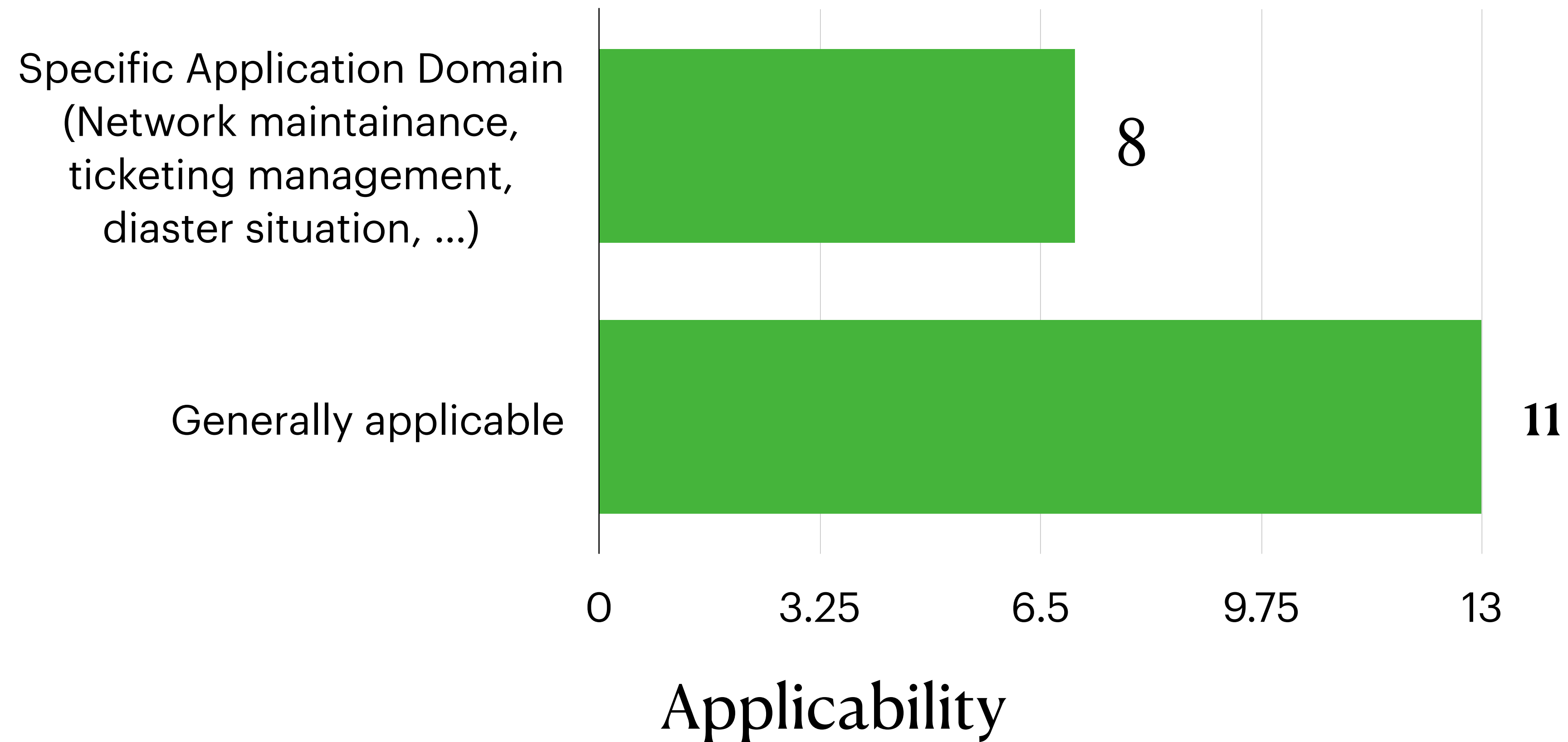


Answers to RQs

- What are the recent trends in human resource allocation?

- 1. More and more studies tend to provide a solution which applies to a specific domain rather than just a general algorithm.
 - Example papers:
 - Simone Guarino et al. 2023. A Spatial Decision Support System for Prioritizing Repair Interventions on Power Network. *IEEE Access*
 - Abderrahmane Benkacem et al. 2022. Supervised machine learning to allocate emergency department resources in disaster situations. *2022 14th International Colloquium of Logistics and Supply Chain Management (LOGISTIQUA)*

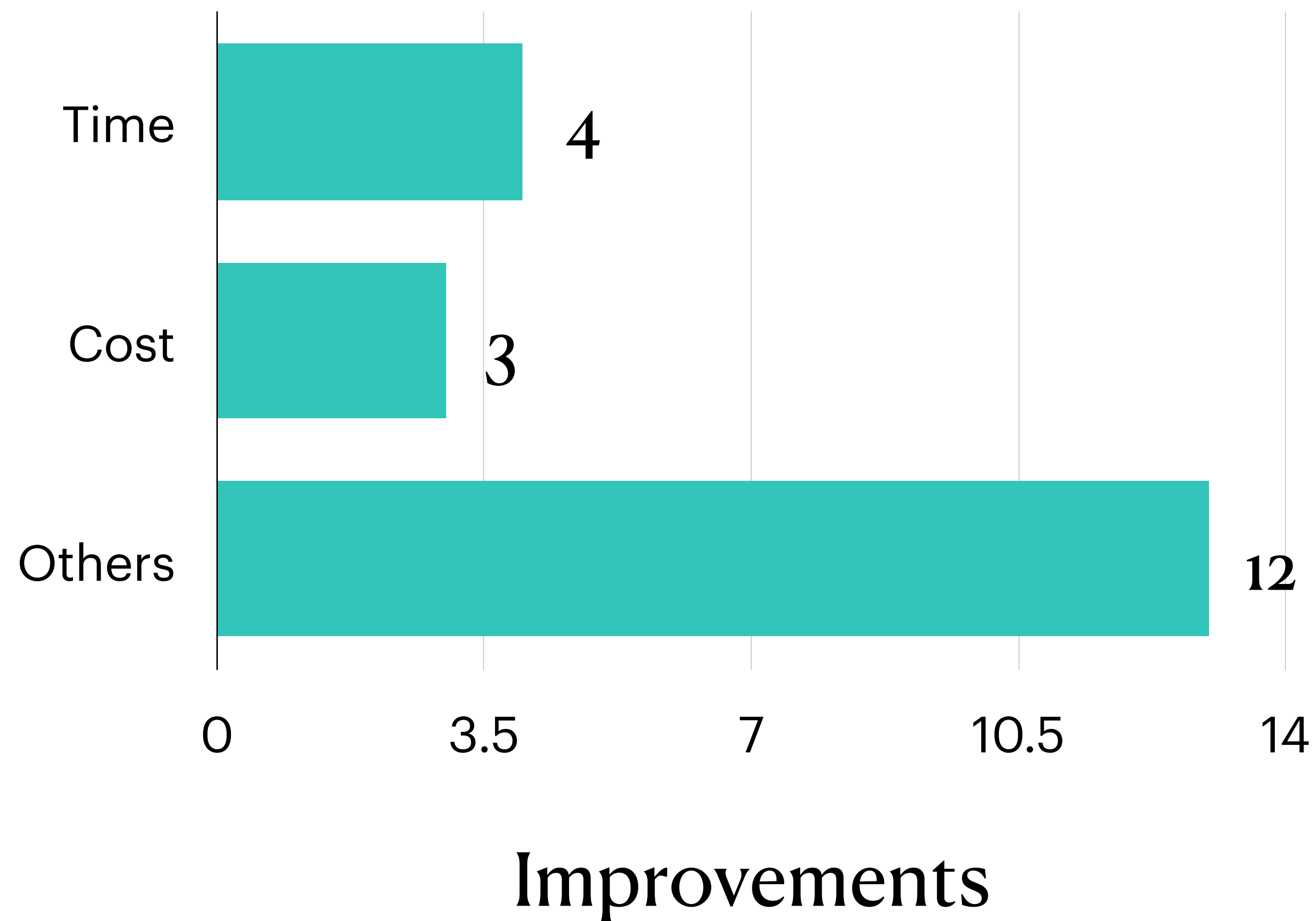
Answers to RQs



Answers to RQs

- 2. Recent studies focus not only on reducing cost and completion time of a task, but also many other aspects.

Answers to RQs



- And many other aspects are considered:
 - Synergy Value
 - Accuracy
 - Rationality
 - Occupancy
 - Balance
 - Skill Covergae Rate
 - Ergonomic Burden
 - Trustworthiness
 - ...

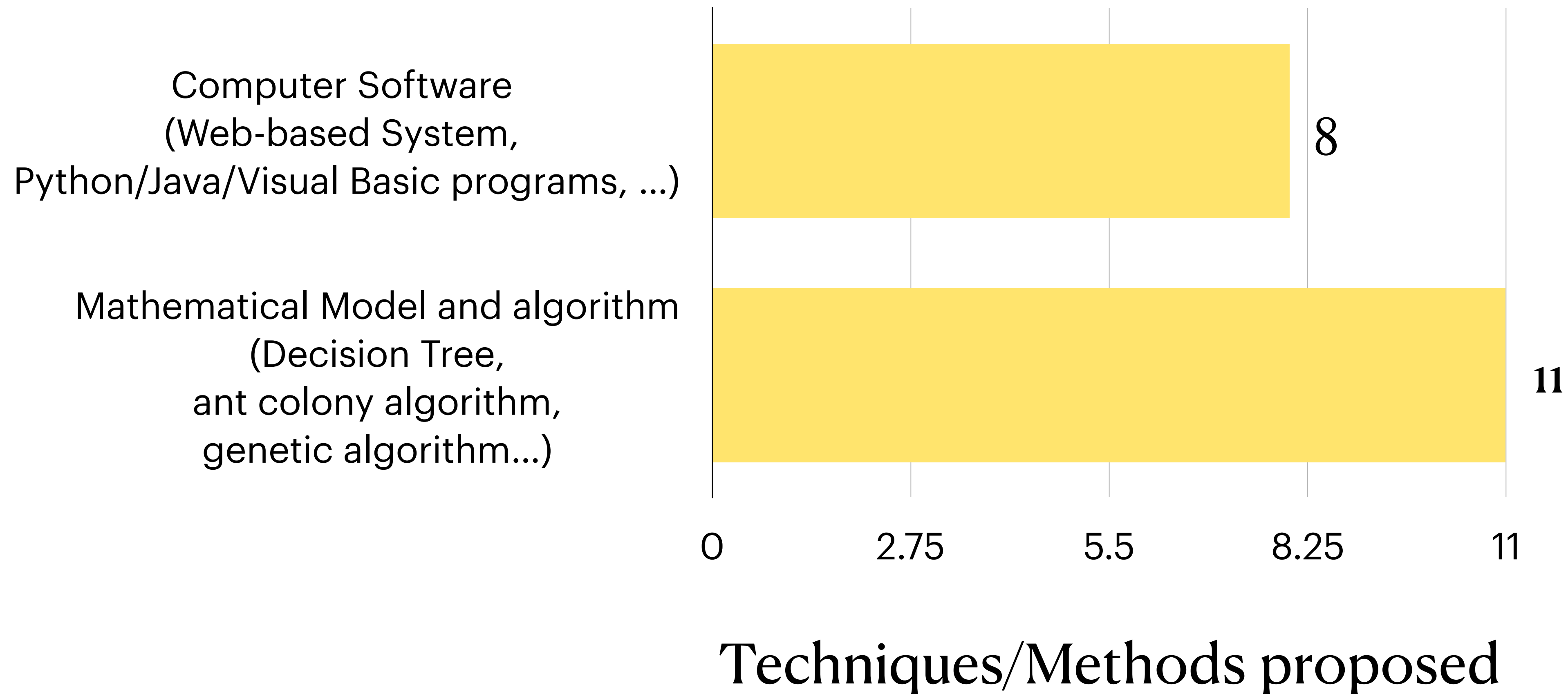
Answers to RQs

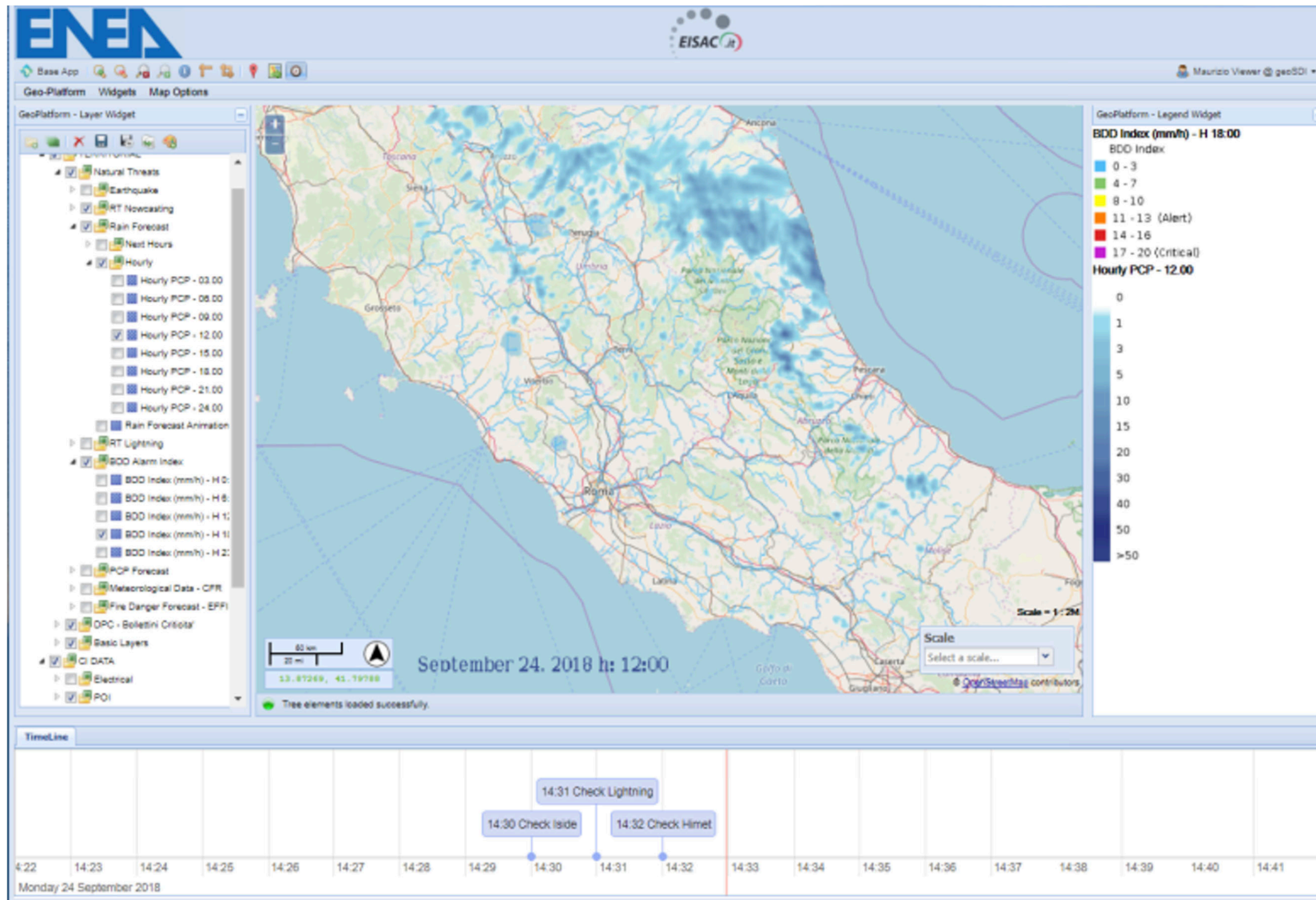
- 3. Some studies consider human resources in groups or teams rather than just individuals
 - Davide La Torre et al. 2021. Team Formation for Human-Artificial Intelligence Collaboration in the Workplace: A Goal Programming Model to Foster Organizational Change. *IEEE Transactions on Engineering Management*
 - aims to allocate appropriate individuals to teams
 - Jiuchuan Jiang et al. 2021. Group-Oriented Task Allocating for Crowdsourcing in Social Networks. *IEEE Transactions on Systems, Man, and Cybernetics: Systems*
 - Investigates in allocating human resource to tasks in groups

Answers to RQs

- What **approaches** have been proposed and what **techniques** have been developed recently?

Answers to RQs





CIPCast Decision Support System Graphical User Interface.

- What **improvements** do these approaches offer? (in terms of **cost, time, ...**)

- Na Feng. 2022. Human Resource Intelligent Scheduling Algorithm Based on Decision Tree Algorithm. *2022 IEEE 2nd International Conference on Mobile Networks and Wireless Communications (ICMNBC)*
 - ~25% scheduling cycle shortened, 28~35% cost reduction rate in different scenarios
- Miljenko Hajnić et al. 2021. A Disruptive Support Platform for Reengineering the Strategic Transfer of Employees. *IEEE Access*
 - Personnel transferring time is reduced by 82.69%, operational cost is reduced by 87.64%

As stated in the *recent trends* section, many other aspects are considered and measured:

- Jiuchuan Jiang. 2021. Group-Oriented Task Allocation for Crowdsourcing in Social Networks. *IEEE Transactions on Systems, Man, and Cybernetics: Systems*
 - 2x~3x synergy value, ~25% less conflicts, 1.8x skill coverage
- Jair José Ferronato. 2022. PM4SOS: low-effect resource allocation optimization in a dynamic environment. *2022 IEEE International Conference on Systems, Man, and Cybernetics (SMC)*
 - 10% and 25% surgery room occupancy improvement and 12 -> 16 and 11 -> 18 number of surgeries increased under different circumstances

Conclusion

- In recent years, researches on human resource allocation remains a heated topic.
- Specific application domain: reliability and feasibility
- More improvement metrics.