

Development of an Online Tool for Chemical R&D Analytics and Portfolio Optimization

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Problem Statement

- **Develop an online decision support system for portfolio optimization**
- **For a given query expressing interest in a project**
 - **Gather textual information from search engines, papers and patents**
 - **Quantify collected information and sort potential production routes**
- **Estimate resource allocation information for projects**
- **Optimize portfolio of projects**

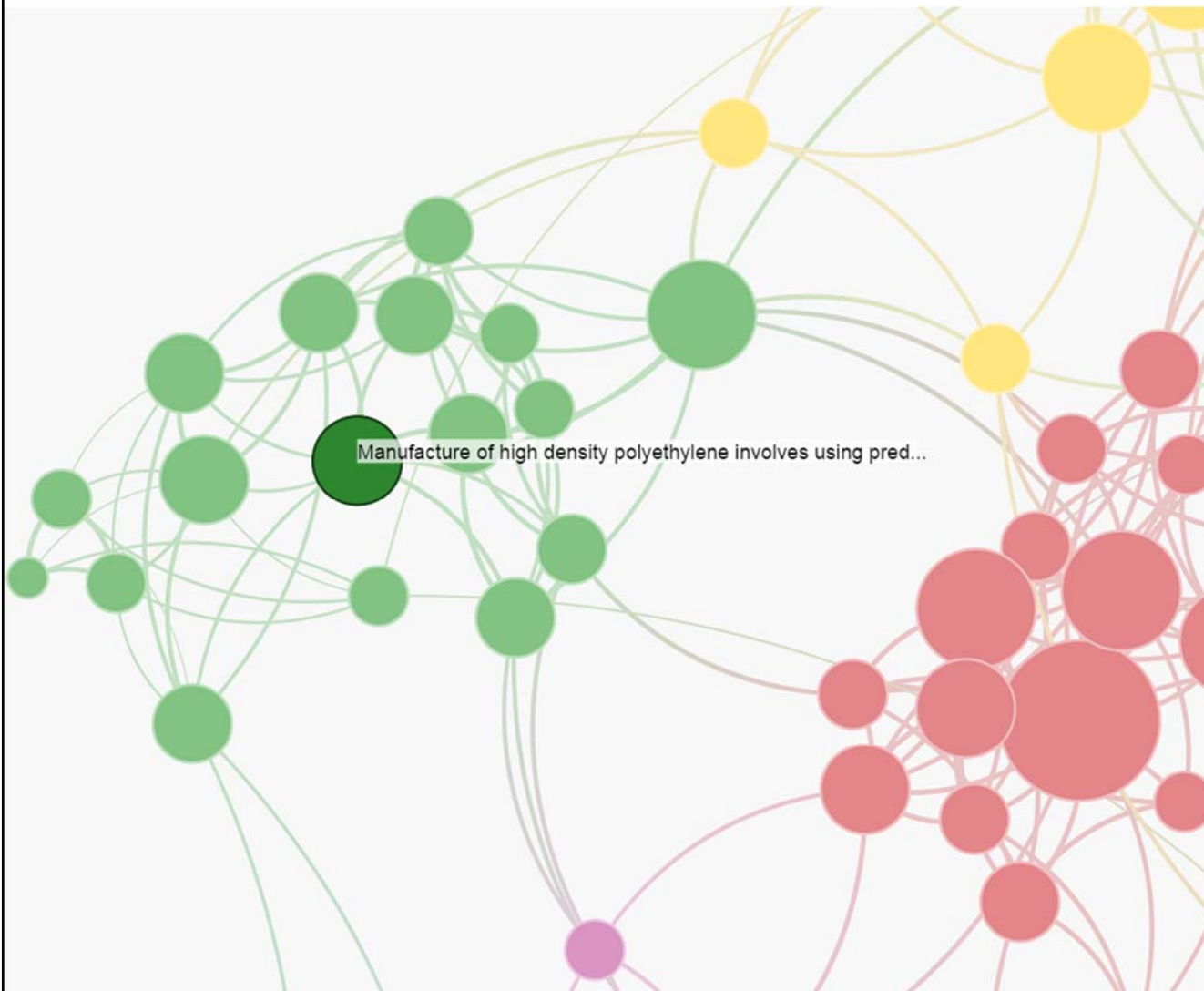
Tools

- **Online searching**
 - **Quid**: a web intelligence platform
- **Decision support system**
 - A web-based DSS using **PHP, MYSQL, AJAX**
- **Resource allocation**
 - Solve a **portfolio optimization problem**

Workflow



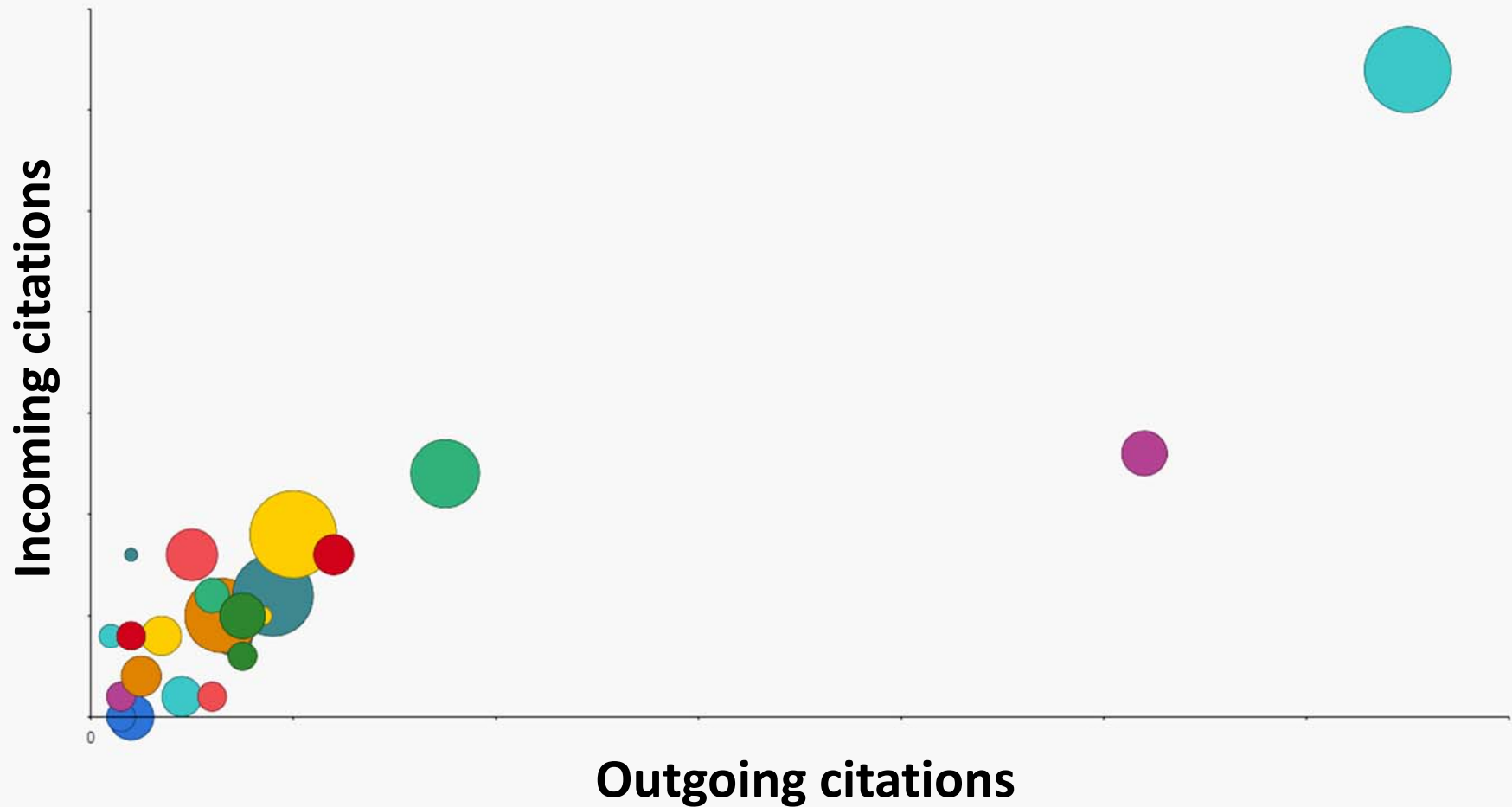
Visualized Patent Network with Quid



**Project subject:
polyethylene
synthesis**

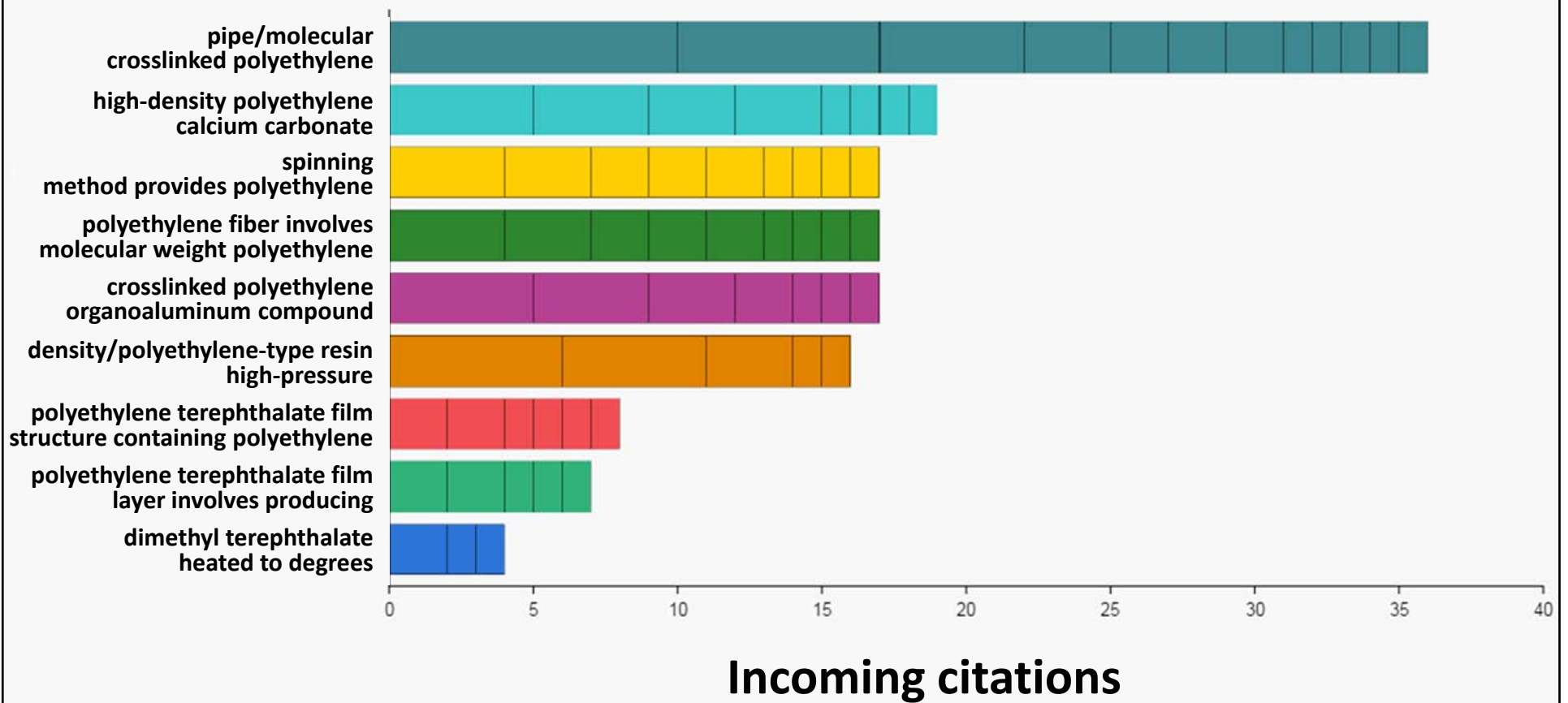
- molecular weight/polyethylene fiber involves/molecular weight polyethylene/average molecular
- molecular weight/polyethylene fiber involves/molecular weight polyethylene/average molecular
- molecular weight/polyethylene fiber involves/molecular weight polyethylene/average molecular
- molecular weight/polyethylene fiber involves/molecular weight polyethylene/average molecular

Incoming vs. Outgoing Citations

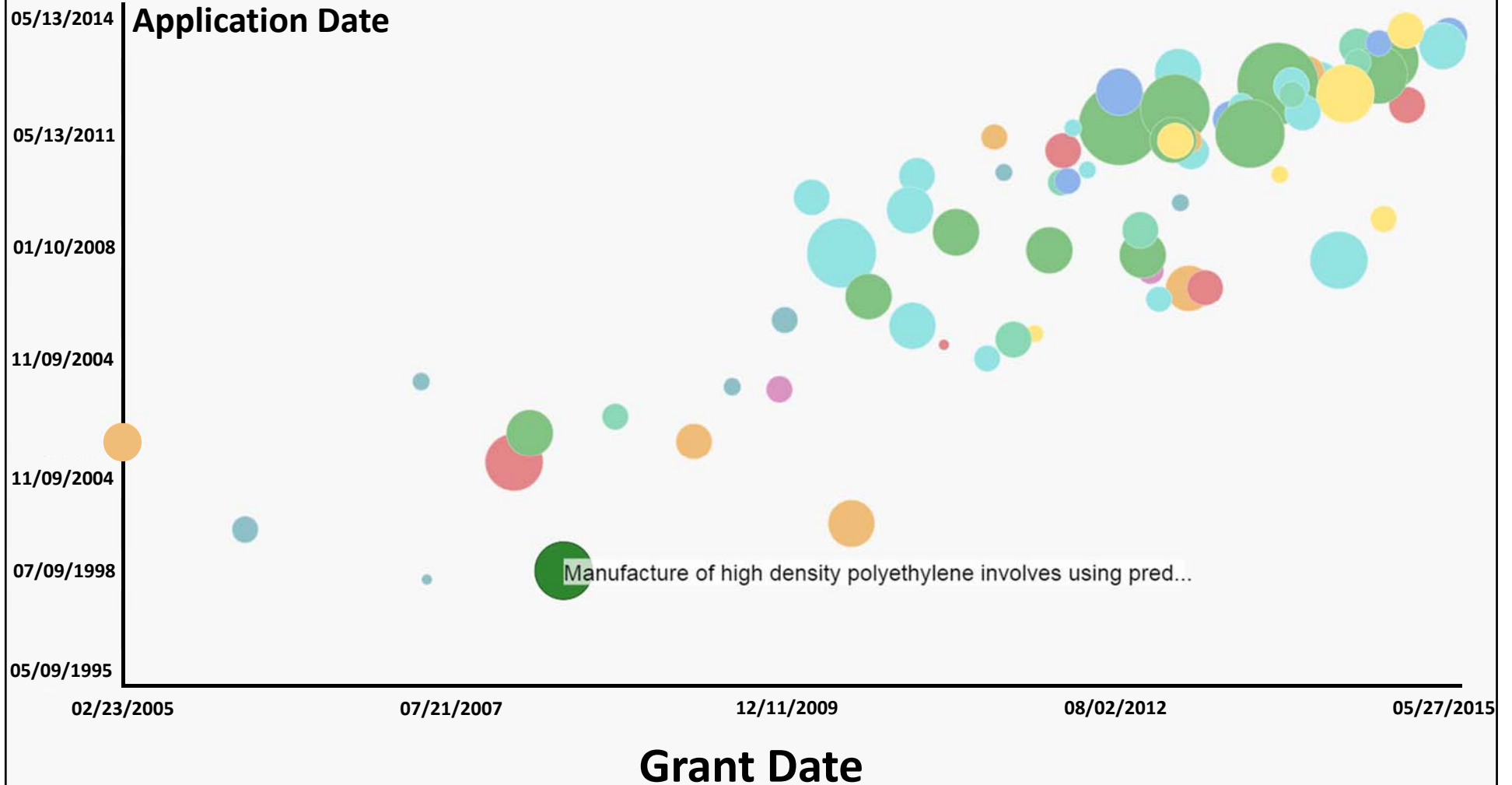


Incoming Citations: the number of citations that a given invention has received from other patents
Outgoing Citations: the number of citations to other patents from a given invention

Incoming Citations by Cluster



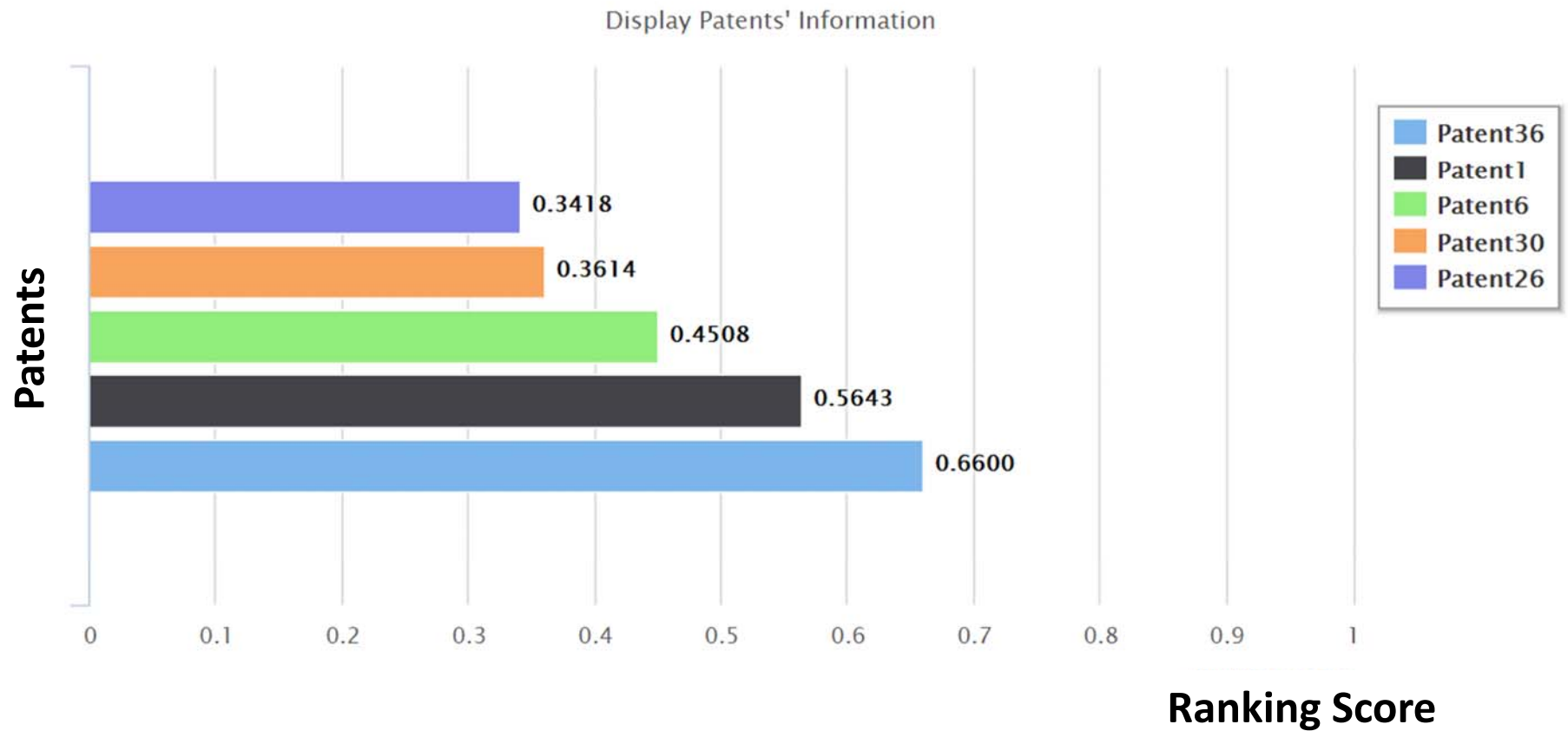
Patents Grant Date & Application Date



Multiple Criteria Decision Making

- Rank patents according to specific criteria
 - **Degree**: how many connections a node has
 - **Triangles**: a proxy for how densely interconnected a node is within a network
 - **Betweenness centrality**: measures the uniqueness of a node's connections
 - Other criteria: **flow**, **inter-cluster fraction**, **page rank**, **incoming** and **outgoing citations**
- Find the weight of each criterion using a **goal programming** methodology
 - Rank the patents using **TOPSIS** algorithm

Patent Ranking Result



Future Work

- **Evaluate different MCDM methods to sort production routes (TOPSIS, VIKOR)**
- **Use goal programming methodology to find the best combination for the criteria's weights**
- **Implement algorithms for the solution of the portfolio optimization problem**