Potential conflict zones in the Barents Sea

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1. Motivation
2. Resources
3. Problem statement
4. Model
5. Application of the model
6. Comparison of scenarios
7. Conclusion
Motivation

Sectorial line along 32° E, sought by the USSR (and Russia)

Map showing geographical locations including Spitsbergen, Franz Josef Land, Medial line, sought by Norway, and Novaya Zemlya.
Important resources: oil and gas
Important resources: fish (codfish)
Main task – allocation of territories with different resources (about 240,000 regions 210,000 square meters each)

Input data – allocation of resources (fish, oil and gas)

Output – different scenarios of territories’ allocation
Utility function

\[ u_k^{Resource}(x) = \begin{cases} 
  f(Resource, x) \cdot \left( \frac{d^* - d_k(x)}{d^*} \right), & \text{if } d_k(x) < d^*, \\
  0, & \text{if } d_k(x) \geq d^*. 
\end{cases} \]

\[ u_k^{Total}(x) = \alpha \cdot u_k^{Oil&Gas}(x) + u_k^{Fish}(x) \]

- \( f(Resource, x) \) - volume of the Resource in region \( x \)
- \( d_k(x) \) - distance from region \( x \) to the nearest point of country \( k \)
- \( \alpha \) - resources importance ratio
1. Current situation
2. Allocation according to the distance
3. Allocation with respect to the level of interest
   a. Modified adjusted winner procedure
      i. Initial allocation: all areas are allocated to Norway
      ii. Initial allocation: all areas are allocated to Russia
   b. Allocation of zones to the most interested country
Modified adjusted winner procedure

\[(x, k_2) \in P \quad u_{k_1}^T(x) \neq 0\]

\[
\frac{u_{k_1}^T(x)}{u_{k_2}^T(x)} \rightarrow \text{max}.
\]

- \(P\) - set of pairs \((\text{region}, \text{owning country})\)
- \(k_1\) - least satisfied country
- \(k_2\) - most satisfied country
Application to the Barents Sea (current situation)
Application to the Barents Sea (distance)
Application to the Barents Sea (modified adjusted winner procedure)

Importance ratio = 1
Importance ratio = 5
Importance ratio = 10
Application to the Barents Sea (to the most interested country)
## Comparison of scenarios

<table>
<thead>
<tr>
<th></th>
<th>Importance ratio = 1</th>
<th>Importance ratio = 5</th>
<th>Importance ratio = 10</th>
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<tbody>
<tr>
<td></td>
<td>Norway</td>
<td>Russia</td>
<td>Norway</td>
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<td>Current allocation</td>
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<tr>
<td>Allocation according to the distance</td>
<td>126655</td>
<td>23833</td>
<td>210150</td>
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<td>Modified adjusted winner procedure (Norway)</td>
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<td>74446</td>
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<td>Modified adjusted winner procedure (Russia)</td>
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<td>Allocation of zones to the most interested country</td>
<td>126655</td>
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</tr>
</tbody>
</table>
1. Different scenarios of territory and resources allocation
2. Different ratios of resources’ importance
3. Opportunity to improve the model by taking into account other resources
Thank you for your attention!