

Citizens' Motivation and Benefits Distribution in Co-Production of Public Services.

A Cooperative Game Theory Approach

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Research questions and our case study

Research questions

- How should be the gained benefit of coproduction of public services distributed between the coproducers (providers, citizens, NGOs, etc.)?
- By what amount should the state motivate the citizens or group of citizens in order to have them actively participate in the production of public services?

About our case:

- 2005 new routes at the overnight public transportation (buses) in Budapest. The lengths of the routes almost doubled.
- The plan is prepared by a NGO, called VEKE. Members are young specialists.
- The public transportation provider, BKV was not supporting the plan, however the mayor of Budapest saw political advantage in it and put BKV to apply it.

Methodology

Why we use cooperative game theory

- Modeling cooperations
- Using the results of cooperative game theory to find a 'fair' allocation
- Core: the whole benefit is divided & it's acceptable for every coalition
- Shapley Value: the average contribution of a player in the game (expected value)

$$\phi_i(v) = \sum_{S \subseteq N \setminus \{i\}} \frac{|S|! (n - |S| - 1)!}{n!} (v(S \cup \{i\}) - v(S))$$

Modeling and data collection

Coalitions:

- First coalition: Budapest Transport Company (BKV), Citizens of Budapest
- Second coalition: Budapest Transport Company, Citizens of Budapest, Urban and Suburban Transit Association (VEKE)
- The values of the other coalitions are zero.

Data between 2002 - 2008

- Citizens: the km performance of the overnight buses (mileage), the length of the overnight bus routes in Budapest
- BKV: the km performance of the overnight buses used only by BKV staff, number of passengers on the overnight buses
- VEKE: number of members of the organization, 1% of tax in HUF, media coverage of VEKE (printed, internet)

But we need an comparable index-number reflecting the value of the coalition

Preliminary result

The game and the Shapley value

We run a principal component analysis to demonstrate the values of the coalitions:

$$v(\text{'BKV\&citizens'}) = 3.924;$$

$$v(\text{'BKV\&citizens\&VEKE'}) = 5.331$$

The Shapley values are:

$$(\text{BKV, Citizens, VEKE}) = (2.431; 2.431; 0.469)$$

Conclusion

Explanation of Shapley values of the players

1. Every player got the same part of the added value produced by the coproduction.
2. The coproduction has a positive effect on the production of public services and increase the social welfare. Every player has a better position inside the coalition.
3. In this case the fair allocation of the added value of the coproduction means that all players get a same amount of it.
4. If we could measure the added values of each players in monetary units than we could tell by what amount should the state motivate the citizens or NGOs in order to have them actively participate in the production of public services.

Thank you!

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