

# **Policyoracle: An Information Market for Civil Participation in Collective Decisions about Global Issues**

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## **Introduction**

Significant efforts and prodigious improvement have been made in comprehending dependencies, interactions and impacts of the policy decisions and actions on the global system. Pursuing the necessity of informing the policy decision process and proactively sensing possible problems concerning global matters, we propose the `market` as an institution which efficiently aggregates diverse information using the price mechanism and the Web as the medium where `Information Markets` (IMs) can be created and run. In this article, we propose a new Web-application, PolicyOracle, for making predictions with the benefit of the “wisdom of crowd” effect.

## **Collective Intelligence with IMs**

IMs are considered an example of collective intelligence because of their capability to aggregate and nowcast information that arrives with a lag by making use of specifically designed contracts that yield payments based on the outcome of uncertain future events. Contract prices provide a reasonable estimate of what the traders in aggregate believe to be the probability of the aforementioned events, and as such, markets are able to generate forecasts. IMs are characterized by their accuracy, easy deployment, and ability to dynamically incorporate new information available to traders by continuously adjusting an event’s price and hence its probability conditioned to the new market information.

## **Our Approach**

PolicyOracle will be an IM for collecting, aggregating and interpreting stakeholders’ and citizens’ opinions, expectations and preferences in order to improve public decision-making. PolicyOracle’s primary focus will be on sustainability transition issues by exploring economic and financial policies mainly based in the energy sector. In that respect, our platform will support decisions on policy matters contingent on the status of key policy variables e.g., “Price of carbon needed to reach 30% GHG emissions reduction by 2030”. Relevant policy decisions could be private or public whereas markets provide information related to a variety of public policy matters such as costs, benefits, net benefits of policy options or the likelihood of certain events depending on the choices of policy makers.

Because of the too distributed information throughout Internet, our approach employs in our platform computational agents besides the human participants.

By analyzing qualitative user opinions, sentiments and assessments expressed through social media sources such as Facebook, Twitter and blogs, and by using techniques such as processing content, opinion mining and sentiment analysis, our computational agents generate quantitative information that predicts public policy-related economic and social indices and participate in the trading process shaping market prices together with human stakeholders. Each agent will represent a social medium, interpret the user-generated content and reflect its beliefs in the market. The functions of our agents are inspired by the Belief-Desire-Intentions (BDI) paradigm, where an agent will intend to do what it believes as a human though without requiring extra incentives but the acquired information, through more rational trading and with only goal of maximizing its portfolios. Agents will evaluate their source information daily and update their belief function validating the nowcasting profit of the IM.

### **IM Design**

PolicyOracle design will feature a Continuous Double Auction with Market Maker (CDAwMM) trading mechanism, which will serve traders and agents to freely buy and sell virtual contracts in automated computed prices. Market makers will ensure market's liquidity by always set the prices based on the logarithmic market scoring rule. We will compute a cost  $C(q)$  and a pricing function  $p(q)$  as follows:

$$C = b * \ln(\sum_j e^{q_j/b}), \quad p_i(q) = e^{q_i/b} / \sum_j e^{q_j/b}$$

where  $q$  is a vector that represents the number of the future contracts which are already accepted by the market maker and  $b$  is a parameter that we intent to examine about its suitable value and its depiction on the liquidity of the market.

Moreover, the market will be organized with contracts of the form "Pays \$  $j$  if the state is  $i$ ". The sum of the contracts prices will be equally to 100 corresponding to the actual probabilities of event occurring.

### **Conclusion**

The purpose of PolicyOracle will be to allow policy makers to tap the collective opinions of the crowd and make better decisions about problems of global relevance spanning from social, economic, financial, to ecological matters. PolicyOracle intends to be an instrument for efficient information exchange based on active participation and trust using the latest research so as to capture optimally the dispersed information.

PolicyOracle is a part of the SYMPHONY research project co-funded by the "ICT for Governance and Policy Modelling" of the European Commission. Currently, the PolicyOracle platform is under development. By the end of this year it will be available online, whereas we are already planning to evaluate our approach by supporting real life global problems in cooperation with organizations such as the Global Climate Forum (GCF), Germanwatch (GW) and the Bank of England