Quantifying the value created from research surveys

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Summary

The paper presents a methodology on how value is created through research. It is based on the idea that value is created through the wiliness to pay of a customer for a research minus the opportunity costs of not buying it. The methodology pivots on the idea that information provided by signals (research) reduces the uncertainty of the customer and increasing the likelihood of a better management. The paper explores three ways of understanding the uncertainty of signals concluding that the expected value of information is a suitable metric that covers all the requirements to consider that value creation is being measured. Finally, the paper applies all these findings on a particular ecosystem service (fisheries) for which in the framework of a case study, the value created by research signals (scientific surveys) is quantified and analyzed.

Introduction

Value has become cornerstone in business strategy even if in many cases value creation is not clearly defined. Some firms try to focus on the value created as a first step to measure the value that can be captured (value capturing strategy). This strategy has at least two problems. Firstly, costs are generally standardized in the accountant system while value is not. Secondly, the quantification problem of the value has eroded the desire of some firms but also of some customers to accept this strategy.

Science suffers from excess social value respect to private one as new technological developments leads to underinvest in inventive activity (Hirshleifer, 1971). There is a theoretical explanation for this (Arrow, 1962) where is claimed how information would be under-produced because economic returns were not fully appropriable. The paper extends Arrow's argument considering that under-production of information is also due to the cost based strategy and not the value based strategy followed by research producers. Furthermore we consider that this cost based strategy is a consequence of the problems encountered to quantify the value created from scientific research. In that sense the paper's objective is how to quantify the value creation by a research provider to a particular customer. For doing so a methodological route is created and applied for the case of an ecosystem service (fisheries).

Material and Methods

Value created is the difference between willingness to pay (WTP) and the opportunity cost incurred by suppliers, that, when positive, can be captured through price (Brandenburger and Harborne, 1996). It implies that value could be created from the opportunity cost that the customer is facing from the information. Quantification of this value created requires the definition of the value element concept.

The value element(s) of the customer is the services and functions of the ecosystem that, when economically valued, are the basis of the opportunity costs. But as seen in Figure 1 the value elements are only the part of the functions and services that customers can observe, understand and are part of their utility function. In this case the amount of uncertainty of the customer that is reduced can be considered as the value created by research.

The paper checks several methods to account for this uncertainty and we end up with a suitable metric to measure the WTP: the expected value of information (EVI) The idea is that if the customer has more information it will take decisions more accurately and it nonetheless provides a valuable upper limit to the value of information. The methodology of the paper is based on calculating the EVI of the value element(s) of the customer.
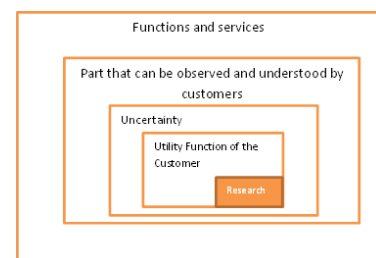

Figure 1. The value elements of a customer.

EVI computation is complex given that all the possible outcomes and all the alternatives have to be calculated. We solve this issue in two steps. Firstly, the expected value of perfect information (EVPI) is computed and seconcly, the works of (Bickel, 2008; Fatti et al., 1987) are used to solve the problem between realism (research is not providing perfect information) and applicability (Bayesian calculations). The idea is simple: research is providing signals of information that when correlated with the EVPI act as predictors of the priors.
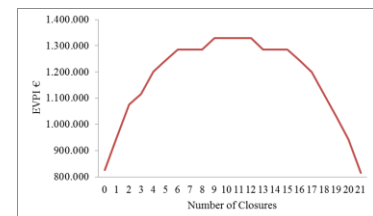
Results and Discussion

We use this methodology for the case of the scientific surveys used to assess the anchovy of the Bay of Biscay. For the case of anchovy the value of the signals exceed the EVPI. It implies that the information provided by the signals is redundant. Which to choose is obviously a matter of the budget constraint of the customer, the cost of each signal, but also of the positive economies derived from the knowledge coming in form of other signals, other value elements and others customers, as in any other good or service.

The methodology is also able to put numbers to the well documented tendency of individuals to be overconfident in summarizing their information, including particularly the tendency to underestimate the probability of surprise, can lead to large underestimates of the expected value of information. We have done through what we have called extreme events (closures of the fishery) and the EVPI has been computed for different scenarios (Figure 2).

As pointed by Arrow, the production of information can be sub optimal due to the "free riding" problem. Information is easily spread and this is why it should be extremely precise the definition of the customer's prior. This phenomenon can also be seen in the customer regional resolution of the simulation made with different customers. If a supra national authority is alone in the signal creation, the EVI will should exceed the value created to the regional customer. Obviously it will depend on the amount of the cost financed by each one but the incentive to "free ride", as pointed out by Arrow, is there.

This sub-optimality also comes from the value creation quantification side. In fact, each signal sold should be evaluated accordingly to the services appreciated by the customer, directly and indirectly. Even further, if the interconnectedness and multidimensionality of ecosystems are considered, signals create value if priors are well understood by customers. For doing so, and as mentioned in (Costanza et al., 1997) ecosystem services should be adequately quantified. Ecosystems economic evaluation increases the chance of quantifying in a proper way the value creation from research. But the customer has to be aware of it (well informed). Our conclusion is that it is necessary to know what the customer wants but also how much.

Figure 2. Evolution of the EVPI for a simulation of different number of closures

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