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Journal of Purchasing & Supply Management 9 (2003) 191–198
JOURNAL OF PURCHASING AND SUPPLY MANAGEMENT
www.elsevier.com/locate/pursup

Electronic decision support for procurement management: evidence on whether computers can make better procurement decisions

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Received 1 October 2002; accepted 1 March 2003

Abstract

We analyse how well purchasing managers are able to judge the likelihood of problems for a given purchasing transaction. The literature on clinical versus statistical prediction suggests that humans in general, including purchasing managers, are often outperformed by relatively simple statistical formulas for such kinds of tasks. Based on a vignette experiment of real purchasing transactions, we compare the performance of purchasing managers with freshmen students and with a statistical formula based on a cross-validated sample. The results show that the formula outperforms the humans, and that experienced purchasing managers do not outperform freshmen students. We conclude that it would make sense to use decision support systems in the daily practice of purchase management so that humans can devote their time to what they are good at, while being guided by statistical software that takes care of multi-dimensional decisions in noisy environments.

1. Introduction

Some purchasing transactions can be foreseen to run smoothly without large investments in time and effort. For other purchasing transactions, a substantial investment in time and effort is necessary. Most people would agree that at least one of the tasks of a purchasing manager is to be able to decide whether a transaction belongs to the first or the second category. Stated otherwise, one of the tasks of a purchasing manager is to decide which of a set of transactions needs purchase management more. For some transactions it makes sense to ask for a lot of tenders, invest a lot in the screening of suppliers, involve lots of time in negotiating, and put a serious effort in writing a detailed contract. For some transactions such investments are not necessary or not efficient (Batenburg et al., 2000). There are, however, compelling arguments on the basis of the literature on *clinical versus statistical prediction* that suggest that purchasing managers — like all other humans — are typically not good at making precisely these kinds of judgments. We set out to test this assertion. First, we briefly review the literature on clinical versus statistical prediction.

2. The state of affairs in clinical versus statistical prediction

Clinical prediction is the term for a situation where a decision maker receives data on several dimensions of a certain decision and subsequently makes a prediction. Clinical prediction is an integral part of our society. Personnel managers predict whether or not an applicant will turn out to be a valuable addition to the company, psychiatrists predict whether a convicted murderer will murder again, doctors assess the likelihood of a patient having a certain disease, and there are certainly many other examples where relevant dimensions are combined into a single prediction or judgment by an 'expert'. In our context, one could think of a purchasing manager who, for some procurement decision, assesses which of a set of transactions is more likely to lead to problems, given possibly relevant dimensions such as market risk, supplier risk, profit risk, the degree of detail in the contract, or whatever other data are available for that decision.

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doi:10.1016/j.pursup.2003.09.001

Statistical prediction (or mechanical prediction) is the term for a situation where on the basis of data on several dimensions, some formula is used to make a certain prediction (Meehl, 1954). The same examples as mentioned above spring to mind, only now it is not the expert (personnel manager, psychiatrist, medical doctor, purchasing manager, etc.) who predicts, but the decision is made by using a formula instead. Analogous to the example given above, one could think of a procurement manager who, for some procurement decision, assesses the relevant dimensions and subsequently uses a score-card or a computer program to predict the probability that problems will occur for that particular transaction.

Perhaps surprisingly, a large number of studies in diverse areas have shown *the superiority of statistical prediction over clinical prediction*. The experts hardly ever predict better and actually often worse than the statistical formula. Topics investigated include the prediction of academic success, business bankruptcy, longevity, military training success, myocardial infarction, neuropsychological diagnosis, parole violation, and the likelihood of violence. In a meta-analysis by Grove et al. (2000), the superiority of statistical over clinical prediction was still standing: "There seem, then, to be no barriers to a general preference for mechanical (=statistical) prediction where an appropriate mechanical algorithm is available" (p. 26).

The areas in which the superiority of statistical prediction have been established have three important aspects in common (Grove and Meehl, 1996):

(1) They are typically areas where accumulated experience, intuition, and *fingerspitzengefuehl* are considered important. Recruiters of personnel claim to know after the first 5 minutes of a job interview whether the applicant is appropriate, managers intuitively feel which of a set of suppliers is best, loan officers are thought to develop over the years a keen sense of which firm is most likely to be able to repay a loan, and clinical physicians are thought to combine the data from blood tests and scans in ways that are superior to merely adding and subtracting measurement results.
(2) Decisions or predictions involve the incorporation of a relatively large number of dimensions (typically more than five).
(3) Decisions or predictions involve the combination of dimensions in a "noisy environment". It is not clear which dimensions should be included, dimensions are hardly ever measured exactly, and it may very well be that combining the available measurements in even the most optimal way still leads to a decision or prediction that is only reasonable, and not good or even perfect.

These three factors are considered part of the explanation why the experts are not that superior as one might imagine. In a nutshell, research mainly in (social) psychology has revealed that for these kinds of decisions — combining a large amount of data and then making a single prediction or decision — (1) experience and intuition does not offer many useful guidelines, (2) most humans are typically bad at consistently combining data on a large number of dimensions, and (3) humans characteristically perform badly in a stochastic environment.

3. Implications for purchase management

Though about two-thirds of the findings on clinical versus statistical prediction concern medical or clinical issues and only about 10 tests have been performed that are related to business predictions (Grove et al., 2000, Table 1), these findings may have substantial implications for the theory and daily practice of procurement management, or even management in general. Typically, management tasks fit the abovementioned three criteria. It is an area where practitioners tend to think that experience, expertise, and "feeling" or "intuition" are important. Many managerial decisions indeed involve the combination of a large number of dimensions (profit risk, market risk, volume of the transaction, involved costs of different kinds, past dealings with the same person or firm, the reputation of the other person or firm, to name just a few). And, decisions are taken in an environment that is undeniably noisy — just think about how or even whether the different dimensions are measured, or about how adequate something like, for instance, the probability of problems can be predicted.

In other words, the perhaps shocking conclusion is that at least some managerial decisions are a likely candidate to be added to the list of topics where clinical prediction comes short of statistical prediction. To put it even more bluntly: *it may very well be that a simple formula outperforms a manager in decisions where the manager strongly feels that he or she is an expert*.

4. A vignette experiment: are computers better purchasing managers?

We will put this hypothesis to the test in an experiment with a group of 30 purchasing managers

Table 1
Spearman correlations between actual and predicted scores, averaged per group

Formula	0.37
Students	0.26
Purchasing managers	0.24