

An analysis of some mistakes, miracles and myths in supplier selection

Luitzen de Boer¹

Associate Professor

Norwegian University of Science and Technology

deboer@iot.ntnu.no

Merijn M. Linthorst

Ph.D. Candidate

University of Twente

UTIPS

m.m.linthorst@utwente.nl

Fredo Schotanus

Ph.D. Candidate

University of Twente

UTIPS

f.schotanus@utwente.nl

Jan Telgen

NEVI Professor of Purchasing Management

University of Twente

UTIPS

j.telgen@utwente.nl

¹Corresponding author address:

Department of Industrial Economics and Technology Management

Faculty of Social Sciences and Technology Management

Alfred Getz vei 1, NO-7491, Trondheim, Norway

Telephone: +47 73 597604

Telefax: +47 73 593565

Summary

This paper analyzes some consequences of formal methods and procedures for supplier selection. It argues that many mistakes and miracles may occur in frequently used procedures. Practical examples are given. In the analysis it turns out that preventing these unwanted effects from occurring may be tackled by methodological improvements. Some examples and guidelines for these are given as well. But another important point lies in the perspectives of the actors in supplier selection: governments and industry policy makers, purchasers, suppliers and (management) researchers. The analysis shows that these different actors often operate from quite different and sometimes conflicting attitudes, assumptions and principles. On the one hand this analysis leads to the conclusion that using some sort of formal approach for supplier selection may be necessary. On the other hand it clarifies the criticism on such an approach and the difficulties associated with its use. The paper concludes with recommendations and implications for policy makers, researchers, and practitioners.

Educator and practitioner summary

In this paper we give practical examples of mistakes and miracles in supplier selection, like undesirable outcomes and fraud. For tackling these unwanted effects we give more practical examples and guidelines. We discuss the necessity of formal approaches for supplier selection and how to deal with different actors involved in supplier selections. We conclude with recommendations and implications for policy makers, researchers, and practitioners.

Keywords

Supplier selection; Formal methods; Perspectives

Introduction of the topic

Supplier selection has attracted quite some attention from academics and practitioners alike. Possible reasons for this are its perceived importance, its visibility (at least in the sense that the ultimate outcome is identifiable), and its suitability for formal, mathematical modeling. Many organizations, especially in the public sector, struggle with the pressure to explain their choices and therefore often rely on some form of formal method. The use of these formal methods is however not without problems as many aspects can play an important role in supplier selection, many decision criteria and methods can be considered, and many decision makers and stakeholders with different perspectives can or must be involved.

On the one hand, we observe ‘successful’ practical use of simple as well as more sophisticated decision methods – sometimes voluntary, sometimes as a result of government regulations – while on the other hand, we also observe resistance, ‘misuse’ and skepticism towards them. These different attitudes could be influenced by among other things risk attitude, (perceived) knowledge, and past (un)successfully perceived experiences with (in)formal methods. We suspect that this variety of attitudes is a reflection of:

1. the quality and appropriateness of the methods used, both in terms of its ease of use, as well as its intrinsic ability to find the best supplier, but possibly even more so in convincing the actors that this really is the best supplier;
2. different assumptions, principles and/or myths held by different actors and stakeholders. This is most evident in the case of the EU-directives for public procurement, especially when it comes to the debate among governments, lawyers, purchasers, managers in the buying organizations and suppliers about the formal execution of the tender process.

In this paper we consider a number of issues with the use of formal methods for supplier selection. We differentiate these issues in those associated with (1) the quality and appropriateness of the methods used and (2) those inherent with the fundamental attitudes, assumptions, principles, and myths for the various stakeholders. We attempt to shed some light on the problematic existence and evolution of formal methods for supplier selection.

Brief literature review

Many academic papers describe and compare various formal decision methods, various decision elements, and various quantitative and qualitative decision criteria for supplier selection, e.g. De Boer et al. (1998), Narasimhan (1983) and Weber and Current (1993). De Boer et al. (2001) present a review of decision methods reported in the literature for supporting the supplier selection process. Already a great deal has been written about how to select suppliers in theory. De Boer and Van der Wegen (2003) conclude on the basis on four empirical experiments that formal decision models can assist purchasers in a variety of ways in selecting suppliers. Their study however, involved buyers' receiving explanation and assistance while using the models and little is still known about what actually happens if formal methods are applied incorrectly. Most of the supplier selection literature focuses on the buyer's perspective. E.g. Choi and Hartley (1996) consider the influence of a buyer's position in the supply chain on supplier selection. Other perspectives like the supplier perspective, the researcher perspective, and the government perspective are considered to a lesser extent. The government perspective for instance is often just seen as a constraint in the selection of suppliers. E.g. Munson and Rosenblatt (1997) describe local government rules and develop models to select suppliers while satisfying these rules. However, as mentioned in the introduction different actors in different perspectives look differently at formal supplier selection methods. These differences could lead to a number of problems related to the two issues mentioned in the introduction.

Research approach

The organization of the paper is as follows. First we illustrate the issues dealt with in this paper by a number of practical examples ('mistakes' and 'miracles') as they have appeared in the popular press and professional literature. Then we present a simple 5 step scheme to classify and explain some of these issues. This section shows in particular the variety in formal approaches available and how the use of different approaches may lead to different outcomes while being applied to the same case. Then we proceed with the remaining issues to show their connection to the stakeholder viewpoints. This section suggests that different stakeholders have quite different views on what formal supplier selection actually entails. We develop a categorization of these different views (and express them as 'myths') and how these different views fuel the debate. The

final section draws conclusions and discusses how the insights could be beneficial to the development of formal supplier selection methods in practice.

For the sake of simplicity we limit ourselves in this discussion to cases where one lot can be awarded to one of many suppliers, with only two criteria playing a role: price and quality. It is rather straightforward to extend the analysis to more complex cases.

Mistakes and miracles

Mistakes and miracles happen in supplier selection in practice. Some could have been foreseen, others are completely unintentional. In the next sub-sections we discuss several examples of mistakes and miracles. In most examples the well known and widely used Weighted Factor Score method is used. In this method price and quality are both awarded a certain score. The supplier with the highest weighted total score is awarded the contract. The purchaser can use various methods for awarding a score to the suppliers.

Example A: same weights, undesirable outcome

One of the uniformed services in the Netherlands needed new uniforms. Price and delivery time were both considered equally important. Price was awarded a score of 100 points up to a price of €550. For every €10 above €550 1 point is deducted from the maximum score of 100. Delivery time scored 100 points up to 8 weeks; for every week above 8 weeks 25 points are deducted from the maximum score of 100.

	Price (in €)	Delivery time (in weeks)	Score on price	Score on delivery time	Total score	Ranking
Supplier 1	650	13	90	0	45	3
Supplier 2	750	13	80	0	40	4
Supplier 3	825	12	73	25	49	2
Supplier 4	1550	9	0	100	50	1

Table 1: Uniforms

The purchasing manager notices to his amazement that supplier 4 wins (see table 1). This means that he has to pay almost twice as much for a lead-time improvement of only 33 percent. He thinks this is strange as he gave the two criteria the same weight.

Example B: good procedure, wrong offer

A municipality that wanted to buy new printers stated it would look at both speed and price. Now supplier A had two possible printers it could offer: a slow but cheap one and a faster (2x) and more expensive (2x) one. It consulted the municipality and asked to be given the relative weights of price and speed. The municipality responded with quoting a 50:50 relation. Then A decided to go in with their cheaper model.

But the job was awarded to supplier B with a product that was about as fast as A's faster product and 3x as expensive. When asking for an explanation the municipality responded (much to its regret) with quoting the 50:50 relation again and stating that B got only one third of the points on price but twice as many on speed. So A got 50+50=100 points and B got 16+100=116. Needless to say A regretted that outcome as much as the municipality.

Example C: the devil is in the detail

In this case, price is considered to be more important than quality. Accordingly, weights were chosen as 0,8 for price and 0,2 for quality. In table 2 the details of the supplier offers are given.

	Price (€)	Quality
Supplier 1	4200	60
Supplier 2	4550	80
Supplier 3	4650	85
Supplier 4	4750	90

Table 2: Details

Now for the details on scoring the price. It has been decided that a price of 4300 should be given 100 points and a price of 8600 should be given 50 points. Then there are two possible simple scoring methods for price that satisfy this requirement:

$$\text{method 1} = 150 - \frac{50 \cdot \text{price}}{4300}$$

$$\text{method 2} = 100 \cdot \frac{4300}{\text{price}}$$

Which one to use?

	Score on price (weight 0,8)	Score on quality (weight 0,2)	Total score	Ranking
Supplier 1	101	60	92,93	4
Supplier 2	97	80	93,67	3
Supplier 3	96	85	93,74	2
Supplier 4	95	90	93,81	1

Table 3: Scoring method 1

	Score on price (weight 0,8)	Score on quality (weight 0,2)	Total score	Ranking
Supplier 1	102	60	93,90	1
Supplier 2	95	80	91,60	2
Supplier 3	92	85	90,98	3
Supplier 4	91	90	90,42	4

Table 4: Scoring method 2

The rank order of the suppliers is completely reversed with the method used (see table 3 and 4)!

Example D: the runner up does not run up

A municipality received bids from 4 suppliers as given in table 5:

	Price (€)	Quality
Supplier 1	100	37
Supplier 2	150	10
Supplier 3	160	41
Supplier 4	170	46

Table 5: Suppliers

Prices were scored as:

$$\text{score on price} = 100 - \frac{50 \cdot \text{price}}{\text{lowest price}}$$

	Score on price	Score on quality	Total score	Ranking
Supplier 1	50	15	65	1
Supplier 2	25	37	62	2
Supplier 3	20	41	61	3
Supplier 4	15	45	60	4

Table 6: Outcome

Table 6 gives the outcomes of the scoring method. It is clear that supplier 1 wins. But then questions were raised about supplier 1: it was disqualified as being illegitimate. Now supplier 2 claimed victory, but scores were recalculated as shown in table 7:

	Score on price	Score on quality	Total score	Ranking
Supplier 1	disqualified	disqualified	disqualified	disqualified
Supplier 2	50	37	87	3
Supplier 3	46.7	41	87.7	2
Supplier 4	43.3	46	89.3	1

Table 7: Outcome with disqualification

By disqualifying supplier 1, the entire ranking was reversed. Now supplier 4 (originally last) claimed victory and supplier 2 finishes in last place.

Example E: With a little help from my friends

The knowledge of the scoring method can also be used to the advantage of certain suppliers. The Dutch Ministry of Economic Affairs recently released a call for tenders in which the best price was awarded 20 points, the second best 18, etc. Now suppose you can guesstimate the bids as shown in table 8:

	Score on price	Score on quality	Total score	Ranking
Supplier 1	20	10	30	2
Supplier 2	18	15	33	1

Table 8: Expected outcome

Then supplier 1 could invite friends (suppliers 3 and 4) to submit bids with the right price (in between 1 and 2) even though they may have dismal quality. The result (desired by supplier 1 of course) is that the order of suppliers 1 and 2 is reversed (see table 9)!

	Score on price	Score on quality	Total score	Ranking
Supplier 1	20	10	30	1
Supplier 2	14	15	29	2
Supplier 3	18	0	18	3
Supplier 4	16	0	16	4

Table 9: Outcome with the help of supplier friends

An analysis of formal decision models for supplier and tender selection

Some of the mishaps mentioned in the examples could have been avoided if the buyers had had followed a rigorous process in the selection of the criteria and the scoring methods. In practice the importance such a rigorous process for supplier selection is often neglected. In our teaching material on supplier selection we use a simple 5-step approach:

1. Choose criteria
2. Relate criteria to each other
3. Choose weights for the criteria
4. Choose scoring methods for the criteria
5. Determine winner

In practice steps 1 and 3 are hardly ever overlooked, even though they might be given too little serious attention (see de Boer (1998) for an adequate treatment). Here we focus on steps 2 en 4, that are usually not acknowledged in practice and consequently given too little attention.

Relating the criteria to each other (step 2)

When relating the criteria to each other almost automatically the Weighted Factor Score method is chosen. But this is only one out of many possible methods. The possible methods can be differentiated in three groups (de Boer, 1998):

1. Compensatory: A low score on one criterion can be compensated by a high score on another criterion.
2. Non-compensatory: A low score cannot be compensated by scoring high on other criteria
3. Semi-compensatory: A low score can somewhat be compensated, but never fully.

Now the Weighted Factor Score is only one of the possible compensatory methods. But many others are possible: dividing quality scores by price, multiplying scores on quality and price, AHP, etc (see de Boer, 1998). The best known non-compensatory methods are lexicographic ordering and Maximin, but in this class there are more too. Lately semi-compensatory methods have gained some popularity in public sector purchasing. In Canada the method of selecting only those suppliers with below average prices and evaluating them on quality is an example. In the Dutch Department of Foreign Affairs it is standard practice to accept only above threshold quality proposals and selecting the lowest bidder from them.

Neither of all these possibilities is superior to the others. Which one is more suitable to a given situation should be determined case by case. But it is our firm belief that this determination should get substantially more attention than it does in the cases above.

Scoring methods for the criteria (step 4)

Now given the criteria (step 1), the way to relate them to each other (step 2), the weights involved (step 3) it is still non-trivial to determine the scores on each criterion. This step 4 is often overlooked. Even in the EU directives for Public Procurement this step is given no attention at all! In practice we usually see either no prior analyses at all, or some selection of minimum and maximum scores. But even then we have to calculate the scores for intermediate offers. Again various methods can be used. Example C clearly shows the importance of this step. Again there is no single best way: we can only stress the importance of careful selection of the method to be used.

Example A and B showed an ill chosen approach for a scoring method. The maximum scores on some criteria were misjudged. This caused the unexpected low scores on these criteria. The real contribution of an attribute is measured not only by the weight of the criterion, but also by the score of the offer on that criterion:

In the case of example A and B the scoring method produced low scores, reducing the real contribution of the attribute. The ignorance of this fact caused the surprised reactions of the users on the outcome of the selection.

Not only maximum and minimum scores in the scoring method should be chosen with care. Intermediate scores and the way to determine (the scoring curve) may be equally important in determining the winner. Figure 1 shows some different scoring curves that are possible with the same maximum and minimum scores. In the case of example C the difference in curves of the scoring methods leads to a completely different outcome of the supplier selection.

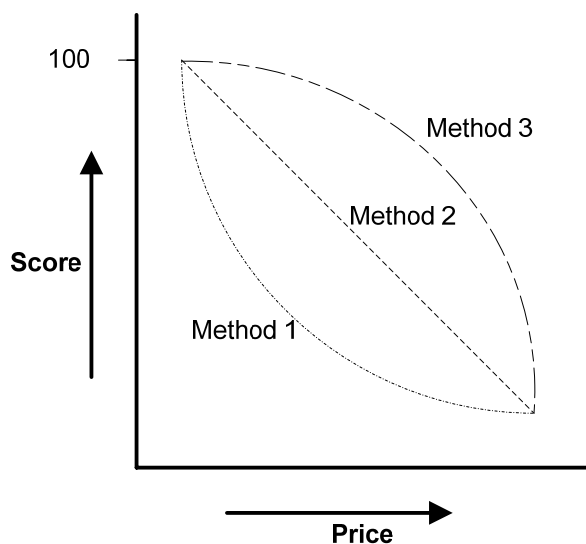


Figure 1: Some different scoring curves

Also important for the outcome of the selection is the choice for a relative or a non-relative scoring method. In a relative score the score of an offer depends on the other offers: the score fluctuates with different other offers being made. Figure 2 shows different scoring curves under a different lowest offered price. Example D and E show the problems that can arise with relative scoring.

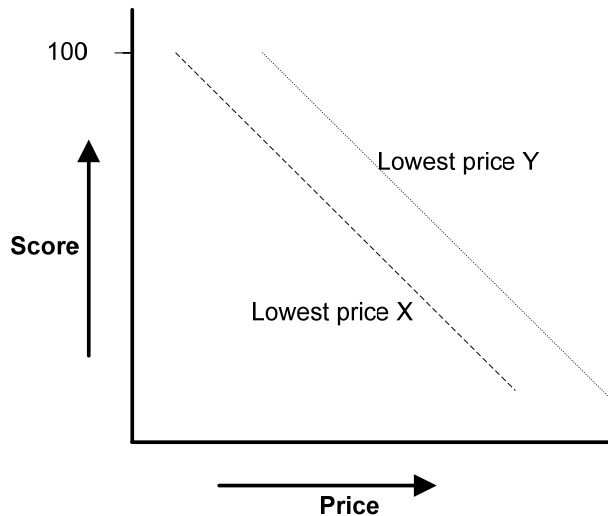


Figure 2: Different scoring curves under different lowest price

This analysis shows that determining the scores on each criterion (step 4) is unjustly overlooked. Many choices must be made when choosing the right scoring method for the situation. The examples pointed out that every scoring method has its pitfalls, but no judgment is made about what method is wrong or right. This analysis only serves to stress the existence of different (scoring) methods for supplier selection.

An analysis of the involved stakeholders' perspectives

We assume that the different stakeholders in the supplier selection process operate from quite different and sometimes conflicting attitudes, assumptions, and principles. These differences towards supplier selection could play an important role in the creation and persistence of a number of myths surrounding supplier selection and lead to the 'mistakes and miracles' discussed in the previous section. Table 10 sums up our analysis of the different points of view.

Stakeholders	Main concern, interests	”Myths”	Resulting problems in practice
Policy makers	Fair and transparent supplier selection process, justification to general public	There exists one method for supplier qualification and selection, this method is objective, widely accepted and known; specifying general priorities upfront is enough for a smooth process	Ignorant of the existence of many different methods. Confusion and conflicts about the question which specific methods actually can or should be used and to which extent the method and the related parameters should be published (and how these are to be interpreted)
Buyers (and suppliers) (positive towards formal selection models)	Transparent, professional, objective and scientifically grounded decision process, suppression of judgments	Using formal methods and techniques, a truly objective and globally optimal decision is made	Overconfidence in a formal approach to supplier selection, ignorant of the necessity of values driving the design of the model
Buyers (and suppliers) (skeptical towards formal selection methods)	Being able to continue to use judgment as the prime motivator for supplier selection, suppression of the need of explicit justification and use of formal methods	Formal models can easily and always be manipulated in order to end up with the desired (existing) supplier	Misuse of formal models, missing the point, a lost opportunity to learn more about one’s own insights and demonstrate the value of the existing supplier
Researchers (positivist)	To develop formal models that specify how an optimal choice is made in the face of multiple, conflicting criteria	Decision alternatives are given and passive courses of action, decision-makers don’t know how to proceed and hire a decision scientist to help, there is room for interaction and repeated information gathering about the alternatives, the model specifies an outcome as input for a final decision by the decision-maker	Limited proliferation of many models in the literature because decision alternatives are neither given nor passive, many buyers do not feel they need help, repeated info gathering is difficult in many formal tender procedures, the model should give the ultimate decision straight away
Researchers (constructivist)	To describe how people construct a logic to explain their actions	Formal models in general – and also in supplier selection – are both irrelevant and virtually absent in practice	Ignorance of the widespread (attempted) use of formal methods in supplier selection, and increasingly in multi-issue e-auctions

Table 10: Overview of stakeholders and their myths in supplier selection

We acknowledge and emphasize that the myths indicated in table 10 are extreme and represent exaggerations. Still, we feel that they also represent the different basic attitudes towards the issue and that they are useful for analyzing the situation.

Discussion and conclusions

The analysis of the examples shows that formal supplier selection is far from straightforward. Applying slightly different models to the same case may result in quite drastic differences in

selection of the winner. These differences are most likely the result of the buyer being unfamiliar with the method under consideration. In these cases the effects are unexpected and undesired. However, the examples also show the possibility of manipulation. Any way, as the examples are inspired by real cases, they show that formal models are used but at times not without problems.

The potential for problems is further increased by the different views that important stakeholders may have when it comes to formal supplier selection. Public policy makers seem to disregard or be ignorant of the multitude of models available which may lead to confusion about which models can actually be applied and to what extent (parts of) the method and its parameters should be announced prior to the submission of bids. In addition, the public policies seem to be based on the idea that once the buyer's subjective values have been expressed in model parameters, for example criteria weights, the remainder of the process can be considered a value-free administrative exercise. This however, may turn out not to be case and signifies an important tension between the original idea behind multi criteria decision models – namely to gradually learn more about one's values by the very building and rearranging of a model – and the strict role these models seem to have been given in especially public procurement policies.

We see the following implications.

First of all, a number of important knowledge gaps seem apparent both between important stakeholders (policy makers, practitioners and researchers) as well as within communities of stakeholders (buyers' approaches seem to range from overly positive to outright defensive ones). It seems therefore important to create more mutual understanding of these different perspectives and improve the stakeholders' knowledge about and awareness of both the many valuable aspects of formal models and their indisputable limitations. This should ultimately lead to more refined and realistic regulations as well as more nuanced attitudes from both buyers and suppliers.

Secondly, we see important challenges and implications for a number of research fields. Purchasing and Management Science researchers developing formal models must gain a deeper understanding of the practical features and dynamics of the area where their models are to be applied. When it comes to supplier selection, an important aspect for future research would seem to be to develop more simple and robust methods that can be applied by practitioners without much training and still are highly insensitive to many of the sources of surprises and problems in many real-life supplier selection cases such as different normalization procedures, removal of bids, extreme 'fake' bids and so on.

Finally, when it comes to research on supplier selection and management, we also plead for a more balanced and nuanced approach to be adopted by researchers. Formal decision models are out there, whether we like them or not. They are often used properly and provide real, effective support to those who use them. In other situations, they are ignored, used inappropriately or lead to undesired outcomes. Future research on supplier selection should take the (problematic) existence of formal methods in practice as a starting point, and be of an integrative nature – combining insights from management research, operations research, psychology and so on – rather than continuing along separate ways either exclusively ignoring or praising them.

References

- Boer L. de, Labro E., Morlacchi P., A review of methods supporting supplier selection, *European Journal of Purchasing and Supply Management*, Volume 7, Number 2, pp. 75-89(15), 2001.
- Boer L. de, van der Wegen L., Telgen J., Outranking methods in support of supplier selection, *European Journal of Purchasing and Supply Management*, Volume 4, Number 2, pp. 109-118(10), 1998.
- Boer, L. de, van der Wegen, L., Practice and promise of formal supplier selection: a study of four empirical cases, *Journal of Purchasing & Supply Management*, Volume 9, Number 3, pp. 109-188, 2003
- Choi T.Y., Hartley J.L., An exploration of supplier selection practices across the supply chain, *Journal of Operations Management*, Volume 14, Number 4, pp. 333-343(11), 1996.
- Munson, C. L., Rosenblatt, M. J., The Impact Of Local Content Rules On Global Sourcing Decisions, *Production And Operations Management*, Volume 6, Number 3, pp. 277-290(14), 1997
- Narasimhan, R., An analytic approach to supplier selection, *Journal of Purchasing and Materials Management*, Volume 19, Number 1, pp. 27-32.
- Weber, C.A, Current, J.R., A multiobjective approach to vendor selection, *European Journal of Operational Research*, Volume 68, pp. 173-184, 1993.