THE CHALLENGE OF BUYING AN INSTRUMENT

Jo Rita Jordan

(Reproduced from the March 2000 issue of Inside Laboratory Management with the kind permission of AOAC INTERNATIONAL, © 2000 AOAC INTERNATIONAL)

Purchasing a new instrument or changing suppliers involves a mixture of reason and emotion, of analysis and salesmanship, of confidence and fear. It's rather like buying a new house or car. There is no perfect choice, and even one that seems ideal before the purchase will turn out to have severe flaws - or the perfect instrument may have abysmal service. How can a lab select an instrument in a way that will minimise the chance for errors? How do laboratories really buy instruments? What roles do tangible and intangible factors actually play? How do you gather adequate information about the suppliers?

If you ask lab managers why they selected an instrument supplier, you will hear any of three popular nominal reasons:

- For repurchase of a familiar instrument type, "good past experience" with a supplier dominates the choice; happy customers come back for more;
- Lowest price;
- Special features.

The first reason covers a lot of territory; satisfaction usually means that the instrument worked as expected, had little down time, and the supplier supported it quickly and expertly. Recommendations from other users can be an important reason for selecting a supplier in the absence of personal experience. Asking for simple, easily summarised reasons for purchase, however, overlooks a complex weave of considerations, which may include possible financial stability of the vendor, the personality of the sales representative, and the risks inherent in seeking a lowest price.

PRICE

The costs of buying and operating an instrument go far beyond the sticker price, of course. An instrument that cannot perform in the intended application will be an unacceptable expense at any price. At the same time, buying too much instrument for a simple, undemanding project would be foolish. A low price can have implications for future performance, service and serviceability, documentation, telephone support, and product quality in general. One must consider the cost of assuming a larger part of the service and support within the lab. A simple, bare-bones instrument may demand costlier expertise in the operator than a more expensive, automated, foolproof design with lots of telephone and service support.

Instrument companies share the common buyer's misconception that a low price is a primary purchase criterion. Salespeople in hot competition for a sale often resort to the easiest tactic - cost cutting. When sales negotiations turn into bidding wars, customers don't always get the capability they need. Regardless of instrument type, lowest price is a primary reason in only slightly more than 10% of sales. Purchasing agents often make the buying decision for consumable items, and they rarely consider quality an important issue (perhaps incorrectly); they will treat any purchase as a commodity unless told otherwise. If quality and performance of a purchase cannot be compromised, as in the case of an instrument or key components like lab gases or columns, the lab must convince the purchasing department of the importance of quality.

A low purchase price may defer costs until after installation, when it shows up as inadequate service or design flaws. Laboratories could suffer the consequences if the cheap instrument (or supplies) compromises their analytical results. Most laboratories balance price against more substantial considerations, and those that buy strictly because of price often regret it.

The leading instrument companies rarely, if ever, are the lowest-priced supplier. They usually provide fast and competent (if expensive) service and may offer training options from courses to tutorials on CD-ROM and support over the internet. None of that comes cheap. Pared-down instruments at rock-bottom prices have their place, but they don't carry the same level of service and support (training, applications advice, telephone support) that most users need sooner or later.

Instrument companies have to cut costs somewhere in order to offer a discounted price, and the ultimate cost of the discount may be in reduced service (without a contract) or increased service costs. A well-established (profitable) company will have trained service representatives on the telephone and in the field. Smaller companies may ask customers to mail equipment back for service at the factory, or they may fly service representatives out from the factory, at the customers' expense. Mail-in service is often excellent, but it's hardly the right choice for a laboratory that can't be down for a week. For a university laboratory, sometimes cheaper is better; students can learn how to fix it.

Nonetheless, laboratory budgets are under tight scrutiny, and even the priciest instrument companies are finding ways to cut manufacturing costs without compromising performance. The first GC/MS (Finnigan) was a magnificent instrument, but practically no one could afford it. Over the years, Agilent (H-P), Varian, and Finnigan have shaved costs, and now excellent, low-priced GC/MS is in reach of most laboratories. There are still custom-made million-dollar instruments, such as ever-more-powerful NMR and Fouriertransform MS, but newer models of the more popular instrument types do more, reliably, at less cost, in smaller packages, than ever before.

Meeting a customer's specifications costs the vendor money; keep in mind that if you demand the lowest price, you can't demand careful adherence to your specifications. If you order beer, don't expect Dom Perignon. Likewise, don't specify performance you don't need, or you'll pay for champagne when you thirst for Fosters.

PERFORMANCE

In addition to meeting a budget, a laboratory needs an instrument that will satisfy its needs for accuracy, precision, detection limits, and identification of compounds. Locating an instrument that will do this means weaving through a maze of sales claims. Sales representatives often overstate their products' performance and denigrate the competition. The buyer has to keep an eye on important issues and ignore the rest. It isn't always easy. If there is to be a demo, it's up to the buyer to submit real samples, lay out the rules for a rigorous demonstration, and be present when the applications laboratory analyses them. Buyers of instruments small enough to move easily may be able to get a trial period in their own labs - the ideal demonstration. The best demo of a large instrument may be to visit (with the salesperson) the lab of a current user. The buyer knows that the instrument is a standard model, and the user's experience adds a touch of credibility.

Unlike actual performance, "features" are often artefacts of the sales negotiation. A feature is an innovative design or special function that may or may not enhance analytical performance. It matters a great deal whether a mass spec is an ion trap, time-of-flight, or a quadrupole (for example), but not all "features" are so critical. A CEO of an instrument company once bragged about his company's ability to use unique (though useless) features to create an illusion of uniqueness. Their salesperson would contact a buyer first, describe their widget, and convince them the feature is utterly essential. The next company salesperson to visit the lab faces the question, "do you have the Feature?" They can only say, "uh, no," putting second salesperson in the position of having to explain why they don't offer it. Any explanation sounds weak and defensive, even if true - even though the widget may be completely worthless. This sales trick is hard to detect when a buyer is entering a new or unfamiliar field. Demand proof of the value of any "unique feature" before accepting it as necessary.

ACCURACY AND PRECISION

Accuracy and precision are usually described in terms of firing at a bull's-eye. "Accuracy" is how closely the average position of many shots come to the bull's-eye. "Precision" is how closely the shots cluster on the target. Accuracy alone means little if the precision is so poor that it takes 100 repeated analyses to get a significant average. Precision doesn't mean much if the gun habitually shoots off to one side, showing a bias. In a vendor demonstration, buyers need to provide samples that are well-characterised by established methods in their own laboratory, as well as standard reference materials, to judge the accuracy of an instrument.

Methods also specify target precision and should define how to test for it. Precision is one of the easiest points where a demonstration can fool the buyer. Some vendors make a few (two or three) quick measurements over a very short period and average them to get a "precision" figure, say, 3.51 ± 0.07. This leaves the incorrect impression that the precision of the measurement is "0.07," when that is simply the standard deviation (or perhaps two or three times the standard deviation) over the short time. What happens

if they make the same series of quick measurements an hour later and get 3.85 ± 0.07? Is the precision the same? How could the average differ by so much when the precision is so "good?"

If the instrument's response drifts around slowly, a few quickly repeated measurements won't see the drift. The instantaneous precision may seem good, but drift shows up in measurements made at longer intervals. Buyers need to consider how often they calibrate and ask for measurements made over a comparable period of time in a demo. If you calibrate once a day, you should specify tolerances on precision over a full day. Otherwise, you may find yourself with an instrument that must be calibrated too frequently, robbing you of working time and sample throughput. Periodic quality checks may fail, resulting in repeated analyses of whole batches. The buyer must tell the vendor how to define and measure precision, and not just take the applications laboratory's word for it.

Even if a demonstration shows excellent accuracy and precision, the demo laboratory may have an instrument that performs better than the standard production model. The variability of instrument quality depends very much on a manufacturer's quality control; some companies are better than others. You might get an instrument that performs significantly worse (or better) than the one your samples were run on. You'll need to set up an agreement that makes sure your instrument is working in your laboratory according to your specifications before you pay the vendor in full. They will need some payment in advance in order to make and ship the instrument to you, of course. Also, a supplier with ISO 9000 certification may be a safer bet than one without it - but not necessarily. Innovation sometimes thrives outside ISO.

SENSITIVITY

One of the biggest battles among sales representatives centres on sensitivity. There are many ways to measure limits of detection; make sure you know how each supplier has measured theirs and that all the figures are consistent. Limits of detection (LOD) and limits of quantitation (LOQ) are critical parameters to laboratories working with trace quantities, and labs must define their needs precisely before buying an instrument.

LOD is a concentration at which an analyte can just barely be detected (not measured) by the equipment. It is usually defined as some factor (f) times the standard deviation of measurements made in pure solvent - the "concentration" equivalent of background noise. It is a limit to the performance of the instrument; no reading below that number has any meaning. If the factor (f) is 2 (not uncommon when vendors want to make their LOD look good), the total signal is twice the LOD. The precision is at least equal to the LOD, so the RSD of the precision is equal to LOD/Total signal, or 50%. There is also a method LOD in which the baseline precision is measured on a blank sample pre-treated according to the method. Be aware of the methods used to define LOD and interpret the numbers carefully. Methods and procedures for trace analysis frequently define the measurement of LOD, and this is the quantity that should be tested, not the manufacturer's claims.

LOQ is a more useful quantity; it indicates where the actual measurement range of the equipment begins. It refers to a signal that is far enough above the background noise, usually a factor of ten, that the precision yields a believable result. There are cases where the LOQ is substantially above the LOD, based only on the baseline precision. If an instrument uses software to seek and locate a peak or spectral line for measurement, its LOQ may need an analyte signal many times the LOD. In this case, the LOQ cannot be defined simply as a set factor times the LOD. Buyers should be aware of the instrument's mechanism of locating and determining the analyte peak when considering sensitivity claims.

RESOLUTION

"Resolution," which determines the degree of separation between adjacent chromatographic peaks or spectral lines in an emission spectrum, absorption bands, or minimum detectable feature in a microscope, is one measure of the quality of a chromatograph or spectrum. If peaks (of any kind) overlap, you may get precisely wrong answers in some matrixes, and you might mistake interferences for the analyte. It happens to the most experienced analytical chemists. Whatever instrument you are buying, include tests for resolution, rather than relying on a manufacturer's published figures. The applications laboratory needs to know what's in your samples so they can test for potential interferences. Otherwise, demonstrations may be done on pure standards, where the interferences of real samples won't appear. With all kinds of complex instruments, resolution is limited by the weakest part of the system.

RUGGEDNESS

A relatively new concern in instrument purchase is how well methods perform on different instruments from different vendors. A careful measurement on one instrument should agree reasonably well with measurements made in other laboratories on other equipment. The method and the equipment design have to be "rugged" enough that the identity of the equipment is not a factor in the measurement. Sometimes it is, however. Wavelength ranges may be limited in low-priced models, precluding their use in some applications.

New technology rarely agrees with old methods, and equipment may not agree among vendors. Completely new instrument types and new techniques take years to come into the mainstream of analytical chemistry, as the differences between their performance and the traditional methods are worked out. Each vendor claims utter superiority of their design, and it's up to buyers to decide if advantages outweigh the differences from accepted techniques. Sometimes advantages can significantly benefit a laboratory's company, and early adoption of a new instrument, before the bugs are worked out, may be worth the learning curve.

SUPPORT

When a laboratory gives the reason of "happy previous experience" for buying from a particular vendor, it usually means they like the service and support. For an instrument that performs adequately (and most do), good service is what keeps users happiest. That means a skilled service representative close by, fast response to telephone calls, and service that is finished in one call. Labs want minimum down time, and they want fast, effective action when something goes wrong. If they're neophytes, they want help while they scale a steep learning curve. Good service costs money. If vendors are to make a profit and still provide good warranty service, they have to manufacture instruments that don't break down. If a supplier is to provide long term service that customers can afford, they must be able to supply parts, service manuals, good service representatives, training, and telephone support. None of that is cheap, but laboratories sometimes assume that it should be free.

Responsiveness and competence are key factors. How fast does the company return phone calls? How quickly can they get a repair person in your laboratory? Once he's there, can he find and fix the problem quickly? Does he have to come back repeatedly for the same problem? Is there continuity - does a different service person come in every time, reinventing the wheel as you pay a steep hourly charge (plus travel expenses)? You won't get answers to these questions from the manufacturer. Talk to users and find out what laboratories in your area, in your type of business, say about the support. Sometimes a company with a terrible reputation overall may have a gem of a service person in a small area. Or vice versa.

Service isn't just fixing a problem. It's answering a phone and giving advice or being able to fix operator error and chemistry. It's training users to understand and maintain their own equipment, and solve common problems with parts sent by overnight express. It's good documentation where basic answers are easy to find and understand. There is a real trend toward minimising on-site service, through training courses, CDs that "play" on the instrument's computer to lead users through routine maintenance, troubleshooting, and simple repairs. Preparing really good documentation and troubleshooting guides are not simple or cheap tasks either, but it can save both vendor and customer time and money in the long run. Look for companies that offer such support, and check it out during demonstrations.

Laboratories don't just start using instruments immediately after installation. They take days, weeks, or longer to validate the performance before they trust its data. This is especially true in pharmaceutical laboratories, where cGMP and GLP prescribe validations procedures. With ISO 9001 and other quality programs, validation is the rule in other laboratories, as well. Most instrument manufacturers now validate instruments before shipment and then help laboratories with their own validation after installation - the time saved is usually worth more than the cost for the service.

SUPPLIERS

Purchasing agents regard instrument purchases in a different light from the lab. They want to know how long a vendor has been in business and if they will be around to support their equipment long term. Small startup companies chafe at being asked for this data, but it's important to laboratories who can't afford to be a proving ground. Company "reputation" is a general reflection of customer respect as much as familiarity. Market leaders have a good reputation because they are well-known, but they gain that market share to a great extent by keeping customers happy. Where there's smoke (reputation), there's often fire (a solid company). It still pays to check with recent customers; things can change, especially if there has been a management change, a merger, or an acquisition affecting your product.

A company's expertise in the basic technique of their products translates into better support for hardware, software, and applications. Some companies were pioneers in their fields and employ scientists who continue to do basic studies on the science underlying the measurement. These companies are as respected in the field as the best academic researchers. Technical experts may also be so enmeshed in technical details that they can't build a simple instrument for routine users. Other companies acquire a patent for a design, hire some engineers, and build an instrument that no one in the company understands profoundly; such a company may even build a fine instrument but can't support it. Learn about company expertise through conversations with users and through papers and contacts at trade shows or specialised industrial shows. You may be able to judge from the depth or flash of a brochure and the quality of publications and applications notes. Can you understand them? Do you learn from them? How do they compare to competitors' offerings?

SALES REPRESENTATIVES

Sometimes a rational discussion about performance, service, and even price evaporates under the spell of the salesperson's charm. Ideally, a salesperson devotes time to making sure a product fits the customers' needs so, as they say, everyone is a winner. Salespeople who know the equipment and its applications and understand the buyers' language are a joy to find.

Most salespeople fall short of the ideal - just as customers aren't always sure what they need or want. A sale often comes down to which salesperson makes the most convincing presentation or cuts prices the most. Customers are rarely the winner when that happens.

The salesperson is the contact point with the vendor and is there to transmit your requirements to the company and to see that their products do what you need. A company has the responsibility to provide well-trained, competent salespeople just as much as decent service technicians. If a salesperson is a barrier to your purchase quest, it may be best to abandon contact with the company. Watch out for competition-bashing, overstating facts, and making verbal promises not supported in writing. Sales representatives should stick to talking about their own products; they are not experts on their competitors' products and cannot judge their performance or quality.

CONCLUSION

Buying the right instrument for the job is largely the responsibility of the buyer. It's a big purchase, and you'll be judged by its success; keep that in mind when the sales representative spins seductive tales. Vendors have a tremendous amount of valuable information, but sales representatives can overstate or hide the true strengths of the product. The buyer has to be critical and alert, always looking out for his or her lab's interests. A successful purchase is a collaboration between the lab and its technical expertise, the purchasing department and their detached perspective, and the vendors, who know their products better than anyone.