Strategic outsourcing: Balancing the risks and the benefits

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Pharmaceutical research organizations can benefit from outsourcing discovery activities that are not core competencies of the organization. The core competencies for a discovery operation are the expertise and systems that give the organization an advantage over its competition. Successful outsourcing ventures result in cost reduction, increased operation efficiency and optimization of resource allocation. While there are pitfalls to outsourcing, including poor partner selection and inadequate implementation, outsourcing can be a powerful tool for enhancing drug discovery operations.

The simple cost calculation for discovering a new drug is astonishing, as each successful drug has to bear the cost burden of the failures. Less than 50 novel drugs enter the market each year at a current combined estimated cost of $60 billion in R&D, resulting in a cost of approximately $1.2 billion per drug[1]. Moreover, the average time to bring a drug onto the market currently exceeds 15 years. It is disputed whether increasing spending alone is the answer to these problems. Given the increasing market opportunities for novel drugs and the growth imperatives of pharmaceutical companies, increased efficiencies in any drug discovery operation or strategy has a large payoff. Successful discovery strategies aim to limit costs, reduce the time to bring drugs to the market, and raise the probability of clinical trial success. Strategic outsourcing is potentially a cost-effective solution for accelerating drug discovery, and it is one that the industry has not largely implemented.

Historical and current discovery outsourcing

The discovery phase of R&D identifies lead compounds and attempts to eliminate obvious problem compounds before progressing into preclinical and clinical trials. It involves selecting therapeutic targets, constructing and managing diverse chemical libraries, screening targets against those libraries, optimizing medicinal chemistry work, and performing early metabolism and toxicity studies (ADME–TOX). Industry data indicates that it takes approximately four years to accomplish these tasks.

Outsourcing in the discovery phase has been limited. It appears that the pharmaceutical industry has been slow to outsource because of four factors:

- Until recently, attractive discovery outsourcing partners were not generally available
- All phases of discovery have been considered core competencies
- The industry has not kept pace with the accelerated technological changes in discovery operations
- Outsourcing is a strategic commitment involving difficult and risky management decisions.

These factors have resulted in limited sharing of targets, a focus on inefficient in-house screening operations, multiple redundant purchases of combinatorial libraries with their associated inventory management, bottlenecked in-house medicinal chemistry work, and slow acceptance of multiple ADME–TOX screening techniques.

Outsourcing – a strategic decision

Outsourcing requires a change from traditional thinking. It involves strategic planning and a rigorous economic and business analysis of the organization's discovery operations, particularly those activities that are not essential to

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the organization's core competencies. Such competencies are substantially unique, and they typically lead the company to new products and/or into new markets. The core competencies for a discovery organization involve the selection of proprietary targets that yield biological insight into disease mechanisms and which can be useful screening targets for lead compounds, and the selection of optimized lead compounds for clinical trials.

These core competencies involve decision processes based on data from many sources, both inside and outside the organization. With the rapid technical change occurring in the industry, the processes involved in generating the data are not necessarily core competencies.

Outsourcing examples

Cost savings

Recent advances in discovery techniques in biotechnology companies, and the appearance of these techniques on the market at competitive rates, has expanded the options available to optimize the time and reduce the money spent on discovering new drugs. Successful business strategies consider outsourcing everything in discovery operations except the core competencies, and can include target validation, library management, primary screening, combinatorial chemistry and ADME–TOX screening.

One example of an outsourcing opportunity is automated high-throughput screening (HTS). Leading supplier companies can now offer screening services in miniaturized formats, using appropriate high signal-to-noise techniques, to generate up to 100,000 data points per day. Market rates from screening service suppliers are approximately $1.50 per data point. This can be extremely cost effective when examining the overall cost per data point now spent in the industry. The exercise to calculate estimated cost per assay point shown in Box 1 illustrates current costs associated with screening in-house today. The estimated cost of $4.38 per test for in-house testing is twofold to fourfold more expensive than current market pricing for outsourced screening. At current market pricing, outsourcing the screening processes could save the industry up to $1 billion per year or, more importantly, more targets and compounds could be screened.

Increased knowledge

Cost savings are only part of the advantage of outsourcing in this instance. By focusing on data interpretation rather than data generation, the in-house discovery operation can spend more time and effort understanding target interactions and relationships using information previously obtained from other screens and other data sources on lead compounds.

Box 1. Exercise to calculate estimated cost per assay point

Cost of screening including screen development
$2.25 billion

- Currently, screening and pharmacological testing makes up approximately 15% of total R&D expenditure.
- With $60 billion projected for R&D spending in 2000, screening and pharmacological testing is projected to be $9 billion.
- Screening and screen development costs include equipment, consumables and personnel (this does not include buildings and the associated overheads), and make up approximately 25% of the $9 billion (i.e. $2.25 billion).

Cost of screening without screen development
$1.75 billion

- Costs include the staffing costs to develop 2000 screens, estimated at one person-year per screen (i.e. 2000 person-years).
- 2000 person-years at $250,000 per person is $0.5 billion.
- The cost of screening without screen development is $1.75 billion.

Estimated cost per assay point
$4.38

- Assuming the top 20 companies are screening approximately 50 targets each year against approximately 300,000 compounds, then that totals 300 million tests per year.
- Assuming the next 50 companies are screening 20 targets per year against 100,000 compounds, then that totals 100 million tests per year.
- Total tests run per year is therefore estimated at 400 million.
- 400 million tests per year at a cost of $1.75 billion is $4.38 per test.

This should increase the choice of lead compounds that are sent to the clinic and improve the chances of clinical success. Cost savings can be multiplied and the time to market reduced, further decreasing costs and increasing sales potential. For smaller companies that are unable to make the investment in HTS robotics and infrastructure, outsourcing could be crucial to remaining competitive with the larger, higher-funded discovery operations. For any size of operation, outsourcing can be used to balance capacity utilization and optimize timing on internal investment in facilities.

The number of potential targets resulting from advances in genomics has created a significant opportunity to understand biological disease processes and discover more higher-quality lead compounds. Using externally generated genomic and proteomic information databases for target selection enhances the effectiveness of the discovery operation. This outsourcing opportunity was one of the first to be exploited by the industry. Companies offer access to genomic data from one centralized and optimized laboratory operation that characterizes genetic data. Subscribers to the data get the power of the combined operation at a fraction of the cost of doing the entire work in-house.

Using diverse compound libraries

The size of compound libraries resulting from advances in combinatorial chemistry has created a significant opportunity to discover new therapies, and discovery companies are now buying access into diverse libraries. One outsourcing opportunity might involve using a central compound storage and management operation that can place compounds into miniaturized plate format on demand. Again, all users would gain the advantage of a much larger and more diverse set of compounds than they could afford to manage alone. Combining this with HTS could generate significant information on proprietary targets in a short period of time.

Sophisticated HTS laboratories have emerged that manage and incorporate many different types of targets into screens and perform primary screening of extensive compound libraries against numerous targets. HTS laboratories integrate a robotic screen–development platform with leading-edge competencies in biology, chemistry, automation, software and advanced technology. Hence, outsourcing can result in increased assay throughput while minimizing library compound usage, the economics for this model being discussed earlier.

HTS can also be used to cost-effectively gain crucial information on the ADME–TOX characteristics of lead compounds and even on entire libraries. This would lead to the quicker identification of obviously problematic lead compounds or problematic concentrations. Outsourcing of this service for an in-house library or access to a prescreened large, diverse library is another opportunity to gain significant advantages in discovery.

Many other opportunities now exist for outsourcing and more will exist in the future. Medicinal chemistry optimization from specialized chemistry experts has been used to augment internal capacity. In the future, access to large diverse databases of test results for targets and compounds could be the ultimate outsourcing opportunity for discovery with the discovery company competence focused on technical and market data analysis.

Key management considerations

Outsourcing should be thought of as a strategic commitment. The decision to outsource drug discovery operations requires time and tough business decisions. Strategic considerations affect the selection of outsourcing partners and determine the nature of the relationship between the organizations. Successful partners understand the organization's discovery operations and work effectively with in-house experts who understand and manage the relationship. Outsourcing partners should be strong business players with competent business and technology teams, not marginal research outfits. They should also demonstrate unquestionable, high-quality approaches to science and business. The most effective relationships with discovery outsource partners are long-term, as building strategic relationships takes time and investment and changing those relationships can be difficult and costly.

Developing a long-term, successful relationship with a discovery outsourcing partner also involves tactical considerations. The partner needs to have:

- Leading edge technology expertise (e.g. information handling, robotics, biology and chemistry)
- Understanding and support for a broad coverage of multiple target classes in therapeutic areas (e.g. known and orphan G protein-coupled receptors, ion channels, proteases, kinases, transcription factors and other enzymes)
- Access to requisite reagents, chemistries and intellectual property that enable a wide variety of research options
- Large-scale data handling capability to capture, reduce, store and analyze large volumes of information
- Flexibility to work with multiple in-house systems and groups
- Sufficient capacity to handle varying demand levels
- A good business foundation (i.e. a long-term viable partner)
- Confidentiality.

Avoiding outsourcing pitfalls

Ensuring long-term success from outsourcing ventures involves the development and implementation of a sound outsourcing strategy, as an unsound or poorly implemented strategy can be detrimental to an organization's competitiveness. The fundamental strategic mistake is to outsource a core competency. Training a potential competitor either how to select valid proprietary targets or on the methodology of drug selection for clinical success, compromises the primary core competencies of discovery organizations.

Most discovery organizations interested in outsourcing will understand this risk.

One of the most common pitfalls in the majority of industries is a poorly implemented outsourcing strategy, and this is no different in drug discovery. Poor implementation typically results from an inadequate partner or a short-term focus for the outsourcing venture, leading to the frequent switching of suppliers instead of making them partners. A short-term focus puts stress on the supplying company, resulting in poor performance because of inadequate time for the supplier to adjust to demand swings, to learn operation expectations and to establish a performance history. Frequent changes in partners also compels the outsourcing organization to constantly establish new relationships and train new suppliers on, for example, communication paths, modes of operation and quality expectations.

The relatively recent emergence of the drug discovery outsourcing market makes partner selection on business reputation alone a difficult task. In the unstable world of viable biotechnology businesses, particularly when business viability can be based on only a few outsourcing arrangements, deciding on a partner with strong business management is vital. Another tactic for picking a viable partner involves selecting one that is already doing business with a large pharmaceutical company. Technically inadequate partners, while a hazard, are usually easy to avoid given diligence and the highly technical nature of drug discovery outsourcing.

Conclusion

Strategic outsourcing can be a cost-effective alternative to in-house discovery operations in a variety of technically driven areas. It is often characterized by cost-effective access to the latest technology (some of which might otherwise be unavailable) and sufficient operational capacity. Given the nature of a competitive market, successful, established outsourcing partners provide effective services at a fraction of the in-house cost. This arrangement frees valuable resources for focused proprietary discovery work, and can avoid costly capital investments in specialized areas that can be better served by a centralized facility serving multiple customers. Technical expertise comes from consultant scientists with leading-edge competencies in appropriate disciplines. Outsourcing can also provide crucial competitive leverage for smaller discovery operations that cannot match the investment of the larger companies.

Strategic outsourcing is an increasingly available option to discovery operations today and should be actively considered and compared to in-house investment, across the spectrum of the discovery processes. While there are potential pitfalls in outsourcing, the overall cost and time benefits can be significant, especially for moderate-sized and smaller pharmaceutical and biotechnology companies.

REFERENCES

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