

United Nations Industrial Development Organization  
Vienna, Austria

International Centre for Science and High Technology  
Trieste, Italy

## Module 3

# TECHNOLOGY ACQUISITION



Training Course on  
Technology Management

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# 3

## TECHNOLOGY ACQUISITION

### 3.1

#### Technology Acquisition Options

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### Introduction ...

#### Technology acquisition option

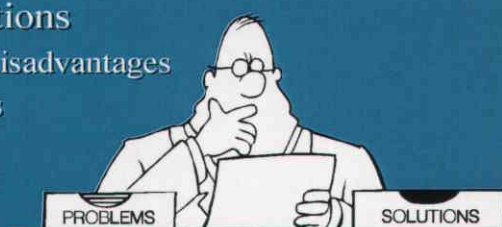
- internal
- external
- combination of internal and external

#### Choosing appropriate option

- present capabilities
- growth plans
- cost/benefit

#### Details on 13 options

- advantages/disadvantages
- benefits/risks
- cost issues



This module explores the different routes through which a firm can acquire the technological knowledge it needs to exploit strategic options. It will illuminate the advantages and pitfalls of each route. It will provide a framework to help in making key decisions about the technology acquisition options that can be considered. Finally, it will provide information that will help a firm learn from its technology transfer process so that it will develop the skills to be a learning organization that will continue to access technology to improve its position in the marketplace.

The information in this module is arranged as outlined below.

#### Explanation of technology acquisition options

- internal acquisition
- external acquisition
- combination of internal and external

#### Choosing appropriate options

- audit of company capabilities and growth plans
- key cost/benefit issues

#### Details on each technology acquisition option

- advantages and benefits
- disadvantages and risks
- cost factors

The terms "technology transfer" or "technology acquisition" have a variety of meanings depending on the person's experience or orientation. Some will say that technology transfer means licensing technology. Others think of buying equipment with embedded technology. Still others think these words describe the acquisition of information that helps the firm do things it could not do before. The fact of the matter is that all these meanings and more are correct. Technology transfer addresses the acquisition of technology from any source — internal, external, or a combination of both.

Through a combination of watching for signals that reveal threats and opportunities and the process of strategy development, a firm will come to a decision as to what technology it needs to acquire. At this point the firm must leave the world of concepts and analysis and become practical. The firm must learn about the possible sources of its desired technology, make some hard decisions about which source is most appropriate, and put the agreements and plans in place that will result in the acquisition of the technology.

# 3 TECHNOLOGY ACQUISITION

## 3.1 Technology Acquisition Options

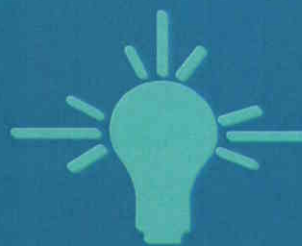
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### Acquiring the technology to support the strategic plan ...

#### Internal sources

- Tacit knowledge
- Internal R&D



#### External sources

- Purchasing
- Licencing

#### Combination of internal and external

- Reverse engineering
- Strategic partnership



Internal technology acquisition is the result of technology development efforts that are initiated and controlled by the company itself. Internal acquisition requires the existence of a technological capability in the company. This capability could vary from one expert that understands the technological application well enough to manage a project conducted by an outside research and development (R&D) group to a full blown R&D department. It also includes the less well-known process of seizing tacit knowledge (understanding and codifying knowledge that already exists inside the company, but is not well enough understood or widely used).

Internal technology acquisition options have the advantage that any development becomes the exclusive property of the company. In addition, the resulting technology will be tailored to meet the company's need. However, internal development also has risks. The development of technology generally takes longer than acquiring and adapting already-developed technology from external sources. Internally-developed technologies generally cost more than those acquired externally. This is primarily because the development costs are often written off against the application for which it was originally developed. Therefore those selling technologies generally do not have to recover the full development costs in their selling price. And, last, but not least, is the fact that the company may not have the expertise to develop or even manage the development of a technology internally.

External technology acquisition is the process of acquiring technology developed by others for use in the company. External technology acquisition generally has the advantage of reduced cost and time to implement, and lower risks. However, almost all technology available from external sources was originally developed for different applications. Therefore external acquisition usually must contain an aspect of adaption to the acquiring company's application. The acquiring company must realize that this adds back in some costs, time, and risks to the project.

External acquisition can take the form of licensing, purchasing equipment with embedded technology, investment in a joint venture which has a technology development purpose, or even the acquisition of a company that has the desired technology. Which external acquisition channel to take generally depends on which channel has the desired technology available. Assuming the technology is available from several sources, the choice becomes a business decision where costs and benefits of each option are compared and the best all-around choice is selected. Care must be taken to consider all the factors when making this decision. The value of fairly intangible things like long-term relationships and public image must be considered along with more technical issues like the fit of the technology to the need, quality issues, function, and price.

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## TECHNOLOGY ACQUISITION

### 3.1

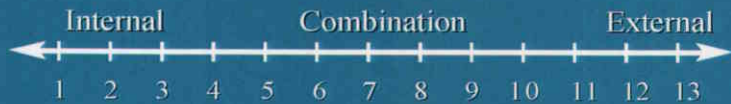
#### Technology Acquisition Options

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### OPTIONS: Continuum from Purely Internal to Purely External ...

1. Seizing Tacit Knowledge
2. Internal R&D
3. Internal R&D with Networking
4. Reverse Engineering
5. Covert Acquisition with Internal R&D
6. Covert Acquisition
7. Technology Transfer and Absorption
8. Contract R&D
9. R&D Strategic Partnership
10. Licensing
11. Purchasing
12. Joint Venture
13. Acquisition of Company with Technology



Many forms of technology acquisition are a combination of external and internal activities. Combination options include the addition of networking to internal activities, reverse engineering (where internal people decipher developments accomplished by others), covert acquisition (the more blatant copying of another company's technology), contracting others to conduct R&D for you, and forming a R&D partnership where portions of the technology development are shared with others. In fact the list of options discussed in this paper form a continuum from purely internal to purely external.

Given the parameters of the world in which we live the first step is to accept the fact that there will not be a perfect solution. All options have advantages and disadvantages. Generally the advantages that a company is looking for will not all reside in one option. In addition, the disadvantages that the company may find hardest to deal with will often come with the option with the advantages most sought after. The company management must investigate each option, consider the pros and cons of each and make the selection that has the best overall combination of assets and problems for the company.

	Purely Internal		Purely External
1. Seizing Tacit Knowledge	X		
2. Internal R&D	X		
3. Internal R&D with Networking		X	
4. Reverse Engineering		X	
5. Covert Acquisition with Internal R&D			X
6. Covert Acquisition			X
7. Technology Transfer and Absorption			X
8. Contract R&D			X
9. R&D Strategic Partnership			X
10. Licensing			X
11. Purchasing			X
12. Joint Venture			X
13. Acquisition of Company with Technology			X

# 3

## TECHNOLOGY ACQUISITION

### 3.2

#### Choosing Appropriate Options

Choosing the best source option for your company ...

Assess the advantages and disadvantages

- Company technological growth
- Exclusivity/competitive advantage
- Company capability
- Time to market
- Risk of failure
- Costs/affordability

Consider all and choose the best overall option



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The advantages and disadvantages of internal, external, and combination internal/external technology acquisition sources will be discussed in the following six pages under the headings listed in the slide above.

### Company Technological Growth

The company's need for technological growth must be an important consideration when deciding among technology acquisition options. Ideally, the company should grow technically from every technology acquisition. This is desirable because if the technology acquisition develops internal capability the company becomes less dependant on others. It is able to deal with problems that arise after the introduction of the new technology and it is able to develop its own enhancements of that technology. This reduces its need to purchase services from others, makes it better able to service its own customers in a timely and responsive manner, and increases its potential to develop exclusive products or processes which will give it a competitive advantage in the marketplace. Company managers must have a plan for growing the company, and growing its technological capability has to be part of that plan. The acquisition of new technology must be considered in light of the company's plan for growth.

Internal technology sources and those that access external information while being driven by internal activities offer the best opportunities for technological growth. When the company's personnel are grappling with the hands-on issues of developing technology, they understand its strengths and weaknesses in a way that cannot be told to them by others. Enhancing internal capability by acquiring information via networking or reverse engineering is good because the company's knowledge base is broadened without loosing its hands-on feel for the technology. External acquisition options are the least likely to develop technological strength in the company. There are, of course, many situations where the acquisition of technology from external sources is the best, or perhaps the only option, that will move the company ahead. Care must be taken to address the need for company technological growth by designing the technology transfer process in a way that maximizes the enhancement of the company's technological capability. This generally means that training sessions on the theory and practice of the technology must be included in the acquisition.

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## TECHNOLOGY ACQUISITION

### 3.2

#### Choosing Appropriate Options

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### External technology sources ...

#### ADVANTAGES

- reduced time to market
- reduced risk
- address internal capability

#### DISADVANTAGES

- low technological growth
- give up exclusivity advantage
- have to adapt the technology



**COSTS** generally lower, but be sure to consider implementation cost

#### **Exclusivity/Competitive Advantage**

Many companies rely on a technological advantage to differentiate their product from their competitors. These companies must use internal technology development via internal research and development or contracting R&D from an exclusive supplier to maintain their competitive advantage. Technology acquisitions that do not give them exclusive access to the technology makes it impossible to prevent their competitors from having the same technology in their products.

There are some exceptions to this general case. If a company can negotiate the exclusive use of another company's technology in a market that is not being served by the company owning the technology, it can have a competitive advantage over its local competitors. A common example of this is when a company in a developing country acquires the use of a technology from a company in a developed country. The technology transfer agreement in these cases generally specify that the acquiring company can use the technology in their country and the providing company will not compete in the market in that country. Another example is when the acquiring company uses the technology in a different customer market in the same geographically area, such as applying a machine tool technology to the health care market. The acquiring company may have the customer base and reputation such that it would be much more successful than the developing company in the new market.

Care must be taken to address the future. Even though the technology acquisition may give the company a competitive advantage, that advantage will not last. Other competitors will develop similar or perhaps better versions. Many acquiring companies include the right to future enhancements made by the providing company in their technology transfer agreements. This assumes the market the providing company is serving is demanding the same enhancements as the market being served by the acquiring company and that the providing company is proactively developing improvements. In order to be fully able to maintain a competitive advantage the acquiring company must develop an internal capability so that it can maintain the technological leadership in its market that the external technology acquisition first provided.

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## TECHNOLOGY ACQUISITION

### 3.2

#### Choosing Appropriate Options

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### External technology sources ...

#### ADVANTAGES

- reduced time to market
- reduced risk
- address internal capability

#### DISADVANTAGES

- low technological growth
- give up exclusivity advantage
- have to adapt the technology



**COSTS** generally lower, but be sure to consider implementation cost

#### Company Capability

Obviously a company without internal technical capabilities cannot conduct internal technology acquisition. Companies with internal technological capabilities have a greater number of options than those that do not. Companies must make their acquisition decisions with a full understanding of their internal capabilities (or lack of them). A company should not overestimate its internal capability. It should not put its people into a position of making decisions or managing situations that are beyond their knowledge base. This can result in errors that can seriously impact the company's health or even be fatal. The company lacking internal technical capability must have a consultant that it trusts, like one of its own employees, to help it make good technological decisions both in the technology acquisition process and after.

As highlighted earlier, a company should be acquiring technology in a fashion that builds its technological capability. This is especially true of the company that is completely dependant on outside support. These companies must pay special attention to be sure that their technological acquisition projects are structured in a way that the internal capability grows at least to the point that it can manage the technical aspects of external development projects with its own people.

#### Time to Market

The length of time from the acquisition of technology until the company begins to recover revenue from its investment via the sale of products or services resulting from the new technology is a key factor in the acquisition decision. Internal acquisition generally takes longer than acquiring already-developed technology from external sources. Managers have to weigh the reduced capability development opportunities and possible lack of exclusivity offered by internal development against the faster time to market offered by external technology acquisition. In many cases it makes absolutely no sense to develop technology that already is able to produce the products or services desired by the company. This does not mean to say that external acquisition is instantaneous. Time must be allowed for the acquisition process, equipment set-up, modification to meet local raw material requirements, staff training, and the necessary changes to the company's promotional material. However, the opportunity cost of taking the time to develop the company's own solution may be such that acquiring existing technology is the best choice.



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## TECHNOLOGY ACQUISITION

### 3.2

#### Choosing Appropriate Options

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### Combination of internal and external sources ...

#### ADVANTAGES

- share risks
- share costs
- can result in exclusivity
- reduced time to market

#### DISADVANTAGES

- reduced technological growth
- implementation problems
- have to share information



**COSTS** generally between internal and external costs

#### **Risk of Failure**

There are risks in all types of technology acquisition. However, the risks change with the type of acquisition. The risks of technological failure are greatest with internal and contract R&D. No matter how good the researchers and designers are, R&D projects may not attain their goals. Research and development, by definition, requires travelling into unknown territory and whenever one is dealing with the unknown it is difficult to predict the outcome. A related and common risk is not absolute failure, but the development taking much longer than expected. In this case the risk is more in the area of unknown costs and length of time until the development can begin earning the company money. Purchasing proven technology greatly reduces the risk of technological failure, but does not eliminate it. The company still has to adapt the acquired technology to its application which may have characteristics that are different enough from those where the technology is successful, that it fails.

There is another area of risk that also has to be considered. That is the risk that the technology will not be accepted by the company's employees. Failure in this area is usually due to lack of education and communication about the benefits of the new technology. Most people see change as a threat. Change that incorporates the acquisition of a new piece of equipment that does work that used to be done by people threatens people where they feel most vulnerable — their jobs. This is a risk that can be managed, but if it is not, it can kill a project that in every other way is viable. This risk tends to be greater in external acquisition projects where the potential for apparent sudden introduction of the new technology can lead to the greatest fears. Internal acquisition projects are more gradual, and although they are not free of this kind of risk, people tend to be more willing to accept a new development created internally than one that arrives from abroad.

#### **Costs and Affordability**

The cost of each technology acquisition option is last but not least in this list of issues to consider. The key to addressing this properly is being sure that all costs are considered in the analysis. In the case of external acquisition, the up-front cost and royalty costs are generally quite clear and relatively easy to compare against the benefits. However, it is easy to overlook the cost of installation, adaption, and training in the area where the new technology is to be introduced, not to mention the costs associated with the impact the new technology has on the rest of the organization. The difficulty in estimating the total cost increases with internal acquisition due to the increased number of unknowns involved.

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## TECHNOLOGY ACQUISITION

### 3.2

#### Choosing Appropriate Options

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Choosing the best source option for your company ...

Assess the advantages and disadvantages

- Company technological growth
- Exclusivity/competitive advantage
- Company capability
- Time to market
- Risk of failure
- Costs/affordability

Consider all and choose the best overall option



#### Cost and Affordability (Cont'd)

Another area that is difficult to estimate, but an important consideration in assessing the cost of various options versus their benefits, is to make an estimate of the value of the benefits. For example one type of technology acquisition may cost more to acquire, but when the value of the benefits such as increased company technological capability are deducted from the cost, it may be the best choice. The higher cost option may perform the required function more efficiency or make a superior product. In these cases, even though it costs more to acquire the technology, after a time this difference is more than made up for by increased sales from the additional or better resulting product. The best way to do cost estimating is for the life to the technology. This will often lead to the result that the highest initial cost choice will be the lowest cost option over the life of the technology due to factors like lower operating costs, higher efficiency, and better quality.

Finally once the company has estimated the cost and net benefit (benefits after costs are deducted) of each option, the choice may still boil down to which one is affordable with the company's present cash and borrowing condition. Even if the "affordability" condition results in the acquisition of the lowest initial cost option which would have been the choice without the analysis, the company has learned about what improvements could be made once it is in a better cash position. It will at least know that it has chosen a lower value option and will have expectations that are in accord with the potential that the option can provide.

#### Making a Decision

The following table summarizes the information provided above and provides some general guidelines to help guide initial thinking. However, generalities do not apply to every situation. Each case must be considered by itself. The company must develop a list of the pros and cons of each option being considered. The areas highlighted in the CONSIDERATIONS column provide a guide to what things to look at. The key to making a final decision is to provide a currency based estimate of the value or impact (negative and positive) of the each technology option for each of the consideration area. The sum of the values and impacts over the life of the technology will show which option has the best potential for meeting the company's needs.

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## TECHNOLOGY ACQUISITION

### 3.2

#### Choosing Appropriate Options

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Choosing the best source option for your company ...

Assess the advantages and disadvantages

- Company technological growth
- Exclusivity/competitive advantage
- Company capability
- Time to market
- Risk of failure
- Costs/affordability

Consider all and choose the best overall option



### Choosing the Best Technology Source for Your Company

CONSIDERATIONS	INTERNAL TECHNOLOGY SOURCE	COMBINATION OF INTERNAL AND EXTERNAL	EXTERNAL TECHNOLOGY SOURCE
COMPANY TECHNOLOGICAL GROWTH	highest potential	medium potential	lowest potential - must address ways to grow technically
EXCLUSIVITY / COMPETITIVE ADVANTAGE	highest potential for unique product or process	may maintain exclusivity, may have to share with partners	generally do not have a unique product or process, may negotiate for a specified market
COMPANY CAPABILITY	must be relatively strong technically	technical strength is required, but it can be weaker	technical strength is an asset, but not essential
TIME TO MARKET	generally longest	can be reduced due to added information	should be shortest
RISK OF FAILURE	technically - highest acceptance - lowest	medium risk	technically - lowest acceptance - highest
COST AND AFFORDABILITY	generally highest cost; high capability; development value	usually medium costs	should be lowest beware of hidden costs

The company must then look at what it can afford relative to the up-front or short-term cost of each option. The best option may not be affordable. It can then choose to select an affordable option knowing full well that it will not be acquiring all the benefits the best option would afford. The company needs to document its analysis along with the assumptions upon which it was based so that it can learn from what actually happens compared to what was projected in the decision making process. This will make future decision making efforts better and will provide the basis for deciding to upgrade to a better technology option if the company's financial position improves to the point that a better option becomes affordable.

### 3

## TECHNOLOGY ACQUISITION

### 3.3

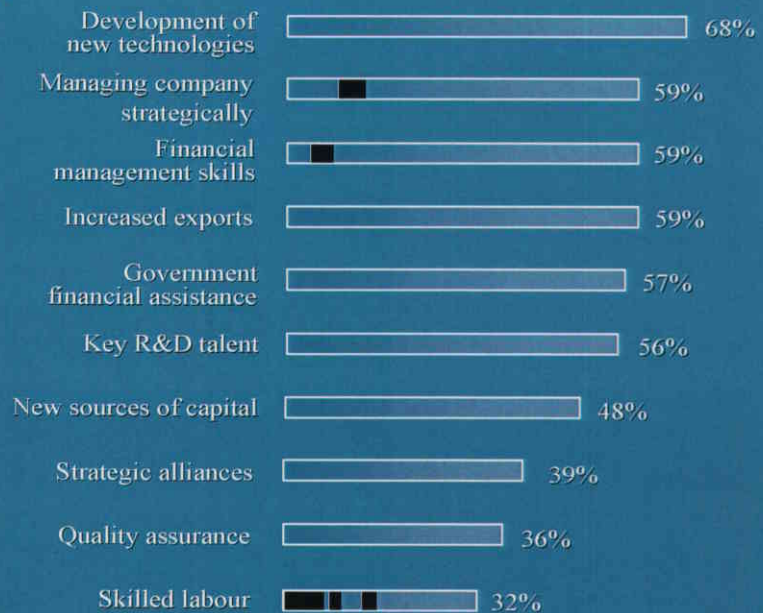
#### Technology Acquisition Option Details

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## Top success factors in global competitiveness

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Technology is absolutely key to global competitiveness as illustrated by the data above.

With the breadth of options that a company has to consider, it must have the internal ability to logically consider all of them and decide which is most appropriate. This ability must span technical and nontechnical issues. A company with internal technical strength is tempted to always develop technology when other forms of acquisition may be a better choice from a financial or long-term relationship perspective. On the other hand, a company without any technical strength is at a great disadvantage when it comes to managing a development project conducted by an outside R&D organization or licensing a technology. Companies acquiring technology from external sources must have sufficient capabilities inside the company to understand the advantages and disadvantages of the choices before it. Lacking a technical person who understands the technological aspects of the opportunity well enough to discern the pros and cons of the various options, will leave the decision making entirely to those who will decide based on price or long-term relationships. A company must make decisions based on an informed understanding of all technical and nontechnical issues if it is to have a successful technology transfer. This section will provide some information that will help you choose among technology acquisition options.

# 3

## TECHNOLOGY ACQUISITION

### 3.3

#### Technology Acquisition Option Details

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### Option 1 - Seizing tacit knowledge ...

#### ADVANTAGES & BENEFITS

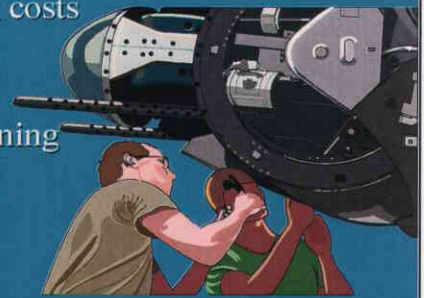
- Knowledge exists in company, so low cost, low risk
- Improve other processes
- Don't lose when person leaves
- Improve employee moral

#### DISADVANTAGES & RISKS

- More people on learning curves
- Documentation, training costs

#### COST FACTORS

- Extra staffing while learning
- Documentation



### Seizing Tacit Knowledge

Companies should make a conscious effort to document the tacit knowledge of its employees. Thorough documentation would convert the tacit knowledge to codified knowledge making it readily transferrable. However, since tacit knowledge is the result of experience it is by definition constantly changing. Codifying tacit knowledge runs the risk of stifling innovation by forcing everyone to conduct an activity according to the instructions that result from the codified knowledge.

The solution is to create an environment where tacit knowledge is transferred with a minimal amount of codifying. One method is to rotate employees through a variety of jobs. This creates the situation where each employee is constantly learning from other employees about how to perform new job functions. The tacit knowledge that already exists is taught to the person new to the job by one that already has significant experience. The person learning the new job acquires tacit knowledge that may enhance his/her regular function. The person experienced in a job, has the opportunity to learn from the new person components of his/her tacit knowledge from another application that can enhance the job being taught.

The investment in having many people spend the time it takes to come up the learning curve on many job functions is more than made up by the following benefits:

- Tacit knowledge is spread throughout the organization resulting in innovations and productivity gains in other parts of company.
- The company is not vulnerable to having key pieces of tacit knowledge contained in one of a few people.
- Employees are motivated to innovate because they see their job security increase with the knowledge to perform more than one job and their job satisfaction increased by the increased variety of work.

Seizing tacit knowledge has low cost and low risks because the knowledge already exists. It will improve processes in other parts of the company and will not leave the company when a key person leaves. The costs involved include the fact that productivity will suffer in the short term because more people are on learning curves, and job functions that could be done by one will at times be staffed by an expert and a learner. There will also be some costs for documentation and in-house training.

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## TECHNOLOGY ACQUISITION

### 3.3

#### Technology Acquisition Option Details

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### Option 2 - Internal R&D ...

#### ADVANTAGES & BENEFITS

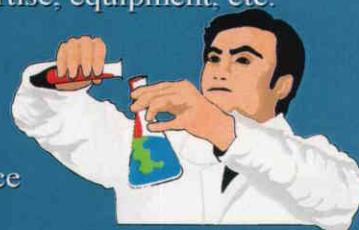
- Develop knowledge in company = stronger company
- Exclusivity = competitive advantage
- May be tax or other government incentives

#### DISADVANTAGES & RISKS

- Long time to market
- Generally more expensive than external acquisition
- Risk of failure = loss of investment and time
- May not have R&D expertise, equipment, etc.

#### COST FACTORS

- R&D Staff
- Equipment
- Office, lab, and shop space



### Internal R&D

Technology acquisition via internal R&D consists of having a research and development group within the company that creates the technology that the company uses. The size of the group relative to the size of the company is dependant partly on the degree of sophistication of the niche that the company serves and partly on the attitude of management toward the value of technology and technology development. Although no one is entirely free of influence from outside sources, we are using the term "internal R&D" to describe the form of technology acquisition that uses creation of new technology based on ideas from within as its primary methodology. This is to be distinguished from "internal R&D with networking" (to be discussed next) that, although the company's technology development activities are done within the company, its R&D staff puts some concerted effort into knowing what others in their field are doing.

Having an internal R&D group is surprisingly common with small companies. Many small companies have grown from the development of a new product idea by the company founder. This has often led to the creation of a small group in the company called R&D that continues to improve the existing product by developing solutions to problems that it may have, creates related products such as ones with higher capacity or more features, and develops other products the company could make in the future. The internal R&D groups in small companies are really product development groups that do almost no research. In fact, if the strict definition of technology is used, they often do not develop technology. Rather, they assemble existing technologies into products that can be made and sold by the company. Since the products tend to take on the characteristics of unique technologies they become treated as a technologies in their own right.

Internal R&D groups in small companies tend to suffer in a number of ways. They often lack the technical strength to do the function required of them. Many R&D groups have either no engineers or are staffed by very junior engineers. They are often managed by an owner or another long-time employee that has much experience but very little theoretical education. These people, because they have no idea what engineering can do, will not let the engineers do engineering. Rather, they conduct product development by trial and error. This limits the degree to which the R&D group can develop excellent technologies and products. They are often very poorly funded which even further limits their ability to accomplish their goals.

In spite of these common shortcomings, companies with internal R&D have some significant advantages. They know their products from a hands-on perspective. They understand the technologies used in the product. When the product fails or when related opportunities are discovered in the market, they can react quickly. Because they have created the products or technologies that they sell, their products tend to be unique. This gives them a basis for a competitive advantage. When a competitor develops an improved version of their product, they are better able to understand the technology behind the improved product and create an even better one.

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## TECHNOLOGY ACQUISITION

### 3.3

#### Technology Acquisition Option Details

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### Option 2 - Internal R&D ...

#### ADVANTAGES & BENEFITS

- Develop knowledge in company = stronger company
- Exclusivity = competitive advantage
- May be tax or other government incentives

#### DISADVANTAGES & RISKS

- Long time to market
- Generally more expensive than external acquisition
- Risk of failure = loss of investment and time
- May not have R&D expertise, equipment, etc.

#### COST FACTORS

- R&D Staff
- Equipment
- Office, lab, and shop space



Internal R&D has an additional advantage in some environments. Many governments encourage the creation of technology by offering development grants or tax reduction incentives. Companies in countries with these incentives can have a portion of their technology acquisition costs paid by the government.

Internal R&D has several significant disadvantages when compared to some forms of external technology acquisition. Developing technology usually takes longer, often significantly longer, than acquiring and adapting already-developed technology. This means that the company acquiring technology from an external source will generally get their product to the market sooner than the one developing internally. It will be making a return on its investment while the internal R&D company is still investing. If the company first in the market handles the business properly, they will be very difficult for the second company to dislodge as the preferred supplier. This situation is complicated further by the fact that not only does internal development take longer, the length of time is also unknown. There is a significant risk that the project will not be completed by the time projected and that the actual completion, even after it has passed the original planned completion date, will still be very difficult to establish.

In-house development is often more expensive than acquiring technology externally. This is because the developing company, especially if it is small, will generally be limited in the areas of technical capability of its staff and equipment. In addition, a company offering a technology for sale is generally making its main revenues from the sale of the products it has developed. It does not have to recover its development costs from the sale of technology. In fact, any amount recovered in this fashion may be considered as a windfall. Therefore, it will often offer technology for sale at less than the full development costs.

Risk of failure is another disadvantage that must be addressed when considering internal R&D. There is always some risk that an R&D project will not accomplish its goals. The more difficult the project and higher the risk. There are some risks with acquiring and implementing existing technology as well, but with good planning and execution these can be managed. However, some things either cannot be done at all or cannot be done by the company with the knowledge, experience and facilities available to it. If the project fails to accomplish its goals, the company loses twice. It loses the money invested in the development and the time spent conducting the R&D that could have been spent implementing known technology. These losses can be significant enough to be fatal.

The cost factors involved with internal R&D include acquiring and paying for the staff, equipment, and space for offices, laboratories and prototyping shop space. This cost alone relative to other sources of technology may be enough to lead a company to not choose internal R&D. It may also indicate preference for use of a combination of small internal R&D capability and external sources of technology. This is especially true for companies either in the start-up phase or those that have not had an internal R&D function to this point.

# 3

## TECHNOLOGY ACQUISITION

### 3.3

#### Technology Acquisition Option Details

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Technology Management



## Option 3 - Internal R&D with networking ...

### ADVANTAGES & BENEFITS

- Develop knowledge in company = stronger company
- Exclusivity = competitive advantage
- May be tax or other government incentives
- Staff exposed to other sources of ideas

### DISADVANTAGES & RISKS

- Long time to market (shortened somewhat)
- Networking costs added, overall costs down
- Risk of failure reduced (better knowledge base)
- Inventiveness can be curtailed

### COST FACTORS

- R&D staff, equipment, space
- Attending trade shows, conferences
- Reading relevant journals, magazines



### Internal R&D with Networking

Internal R&D with networking has all the same advantages and disadvantages discussed under Internal R&D. The main difference is the fact that the R&D staff make a fairly concerted effort to keep current on the state of development of the technologies affecting their products. They network with technology creators at conferences and trade shows. They follow technological developments published in magazines and journals. They follow the developments made by their competitors by reading magazines, journals, and sales literature where competing products are discussed. They attend meetings, demonstrations, and trade shows where their competitors' products are on display.

This adds some up-front costs to operating an internal R&D group, but provides the staff with exposure to other ideas. It keeps them from "re-inventing the wheel". It reduces the risk of failure because the staff is working with a better knowledge base. For the same reason, it reduces the time to market which more than makes up for the added costs for networking activities. The only possible disadvantage of this approach when compared to pure internal R&D is the possibility that the staff's inventiveness will be curtailed because their vision may become limited by the alternatives exhibited by their competitors.

This approach actually improves the company's external technology acquisition capabilities. Its R&D staff are familiar with options that are readily available in the market. This uncovers technology acquisition options that might not be considered by a purely internal R&D company.



# 3

## TECHNOLOGY ACQUISITION

### 3.3

#### Technology Acquisition Option Details

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## Option 4 - Reverse engineering ...

### ADVANTAGES & BENEFITS

- Less costly, less risky, less time compared to internal R&D
- Opportunity to improve product to gain competitive advantage

### DISADVANTAGES & RISKS

- Me-too product
- Risk of not fully understanding original design
- Some legal risks

### COST FACTORS

- Strong engineering capability
- Some office, lab, shop space
- Possible legal costs



## Reverse Engineering

Reverse engineering is the determining of the technology embedded in a product through rigorous study of its attributes. It entails the acquisition of a product containing a technology that the company believes would be an asset, disassembling it, and subjecting its components to a series of tests and engineering analysis to ascertain how it works and the engineering design criteria used in the product's creation. The tests used depend on the technologies involved. For example, mechanical devices require physical measurements including the measurement of many duplicate pieces to learn the statistical tolerances involved in the original design. They require structural tests to learn about deflection versus load, chemical tests to accurately determine the material from which the piece was made, abrasion tests to determine the wear capabilities, etc. Similarly, electronic products have a series of tests that can be conducted to determine the design characteristics of the products, chemical products have another set, and so on.

Reverse engineering requires a very good understanding of the application the product being studied is used in so that the tests used to ascertain its design criteria are appropriate. It also requires strong engineering capability. To be a good reverse engineer, one must be a good design engineer. He/she must understand engineering principles very well. He/she must be able to design and conduct tests that produce the kind of engineering data that can be used to produce a design capable of duplicating the original product. A person (or company) with a build-and-try design strategy will not have the capability to reverse engineer products. The materials, the tolerances, the shapes, the assembly of the original product all have design implications and the reverse engineer must understand them.

Reverse engineering is a serious discipline in the automobile and machinery industries. Before designing competing products, companies reverse engineer their competitors' products to ascertain their strengths and weaknesses. New designs maintain the strengths and solutions are developed for the weaknesses resulting in a competing product that is better than the originals. Reverse engineering is less costly, less risky, and takes less time to market compared to internal R&D. It creates the opportunity to result in a product that meets the competition in all its areas of strength and has a competitive advantage in the competitor's areas of weakness. On the negative side, it has the potential to result in a "me-too" product. Me-too products are essentially the same as the competitor's and offer the customer no reason to switch from the competitor. There is the possibility that the reverse engineering team did not properly understand the original design and the new product is actually poorer than the one studied. There is also potential that the reverse engineered product infringes on patents or other legal protection the original product has, leading to legal costs.

# 3

## TECHNOLOGY ACQUISITION

### 3.3

#### Technology Acquisition Option Details

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## Option 5 - Covert acquisition with internal R&D ...

### ADVANTAGES & BENEFITS

- Low cost, low risk, short time to market
- Can improve the product

### DISADVANTAGES & RISKS

- Illegal or immoral
- Develop little technical strength
- Me-too product

### COST FACTORS

- Camera, binoculars
- bullet-proof vest
- Lawyers, court costs:  
likely to be sued
- Some R&D staff and facilities



### Covert acquisition with Internal R&D

Covert acquisition has similarities to reverse engineering. However, it is less above board. It entails finding out about technology developments being conducted by a competitor that are not open to the public. Most companies do this to some extent by questioning suppliers about components being sold to the competitor or by socializing with the competitor's employees. The less scrupulous companies become involved in industrial espionage using cameras, binoculars, and break-and-enter techniques to learn about the happenings inside the competitor's plant.

Using internal R&D along with covert acquisition has the same benefits as reverse engineering. It can result in a product that is similar but not exactly a me-too product. Internal R&D can improve upon the competitor's product by adding value and solving technical problems it may have. Companies that are good at covert acquisition and internal R&D can capitalize on being second into the market because they can improve upon the introducer's mistakes.

Costs, risk, and time to market can all be reduced. However, risks include being sued and developing a reputation of being an unscrupulous company. Customers who would otherwise appreciate the lower price or improved product that a company with this strategy can offer, may also be unwilling to give their business to this company. They may have the thinking that anyone who would "steal" product ideas and technological knowledge is not to be trusted in business dealings. In situations where the ratio of covert acquisition to internal R&D is high, a company may not develop much technical strength and may produce a me-too product. This situation results in a company that is less able to adapt to changes in the market and more likely to be sued for infringing on the rights of its competitor.

### 3

## TECHNOLOGY ACQUISITION

### 3.3

#### Technology Acquisition Option Details

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### Option 6 - Covert acquisition ...

#### • ADVANTAGES & BENEFITS

- Even quicker and lower cost than Option 5
- Launch competing product for lower cost

#### • DISADVANTAGES & RISKS

- No technical strength developed
  - Can't improve the product
  - After sales support problem
- No competitive advantage in product
- Image and legal risks

#### • COST FACTORS

- Camera, binoculars, bullet proof vest
- Lawyers, court costs: you WILL be sued



### Covert Acquisition

Covert acquisition without internal R&D guarantees the product will be a copy (generally a poor copy) of the competitor's product. The company can introduce it at a lower price because there are no development costs to recover. However, with the exception of price, the product will have no competitive advantage. Without internal R&D it is likely that the product will not be copied accurately and the product will actually be worse than the original. A company with this technology acquisition strategy is likely to have inferior products, an inability to improve its products, an inability to deal with technical problems the products may have, a poor image, and high legal costs.

# 3

## TECHNOLOGY ACQUISITION

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#### Technology Acquisition Option Details

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## Option 7 - Technology transfer and absorption ...

### ADVANTAGES & BENEFITS

- Reduced risk due to known technology
- Reduced time to market
- Develops internal capability

### DISADVANTAGES & RISKS

- Risk in applying technology to new application
- Very little support available

### COST FACTORS

- Searching, networking
- Some internal technical staff
- Adoption/adoption costs



### Technology Transfer and Absorption

Technology transfer and absorption is similar to Internal R&D with networking. The difference is that there is much more effort put into searching for, learning about, and translating existing, no-cost technologies to the company's applications. Internal technical capability is required to understand the technologies found and to develop them into solutions for the company's applications. This approach is relatively low cost because the external technology is not paid for. Internal costs include the salaries of the internal technical staff, search and networking costs and the development of company-unique equipment using the technology found in public sources. Depending upon the degree of in-house development required, lab and shop space may also be required to build and test prototypes and final solutions.

Technology transfer and absorption is most often used with process technologies. An example would be where the company finds a process technology that has been invented by a university or government institution, and applies the technology to its own production line by acquiring components and attaching them to its existing equipment. Another example is the situation where a company acquires the components of a technology that is proven in one application and installs them in a completely new application. Both of these have less risk compared to internal R&D because the technology has been shown to work in some situations. However, it is still quite risky due to the potential for not fully understanding the technology, the application, and the interaction between the technology and the application.

A company employing this type of technology acquisition is using externally developed technology with little possibility for acquiring support. On one hand, this helps develop technical capability because company personnel are forced to work with the technology in a hands-on fashion. On the other, the lack of readily-available support results in many mistakes and wrong decisions. Generally companies that take this approach do not like to pay for technology. They prefer to develop things themselves, although they are more than willing to acquire technology from any external source than those employing internal R&D, provided the technology itself is no cost. With the right team of in-house expertise this can be a very effective form of technology acquisition. However, if the approach results in the application of new technology to an application without enough attention to detail, it can have disastrous results.

# 3

## TECHNOLOGY ACQUISITION

### 3.3

#### Technology Acquisition Option Details

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## Option 8 - Contract R&D ...

### ADVANTAGES & BENEFITS

- No investment in facilities
- Low investment in staff
- Own technology = unique product

### DISADVANTAGES & RISKS

- Do not have hands-on knowledge in-house
- Harder to keep confidential
- Same time, cost, and risk issues as internal R&D

### COST FACTORS

- Staff to understand technology, manage contract
- Contractor fees: maybe lower than internal R&D



## Contract R&D

Companies choose to contract research and development for a variety of reasons. This is an ideal option for those that lack the necessary facilities and expertise to conduct the required work but still want to maintain control over the development and own the results exclusively. It is also a good choice for those that need a specialized set of equipment or expertise for occasional short-term projects. This avoids the investment in these facilities and the ongoing commitment to staff that would normally be underutilized. It allows short-term access to world-class personnel and facilities for specialized projects that would otherwise be completely beyond the company's means.

Some companies with strong internal R&D still choose to contract out R&D projects. One successful strategy is to maintain internal strength in technologies core to the company's business. R&D needs in other areas are contracted out. This ensures that developments crucial to the company's success are conducted under the company's roof while those that are important for a project, but not for the company's overall business are done by those more expert in the field. A simple example is a electronics product-oriented company doing its electronic and software developments in house while contracting mechanical aspects of product development and its process development activities to others. Another successful strategy is to occasionally contract R&D in core technology areas as well. This exposes the company's R&D personnel to technology experts in other environments. This form of technology acquisition has the side benefit of staff enrichment.

Contracting R&D reduces the company's hands-on experience with the technology. Those companies most successful at contracting R&D have an internal project manager who is well versed in the technology involved. This enables the company to acquire the benefits of avoiding investment that would be underutilized and accessing highly-specialized people while still maintaining control and learning from day-to-day happenings on the project. Although contract R&D offers the benefit of acquiring external technology without sharing ownership, it is more difficult to keep the work confidential. Care must be taken to ensure that the contracting organization meets the company's confidentiality standards.

The following checklist will help when searching for an R&D supplier:

- necessary skills (technical and business)
- track record
- confidentiality
- facilities
- communication skills
- specialized expertise in desired technology area

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## TECHNOLOGY ACQUISITION

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#### Technology Acquisition Option Details

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### Option 8 - Contract R&D ...

#### ADVANTAGES & BENEFITS

- No investment in facilities
- Low investment in staff
- Own technology = unique product

#### DISADVANTAGES & RISKS

- Do not have hands-on knowledge in-house
- Harder to keep confidential
- Same time, cost, and risk issues as internal R&D

#### COST FACTORS

- Staff to understand technology, manage contract
- Contractor fees: maybe lower than internal R&D



Project managers must be capable and willing to deal with contractual issues. Many contract R&D performers are experts in their technology areas, but are quite poor in the contracting side of the business. Having a standard contract which contains a standard set of the company's requirements will help when dealing with these organizations. Key issues to be addressed are ownership of technology, confidentiality, deliverables, schedules, price, project communications, and consequences for not meeting commitments. Companies must be willing to be flexible on the consequences aspect considering the unpredictable nature of R&D. However, scientific institutions can be more interested in the science discoveries that the R&D may uncover than the company's welfare. Company project managers have to convey to the contractor that the decision to contract R&D was a business one and the results of the work have serious impacts on the company's business. Regular project communication is essential because issues like delays or unexpected findings can be discovered early and adjustments can be made.

The following must be addressed in the contract

- clear deliverables
- clear milestones (schedule)
- ownership of technology
- communications plan
- contingency plan (exit clause)

On the surface, contracting R&D has the same risks of failure as internal R&D. However, with the selection of the right contractor for the work required, the company should be able to have a more capable team than it could assemble internally. So, provided the contractual and communication issues are handled properly, the risk of project failure should be reduced. The company has to be especially careful that overall failure does not happen at the next step, which is the introduction of the results to an application in the company. It must be sure that it fully understands the results in light of the company's application.

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## TECHNOLOGY ACQUISITION

### 3.3

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## Option 9 - R&D strategic partnership ...

### ADVANTAGES & BENEFITS

- Share risk
- Lower cost
- Learn from partners

### DISADVANTAGES & RISKS

- Have to share knowledge with partners
- Have to adapt research results to own application

### COST FACTORS

- Company's share of R&D staff, equipment, facilities
- Post research implementation costs



## R&D Strategic Partnership

R&D strategic partnerships have much in common with contracting R&D. They generally consist of a group of companies with a common need that collectively contract a research institution to conduct the work for them. This allows the companies to share the risk and cost. It also creates a situation where they can learn from each other as well as from the experts conducting the research. All the same contracting and communication issues discussed under contract R&D apply here as well.

The companies in R&D strategic partnerships are often competitors. Therefore the kind of projects that are most conducive to this type of technology acquisition are precompetitive research. These are usually applied research projects that are too risky and too expensive for any one company to handle, but if certain results were achieved the industry as a whole would benefit. As a result, the company must have either an internal R&D or a contract R&D capability to translate the results of the applied research into technology the company can use. Companies must be aware that the company's share of the R&D strategic partnership costs are not all the costs. The costs of developing the findings further and implementing them must also be considered.

R&D strategic partnerships can be initiated by one company inviting others to join, by an informal group of companies, by a formalized association of companies in an industry, or by the R&D institution itself. The last model is the most common. The institution is motivated by its need to have its work funded. Companies, who are generally too competitive to consider inviting other companies to join with them, are willing to consider a proposal presented by an independent organization. This is especially true of small companies. R&D strategic partnerships are becoming relatively common with large companies in electronics/computers, automobiles, oil, and mining, while they are still very rare with small companies.

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## TECHNOLOGY ACQUISITION

### 3.3

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### Option 10 - Licensing ...

#### ADVANTAGES & BENEFITS

- Costs and risks less than internal R&D
- Less time to market
- Implementation support available

#### DISADVANTAGES & RISKS

- May not have exclusivity
- Implementation risks, costs
- Do not develop internal capability

#### COST FACTORS

- Up-front and royalty payments
- Implementation costs



### Licensing

Licensing existing technology is a popular and effective form of technology acquisition. It enables companies to skip the technology development phase of technology acquisition and move directly into implementation. Its major benefit is a significant reduction in time to market relative to forms of technology acquisition that require development. It also enables the acquiring company to share the financial risks of acquiring the technology with the provider because the bulk of the payments are generally in the form of a royalty - a percentage of sales of product made using the new technology.

It has the appearance of being low-risk to almost risk-free. If the acquiring company's application is identical to the one for which the technology was developed it can be fairly low risk. Technological risks are almost eliminated because the technology has been proven to work in the application being considered. However, there are still implementation risks to be addressed. The main potential for failure in implementation is resistance to change by the company's employees. If the new technology is perceived to put their jobs at risk, employees will strongly resist implementation resulting in the failure of proven technology. Special attention must be made to communications ensuring the acquisition process to ensure that employees will not kill the project. The providing company can help. The licensing agreement should include training and communication support so that the acquiring company can benefit from the developing company's experience.

When the new application is not identical the risks can be significant. These projects can quickly begin to resemble internal R&D projects. If companies realize this and plan accordingly the results can be very positive. Many companies, including small ones, have licensed a technology that was either developed for another application or has not been fully developed. They have added their own R&D and have been successful in the market with a new and unique product. However, there are also many failures where a company mistakenly thought it could license a technology and use it for a new application with little effort.

Costs can be (and should be) lower for the receiving company because the providing company (presumably) is making sufficient revenues from its use of the technology to pay for the investment made in developing it. Therefore it is in a position to license at a price that is lower than the cost of development. However, there are costs in addition to the licensing fee that are not obvious at first. Additional internal development and implementation costs have already been mentioned. Another factor to address is that fact that if done poorly licensing can do little for the development of internal technical strength. The developing company has significant technical capability and experience with the technology that should also be transferred to the acquiring company. This can add to the initial cost, but will result in a company that is much more prepared to deal with customer service and future product development issues.



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## TECHNOLOGY ACQUISITION

### 3.3

#### Technology Acquisition Option Details

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### Option 11 - Purchasing ...

#### ADVANTAGES & BENEFITS

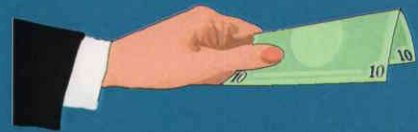
- Quickest, ready to use
- Lowest risk, proven technology
- Implementation support

#### DISADVANTAGES & RISKS

- Exclusivity, competitive advantage issues
- Possible implementation problems
- Builds little technical strength

#### COST FACTORS

- Up-front payment
- Training costs
- Should be lower than developing because development cost shared by many



### Purchasing

A common and effective external technology acquisition method is purchasing technology. This is normally done in the form of buying a piece of production machinery with embedded technology. This is generally the quickest form of technology transfer because the technology is already packaged and ready to use. It is low risk because the equipment has been proven to work technically and evidence can be acquired from other users to back up the providing company's claims. In addition, the providing company can also provide implementation support in the form of set-up and training. The costs will be lower than developing the technology because the providing company is generally in the business of providing the machines containing the technology to many users thereby spreading the development costs over several customers.

Care must be taken to not overlook the costs of internal activities such as staff time spent on training and the disruption of the present production that will happen during the installation of the new equipment. The temptation will be to consider the price paid to the provider to be the entire cost of the technology acquisition. It also must be understood that the providing company is generally in the position of selling machinery to as many users as possible which makes exclusivity highly unlikely. The acquiring company has the same potential resistance problems discussed under Licensing. The implementation project must be designed in a way that these risks are minimized. Technology acquisition in this form also does little to build internal strength. This may not be an issue, as in the case where the purchased production equipment is not the company's core technology. They need only address maintenance and operation training which can be acquired from the provider as part of the purchase.

Another form of purchasing technology is to pay for the know-how behind a technology and the right to use it in the company's application. This is very similar to licensing, except it is a one-time purchase rather than an ongoing relationship. It has all the same risks and benefits of licensing a technology for a new application discussed in the Licensing section. The major difference is in the areas of cash flow and risk. The purchasing company generally pays for the technology in one or a very few payments. Licensing normally has the bulk of the payments made in relation to the sales the acquiring company makes using the technology. The payments in a purchasing situation are for an agreed price and are not tied to any revenues the acquiring company receives with the technology. The acquiring company is carrying more of the risk in hopes of greater returns in the future because they do not have to be shared. As a result the price of technology purchased in this fashion is generally lower.

# 3

## TECHNOLOGY ACQUISITION

### 3.3

#### Technology Acquisition Option Details

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## Option 12 - Joint venture with technology provider ...

### ADVANTAGES & BENEFITS

- Immediately implementable after training
- Proven technology - low risk
- Probable exclusivity in a region
- Learn from provider

### DISADVANTAGES & RISKS

- Market risks
- Do not have control: have to agree with partner
- Does not develop technical strength

### COST FACTORS

- Up-front investment in new business
- Ongoing operational costs
- Training costs



### Joint Venture with Technology Provider

Entering into a joint venture agreement with a technology provider is another form of external acquisition that can be very effective. Typically this is a partnership between a company with a technology and a company with market access. It can take the form of the creation of a new company with each of the partners owning shares in the new company in proportion to the value of their contribution to the new company. In this case, production facilities are installed in the new company with the partners bringing technology and market know-how along with capital investment into the new company. The distribution and marketing of the product may use the system that the company with market access has in place, or that company's know-how may be used to create a dedicated system for the new company.

Another version of this is very similar to licensing. The providing and acquiring companies form a contractual agreement describing who provides what and how the revenues are to be shared. The primary difference between this and licensing is the fact that the technology provider has an expanded relationship with the acquiring company. They make joint decisions about production and marketing even though the acquiring company actually produces the product and provides it to the market. The advantage is that both companies learn from each other. The disadvantage is that either company cannot make decisions on its own, the partners have to agree.

Both forms of joint venture with a technology provider generally have the advantage of low risk. The technology is proven and immediately-implementable technology (after training and installation). The acquiring company will get exclusivity in a region. It will have an ongoing relationship with the provider providing opportunity to learn from the provider. There are some market risks. Even though the acquiring company will likely have access to the market, the new product may not be accepted by the market. Joint ventures typically have higher up-front costs than licensing, especially when a new company is created. Both also have the constraint of the partners having to agree on operational issues. This may be an advantage or a disadvantage depending on the situation.

# 3

## TECHNOLOGY ACQUISITION

### 3.3

#### Technology Acquisition Option Details

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## Option 13 - Acquisition of a company with the technology ...

### ADVANTAGES & BENEFITS

- Short time to market, perhaps already in market
- Low risk
- Could buy good image

### DISADVANTAGES & RISKS

- May have to adapt technology to needs
- May acquire negative baggage
- May have merger problems

### COST FACTORS

- Depends on purchase price of the company
- Should be proportional to technological assets



### Acquisition of a Company with the Technology

The final form of external technology acquisition to be discussed in this course is the acquisition of a company that has the technology desired by the acquiring company. This can happen when one company has a technological innovation that is impacting another company's business. Rather than trying to duplicate or improve upon the first company's innovation (which would take time and may not have the desired results), the second company negotiates to purchase the entire company. This can result from a defensive action as mentioned above or it can be a deliberate technology acquisition strategy. This option has very little technical risk, and if the product is on the market and doing well, it can also have low market risk.

Acquiring companies to get technology does have some areas of concern. If the acquired technology is to be used in a different application, some internal R&D with its associated risks and problems may be required. The acquired company may have other problems such as an undisciplined work force or poor image with the public due to an unrelated problem like an environmental spill. If the acquired and the acquiring companies have to work together as one organization, there will be system integration issues to deal with. There could be key members of the acquired company who resent the take-over, causing them to leave and take key undocumented tacit knowledge with them.

The cost should be proportional to the value of the company's assets including the technology. However, this is not always the case. The company's hard (physical) assets may be of little value to the acquiring company which may increase the cost of the acquisition above the value of the technology alone. On the other hand, the providing company owners may be in a desperate financial situation, and willing to sell the entire company for considerably less than its full market value. When negotiating such a purchase, the acquiring company must have a full understanding of the value of the things it wants. These would include the technology (including the impact of the reduced time to market), and perhaps its market reputation and/or its production capabilities. So long as the purchase price is less than the value of the desired components and this plus the internal costs are affordable, technology acquisition via purchasing a company is viable.

### 3

## TECHNOLOGY ACQUISITION

### 3.4

#### Summary

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### Summary ...

There are internal, external, and combination internal/external sources of technology.

Companies need to assess the advantages and disadvantages of all sources considering:

- Company technological growth
- Exclusivity/competitive advantage
- Company capability
- Time to market
- Risk of failure
- Costs/affordability
- Appropriately-timed technology acquisition from the appropriate sources can have impressive results.

Consider the following true story, "A Tale of Two Companies".

A small company was founded by a farmer who had invented the company's initial product. It grew very slowly operating out of his farm yard over the first 20 years until the day it licensed another invention from another farmer which greatly enhance the use of its core technology. At this time it moved into the city and set up operations on the east side of a street in an industrial park and hired its first engineer. About this time, a university professor who had started a company to commercialize a technology he had developed at a university move to the lot on the west side of the street directly across from the east company. The two companies were both serving the agricultural machinery market, but with completely different products using completely different technologies (mechanical for the east company and electrical for the one on west).

The east company began to grow rapidly as it pursued a strategy of technology acquisition. Over the almost thirty years that have passed from the time it set up on the east side of the street it used every form of technology acquisition discussed in this module except covert acquisition. Most of its early acquisitions expanded its product line and increased its capability in its core technology area. Only after it was very well established did it move to acquire technology in new but complementary areas. It grew to its present day situation of being the largest agricultural machinery company in Canada with 1900 employees and an internal R&D department that boasts 70 engineers and 100 support staff. It has a dominant position in the Canadian market and sells products on five continents.

The fortunes of the company on the west side of the street were not so good. It began to notice the success of its neighbor, and even though it originally was not in the mechanically based agricultural products business, it decided that it could produce products of the same type. It began to "look over the fence" and create products that were very similar to the ones being developed on the east side. So similar that the east side company sued it for patent infringement on several occasions. The company grew to about 200 (including two engineers) and then began to shrink as its reputation as the low cost (and low quality) producer began to cost it more business that it earned.

The west side company never took a technology acquisition strategy, choosing rather to copy its neighbor thinking it could sell low due to reduced development cost. The reality was that it never understood the products it was copying well enough to copy them well or to service them properly. Within 20 years of setting up on the same street with a similar sized operation as the east company, the west company sued for bankruptcy. Some former employees bought the assets and continue to operate in the same fashion as the founder, with the same level of success. It presently continues with a product line much like the east side company, no engineers, and a staff that fluctuates from 20 to 50 people, depending on seasonal demand.

As the tale of two companies shows, choosing the appropriate technology acquisition strategy can have a profound impact on a company's success in the market place.

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