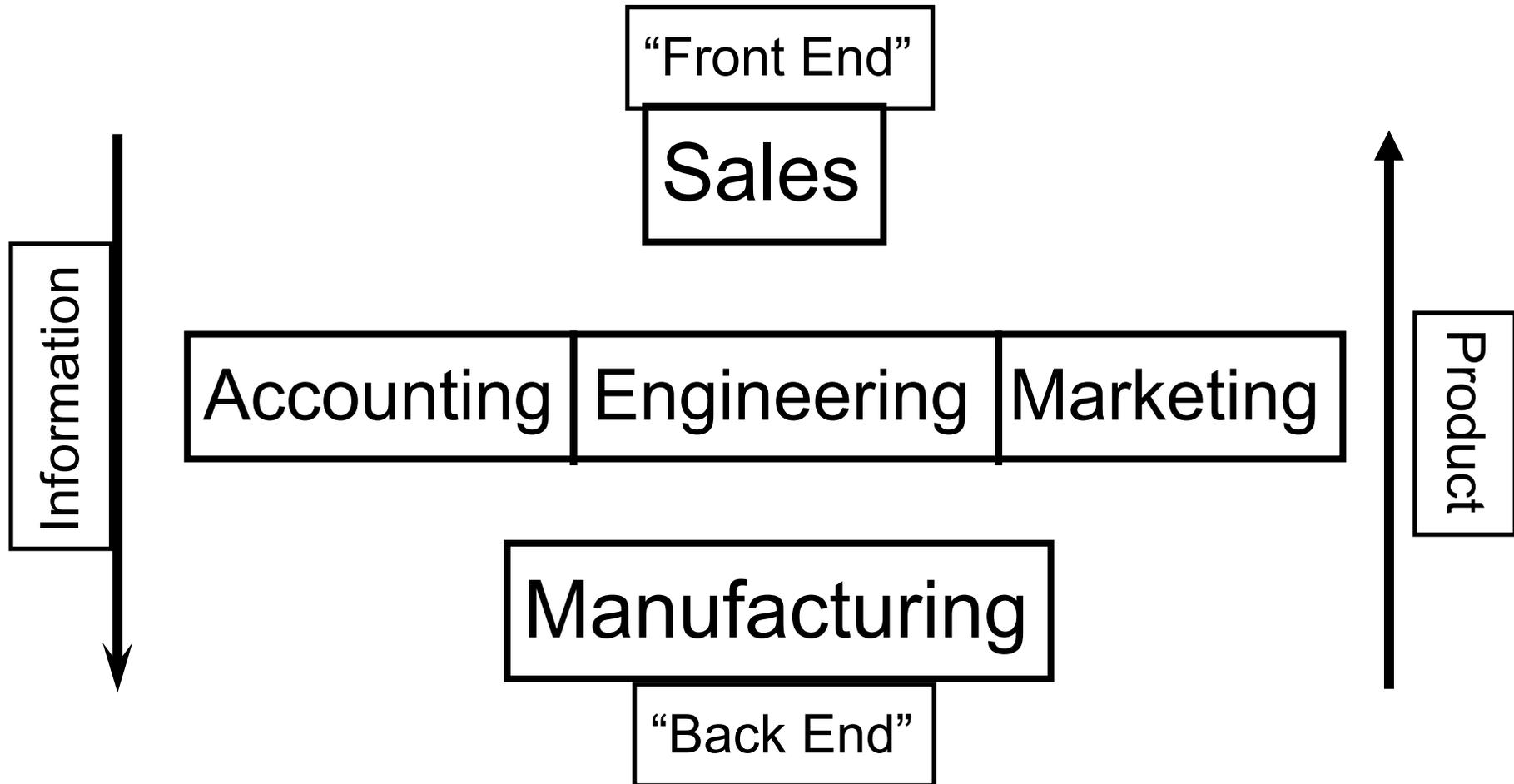# Product Economics

You have a design for your ICT product, but there still is a very important issue: money! What is your product development process going to cost? How much is the product really worth? How much can you charge for it? To answer these, we need to look at:

1. How to determine product value
2. How to determine product price

Reading assignment: Textbook Chapter "Product Development Economics"

Corporate structure for the discussion

"Front End"

Sales

| Accounting | Engineering | Marketing |

Information

Product

Manufacturing

"Back End"

Familiar to you, but we have added now an accounting department.

Main things that go into product economics

- **Costs**
  - How much will it cost to make the product?
  - Where does the money go?
- **Time**
  - How long will it take to get to market?
  - How long will it sell in the market?
- **Risk**
  - What is the chance of success?
  - What if you aren't sure about success?
- **Analysis**
  - How do you use economic data to optimize the product development process?

Money

- Developing and producing a product involves spending and earning money.

- Companies revolve around products and customers as we have discussed.

- But money is the fuel that powers the process.

- Money has a complex role in a company. It is more than just an evaluation metric in the product development process.

- In most companies, income from selling products pays the costs of developing the product and running the company.

- To work with this, you need to understand the types of costs.

Different kinds of cost

Not all costs are *directly* connected to product realization, but they all have some kind of effect on the process.

- Variable costs
  - Costs that vary depending on # units made, ie materials
- Fixed costs
  - Costs that don't change regardless of # units made, ie tools
- Direct costs
  - Costs directly due to product production, ie factory labor
- Indirect costs
  - Costs due to product production consequences, ie security
- Controllable costs
  - Costs a manager can control, ie advertising and sales
- Uncontrollable costs
  - Costs a manager can't control, ie benefits and insurance

Product Costing involves 3 general elements

- Direct Materials
  - This is how much the parts and other materials cost to make the product
  - For ICT products, this is often called the Bill of Materials (BOM) cost
  - It is both a direct and a variable cost, and the effect on cost by unit volume is complex due to economy of scale

- Direct Labor
  - This is the cost for people who actually design and manufacture the product
  - It is also a direct and a variable cost, and can vary with the kind of labor, ie regular employees or consultants

- Manufacturing overhead
  - A complex catch-all for all other costs

Manufacturing Overhead

- Indirect labor, ie security guards, cleaning staff
- Indirect materials, ie factory consumables like solder
- Utilities, ie electricity, water, heat (variable cost)
- Factory facilities, ie tooling, the building (fixed cost)
- Taxes (an uncontrollable cost)
- Insurance (another uncontrollable cost)
- Maintenance and Repairs (variable cost)
- Other administrative functions, ie Human Resources

Depending on the product, there can be others.

These also can vary by country, region and market.

There is more yet to costing.
Consider these additional kinds of costs

- **Cost of Sales**
  - Costs from attracting customers and getting them to buy, ie advertising, entertainment, store costs, etc
- **Differential costs**
  - These are costs that result from choosing a specific way to produce or sell a product, ie retail vs direct sales on the internet
- **Opportunity costs**
  - These are costs that result from choosing to produce one particular product instead of another, or something else to do with your money
- **Sunk costs**
  - These are costs that result from expenditures already made and cannot be undone, even if you decide to produce a different product or adopt a new method, ie tools or the corporate jet

Factors that determine Price

- Required profit
- Production costs
- Distribution costs
- Sales costs

} These are easy. Just do arithmetic.

- Market type, size and share
- Market perception
- Customer value
- Competition and differentiation
- Associated products such as consumables

} These are more abstract

Marketing usually has the biggest role in setting price, but often you are the one with the data to do this.

The best way to look at this is with some examples.

Pricing factors example: 10 years of PDAs

OmniGo 100 (1996)

IPAQ 5455 (2006)

Marketing: Market Type and Size

"This was a huge issue for their division. They could never agree on which segments within the mobile professional market to target. Consequently, their messages and product offerings were not focused on meeting specific needs for any one segment."

(In situations like this, it is very hard to determine the right price for the product.)

Marketing: Customer Value

"All messages are centered primarily around <u>convenience</u> with secondary messages around <u>productivity</u>. Convenience means you can work wherever and however you want to. Product features to support this claim are long battery life, small size, lightweight, wrap-around screen, pen and keyboard input and instant-on."

Marketing: Competition and differentiation

"Competition for the OmniGo includes other electronic organizers such as ones from Casio, and Sharp. In addition, paper organizers from DayTimer and others present real competitive threats. As they designed the OmniGo, they focused on the limitations of both electronic and paper-based versions to <u>establish their differentiation</u>."

Marketing: Market perception and price Points

- ## $1000 and up
  - High end. A shared resource, for example something that a family would all use like a home theatre. Not generally considered personal.

- ## $999
  - New, cutting edge, devices with respect to functionality vs price.

- ## $499
  - Where the $999 stuff is expected by consumers to be after a year or two.   Not cheap, but good value. Discretionary purchase for most buyers.

- ## $299
  - Mainstream complex consumer devices such as TVs, video players, tablet computers, etc. Discretionary purchase for half, nondiscretionary for half.

- ## $99
  - Nondiscretionary, impulse purchase stuff. No hesitation to buy the next better version when it reaches this price. Disposable.

Using economic data to determine _Value_

The textbook talks about this. It is straight forward once you know the rules.

- A decision to proceed with developing a product depends on the _value_ of that product with respect to money.
- In business, these decisions are not made based on the past. It doesn't matter what happened in the past. It's about the value _now_.

- Decisions based on money are always referred relative to _Present Value_. The value of a product right now, because _right now_ is all that matters.

- Note that this doesn't mean that the future is not important. It is. But if a product doesn't look good now, you don't want to tie up resources producing it now. You can always do it later.

- But regardless of what you do in the future, you need to decide what you are going to do _now_. (Remember execution.)

Present Value

- *Present Value* is the value of an asset right now as compared to what it will be worth later.

- For some things like fixed assets, it's easy to see. For example, if you have a smart phone, then it has a present value.

- As time goes on, its present value changes. In the case of owning the smart phone it probably goes down.

- You can conclude that the present value of your smart phone is always the highest value. As long as that value is high enough, you will continue to own it.

Present Value and Time

- This also works for money itself, but it requires a different point of view.
- You need to think in terms of *value*, not just amount.

- Suppose I want to buy a bicycle, so I go and choose one. Let's say it costs 5000 SEK. So, its present value is 5000 SEK.

- But, suppose I also know that the rate of inflation for bicycles is 3% per year. That means in one year, that same bicycle will cost 5150 SEK.

- That means that right now, the present *value* of the bicycle is greater than it will be in a year (*value*, not amount). It has more value to me because it cost me less money to get. It represents better value.

- In general, the value of something now is often greater than it will be in the future.

Mark Smith KTH School of ICT

Determining product value

- A product, however, is an aggregate of many values. These values are reflected in costs involved in developing and making the product, and income from selling it. So:

- The present value of a product is the aggregate of all the present values of all the costs and incomes expected over time.

- This aggregate is called Net Present Value (NPV).

- To compute it, you need to identify all the costs and all the incomes, over the entire lifetime of the product and compute their present values. (That's why we studied product life cycles).

- You then add up all the present values. That gives NPV for the product.

- If the NPV is high enough, you move forward with the product.

Present value and the future

How do you compute present value for something that will happen in the future?

- This is necessary because you need to compute the present value of something that you will not sell until some time in the future. For example, what is the value *now* of something you will sell over the next several years?

- It's simple because it is just based on a percentage that reflects the actual value of the money or *capital* used to realize the product.

- In other words, what is the value <u>right now</u> of your product that you will sell in the future with respect to the value of something else you could have done with the money?

- Here are some examples.

Example 1: Present value and the future

How do you compute present value for something that will happen in the future?

- Simple example. Suppose I have a product that I could realize and sell next year for 12546 SEK. Also suppose that *instead* of realizing a product I could instead put all my capital into a bank account and earn 2% interest over the next year.

- What is the Present Value of my product?

$$PV = 12546/(1 + 0.02) = 12300\,\text{SEK}$$

Example 2: What if I can invest the money for a lot more?

- Suppose instead of a 2% interest rate, I find instead that I can invest and get 10% over the year. The price of my product would still be 12546 SEK. What is the PV?

$$PV = 12546/(1+0.1) = 11405\,\text{SEK}$$

- Recall the previous PV was 12300 SEK.

- What this means is that the Present Value of my product given what I could do with the capital to realize it has a lower value.

- If can get 10% interest this year, and only 2% next year then should I wait a year to realize the product??

Present value and the future

The general form for Present Value is pretty easy. The book shows it:

$$PV = \frac{\text{Amount}}{(1+V)^n}$$

- *V* is the percent "discount rate" applied to a time period
  - For example: %/year.
- *n* is the number of time periods at that discount rate.
- For <u>costs, the "Amount" is negative</u>. For income it is positive.

- The discount rate you use is the Opportunity Cost of capital.
- It is the best rate you can get if you invest it in anything you could.
- Stocks, real estate, bank account, gold. Any model you want.
- The higher the PV the better. You have to decide what is high enough to move forward.

Net Present Value

- To do this, you just apply the formula for PV to all your costs and income over the expected life of the product.

- The book gives good examples of what that looks like:

[See textbook exhibit 15-6]

In this example, the time period is quarters, and the discount rate is 10%/yr.

Using NPV

- You use it to analyze different product scenarios, and to make decisions. Use some spread sheet like Excel. Has built in NPV.

- Suppose you do something to lower your development cost, for example by reducing engineering demand. You can see the result in higher NPV.

[See textbook exhibit 15-8]

Using NPV

- Now reduce engineering demand by lengthening the development time schedule. You can see how that will lower your NPV.
- Project managers live in dread of this.

[See textbook exhibit 15-10]

Uncertainty and risk

- What if you don't know what a cost or a selling price will be in the future, but you still need to do an analysis?

- No problem!
  1. Figure out the probabilities of a cost or price
  2. Be sure all the probabilities for a cost or price sum to 1.
  3. Multiply each cost or price by its probability.
  4. Proceed to calculate PV for each probability.
  5. Then sum everything up to calculate NPV in the usual way.

- Example: Suppose you are developing a product, and your R&D team think they have a technical breakthrough. If they succeed, the cost of your product materials will be some amount, X. If they fail, then the cost of your materials will be 10X. How do you compute PV of the product materials?

Uncertainty and risk

1. Determine the probability of success by the R&D team. You talk to them, and you determine that their probability of success is 0.3, with 0.7 being their probability of failure.

2. Calculate the present value for success (PVs). Remember that X is a cost, so it is negative.

$$PV_s = \left[\frac{-X}{(1+V)^n} \right] * 0.3$$

Uncertainty and risk

3. Next, calculate the present value for miserable failure (PVf).

$$PV_f = \left[\frac{-10X}{(1+V)^n} \right] * 0.7$$

4. The PV of your product materials is just the sum: PV=PVs + PVf.
5. Finally, compute the NPV by summing up all the PV data just like before.

Managing the risk

- These techniques are very simple, but at the same time very powerful.
- You can use any statistical model you want to come up with the probabilities.
  - The probability of getting a lower price on materials
  - The probability of increasing your engineering capacity
  - The probability of getting to market faster
- You understand these probabilities better than any marketer or sales person. If you use these tools, you have a large influence on what gets build, and what doesn't.
- If you are an R&D person, you can dramatically show what your technology can do to the project's NPV.
- As a decision tool, usually (but not always) as long as there is positive NPV, you can continue provided your discount rate is accurate. Remember opportunity costs!!

- But beware. If your numbers are meaningless, so will your NPV. (Garbage in, garbage out).