ECONOMICS AND MANAGEMENT OF TECHNOLOGY
MASTER DEGREE IN MECHANICAL ENGINEERING

MONOPOLY
INNOVATION

Drastic/non drastic innovation
Process vs. product innovation

**Process innovation**: generation, introduction and diffusion of a **new production cost-saving process** (with the products remaining unchanged). Examples are: robotics and CAD/CAM technology.

**Product innovation**: generation, introduction and diffusion of a **new product** (with the production process being unchanged). Examples are: DVD’s, PDA’s, and cell phones.

Drastic vs. nondrastic process innovation

**Drastic (or major) innovation**: allows the innovator to behave as a **monopolist without being constrained by price competition in the industry** (we will focus on the case where the industry behaves as a perfect competitive industry).

**Nondrastic (or minor or incremental) innovation**: innovator may gain some cost advantage over its rivals but **competition in the industry constrains the innovator** (we will focus on the case where the industry behaves as a perfect competitive industry).

**Drastic innovations** have such great cost savings that they permit the innovator to price as an unconstrained monopolist.

**Non-drastic innovations** give the innovator a cost advantage but not unconstrained monopoly power.
- Homogeneous product market

- Perfect competitive firms produce at $c_0$ and the market price is $p^c=c_0$

- Innovation brings cost below $c_0$ ($c_d$ when the innovation is drastic, $c_{nd}$ when the innovation is non drastic)

Innovation is drastic if monopoly output $Q_{(d)}^m$ at MR = new marginal $c_d$ exceeds the competitive output $Q^c$ at old marginal cost $c_0$
Suppose that demand is given by: \( P = 120 - Q \) and all firms have constant marginal cost of \( c = $80 \). Q is initially 40.

Let one firm have innovation that lowers cost to \( c_M = $20 \)

This is a **Drastic** innovation. Why?

Marginal Revenue curve for monopolist is: \( MR = 120 - 2Q \)

If \( c_M = $20 \), optimal monopoly output is where \( 120 - 2Q = 20 \), that is: \( Q_M = 50 \) and \( P_M = 120-50= $70 \)

Innovator can charge optimal monopoly price ($70) and still undercut rivals whose unit cost is $80.

If cost fell only to $60, innovation is **Non-drastic**.

Marginal Revenue curve again is: \( MR = 120 - 2Q \)

Optimal Monopoly output is where \( 120 - 2Q = 60 \) and price: \( Q_M = 30; P_M = 120-30= $90 \)

However, innovator cannot charge $90 because rivals have unit cost of $80 and could under-price it.

**Innovator cannot act as an unconstrained monopolist**

Best innovator can do is to set price just under $80-\( \epsilon \) and supply nearly all \( 120-(80-\epsilon)=40+\epsilon \) units demanded.
INNOVATION

Monopoly/perfect competition: replacement effect
How much is a firm willing to pay for an innovation that it would be the only one to use?

- **Profit incentive**: willingness to pay for the innovation measured by the *increase* in profit that the innovation generates

- **Incremental profits matter!**
Case 1: *Prior innovation there is perfect competition among firms*
Suppose that demand is given by: \( P = 120 - Q \) in a perfect competitive market, and all N competitive firms have constant marginal cost of \( c = \$80 \). Q is initially 40. Initial Welfare is Yellow Triangle (= consumer surplus).

Each firms’ surplus (and profit) is 0.
• Innovator lowers cost to $60 and can sell all 40 units at $P = 80 - \epsilon$ ($\epsilon > 0$) (This is a non-drastic innovation: see previous example).

• Innovator’s surplus is almost Area A $800 (Orange rectangle).

• Incremental profit is 800-0=800
First lesson: Innovators consider only monopoly profit that the innovation brings and fails to appropriate the additional consumer surplus in Area B (Blu triangle) that innovation would bring.
Case 2: Prior innovation there is a monopoly
• Now consider innovation when market structure is monopoly. Suppose that demand is given by: \( P = 120 - Q \) and marginal cost is constant, \( c = $80 \).

• Initially, the monopolist produces where \( MR = 120 - 2Q = MC = $80 \) at \( Q = 20 \) and \( P = $100 \), and earns surplus (Area C) of $400, while the yellow Triangle is consumer surplus.
• Suppose innovation allows monopolist to produce where MC = $60.
• The monopolist produces where MR = 120 – 2Q = MC = $60 at Q = 30 and P = $90, and earns surplus (Area D, Green rectangle) of $900, (while the yellow Triangle is consumer surplus)
• Incremental profit (net of expenditure for innovation) is 900-400=500. This is a gain of only $500 over initial profit

Second lesson:

Replacement Effect

prior to the innovation, the monopolist already earns a positive profit, whereas the competitive firm just recoups its costs and earns zero economic profit

A competitive firm places a larger value on a minor process innovation than a monopoly does.
Case: Microsoft’s incentives to innovate

The argument about the replacement effect can be extended to a multiproduct firm.

Prediction: higher incentives to innovate on market segments where firm faces competition than on those segments where it enjoys significant market power.

Microsoft’s launch of the Xbox in 2005

"It is surely no coincidence that Microsoft's hidden ability to innovate has become apparent only in a market in which it is the underdog and faces fierce competition. Microsoft is far less innovative in its core businesses, in which it has a monopoly (in Windows) and a near monopoly (in Office). But in the new markets of gaming, mobile devices and television set-top boxes, Microsoft has been unable to exploit its Windows monopoly other than indirectly -- it has financed the company's expensive forays into pasture new."