Technology and Innovation Management: Introduction

Introduction

Why Does Innovation Matter?

- main driver of growth
- OECD estimate is 60-70% of labour productivity growth
- under capitalism innovation becomes mandatory

Product or service innovation:

- to generate/increase Sales
- must be established on the market

Process innovation:

- to enable/improve production of goods or services
- must be established inside the organisation

Business model innovation

- Reshuffling of value proposition, processes, products, services, ...
- Example: Ikea selling unassembled furniture

The Vasa

- Failed Innovation
- Lack of communication, nobody dares to voice concerns

Patterns in Innovative Activity

Long-term patterns of technological change

- Technological change is cumulative and evolutionary
- Most innovations are new combinations of existing technologies or the introduction of new elements into existing systems
- some changes can be identified as revolutionary

Innovation shifts socio-economic paradigms

K-waves/Schumpeter's waves: Long cycles of economic growth and decline (50 years), where new inventions start new cycles of growth

Patterns in Technological Evolution

S-curve

- X-axis: Aggregate R&D spending (or time)
- Y-axis: Performance over time
1. Emergence: low performance
2. Rapid improvement: accelerating performance
3. Declining improvement: deccelerating performance
4. Maturity: saturated performance
- Often, a technology follows the S-Curve
- New technology at some point surpasses old technology's s-curve
- S-curve does not always represent reality (e.g. lithography)

Sailing ship phenomenon

- S-cuves of sailing ships and then steam ships
- Right before steam ships overtake sailing ships in performance, new better sailing ship technology (the Cutty Sark)
- Final sprint of old technology motivated by accelerating performance of new technology

Product Life Cycle (PLC)

Fluid Phase:
- In the early phase of a new product, frequent product changes occur
- diverse design
- Unspecified focus of R&D
- entrepreneurial organisation
- Much competition, more players enter market than exit

Transitional Phase:
- Major process changes
- One product design
- One R&D focus
- Organisation through project and task groups

Specific Phase:
- Incremental changes and innovations
- Only standard products
- R&D on incremental product technologies

- Well structured organisation
- More players leave market than enter

Adopter Categories

- Innovators
- Early adopters
- Early majority
- Late majority
- Laggards

Jeffrey Moore: Crossing the Chasm:
- Chasm is hurdle between early adopters and early majority
- Central question in marketing of new technology

Who Innovates, and Why?

Costs and benefits of innovation are the dominant drives of innovative activity
- Whoever gains the most is most likely to perform it
- Whoever has the lowest cost is most likely to do it

Schumpeters classical question: What market structure is most conducive to innovation?
- Schumpeter I: Entrepreneurs and new firms drive innovation => fragmented markets
- Schumpeter II: Large firms drive innovation => markets with some monopoly power

Arrow's Model

- q: Quantity
- p: Price
- $p(q) = 100 - q$: Linear demand curve. Higher price causes less demand (reversed linear function).
- c_0: Cost before innovation
- c_1: Cost after innovation
- $TR = q \times p$: Total revenue if selling q products at price p.
- MR: Marginal Revenue when selling one more product at price p. Ideally, this should be equal to marginal cost c_0, to maximize the potential profit. We can find the marginal revenue by substituting the price by the demand function in the total revenue formula, and then finding the zero point by deriving by q.

$$TR = q \times (100 - q)$$

$$TR = 100q - q^2$$

$$MR = \frac{\partial TR}{\partial q} = 100 - 2q$$

The point where the resulting line from $MR = 100 - 2q$ intersects c_1 tells us how much how much quantity q_1 we should sell to maximize profits.

Case A: Ex-ante perfect competition => ex-post monopoly:

Profit ex-ante: 0
Profit ex-post: $area(ABCD) = D - A \cdot C - D$
- $A = (0, c_1)$
- $B = (q_1, c_1)$
- $C = (q_1, p(q_1))$
- $D = (0, p(q_1))$

Case B: