Technology and Technology Strategy

Technology is the way an organization produces output from input.

Technology strategy *is an integrated set of choices about* ***how to use new technology*** *to produce superior financial returns in the long run.*

- We focus on Clayton Christensen's **disruptive innovation** framework
  - Classic Schumpeter idea of “creative destruction” by technological revolutions
  - This lecture: managing (disruptive) innovation as an incumbent
  - Next lecture: managing (disruptive) innovation as an innovator

Managing New Technologies as Incumbents

A useful dichotomy

Sustaining innovations further the differentiation of existing products

- New technologies that reinforce incumbents' existing assets, leading to better products with higher customer WTP.
- Incumbents are likely to adopt sustaining technologies

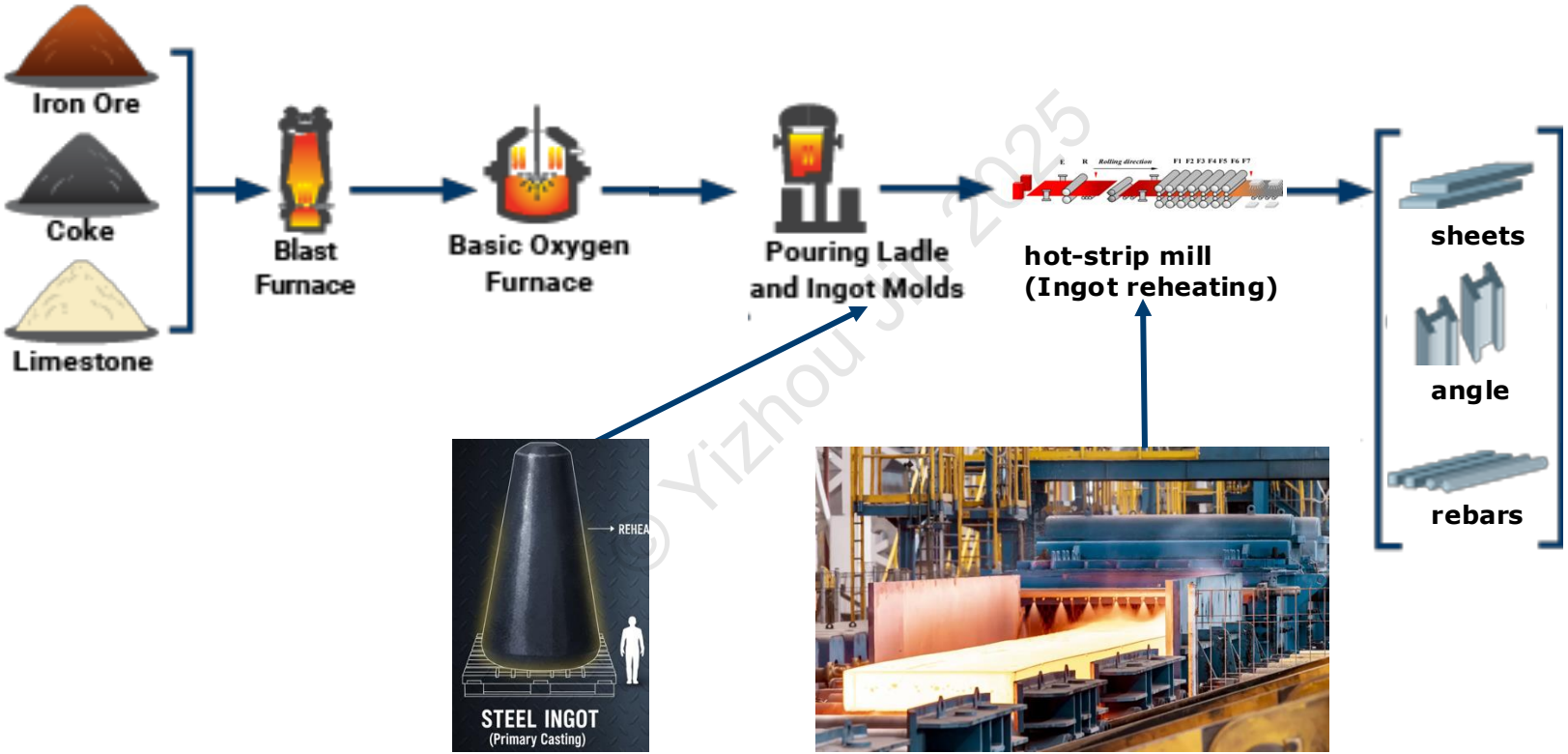
Disruptive innovations create new substitutes at low cost

- New technologies that are incompatible with incumbents' existing assets, leading to alternative ways of value creation.
- In the beginning, these substitutes tend to offer lower quality products at lower cost, targeting price-sensitive customers. Incumbents are unlikely to adopt.

Case: U.S. Steel Industry

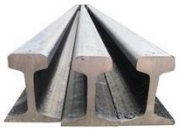
- 20th century large **integrated steel mills**
- A few big firms
  - e.g. US Steel
  - Huge plants and fixed cost
- Vertically integrated:
  - mining iron ore
  - iron-making
  - steel-making
  - casting

Integrated Steel Mills - Technology



End Products: Quality Tiers

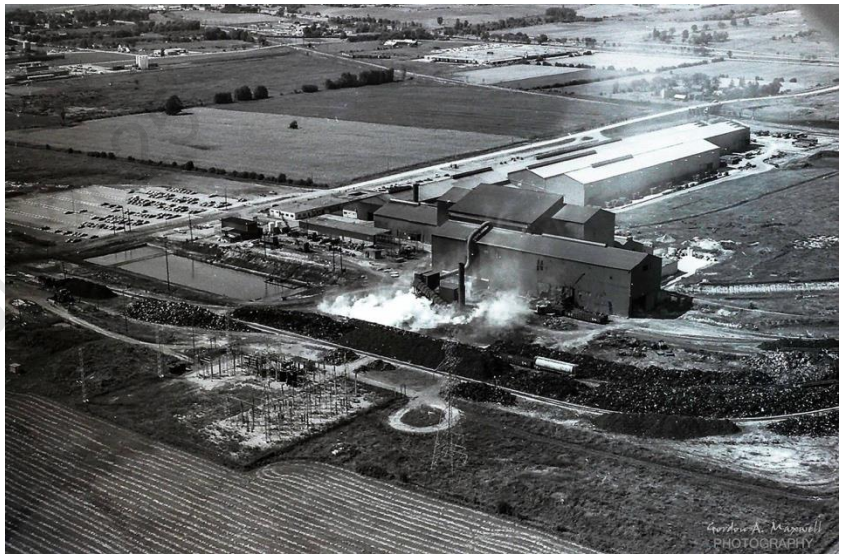
- rebars (concrete reinforcing bars)
- structured/angle steel
- sheet steels

quality	margin	use case
low	low ~5%	
mid	mid ~10%	 
high	high ~20%	 

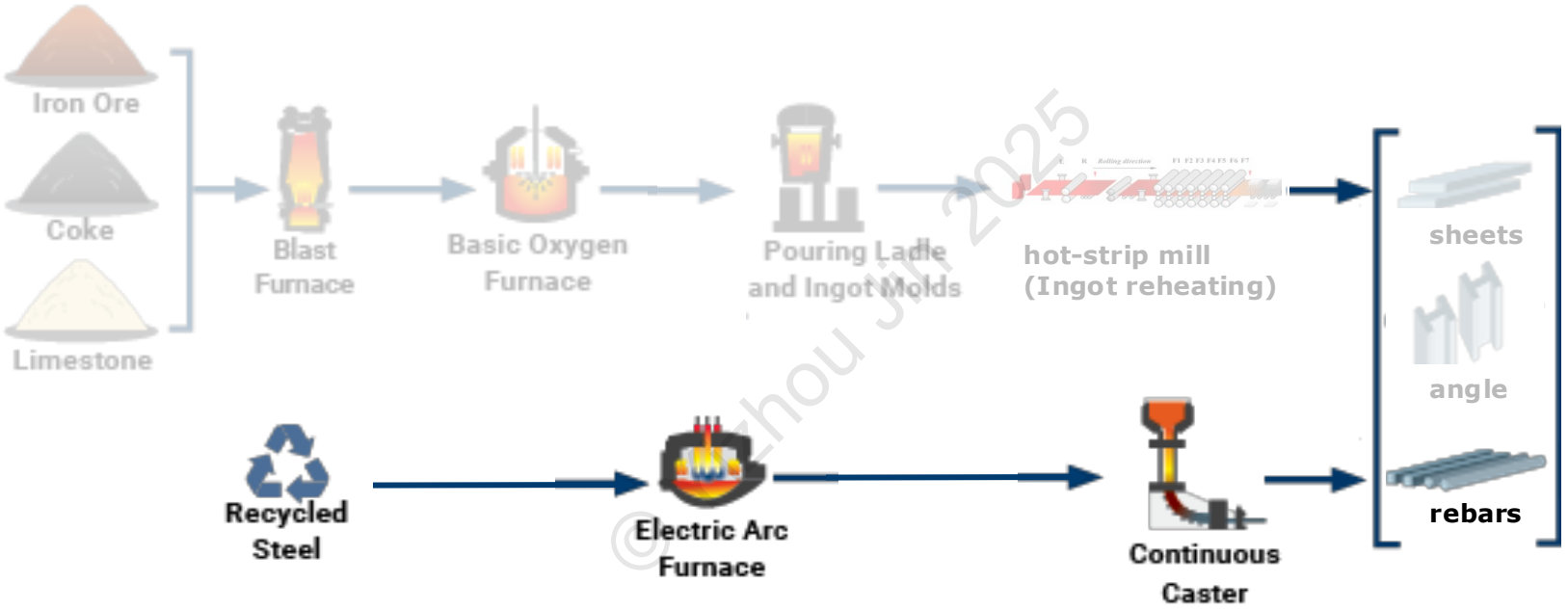
Mini Mills - Disruptive Innovation

- 1960s: emergence of **Mini Mills**
  - e.g. LASCO (Lake Ontario Steel Company)

- A disruptive innovation that drastically reduced cost
  - scraps as input (vs. iron ores)
  - electricity arc furnace (vs. blast + oxygen furnace)
  - continuous casting process (avoids hot-strip mills)



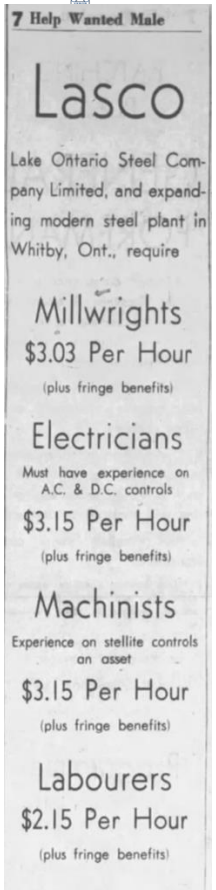
Mini Mills - Disruptive Innovation



Initially: Low Quality at Low Cost

- In late 1960s, mini mills could produce rebars at 20% lower marginal cost.
  - Lower fixed and variable (input/electricity/labor) costs
  - Big threat to incumbent integrated mills, but only for low-quality rebar products

- How did integrated mills respond? Why?
  - Adopt and invest in mini-mill production
  - Retreat to higher-quality products (angle/sheet steel)


7 Help Wanted Male

Lasco

Lake Ontario Steel Company Limited, and expanding modern steel plant in Whitby, Ont., require

Millwrights
$3.03 Per Hour
(plus fringe benefits)

Electricians
Must have experience on A.C. & D.C. controls
$3.15 Per Hour
(plus fringe benefits)

Machinists
Experience on stellite controls an asset
$3.15 Per Hour
(plus fringe benefits)

Labourers
$2.15 Per Hour
(plus fringe benefits)

Why Didn't Integrated Mills Adopt the Mini Mill Model?

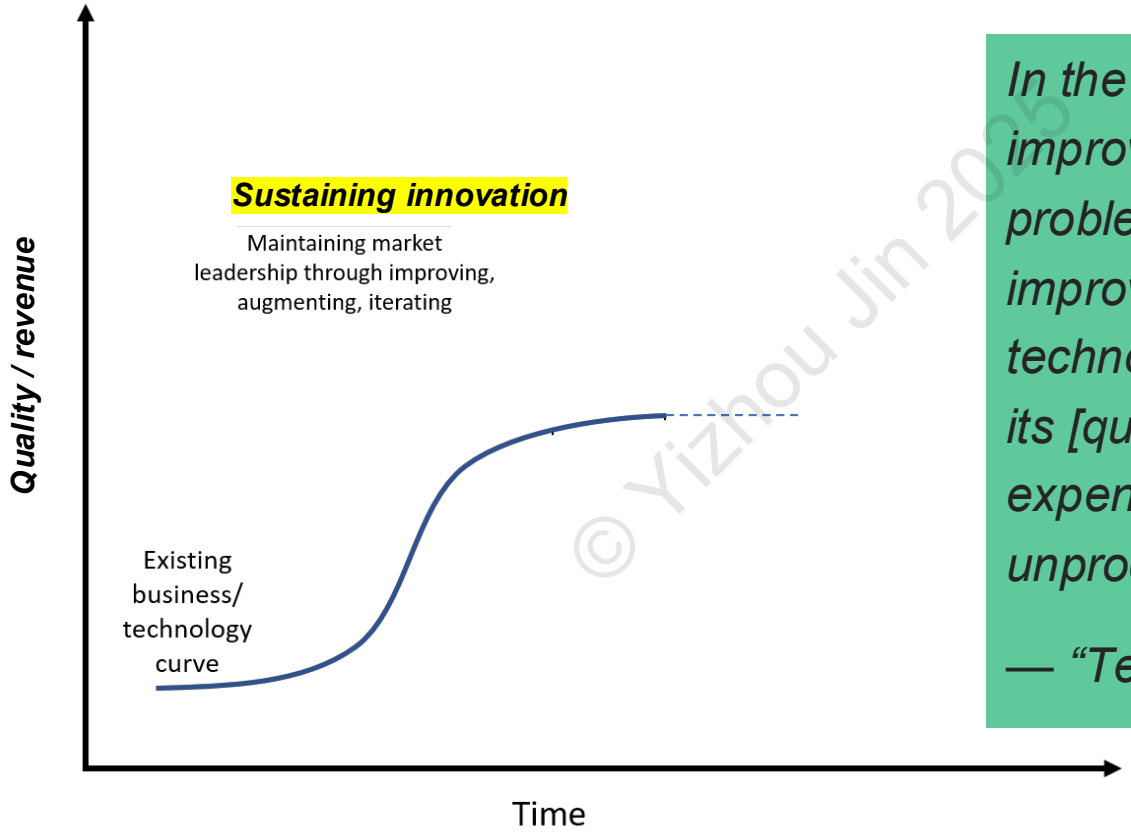
- Integrated mills made rational decisions: ceding the rebar market and doubling down on sheet steel market
  - Why fight for a 5%-margin **low-quality** product?
  - Lots of **uncertainty** in whether mini mills could eventually produce higher quality products like sheet steel. *Could Integrated mills have predicted the development of thin-slab casting?*

  → Focused on sustaining innovations on **high-margin** sheet steels
  - e.g. perfected blast furnaces and adopted thick-slab continuous casting (much more efficient than ingot casting but still required massive hot-strip mills).

- Mini-mills reinvested their profits into their own sustaining innovations, which ultimately yielded disruptive results.
  - **Thin-slab casting**, in particular, which relied on smaller production scale, allowed them to produce high-quality sheet steel directly in the casting process without hot-strip mills.

The Innovator's Dilemma

Illustration using the "technology S curve".

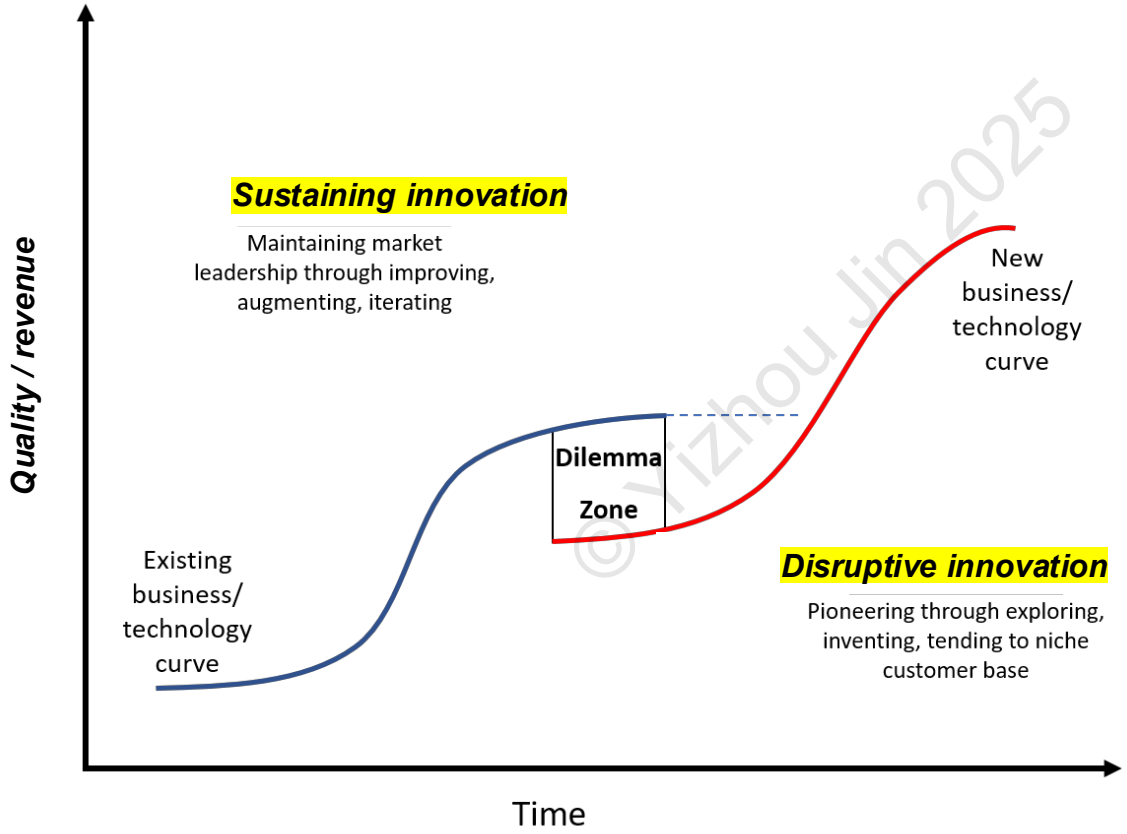


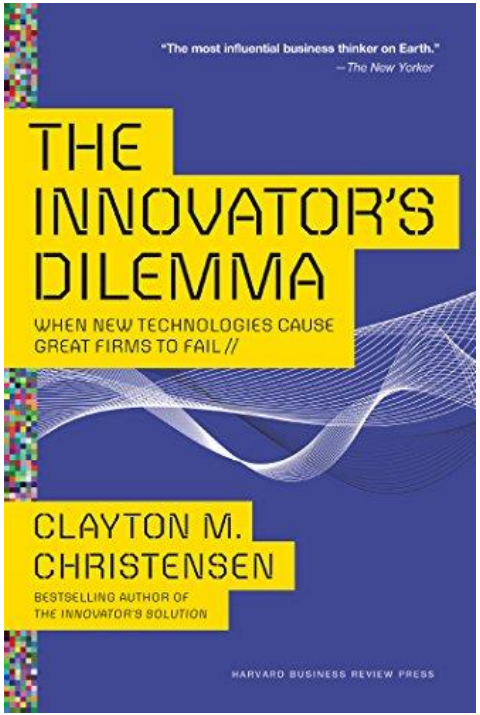
In the beginning, [quality] improves slowly. Then, as problems are solved, [quality] improves rapidly Finally, technology reaches its [quality] limit, and additional expenditure/time to improve it is unproductive.

— "Technology Strategy" p10

The Innovator's Dilemma

Illustration using the "technology S curve".





Why Don't Incumbents Adopt Disruptive Tech

Failure to manage disruptive tech is a strategy problem.

- **Asset** incompatibility (substitute)
  - The adoption of new technology requires a set of complementary assets. Disruptive innovations create substitutes and requires assets that incumbents don't have.

- **Organizational** frictions
  - hard to align internal stakeholders to invest in something that their customers don’t want and sells for less.

- **Uncertainty** in the value of disruptive technology
  - few potentially disruptive techs can be successfully commercialized – why jump off a cliff for something unproven and are low-quality?

The decision not to adopt disruptive tech could very well be rational.

Strategies for Incumbents

How to get ahead of disruptive technologies?

Tackling organizational change:

Set up a dedicated organizations that is **small** and **independent**

- Focus on developing **low-cost** substitutes: satisfy the same consumer demand with new tech.

In other words, adopt a purely demand view of industry definition and forego the production view

Tackling the uncertainty issues:

Experimentation

- With each potentially disruptive tech, develop **low-quality prototypes** (“MVP” – minimum viable products) catered to niche/price-sensitive customers. Continue to invest according to feedback.

Disruptive Technology for Innovators

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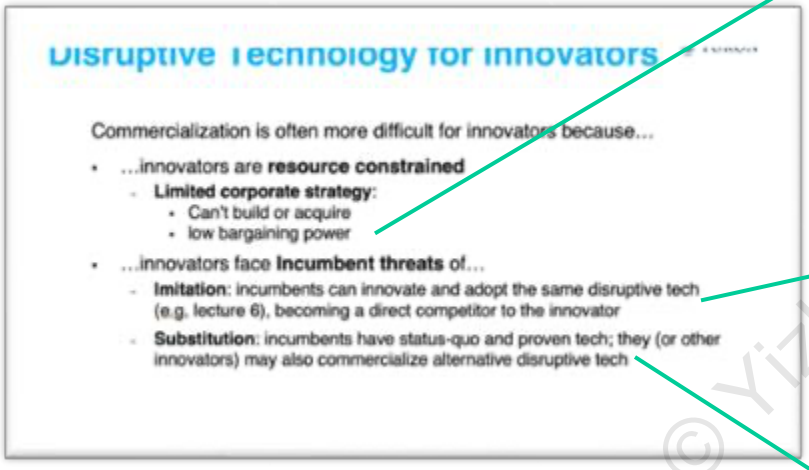
Commercialization is often more difficult for innovators because…

- …innovators are **resource constrained**
  - **Limited corporate strategy**:
    - Can't build or acquire
    - low bargaining power
- …innovators face **Incumbent threats** of…
  - **Imitation**: incumbents can innovate and adopt the same disruptive tech (e.g. lecture 6), becoming a direct competitor to the innovator
  - **Substitution**: incumbents have status-quo and proven tech; they (or other innovators) may also commercialize alternative disruptive tech

Vs. the incumbent view:
** resource incompatibility*
** uncertainty*
** organizational frictions*

Growth Strategy for Innovators

Three Key Threats to Growth



Buyer Bargaining Power (can your customers squeeze you?)

Relationship specific investment: how to invest in OEM relationships when they have such high bargaining power?

*This is called the **Hold-up problem**: RSI is "held up"*

Imitation (can others enter?):

How to build barriers to entry so others can't easily copy our product and tech?

Substitution (what about other techs?):

How to mitigate threats from substitute products or technology that exist now or will exist in the future?