Profiting from Innovation in the Digital Economy

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Profiting from Innovation Framework (PFI)

I. Observations:
- Pioneers are often the losers (so much for "first mover advantages")
- Innovators seem unable to capture much of the rents from innovation (Mansfield Studies: Social returns in order of magnitude greater than private returns)
- It is not only consumers that benefit; competitors (imitators/emulators/followers) often capture the lions share

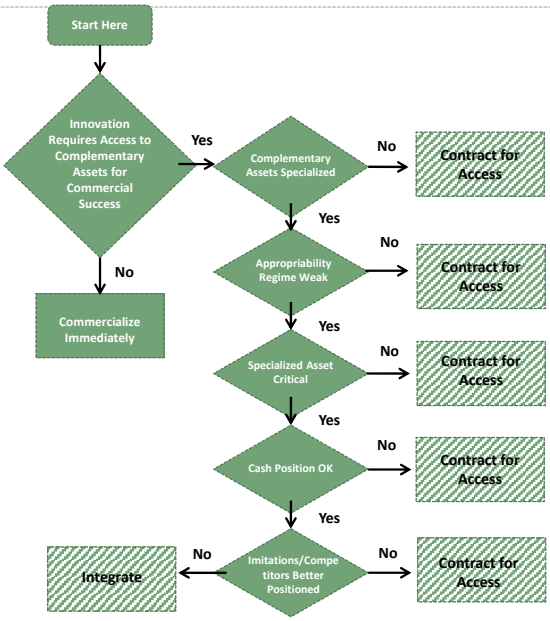
PFI was developed to explain the distribution of returns.

A simple model developed which highlighted:

- Strength of appropriability regime
  - Intellectual property rights
  - Nature of knowledge (difficult to copy?)
- Standards and timing
  - Pre or post dominate design?
  - Does innovator "control" the standard?
  - Is investment strategy consistent with standards evolution?
- Complementary Assets
  - Specialized or co-specialized?
  - Generic?
- Strategy / Business model

Value Capture Strategy

Business model choice (licensing vs. integration) to determine value capture strategy



The "Reflections" Paper (2006) Added:

- Installed base effects
- Complementary innovations
- Integration Strategy recast as business model choice (licensing vs. direct investment)
- Summarized the challenge of PFI as crafting the right business model and identifying and owning (controlling) the "bottleneck" asset (which could change with industry conditions)

Contract and integration strategies and outcome for Innovators: Specialized asset case

key: strategies / outcomes

market power of innovators/initiators versus owners of complementary assets	Strong Legal/Technical Appropriability	Weak Legal/Technical Appropriability: Innovator Excellently Positioned versus Imitators with Respect to Commissioning Complementary Assets	Weak Legal/Technical Appropriability: Innovator Poorly Positioned versus Imitators with Respect to Commissioning Complementary Assets
innovators and imitators advantageously positioned vis a vis independent owners of complementary assets	(1) contract / innovator will win	(2) contract / innovator should win	(3) contract / innovator or imitator will win; asset owners won't benefit
innovators and imitators disadvantageously positioned vis a vis independent owners of complementary assets	(4) contract if can do so on competitive terms; integrate if necessary / innovator should win; may have to share profits with asset holders	(5) integrate / innovator should win	(6) contract (to limit exposure) / innovator will probably lose to imitators and/or asset holders

David- we do not have a sharper copy. I'm not the best chart maker, but perhaps Sohvi could recreate?

2016 Context

Techno-Business Environment Changed since 1986

- Digital convergence
- Internet increasingly pervasive
- Installed base effects and digital platforms ubiquitous
- Multi-invention context more common (100,000+ patents implicated in the iPhone)

New Version of PFI Framework

Need more granularity/specificity around:

- Enabling technologies and General Purpose Technologies (GPT)
  - Pervasive
  - High potential
  - Enhance research productivity
- GPT's often start out as something less, (e.g. user invented with no initial obvious application)
- More heterogeneity around complementarities (Hicks v. Edgeworth v. Hirshleifer)
- Differentiation with respect to standards (standards setting v. standards development)
- Business Model Design

The salience to PFI of General Purpose Technologies

- Difficult to design a business model to capture anything but a small sliver of social returns
- Need to engage with partners to develop full potential of the technology (implies rent sacrifice)
- GPT serve to illustrate that business models matter and are inherently limited as value capture structures
- Thomas Edison: usurpation of profits by imitators / pirates are "particularly apt to result in the case of some extraordinary patent"*

*Quote attributed to Edison by his biographer, Remsen Crawford

Heterogeneity with respect to Complements and Complementary Assets

"The time is ripe for a fresh, modern look at the concept of complementarity … the last word has not yet been said on this ancient preoccupation of literary and mathematical economists. The simplest things are often the most complicated to understand fully."

(Samuelson, 1974, p.1255)

Types of Complementarity	Nature
Hicks:	Decrease in price of "x" leads to an increase in quantity of "y"
Edgeworth:	$U_{xy} > 0$ U= Utility Complementarity is symetric
Hirshleifer:	Asset price complementarity. Innovation causes complements to increase in price & substitutes to decrease in price (Whitney's Cotton Gin)
Counot:	Goods are used together but sold by separate companies
Teece:	Full benefit of technology requires another (complementary) technology

PFI Implications for Each Type of Complement are Different

- Technological complements are critical; Schumpeter saw innovation coming from "new combinations", and he was right
- Competence destroying and competency enhancing innovation (Tushman) can be understood in part as Hirshleifer type complementarity
- Neither Edgeworth nor Cournot's complementarity are central to the PFI story.
- The requirement to access multiple complements to commercialize a technology across downstream applications inherently constrains the upstream inventors ability to capture value (this was ignored by both Teece '86 and Levin et al '87)

Standards & Platforms

Platforms can be defined as:

> "evolving ... meta-organizations that: (1) federate and coordinate constitutive agents who can innovate and compete; (2) create value by generating and harnessing economies of scope in supply or/and in demand; and (3) entail a modular technological architecture composed of a core and a periphery."

Gawer, A. 2014.
"Bridging differing perspectives on technological platforms: toward an integrative framework".
Research Policy, 43(7), p.1240.

Two Paradigms of Standards Activities

	Standard Setting Organization(SSO) (Model One)	Standard Development Organization (SDO) (Model Two)
Process	Selection amongst known alternatives offered by contributors; choices serendipitous… no clear winner	New technologies developed, often at great expense to contributors. Standard adopted because it's of superior performance
Outcomes	Uniformity, compatibility	Innovation, uniformity, compatibility
Pricing	Usually zero (patents & trade secrets only rarely implicated)	FRAND (fair, reasonable and non-discriminatory)
Examples	Left- v Right-hand drive autos, SAE component; British v American electrical outlets	3G, 4G, LTE; 802.11 wi-fi (IEEE, ETSI)

SL1

Standard Setting v. Standards Development

	Industrial Economy Notion STANDARD SETTING ORGANIZATION (e.g. SAE)	Knowledge Economy Notion STANDARDS DEVELOPMENT ORGANIZATION (e.g. IEEE/ETSI)
Compatibility Issues Implicated	Yes	Yes
New Technology embedded in Standards	No	Yes

The goal of PFI has always been to ask:

1. Where is the bottleneck in the value chain?
2. What is the business model to let the innovator land there and control the bottleneck?

Observation:

When intellectual property protection is weak, the innovator must rely on the business model and strategy to capture value… and this is hard, especially if the invention/innovation is enabling/ GPT

Slide 15

SL1 Sohvi Leih, 26/06/2016

Complements and Coevolution

Complements: Significance lies not just with business model dimensions; without the entrepreneur assembling complements, innovation often simply won't happen

Co-evolution: With the introduction of the time element, co-evolution becomes important

Implications

- Complementary assets and complementary technologies are more significant than ever in a world of competing and intersecting platforms (Evans and Gawer, 2016).
- Business ecosystems are increasingly the relevant competitive units and drive firm-level profits;
- Multi-invention contexts, in which individual products draw on multiple internal and external sources of technology (patented and unpatented), are pervasive (Somaya, Teece, and Wakeman, 2011); and
- Business model choices for a new innovation, even with reference just to appropriability, are more complex than the original "licensing versus in-house production" appropriability model (Teece, 2010; Zott et al., 2011).
- Enabling and GPT technology goes under-rewarded because of inherent limitations in licensing as a business model

Conclusions

- Enabling technology/GPT raise very challenging PFI/Appropriability issues
- SSO's/SDO's play critical roles in innovation and raise PFI/Appropriability issues
- Ecosystem success requires managing both standards and complements
- Profiting from innovation is challenging: public policy should facilitate it, and do so most aggressively for enabling technologies/GPTS