Technology and Innovation Management

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Innovation Ecosystems

Last time, and today

From products to platforms

A platform is a **foundation technology** or service that is essential for a broader, interdependent ecosystem of businesses.

<u>Common assumption</u>: Modularity and platforms firms can design and control their environment

Today: Organizations as system, What happens when firms cannot fully control their environment (Ecosystems)

Learning objectives

Key concepts

- Business ecosystems
- Risk (initiative, interdependence, integration)

Methods

- Discussion of cases and examples

Abilities

- Critical assessment of risk management approaches
- Understanding of leadership in business ecosystems

Required Readings for today

- Adner R (2006) Match your innovation strategy to your innovation ecosystem. Harvard Business Review. April. Pp. 98-107.
- Jacobides, M. G., Cennamo, C., & Gawer, A. (2018). Towards a theory of ecosystems. *Strategic Management Journal, 39*(8), 2255-2276.
- Teaching case, 3D Printing industry

Suggested Reading for today

- Adner, R. and Kapoor, R. (2010), Value creation in innovation ecosystems: how the structure of technological interdependence affects firm performance in new technology generations. Strat. Mgmt. J., 31: 306–333.

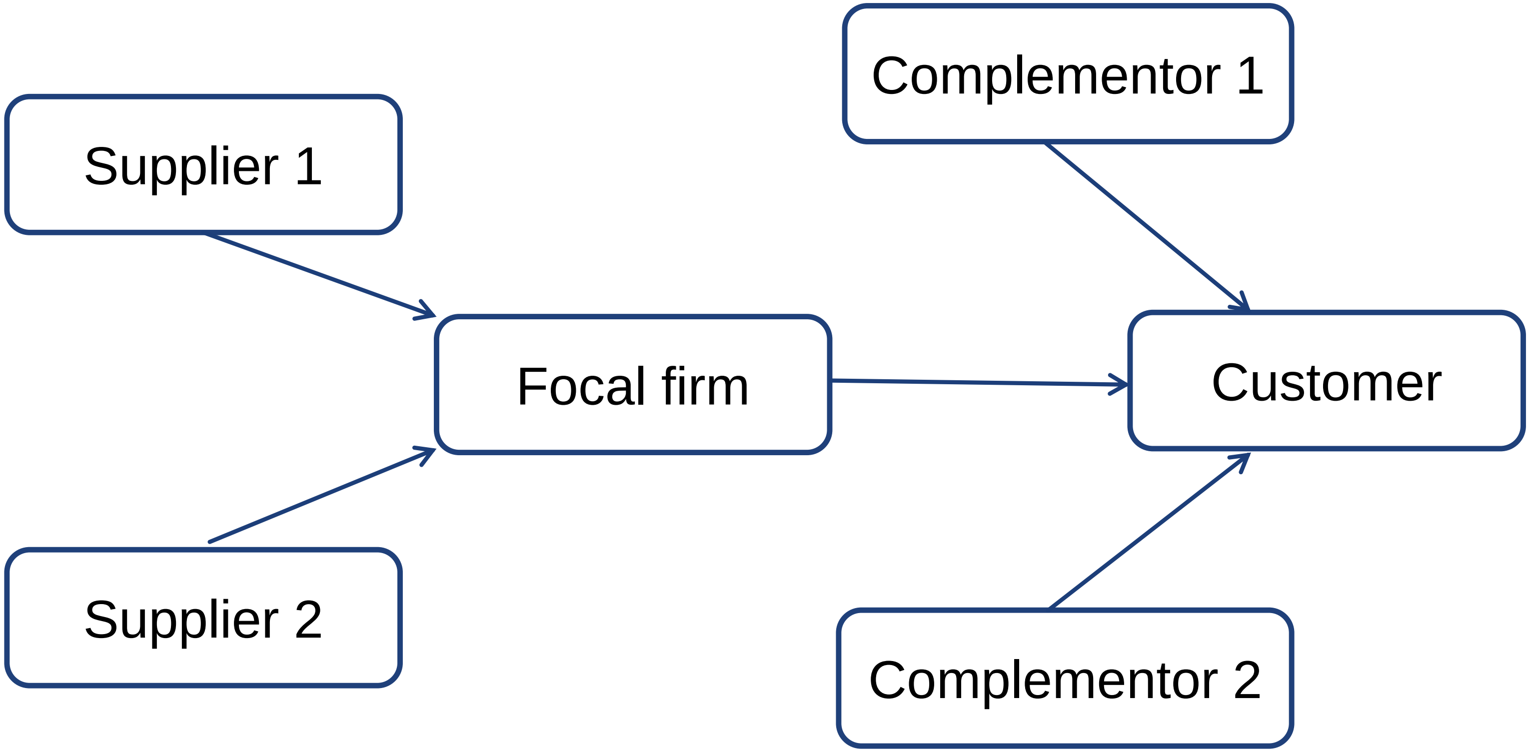
Background

- Innovations do not stand alone
  - Interdependencies across subsystems
    - See, e.g.,: Henderson and Clark (1990)

- Focal firms and suppliers, traditional focus
  - Modularity and modularization
  - See, e.g.,: Sanchez and Mahoney (1996)
  - Platforms

- Additionally: **complementors**

A generic ecosystem



Source: Adner and Kapoor 2010


The Michelin PAX System
Tire
Support
Alloy Wheel
Pressure Detector
www.familycar.com

Michelin’s PAX System

- Need: solution for flat tires
  - 60 of US drivers experience a flat tire every 5 years
  - 250,000 accidents/year due to low tire pressure

- Inferior competition
  - Self supporting, run-flat tires of Goodyear, Bridgestone, etc. were too heavy, stiff ride, poor MPG
  - These occupied <1% of market

- PAX System
  - Run-flat tire with support ring clamped to alloy wheel with pressure monitoring device
  - Most radical and functional change since the radial tire

Expectations and Reality

- Michelin and Goodyear collaboration launches product in 2001
- Rapid adoption on high end cars
- In 2004, JD Powers predicts 80% of cars will have “run-flat” tires by 2010
- 2005, Link with Honda, PAX on Oddessy and extended 2-year warranty
- **In 2007, the PAX system was discontinued with huge corporate losses**

Michelin’s Normal Business Practice:

Michelin Tires → **Vehicle Manufacturer** → **Driver/Customer**

Michelin Tires → **Tire Dealer** → **Driver/Customer**

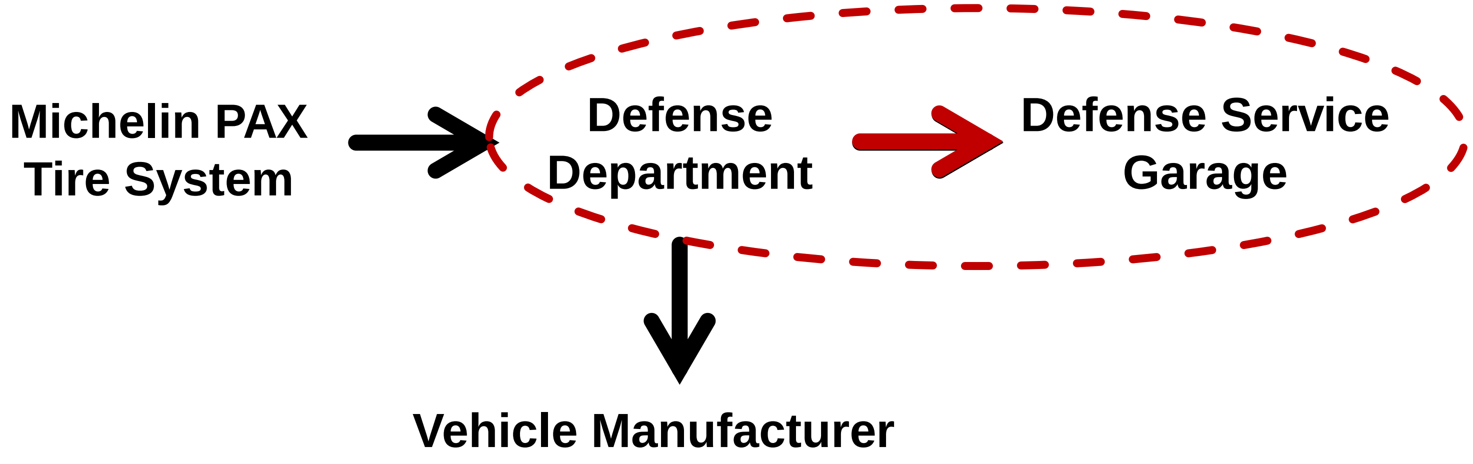
What Was Required for Successful PAX Business Practice:

Michelin PAX Tire System → **Vehicle Manufacturer** → **Tire Dealer** → **Driver/Customer**

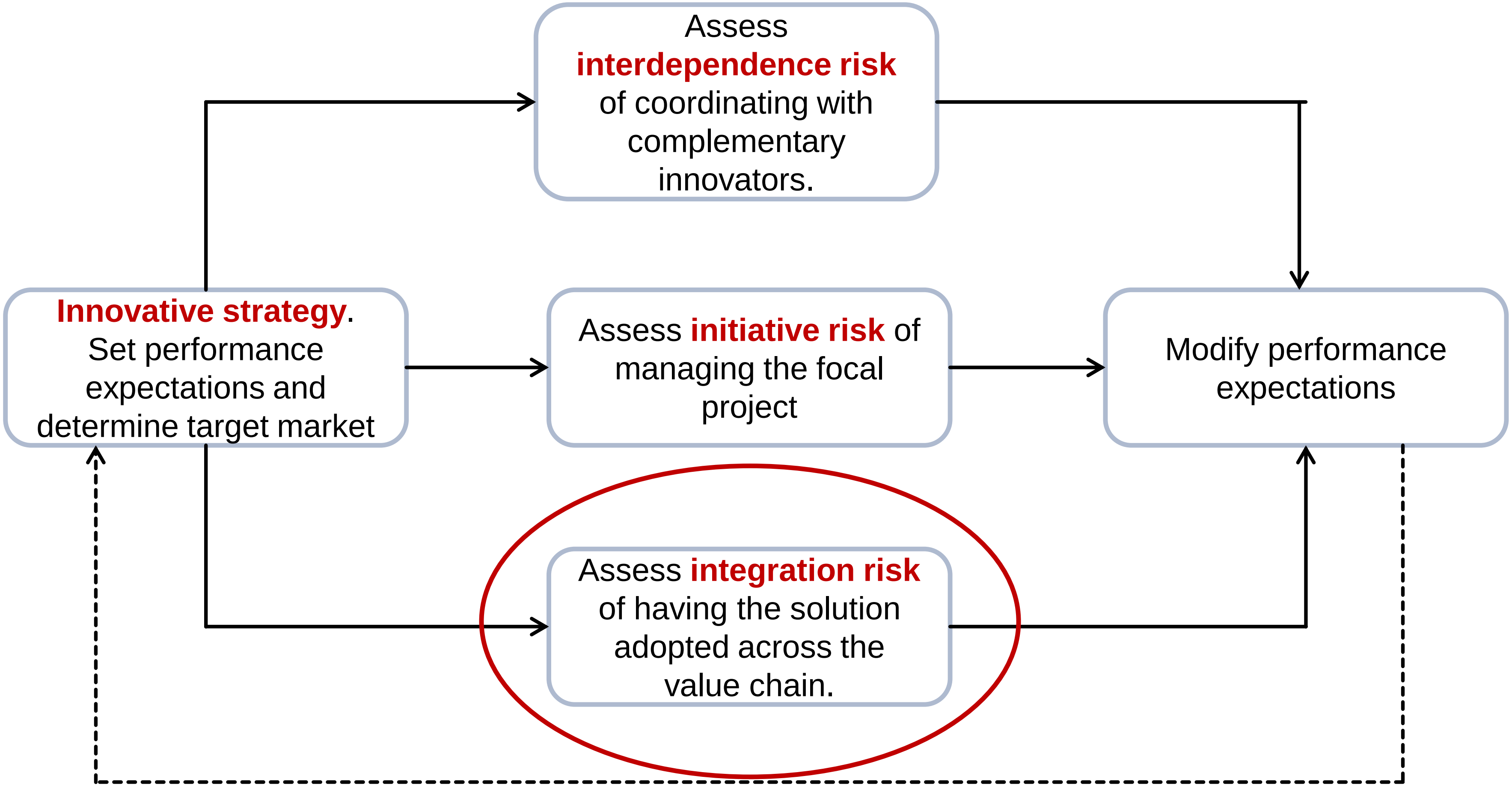
Service Garage

Lessons learnt

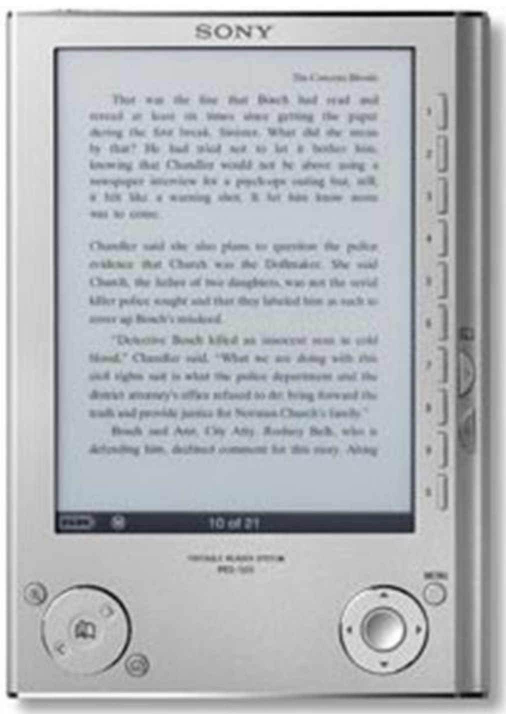
- For successful products to produce revenue, you must manage more than your internal ecosystem (innovation, marketing and execution), <u>you must manage your external ecosystem as well!</u>
- Michelin learned and found an ecosystem for the PAX System – the US Military:

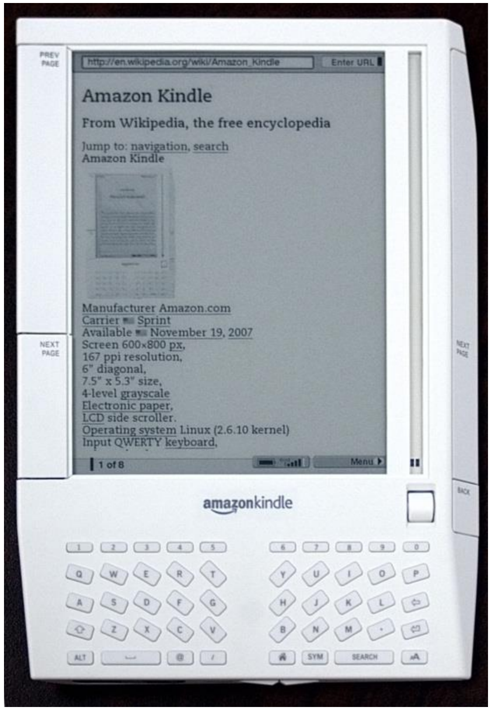


Strategizing in the PAX ecosystem



Sony Reader vs Amazon Kindle





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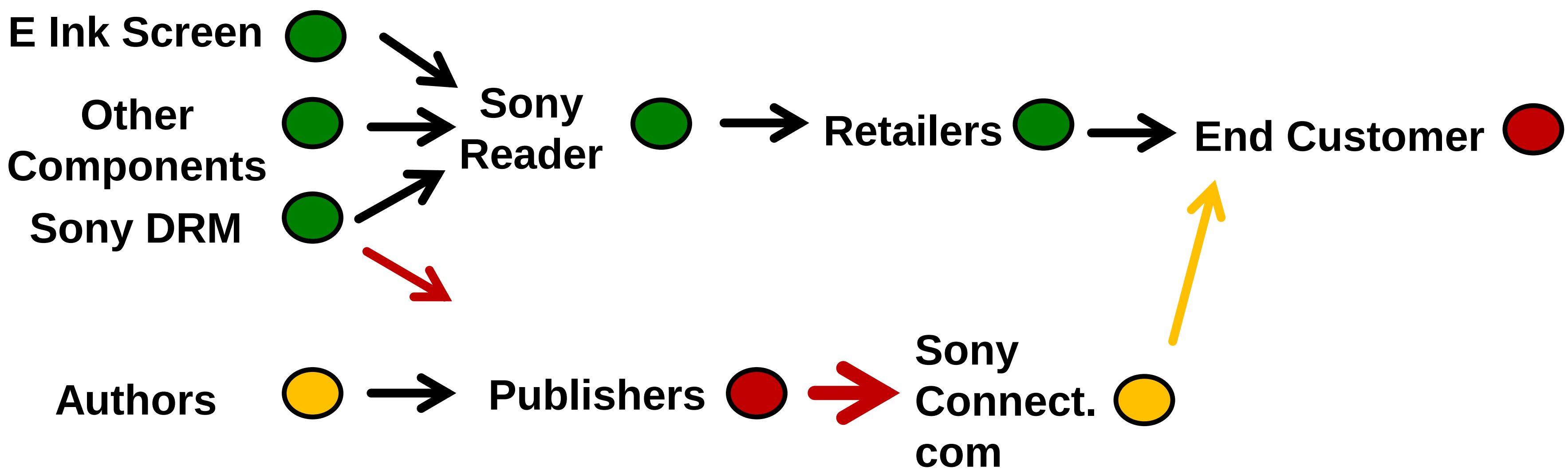

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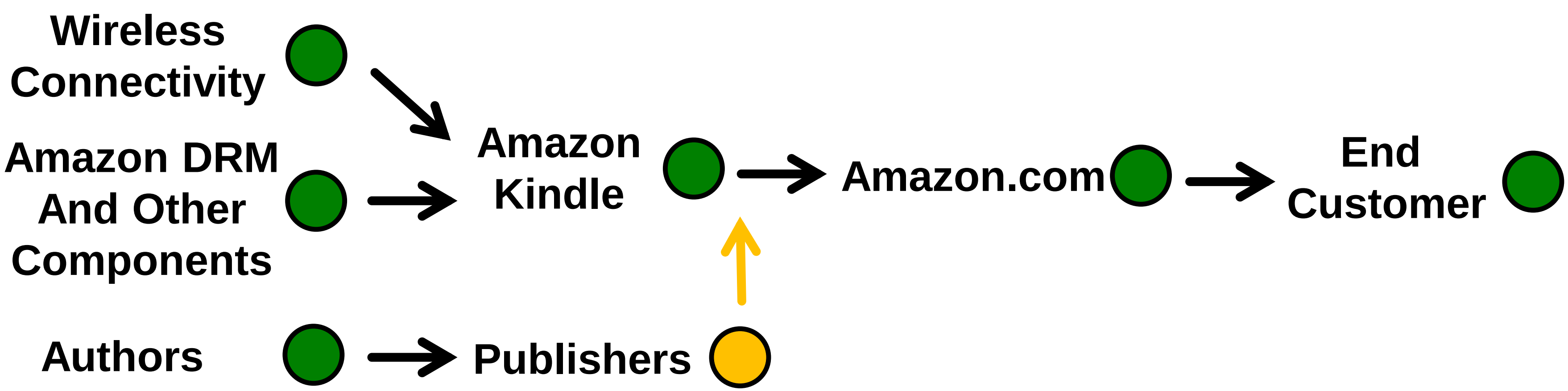


From modularity to ecosystems

Ecosystems arise when

1. Modularity allows for division of labor along technical architectures

AND

2. Complementarities between subsystems create the need for coordination

- Modularity as the key necessary condition:
  - Divide technical development/production tasks within a larger product
  - Enable ‘embedded coordination’
- Complementarities in production vs. in consumption

Modularity and Complementarities Jacobides et al., 2018

Types of complementarities

- Generic: combination of A and B is more valuable than sum of separate parts
  - However, components can also be used with others
  - E.g. boiling water, tea leaves, cup

- Unique: A does not function without B
  - E.g. game console and game (two-way), phone and apps (one-way)

- Supermodular: more of A makes more of B more valuable
  - = network effects!
  - E.g. any multi-sided platform

Type of Complementarity in Production ↓ / Type of Complementarity in Consumption →	**Generic** Joint consumption generates greater utility than separate consumption, but these complements can be consumed jointly with others as well	**Unique** Joint consumption generates greater utility than separate consumption, and these complements have less value when not consumed together	**Supermodular** Increasing returns of joint consumption of complements
Supermodular The more of items A are produced, the cheaper (or the better quality) B and C are produced; *or* The more agents A are involved in producing B, the better quality B is *or* The more activities A are conducted, the more efficiently activities B and C are performed	• No group-level coordination needed but greater quantity in production increasingly improves the quality / the availability /lowers the cost of compatible components • Joint consumption of complements generates greater utility than separate consumption but these complements can also be consumed jointly with others as well • (e.g., 3G- and 4G-compatible telecommunications networks and compatible devices , now that 3G and 4G are stable standards)	• Group-level coordination in production needed, and as it increases it improves the quality / the availability / lowers the cost of production compatible components • Joint consumption of complements generates greater utility than separate consumption and these complements have less value when not consumed together (e.g., 5G-compatible Internet-of-Things product systems (5G is not standardized yet); NASA-led innovation contests)	• Group-level coordination in production needed, and as it increases it improves the quality / the availability /lowers the cost of production compatible components • Increasing returns of joint consumption of complements • (e.g., Open source software such as Android, which is subject to supermodular complementarity in production as "more eyeballs catch more bugs" + is also subject to supermodular complementarity in consumption as "more Android-compatible apps complements will increase the value of consuming Android…")
Unique Items A and B (and C) cannot be produced without coordination across producers or adherence to a standard within a modular system	• No group-level coordination needed to allow production of compatible components, but adherence to an open standard is required • Joint consumption of complements generates greater utility than separate consumption but these complements can also be consumed jointly with others as well (e.g., computer laptops and open-standard Bluetooth-, USB-, or Wifi-compatible peripherals)	• Group-level coordination needed across producers to allow production of compatible components • Joint consumption of complements generates greater utility than separate consumption and these complements have less value when not consumed together (e.g; Solar photovoltaic panel producers, racking producers, and installation providers)	• Group-level coordination needed across producers to allow production of compatible components • Increasing returns of joint consumption of complements • (e.g., Nike products and connected wearable technology devices and sports apps; Apple iOS and compatible apps; Sony-compatible video games and Sony videogame consoles)
Generic Items can be produced in coordination, but can also be produced independently from each other	• No group-level coordination needed to allow production of compatible components • Joint consumption of complements generates greater utility than separate consumption but these complements can be consumed jointly with others as well (e.g., Stylistically matching home or sartorial accessories; musical instruments of a symphony orchestra; hotel and gym and swimming pool)	• No group-level coordination needed to allow production of compatible components • Joint consumption of complements generates greater utility than separate consumption and these complements have less value when not consumed together (e.g., Cars and tires; Manual razors and generic blades and shaving cream; Tennis rackets and tennis balls)	• • No group-level coordination needed to allow production of compatible complements • Increasing returns of joint consumption of complements (e.g., Multi-sided platforms (MSPs) such as eBay, or Airbnb, or Uber; Barbie dolls and Barbie-compatible clothes)

These coloured blocks are ecosystems

Jacobides et al., 2018

3D Printing case

Additive manufacturing: 3D Printing

- Manufacturing process that builds layers to create three-dimensional solid objects from a digital model
- Materials usually plastics or metals; polymerized, fused, bonded or melted together
- Applied in manufacturing for rapid prototyping up to complete part production

Firms in 3D printing

- 3D Systems, founded in 1986 in California, US
- Founded by Charles Hull, previously in UVP, inc (tabletop coating using UV light)
- Technology: vat polymerization

- Stratasys, founded in 1989 in Minnesota (US)
- Founded by Scott Crump, formerly in IDEA, inc. (force, load and pressure transducers)
- Technology: Material Extrusion

- Electro Optical Systems (EOS), founded in 1989 in Planegg, Germany (region of Munich)
- Founded by Hans Langer, previously in General Scanning
- Technology: Powder Bed Fusion (initially vat polymerization)

Source: Master thesis (Zeijen, 2015)

Timeline 3D printing

2010-… Societal impact:
3D printed…
- Guns
- Fashion
- Houses
- Food
- 3D printers

1985-1990: early developments:
Stereolithography: 3D Systems
Laser Sintering: University of Texas
Fused Deposition Modeling: Stratasys

1990-2000: additional processes

1985

2015

2000: First 3D printed parts used as end-products:
Boeing: air ducts in jet fighters (2000)
NASA: instrument tray in spacecraft (2000)

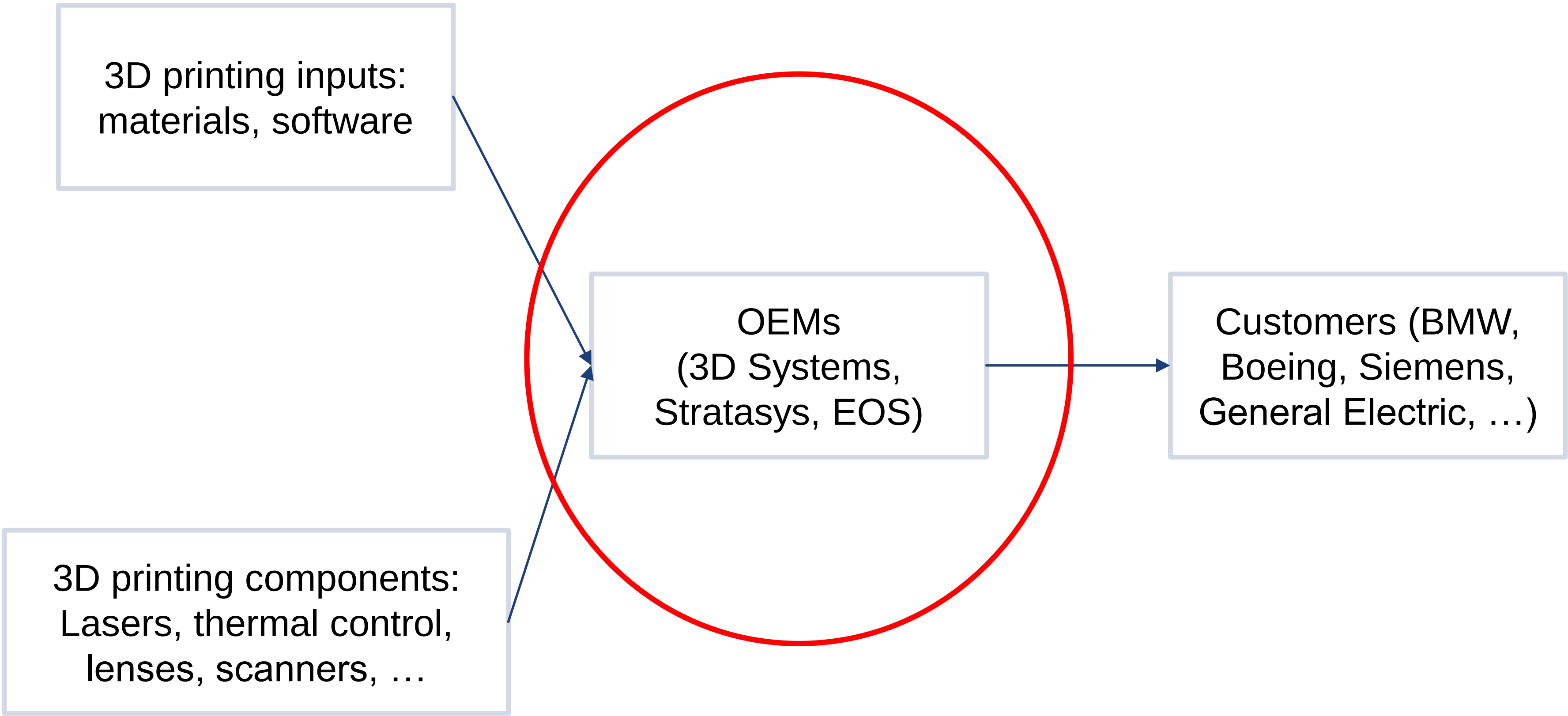
Questions for you:

1. Sketch the innovation ecosystem of the 3D printing industry at the three points in time (1995, 2005, 2015). Identify the main actors, their roles and the connections between them.

2. What was the crucial problem for focal firms to solve at these points in time, relating to the ecosystem?

3. What kind of risk did the focal firms face at each point in time? How did they tackle this risk?

3D printing ecosystem structure: 1995



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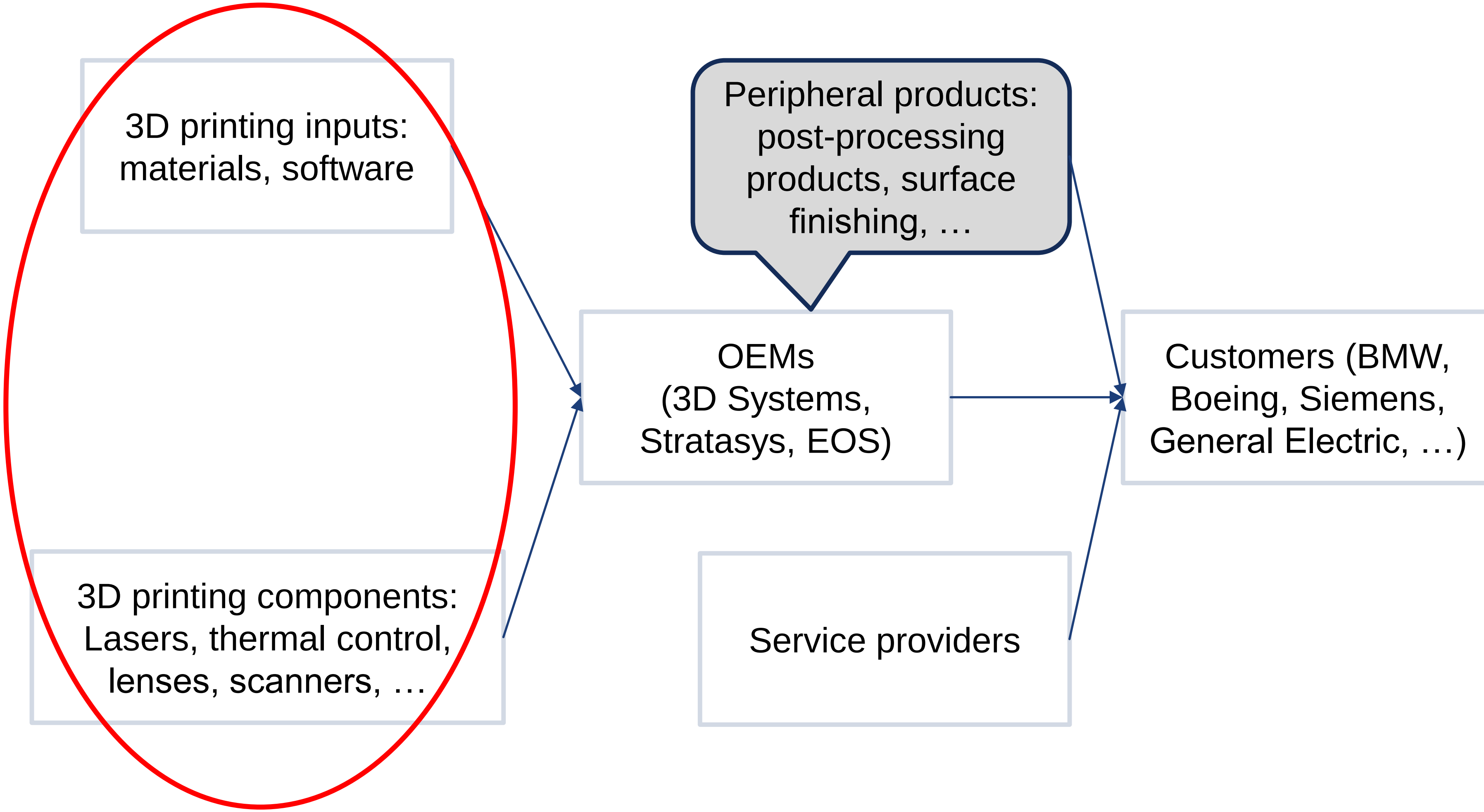
3D printing ecosystem structure: 2005



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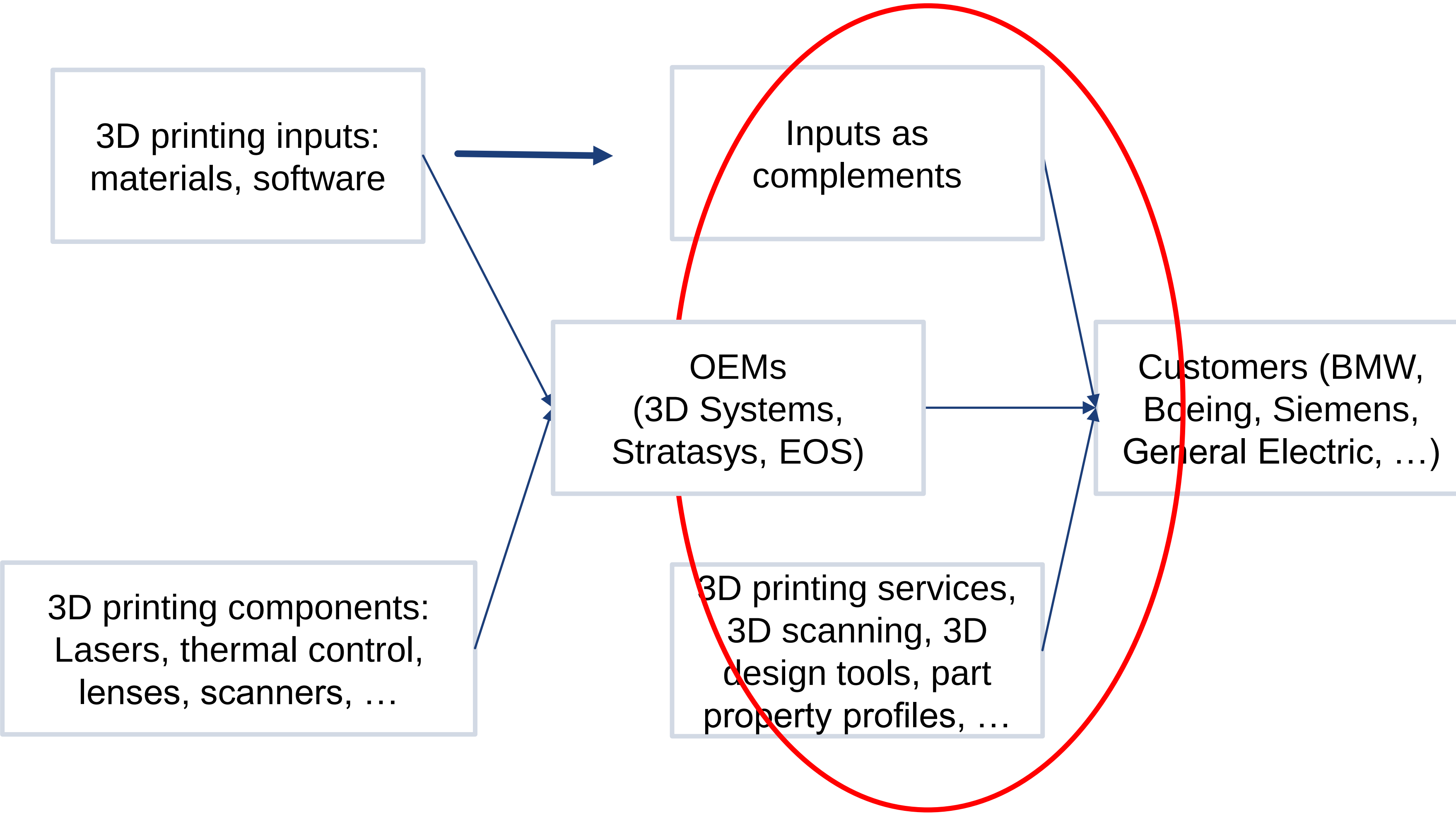
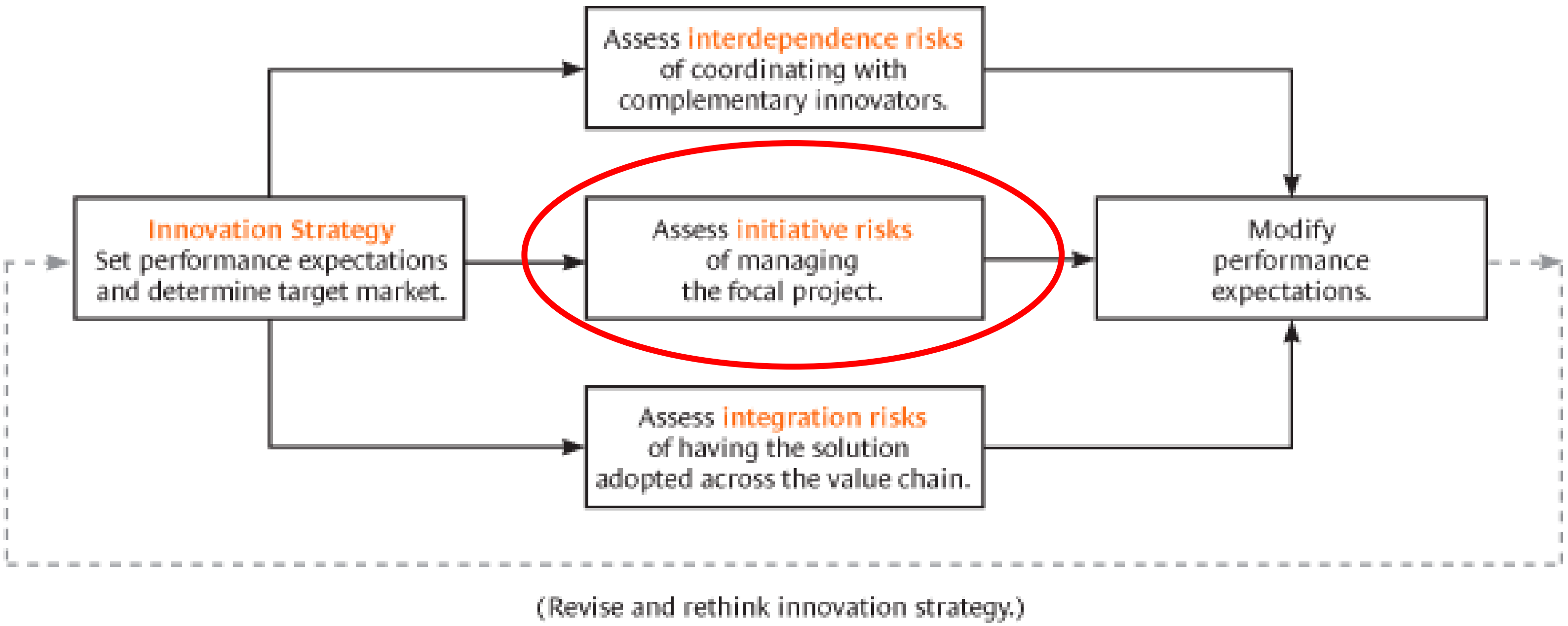


Source: Master thesis (Zeijen, 2015)

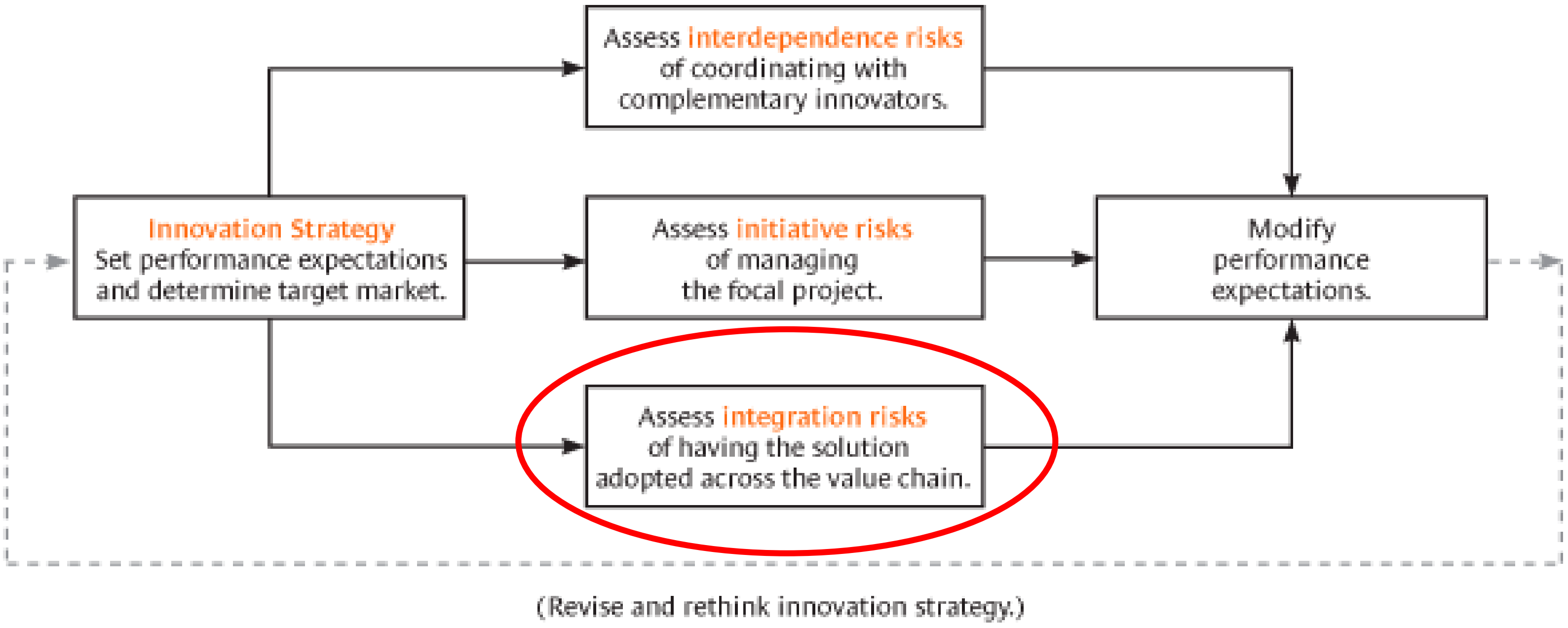
3D printing ecosystem risk: 1995

- Functionality and reliability of focal product is main issue
- Firms optimize internal tradeoffs, try out different configurations



3D printing ecosystem risk: 2005

- Need to increase performance through innovation in components
- Making 3D printing usable and attractive in the production process
- Risk mitigation through changing relationships with suppliers



3D printing ecosystem risk: 2015

- Value created by *additive product development*, 3D printing as tool
- Problem of aligning ecosystem elements to support 3D printing
- Mitigated through forward integration

Source: Adner (2006)

What is happening now?

GE Seeks to Drive 3D Printing Future With $1.4 Billion in Deals

By **Rick Clough**, **Niclas Rolander**, and **Andrea Rothman**
6 september 2016 09:02 CEST *Updated on* 6 september 2016 17:28 CEST

Incumbent OEMs are threatened from all sides:

- **Diversifying**: HP (printing), Trumpf (machine tools)

  “We have most of the capabilities anyway, why not jump into 3D?”
- **New entrants**: Additive Industries with radically open systems

  “The bottleneck is not the machine, but getting the business model right”
- **Complementors**: Autodesk (AutoCAD) (but gave up)
- **Customers**: GE acquires two OEMs for USD 1.4Bn

  “We tried to work with them, but the OEMs don’t understand what we need to use 3D printers. So we just take control”

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