Technological core competencies: reality or myth?

Felicia Fai
University of Bath, UK
Background

• What are core competencies?
• Why should we be interested in them?
• Core competence idea, hot managerial topic in 1990’s (Prahalad & Hamel, 1990)
• 1980’s period of corporate de-layering, flattening. Trying to establish more coherent, efficient corporations.
• Get rid of slack/ ‘stick to the knitting’ - get out of those operations not within the corporations key business areas.
• However, product lifecycles are short. Firms focusing efforts on key businesses threatened.
• Focussing on core competences better. Use of competence in 1 area, does not reduce that available to other areas. Sustainable resource.
• It enables a firm to be inventive, flexible, responsive to changing environmental conditions.
• Shift in emphasis from products to competences.
Prahalad & Hamel define core competences as:

- “…the collective learning in the organization, especially how to coordinate diverse production skills and integrate multiple streams of technologies...it is also about the organization of work and the delivery of value” p.82
Core competencies: the roots of competitiveness

1. Business 1
2. Business 2
3. Business 3
4. Business 4
5. Core Product 1
6. Core Product 2
7. Competence 1
8. Competence 2
9. Competence 3
10. Competence 4
Characteristics of core competencies

- Provides potential access to wide variety of markets (i.e. end products)
- Makes a significant contribution to the perceived customer benefits of the end product
- Is difficult for others to imitate

- World-leading companies will generally possess no more than 5-6 core competences.
Examples: 3M

- Core competences: substrates, coatings, adhesives
- Markets: post-it notes, magnetic tape, photographic film, pressure sensitive tapes, coated abrasives
Example: Chrysler vs Honda

- Honda invests in engine-related technologies. Motorcycle engines → automotives engines. Has ability to develop more fuel efficient, cleaner engines.
- Chrysler outsources engines and power trains to other firms (Mitsubishi, Hyundai). (Brusoni Lecture, Sanchez paper)
- Limited ability to diversify products.
- Constrained in ability to pursue ‘greener’ car designs of current market trend.
Technological competence

• Prahalad & Hamel’s discussion of core competence, wider than technology alone but its characteristics apply to technology well:
  – Enables firms to enter wide variety of markets
  – Has significant contribution to perceived customer benefits (better functionality/features/design, price)
  – Is difficult to imitate – incremental, path-dependent, cumulative → firm specificity.
Definition of technological competence

- **Technological** competence: ability to create and use a particular field of technology effectively, which is gained through extensive experimentation and learning in its research, development and employment in production (Fai & von Tunzelmann, 2001).
Tushman & Anderson (1986)

• Technological changes can alter industrial composition & intra-industry structure. How, depends on nature of technological change.

• Technology: “tools, devices and knowledge that mediate between inputs and outputs (process technology) and/or create new products or services (product technology). (Rosenberg, 1972)” p. 440
Technological progress generally evolutionary & incremental. Enhance and extend existing technology. Reinforces status quo.

However, it is occasionally punctuated by more radical breakthroughs → period of discontinuous change, establish new product class or substitutes for a pre-existing one.
US firms

Identify 3 product classes cement, minicomputers and domestic passenger airline transport.

Despite differences in product classes (low/hi tech, manufacturing services, relative age etc.) strong consistency in findings (although small numbers of cases in sample precludes conclusiveness of results).
Competence **destroying** discontinuities

- Mastery of new technology fundamentally alters set of relevant competences in a product *class*.
- *Product* discontinuity – new product *class* or substitute for existing one: steam engines to diesel
- *Process* discontinuity – entirely new way of making *established* product: float glass
- Requires different skills & knowledge.
- Changes distribution of power and control among firms and industries.
• Undermine existing industrial structures
• Establish new industry, with new firms
• Industrial ‘ferment’
• Shake-out (Tell’s earlier lectures on Klepper)
• Remaining firms centre around established dominant design
• Begin more incremental innovation and technological progress
• Are rare – 8 instances in 190 years (total of years observed in all 3 industries)
Competence enhancing discontinuities

- Order of magnitude improvement in price/performance built on existing knowledge in a product class.
- Substitute for older technologies but NOT the associated underlying skills.
- Products e.g. jets $\rightarrow$ fan jets
- Process e.g. Computer-assisted design for architecture
• New possibilities opened to established firms Extends their realm of possibilities (Leiponen’s lectures on breadth)
• Re-enforces the position of incumbents (Marengo’s Lectures on persistent innovation)
• Difficult for new firms to enter market
Problem:

- (P&H) tells us that it is in firm’s interests to focus on core technological competences.
- (T&A): environment is changeable, ex-ante a firm never knows if a technological breakthrough is:
  - incremental/ radical.
  - A competence-enhancing discontinuity.
  - competence-destroying discontinuity).
  - =>To focus on a small number of core technological competences (P&H) can be high-risk.
What does empirical evidence tell us?

• A number of firms date back to 19\textsuperscript{th} century.

• Witnesses to several “discontinuities”, some of which are more ‘radical’ / disruptive yet they survive. Why?

• What’s going on in these firms?
Cantwell & Fai, 1999

• There is strong **persistence** in corporate technological profiles (often at least 60 years) across range of industrial sectors (Chemicals, Electrical/Electronics, Mechanical, Transport).

• Exceptionally, mergers, acquisition divestments etc act to fundamentally shift the firm across industrial boundaries and persistence erodes.
• persistence in corporate portfolios is strong, but evolving towards broader diversification – i.e. more technological areas.

• not a recent ‘fashion’ (happened in 1930-60’s)
• Questions this empirical evidence leads to...

• Does notion of ‘core technological competence’ (as per P&H, 1990) exist? i.e. appears corporates hold more just 5/6 key technologies.

• Technological persistence of corporate activity for 60 years+ questions the notion of competence-destroying discontinuities (T&A, 1986)
• In Tushman & Anderson, put technological evolution down to exogenous activity a “response to the interplay of history, individuals and market demand.” p.440.

• They acknowledge
  – Chance events driven by technological genius (accidents on inventors or scientists) exogenous shocks
  – Historical necessity
  – A result of economic demand (Schmookler’s demand-pull)

• C&F believe, THE FIRM is the principle source of innovation and growth. Adopt a competence-based perspective.
Demand side (market pull):

• Classical approach:
  • new markets → firm growth → capital accumulation, which via division of labour → specialisation → learning → better skills → inventiveness

CAPITAL ACCUMULATION → TECHNOLOGICAL ACCUMULATION

Fai DIMETIC April 2011
Supply side (science/technology push)

- In 19th century
- science → mechanisation → innovation → improved productivity in established products
Put emphasis on the firm

- In 19th century, organisational routines & team learning → Collective build up of tacit capability → better skilled workers → new capital revenues, rising wages & incomes

TECHNOLOGICAL ACCUMULATION → CAPITAL ACCUMULATION

- Modern scientific advance requires transformation in production systems to have an impact. This requires locally-specific knowledge e.g. as embedded in corporate capabilities of large companies which in turn, are largely nation-specific
- Production systems based on national- & firm-specific competences
Combining perspectives & shifting emphasis on the sources of innovation

- Science Base
- Corporate R&D
- Complementary assets/distribution networks
- Learning in production
- Markets

Fai DIMETIC April 2011
Firms as the source of innovation & growth

• Production is not just technology-dependent, but is also technology-producing.
• Need specialised technological competence to produce goods & services, but by learning in production, they generate FIRM-SPECIFIC competences.
• Firm-specific learning in production via cumulative and incremental problem-solving can → Technological innovation.
• This may be within the firm but also takes place on organisational boundaries i.e. between firms (competition and cooperation), institutions, universities etc. Upstream & Downstream entities.
• → distinct corporate technological specialisation patterns over time.
• Leads to increases in productivity, firm & economic growth.
• Competence has the potential to generate longevity of the firm unlike products/processes (agree with P&H, 1990).
Corporate learning is incremental, path dependent; provide basis for institutional stability & continuity in evolution even when markets & products change.

The corporation becomes a repository of competence and a device for learning and accumulating further competences.

They are able to synthesise new emergent fields with their established technologies.

Firms have to consider their current competences, the fields in which they are learning and how this interaction → new or improved competences
• Firms have to **organise** the learning process that leads to innovation.
• They must coordinate the dual stimuli of science-push and demand-pull factors, but do so conscious of what the firm itself already knows.
• Innovative learning, at the firm level, gathers a cumulative and incremental logic of its own.
• Firm **interacts** with its environment, it is **not** driven by it.
• Technological change may disrupt the external spheres dramatically – new scientific areas, potential new product classes and markets, but beneath this, lies the steadier learning process of firms.

• Does not mean competence in firms does not evolve, it can and does, firms will diversify their technological activities, generate new competences but its technological origins will remain obvious for a long time in subsequent trajectories (with institutional continuity).
• So firms have a wider set of technological competences than P&H suggest,
• But these competences do enable firms to be flexible and ride-out the more destructive changes in products and markets
• By managing **broad** portfolios of technological competences, they can mitigate the threat of competence-destroying discontinuities which would be disastrous if firms only focussed on 5/6 “core” technological competences.