Patents and Innovation for Growth in a Converging World Economy

Intellectual Property Strategy and Technology Commercialization

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Outline

- Patents and Innovations for Growth - Macro Level Background
- Patents and Innovations for Growth - Micro Level
- Strategy ladder
- Do patents help commercialization?
- Do patents hinder commercialization?
- Do IPR impede the market for corporate control?
- Do patents impede standard setting?

Patents and Innovations for Growth
Macro Level Background

Technological/R&D changes

1. Emergence of new technological systems (families of interrelated technologies), in particular ICTs, biohealth technologies (BHTs) and material and energy technologies.
2. Continued build-up of in-house R&D and various forms of corporate innovation systems in industry, now controlling most of worldwide technology and an increasing share of worldwide science.
3. Increasing specialization and division of R&D labour, use of technology markets and external technology acquisition.
4. Increasing technology diversification of products and processes, leading to increasing interdependencies among technologies, companies, products and processes.
5. A continued transition from individually based research and invention (for which IPR laws originally and still cater) to intra-company team-based and further to inter-company team-based, i.e. to inter-organisational R&D collaboration. Scale, critical mass, scope, interdisciplinarity, and speed to market will make collaborations and networking an increasingly appealing governance mode over purely market-mediated coordination.
6. Internationalisation, globalisation and “glocalisation” of R&D and technology acquisition (i.e. global coordination of firm R&D with increasing concentration in certain technology-intensive regions around the world).
7. Technological changes in the production and distribution of new technologies. Emergence of what can be called “e-Research” in intra- and inter-firm R&D through use of various infocom technologies as research tools (Internet, multimedia conferencing, networked databases, artificial intelligence tools, distributed computing, data grids, large-scale simulations etc.).

Economic changes

1. Economic rise of Japan and Asian NICs in the 1980s and disintegration of the Soviet Union political empire and economic system in the 1990s, changes which in large part were innovation- and technology-related.
2. Gradual emergence of a new type of economy (more knowledge- and innovation-based, ICT-driven, IP-oriented, etc.) with more use of technology and information markets, firms and products.
3. Military R&D, still amounting to roughly half of the world's R&D, is shifting in character, including increase of IP relevance.
4. Increasing importance of dynamic innovation-based competition across nations, sectors, companies and markets (including markets for labour, knowledge/ideas and financial services).
5. Increasing gaps of technology and competitiveness between the USA and Europe, including the defence sector.
6. Perceived underinvestment in R&D in Europe has prompted the European Commission to adopt the goal that overall spending on R&D and innovation in the EU should be increased with the aim of approaching 3% of GDP by 2010.
7. Universities and public research organisations are becoming more economically focused, i.e. becoming more industrialised, commercial, competitive, international, alliance-prone, strategic, and IP-conscious.

IP legal changes

1. Increasing strengthening, widening, awareness, use and enforcement of the various IP systems around the world, with growth on average of patents, patent portfolios, IP values, IP disputes, damages etc.

2. Increasing interaction between IP policies and other economic policies, especially trade policies through TRIPs and the WTO.

3. Extension of patentable and IP-protectable subject matter and IPR types (e.g. database rights).

4. Increasing international harmonisation of IP laws and practices.

5. Increasing strategic role and use of IPRs in various industries.

6. Increasing protests against the IP system and disputes within the IP system, with increasing litigation costs.

7. Increasing interaction between various IPR types and between IP laws and other areas of law, especially contract law, trade law and competition law.

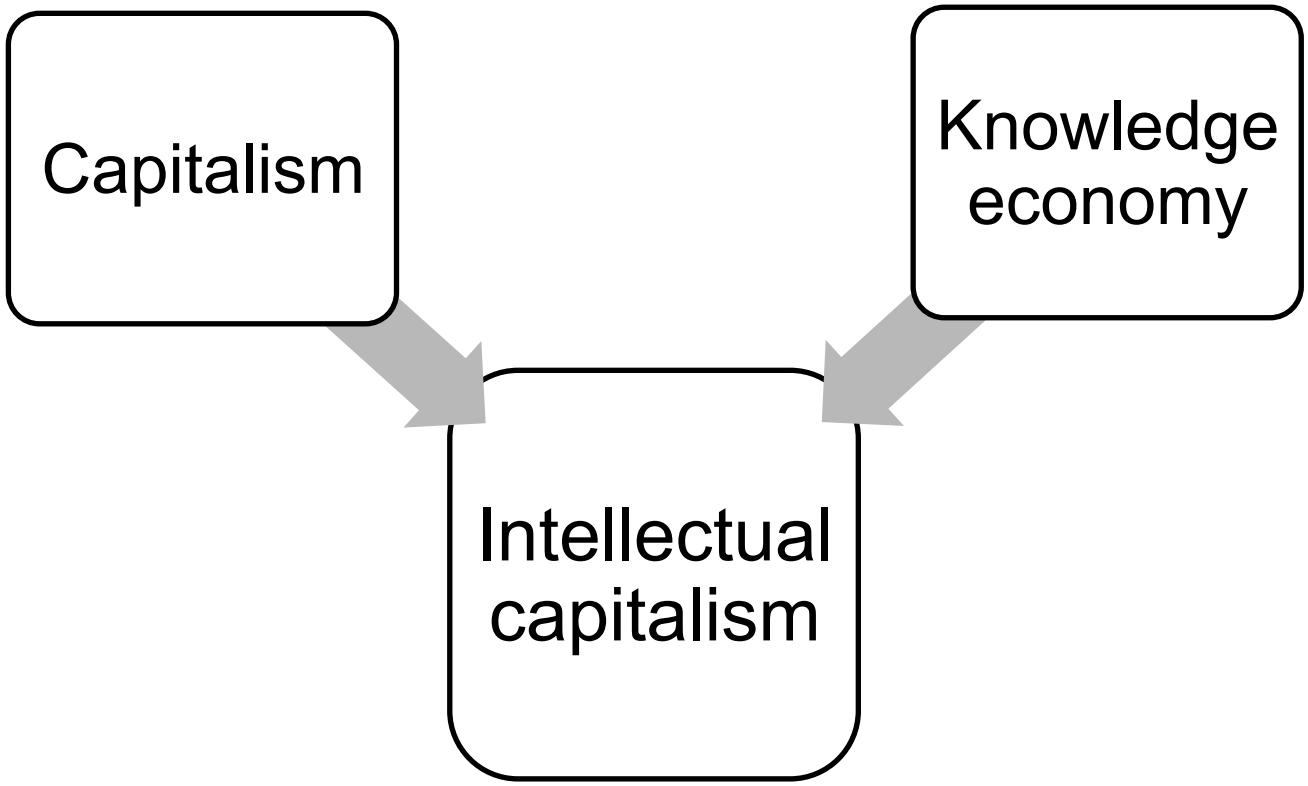
Some Convergence Trends in a Converging World Economy

M Managerial

E Economical

L Legal

T Technological


Capitalism
Knowledge economy
Intellectual capitalism

Som Challenges in a Converging World Economy

- Volatility ↑
- Diversity ↓
- Risks↑
- Financial crises ↑

How to organize the world's growing IP?

Intellectual Capitalism requires a.o.

1. Well defined property rights
   - Physical (PPRs)
   - Intellectual (IPRs)

2. Well functioning markets for
   - products/services
   - technologies
   - shares in companies/ventures

NB: No property rights – No trade

Economic Theories of the Patent System

Received economic theories	Newer economic perspectives on patents
Incentive-to-Invent theory Focus: Impact on invention and R&D Concerns: • Distortion of R&D (e.g. too much substitutes/too little complements, too little basic/too much applied, too much patentable/too little unpatentable) • Barriers to competition • Heterogeneity of industries/firms/inventors	**Patents as a joint incentive to innovate and diffuse** Focus: Impact on dynamic competition through ”continuous” and entangled (interdependent) innovation and diffusion processes Concerns: • As for incentive-to-innovate • Efficiency/distortion of diffusion • Interdependence of inventions and innovations over time (e.g. in sequential innovation) • Dynamic interaction between innovation and diffusion processes
Incentive-to-Disclose theory Focus: Impact on secrecy Concerns: • Quality/quantity of disclosure • Impact on R&D (e.g. stimulation, coordination) • Impact on diffusion (e.g. on technology markets)	**Patent rights and patent information as a governance mechanism** Focus: Property rights allocation and disclosure as a mode of incentivizing and organizing for decentralized governance through management hierarchies and markets and hybrids of these two governance modes. Concerns: • Allocation and transfer of rights • Cumulation and dispersion of rights • Interdependence of rights • Scope and duration of rights • Enforcement of rights • Governance efficiencies, e.g. in terms of coordination and communication costs, e.g. market efficiencies, e.g. in terms of transaction costs • Optimal decentralized “tariffs” or ”taxation” (through prices or damages) • Role of governance bodies and institutions (legislators, courts, patent offices, patent management, patent pools, clearing houses, anti-trust authorities etc.) • Alternative governance mechanisms
Incentive-to-Innovate theory Focus: Impact on innovation and competition Concerns: • Incentives ex ante and ex post invention • Impact on complementary investments • Transaction costs • Invention/innovation distinction • Patent scope and duration	
Prospect theory Focus: Resource exploitation efficiency Concerns: • Coordination and duplication of R&D • Exploration • Improvement • Firm strategies	

Thus: **A Pro-IP era**

must be accompanied by

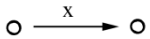
A Pro-licensing era

License types:

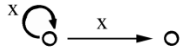
Seller *Buyer*

Rights of x kept ("Self-license")

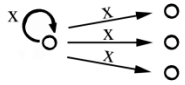
Exclusive (only buyer gets right)



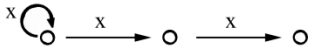
Sole (seller keeps right as well)



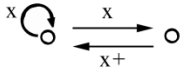
Simple (non-exclusive)



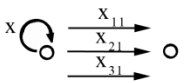
Sub-license (exclusive)



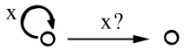
Grant-back license



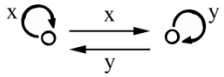
Block/packet license



Blanket license

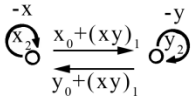


Cross-license

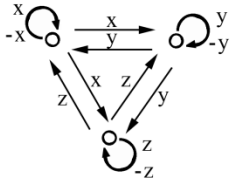


Collaboration types (illustrative):

Bilateral cross-licensing of background knowledge and co-owned foreground knowledge



Multilateral patent pool (3 party) (everyone shares knowledge except their sideground knowledge)



Legend:

x, y, z	agent x, y, z possessed technologies (technology pieces)
x_t, t=0,1,2	back-, fore-, postground knowledge/technology
x+	improvement of x
-x	sideground knowledge (agents' knowledge apart from x)
x_{it}	different sub-technology (pieces) i of agent x at time t
x?	yet unknown technology (developed in future)
xy	jointly developed and co-owned

Patents and Innovations for Growth
Micro Level

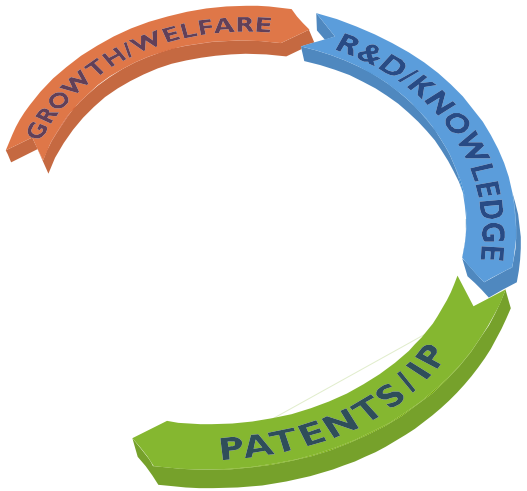
Fundamental relations between patenting and economic growth

The IP-Growth Spiral –

– Start-up knowledge…

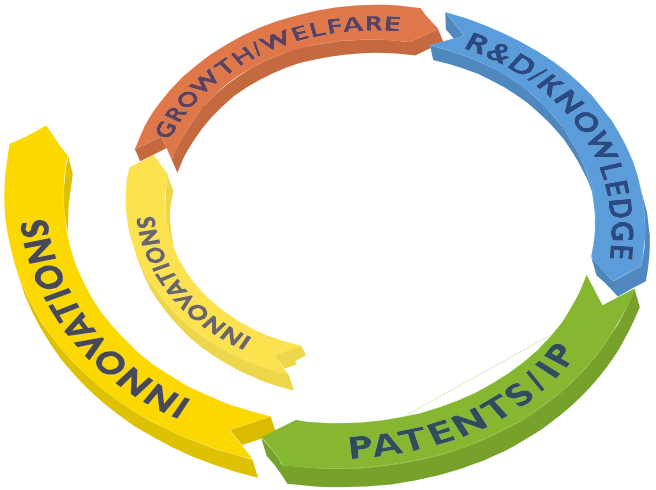
The IP-Growth Spiral

…creates IP and is fed by resources…



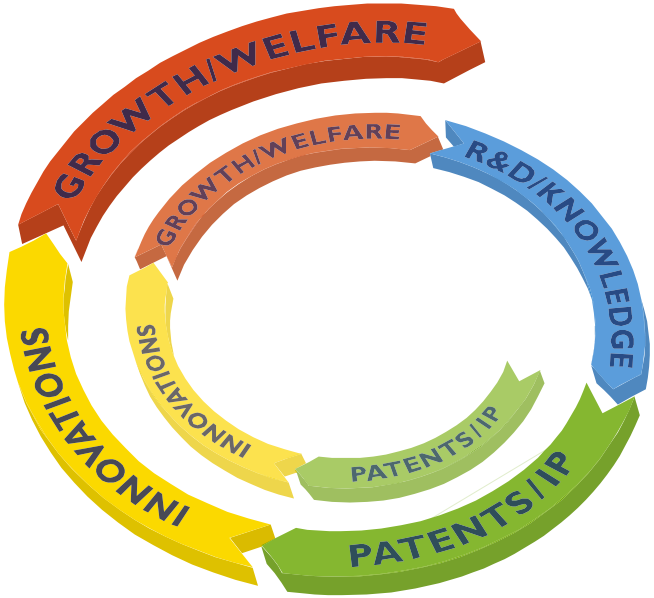
The IP-Growth Spiral

…fostering and fostered by innovations…



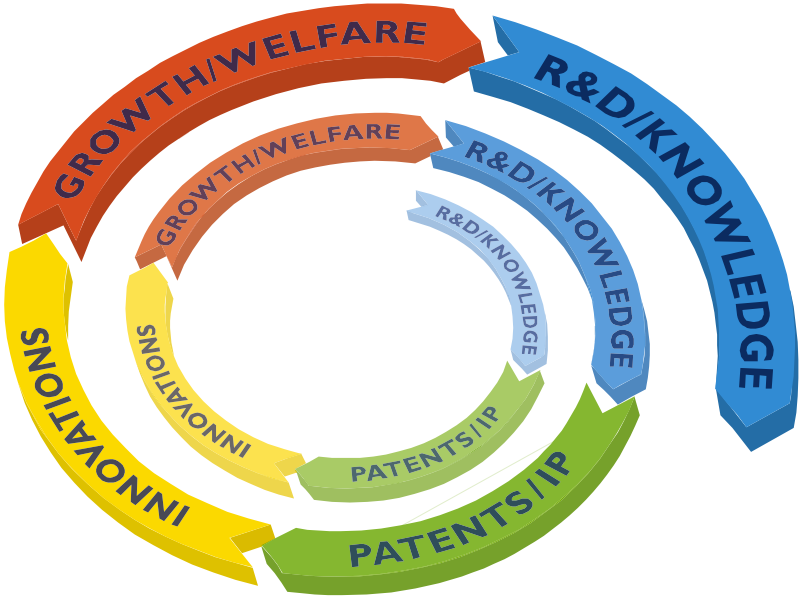
The IP-Growth Spiral

…fostering economic growth and welfare and fostered by patents and IP…



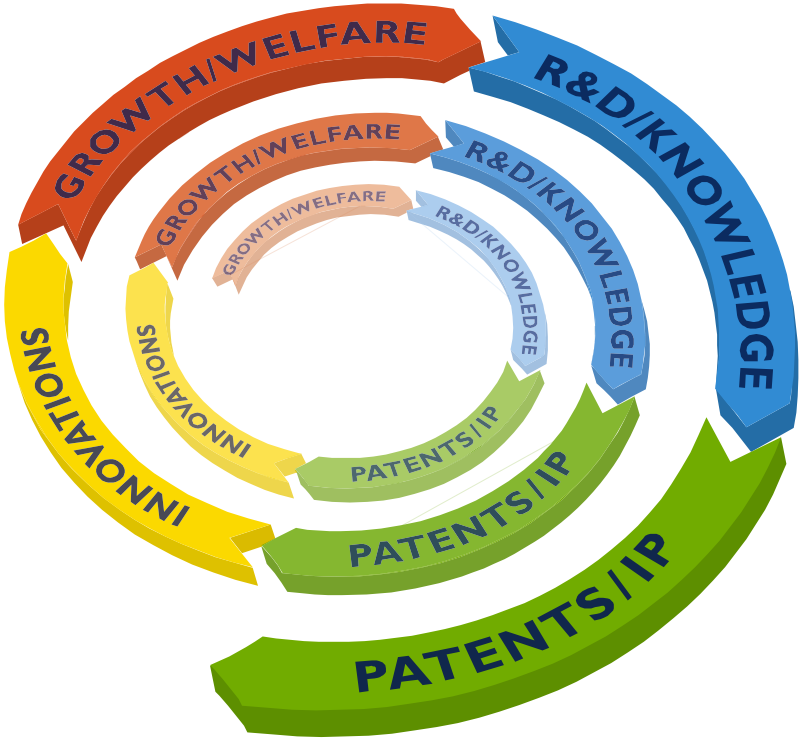
The IP-Growth Spiral

…feeding into more R&D and knowledge…



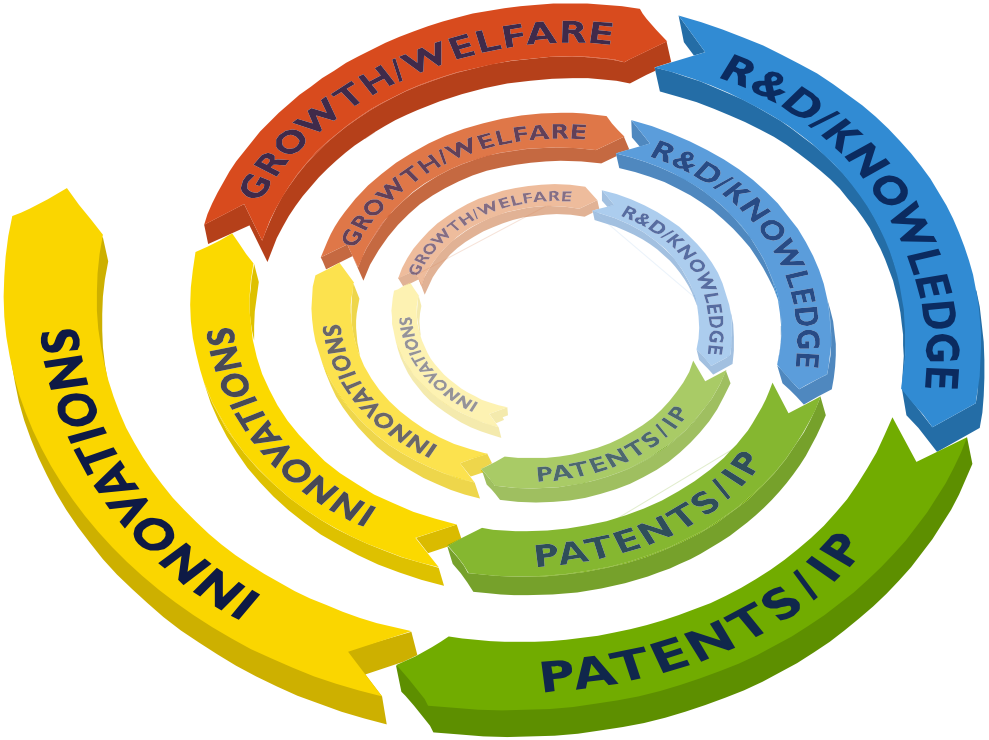
The IP-Growth Spiral

…etc., leading to…



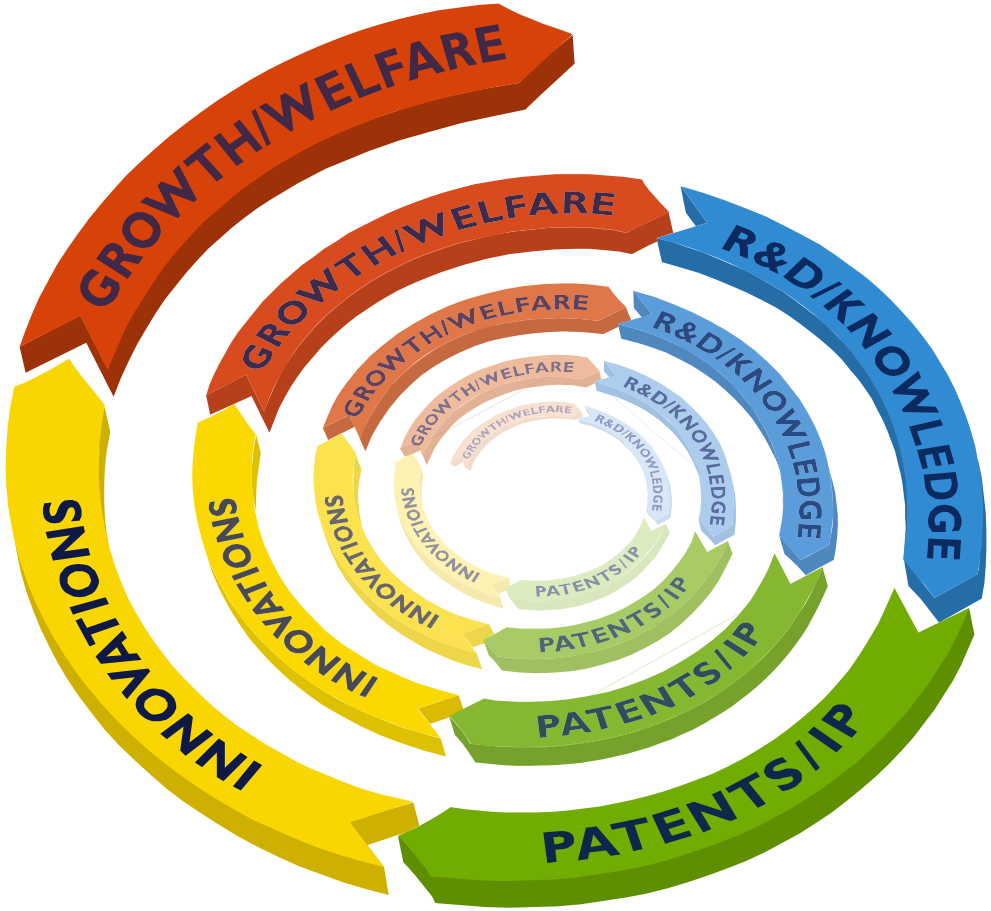
The IP-Growth Spiral

…a case of positive feedback



In other words

Patents and Innovations for Growth and Welfare



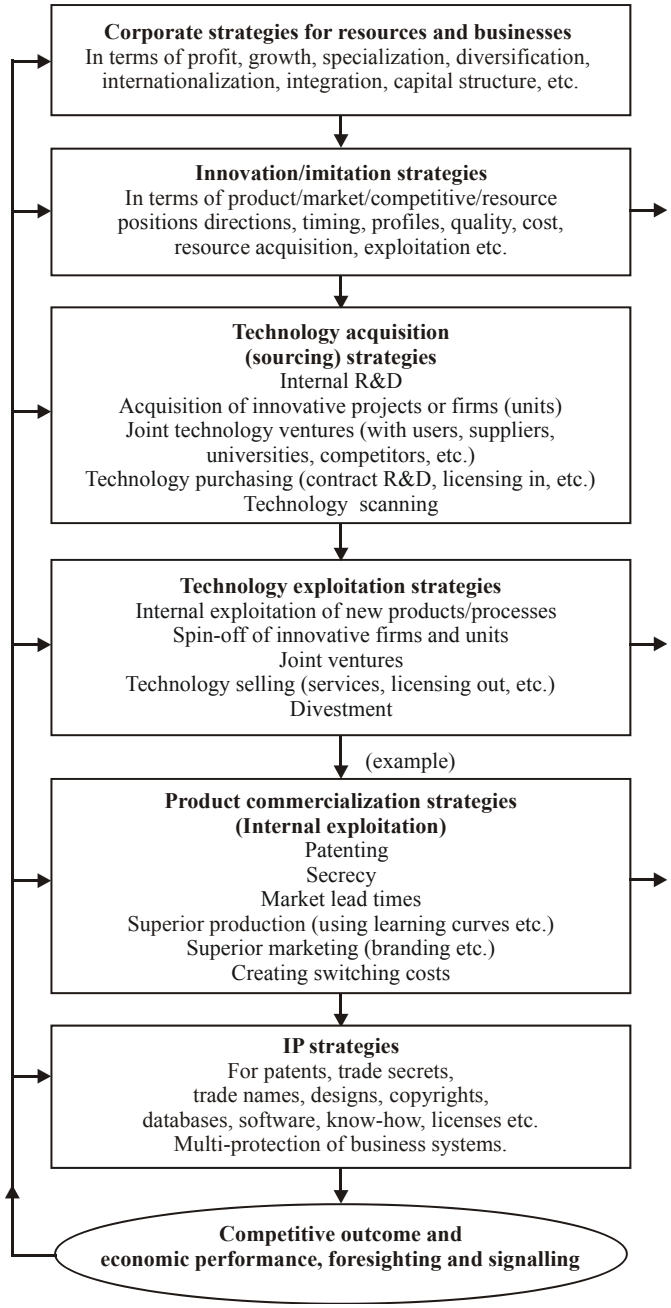
Assessments of the elasticities of different variable connections in the patent/growth spiral

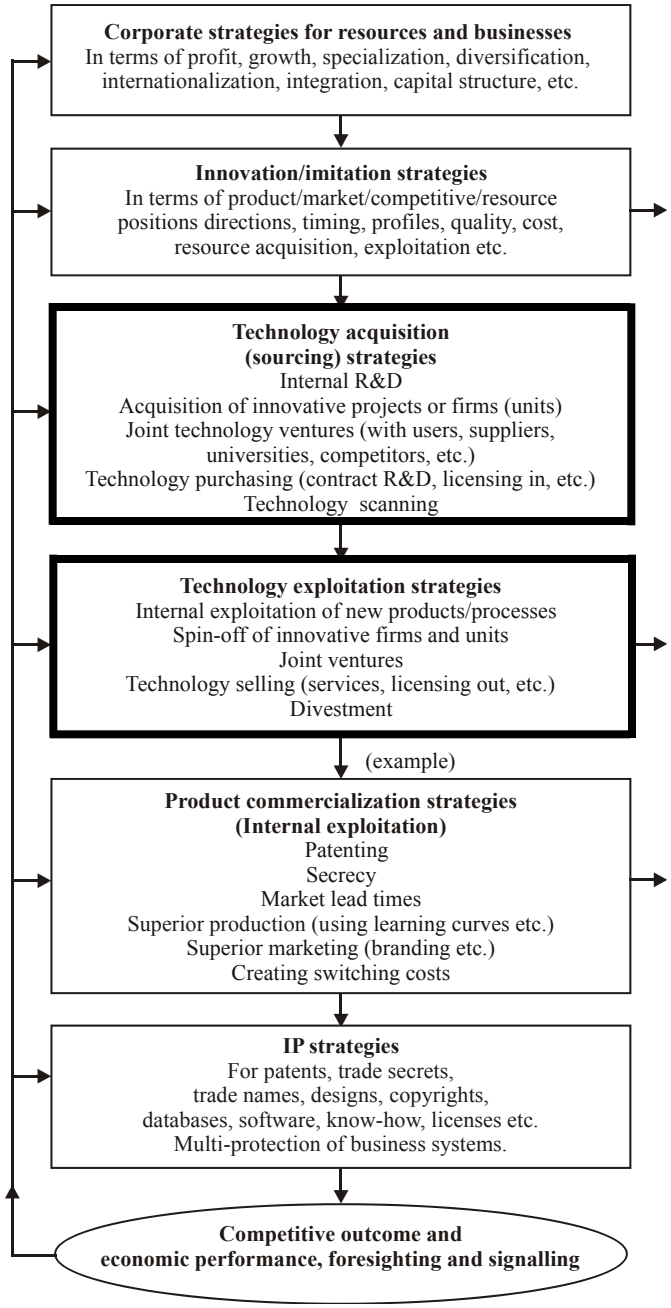
Question	Average
Q5.1.1a Assume that your company or group of companies increases its R&D investments by 10 %.	
1. Approximately how much, if at all, would then the number of patented inventions increase?	7.6 %
2. Approximately how much, if at all, would then the sales increase?	5.5 %
Q5.1.1b Assume that your company's or company group's sales were to increase by 10 %. Approximately how much would then the R&D investments increase?	8.3 %
Q5.1.1c Assume that your company or group of companies increases its total patent resources by 10 %.	
1. Approximately how much, if at all, would then the number of patented inventions increase?	5.4 %
2. Approximately how much, if at all, would then the sales increase?	2.6 %
3. Approximately how much, if at all, would then the R&D investments increase?	2.5 %

The influence of the patent system on company R&D, new products, and growth

Question	Average
Q3.3.4a Estimate how large a proportion of the new products introduced during the last five years (2000–2004) would not have been developed and introduced on the market if it had been foreseen that for them patents could not be granted:	31.5 %
Q3.3.4b Give the proportion (in percent) of inventions developed during the last five years which would not have been developed if they could not be protected by patents:	30.3 %
Q5.1.6 If your company's patent protection for a typical new product on the market were to cease for some reason, how much would this:	
a) reduce the product's sales, in approximate %?	25.1 %
b) reduce the product's sales margin (profitability margin before write-offs), in approximate % (of the percentage sales margin)?	24.2 %
c) reduce the product's market lifetime, in approximate %?	25.0 %
Q5.4.1 Assume that the maximum patent protection time is changed in all of the important markets where your company or group of companies operates. What would be the effect on your company's or company group's total R&D budget if the maximum patent protection time were changed as suggested below? (Try to make a rough estimate.)	
a) increased by 3 years	2.0 %
b) reduced to 10 years	-16.3 %
c) reduced to 0 years (i.e. the patent protection ceases entirely)	-37.2 %

Strategy ladder


Corporate strategies for resources and businesses
In terms of profit, growth, specialization, diversification, internationalization, integration, capital structure, etc.
Innovation/imitation strategies
In terms of product/market/competitive/resource positions directions, timing, profiles, quality, cost, resource acquisition, exploitation etc.
Technology acquisition (sourcing) strategies
Internal R&D
Acquisition of innovative projects or firms (units)
Joint technology ventures (with users, suppliers, universities, competitors, etc.)
Technology purchasing (contract R&D, licensing in, etc.)
Technology scanning
Technology exploitation strategies
Internal exploitation of new products/processes
Spin-off of innovative firms and units
Joint ventures
Technology selling (services, licensing out, etc.)
Divestment
(example)
Product commercialization strategies (Internal exploitation)
Patenting
Secrecy
Market lead times
Superior production (using learning curves etc.)
Superior marketing (branding etc.)
Creating switching costs
IP strategies
For patents, trade secrets, trade names, designs, copyrights, databases, software, know-how, licenses etc.
Multi-protection of business systems.
Competitive outcome and economic performance, foresighting and signalling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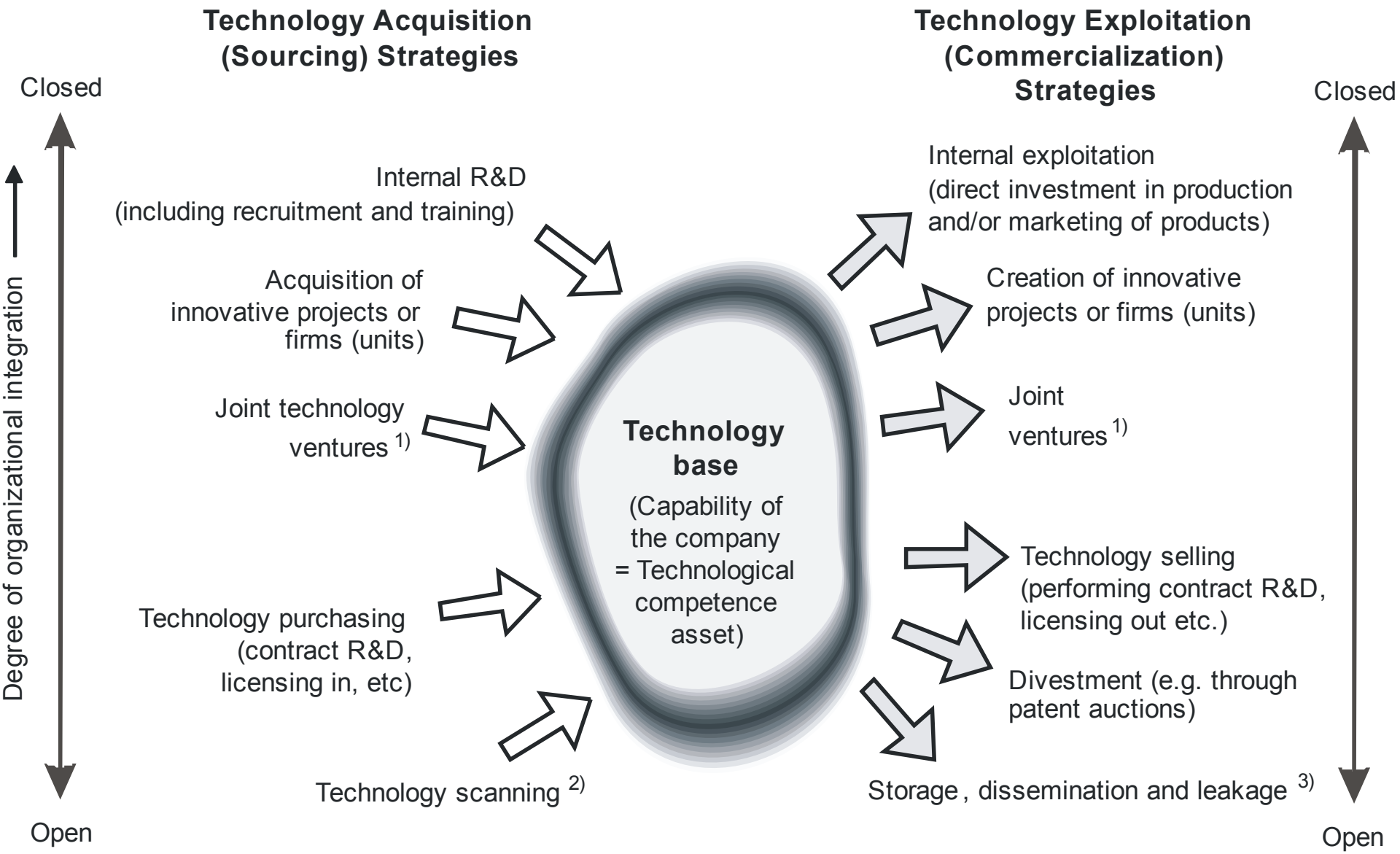

Technology Acquisition (Sourcing) Strategies
Technology Exploitation (Commercialization) Strategies
Closed
Open
Degree of organizational integration
Internal R&D (including recruitment and training)
Acquisition of innovative projects or firms (units)
Joint technology ventures 1)
Technology purchasing (contract R&D, licensing in, etc)
Technology scanning 2)
Technology base
(Capability of the company = Technological competence asset)
Internal exploitation (direct investment in production and/or marketing of products)
Creation of innovative projects or firms (units)
Joint ventures 1)
Technology selling (performing contract R&D, licensing out etc.)
Divestment (e.g. through patent auctions)
Storage, dissemination and leakage 3)
Closed
Open

Perceived importance of technology acquisition strategies 1982, 1987 and 1992

Strategy	*Total*		*Japan*			*USA*		*Sweden*		
	1982	*1987*	*1982*	*1987*	*1992*	*1982*	*1987*	*1982*	*1987*	*1992*
Internal R&D	3,70	3,60	3,80	3,60	3,79	3,80	3,80	3,40	3,00	3,65
Acquisition of innovative firms (or business units)	1,70	2,30	1,20	2,00	1,78	2,10	2,40	1,70	2,30	1,04
Joint venture and other forms of cooperative R&D	1,90	2,70	2,10	2,90	2,67	1,80	2,80	1,70	2,10	2,09
Contract R&D	1,70	2,30	2,20	2,60	2,00	1,40	2,00	1,70	2,40	2,00
Licensing in	1,90	2,10	2,30	2,30	2,30	1,60	2,10	1,90	2,00	1,14
Technology scanning	2,70	3,20	2,90	3,30	2,83	2,80	3,20	2,10	2,70	2,30
$TEXT^A$	6,34	7,80	7,14	8,26	7,29	6,06	7,68	5,66	7,04	5,46
$Openness^A$	0,47	0,48	0,49	0,49	0,47	0,45	0,47	0,45	0,49	0,45

Note:

$TEXT^A$ = (1 * Technology scanning) + (0,8 * Licensing in) + (0,6 * Contract R&D) + (0,4 * Joint venture and other forms of cooperative R&D) + (0,2 * Acquisition of innovative firms) + (0 * Internal R&D)

$Openness^A = TEXT^A / \sum PI$

(Scale: No importance = 0, 1, 2, 3, 4 = Of major importance)

Perceived importance of technology acquisition strategies in Japanese large corporations 1992

Strategy	*Chemical (n=4)*	*Electrical (n=10)*	*Mechanical (n=5)*	*Total (n=24)*
Internal R&D	3,89	3,70	3,80	3,79
Acquisition of innovative firms (or business units)	1,88	1,40	2,40	1,78
Joint venture and other forms of cooperative R&D	2,89	2,40	2,80	2,67
Contract R&D	2,25	1,70	2,20	2,00
Licensing in	2,75	1,90	2,40	2,30
Technology scanning	2,88	2,70	3,00	2,83
$TEXT^A$	7,96	6,48	7,84	7,29
$Openness^A$	0,48	0,47	0,47	0,47

Note:

$TEXT^A$ = (1 * Technology scanning) + (0,8 * Licensing in) + (0,6 * Contract R&D) + (0,4 * Joint venture and other forms of cooperative R&D) + (0,2 * Acquisition of innovative firms) + (0 * Internal R&D)

$Openness^A = TEXT^A / \sum PI$

(Scale: No importance = 0, 1, 2, 3, 4 = Of major importance)

Perceived importance of technology acquisition strategies in Swedish large corporations 1992

Strategy	*Chemical (n=8)*	*Electrical (n=3)*	*Mechanical (n=12)*	*Total (n=23)*
Internal R&D	3,63	4,00	3,58	3,65
Acquisition of innovative firms (or business units)	1,13	1,33	0,92	1,04
Joint venture and other forms of cooperative R&D	2,38	2,33	1,83	2,09
Contract R&D	1,75	1,67	2,25	2,00
Licensing in	1,14	1,33	1,08	1,14
Technology scanning	2,25	2,00	2,42	2,30
$TEXT^A$	5,39	5,26	5,55	5,46
$Openness^A$	0,44	0,42	0,46	0,45

Note:

$TEXT^A$ = (1 * Technology scanning) + (0,8 * Licensing in) + (0,6 * Contract R&D) + (0,4 * Joint venture and other forms of cooperative R&D) + (0,2 * Acquisition of innovative firms) + (0 * Internal R&D)

$Openness^A = TEXT^A / \sum PI$

(Scale: No importance = 0, 1, 2, 3, 4 = Of major importance)

Perceived importance of technology exploitation strategies in large Japanese corporations 1987 and 1992

Strategy	*Chemical (n=9)*		*Electrical (n=10)*		*Mechanical (n=5)*		*Total (n=24)*	
	1987	*1992*	*1987*	*1992*	*1987*	*1992*	*1987*	*1992*
Internal exploitation	3,89	3,89	3,47	3,50	3,74	4,00	3,68	3,75
Creation of innovative firms	1,60	2,00	1,92	2,00	1,60	2,40	1,76	2,09
Joint ventures	1,74	2,44	1,88	2,50	1,86	2,60	1,82	2,50
Technology selling	1,52	1,89	1,75	2,50	1,26	2,40	1,54	2,25
$TEXT^A$	2,24	2,89	2,54	3,40	2,07	3,44	2,31	3,22
$Openness^A$	0,26	0,28	0,28	0,32	0,25	0,30	0,26	0,30

Note:

$TEXT^A$ = (0,8 * Technology selling) + (0,4 * Joint ventures) + (0,2 * Creation of innovative firms) + (0 * Internal exploitation)

$Openness^A = TEXT^A / \sum PI$

(Scale: No importance = 0, 1, 2, 3, 4 = Of major importance)

Importance of different strategies for exploitation of Sweden's largest innovations in pharmaceuticals and biotechnology during 1980–2005

Strategy	*BIO SSI (n=17)*
Internal exploitation (direct investment in products and/or processes based on the innovation)	3,94
Creation of innovative firms (units, spin-offs)	1,13
Joint collaborations, e.g. joint ventures	0,88
Licensing out	0,56
Technology selling, e.g. contract R&D	0,38
Divestment	0,50
$TEXT^{A}$	1,72
$Openness^{A}$	0,23

Note:

$TEXT^{A}$ = (0,8 * Technology selling) + (0,4 * Joint ventures) + (0,2 * Creation of innovative firms) + (0 * Internal exploitation)

$Openness^{A} = TEXT^{A} / \sum PI$

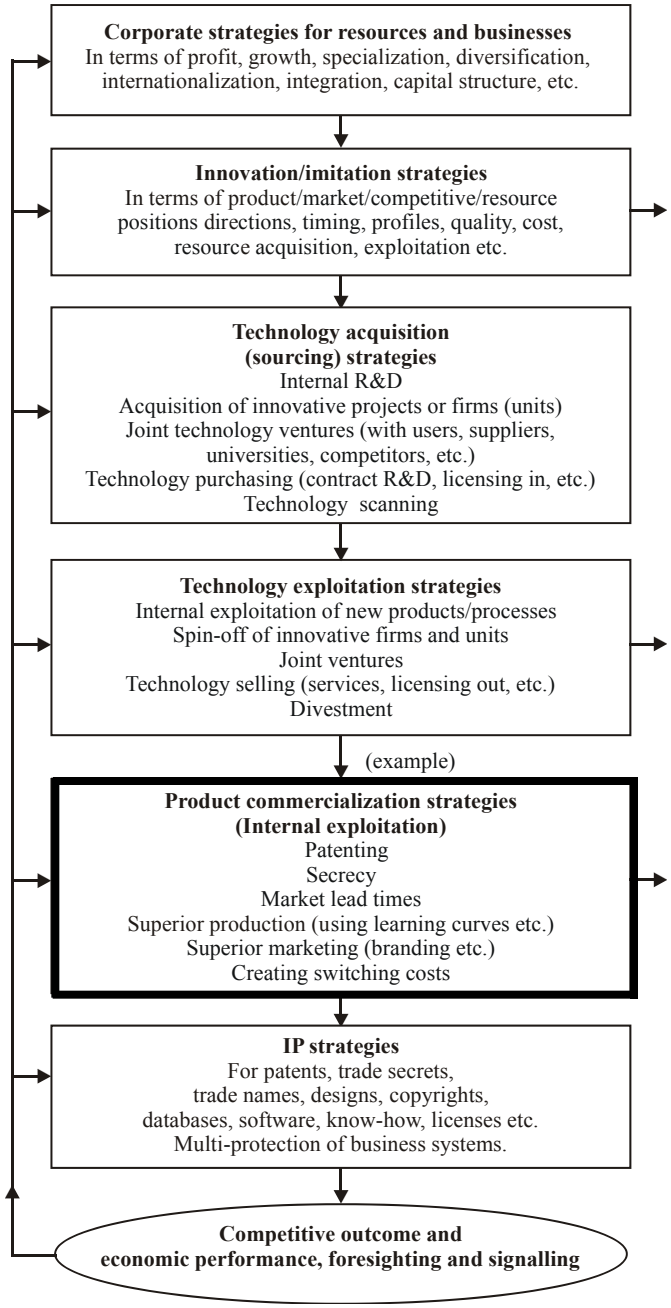
(Scale: Of no importance = 0, 1, 2, 3, 4= of major importance.)

Importance of different strategies for exploitation of Sweden's largest innovations in pharmaceuticals and biotechnology during 1980–2005

Question		Importance (n=17)
What was roughly the relative importance of the following strategies for exploiting the technologies of the innovation?		
a	Internal exploitation (direct investment in products and/or processes based on the innovation)	**3.94**
b	Creation of innovative firms (units, spin-offs)	1.13
c	Joint collaborations, e.g. joint ventures	0.88
d	Licensing out	0.56
e	Technology selling, e.g. contract R&D	0.38
f	Divestment	0.50

(Scale: Of no importance = 0, 1, 2, 3, 4= of major importance.)

Do patents help commercialization?


Corporate strategies for resources and businesses
In terms of profit, growth, specialization, diversification, internationalization, integration, capital structure, etc.
Innovation/imitation strategies
In terms of product/market/competitive/resource positions directions, timing, profiles, quality, cost, resource acquisition, exploitation etc.
Technology acquisition (sourcing) strategies
Internal R&D
Acquisition of innovative projects or firms (units)
Joint technology ventures (with users, suppliers, universities, competitors, etc.)
Technology purchasing (contract R&D, licensing in, etc.)
Technology scanning
Technology exploitation strategies
Internal exploitation of new products/processes
Spin-off of innovative firms and units
Joint ventures
Technology selling (services, licensing out, etc.)
Divestment
(example)
Product commercialization strategies (Internal exploitation)
Patenting
Secrecy
Market lead times
Superior production (using learning curves etc.)
Superior marketing (branding etc.)
Creating switching costs
IP strategies
For patents, trade secrets, trade names, designs, copyrights, databases, software, know-how, licenses etc.
Multi-protection of business systems.
Competitive outcome and economic performance, foresighting and signalling

Study	Dataset	Main measure	Main findings
Levin et al. (1987)	Survey of 650 individuals representing 130 lines of business in the US	Effectiveness of alternative means of protecting competitive advantages of new or improved products and processes	Effectiveness of different means varies over industries Patents are more effective than secrecy for new products, but secrecy is more effective for new processes Sales or service efforts, lead time and learning are most effective Competitors' ability to legally "invent around" patents is the most important limitation to the effectiveness of patents
Harabi (1995)	Survey of 358 individuals representing 127 lines of business in Switzerland	Effectiveness of alternative means of protecting competitive advantages of new or improved products and processes	Patents are the least effective means of appropriation Sales or service efforts, lead time and learning are most effective, followed by secrecy Competitors' ability to legally "invent around" patents and information disclosure are the most important limitations to the effectiveness of patents
Kitching and Blackburn (1998)	Telephone survey of 400 SMEs and subsequent face-to-face interviews with 101 of them	The use of informal and formal means of appropriation	Patents are the least used means of appropriation Costs related to formal means of appropriation is the main reason behind the low use SMEs lack resources for litigation in case of infringement
Brouwer and Kleinknecht (1999)	Survey of 1008 Dutch manufacturing firms	Effectiveness of various mechanisms for protection of innovations against imitators	Time lead on competitors is the most effective mechanisms, followed by keeping qualified people in the firm and secrecy before patents and other formal means Only 25% of the firms rated patents as very important or crucial for protecting products, and 18% for protecting processes
Granstrand (1999)	Survey of 25 Japanese and 20 Swedish firms (covering >50% of Japanese and >80% of Swedish corporate R&D expenditures)	Effectiveness of various means for protecting product technologies against imitation	The different means are rated differently in different countries and industries (in order of effectiveness): Japan: Patents, cost reductions, lead times, marketing, secrecy, switching costs Sweden: Marketing, cost reductions, lead times, secrecy, patents, switching costs
Cohen et al. (2000)	Survey of 1478 US manufacturing firms	Percentage of innovations effectively protected by various appropriation means	Patents are the least effective means of appropriation Secrecy has increased in importance since the study by Levin et al. (1987)
Arundel (2001)	CIS survey of 2849 European R&D-performing manufacturing firms	Value of secrecy vs. patents	Secrecy is in general rated more valuable than patents for all firm sizes The probability with which firms rate secrecy over patents decreases with increasing firm size in the case of product innovations
Leiponen and Byma (2009)	Survey of 504 Finnish SMEs	Most important mechanism for protecting innovations	Informal means of protection are more commonly than patenting most important However, firms with university cooperation are likely to identify patents as most important

Holgersson, under review

Means for commercializing new product technologies

Means	Japan[1)]	Sweden[1)]	US[2)]
(a) Taking out patents to deter imitators (or to collect royalties)	3.3	1.9	2.0
(b) Exercising secrecy	2.4	2.0	1.7
(c) Creating market lead times	2.7	2.4	2.9
(d) Creating production cost reductions	2.9	2.7	2.7
(e) Creating superior marketing	2.7	3.0	3.1
(f) Creating switching costs at user end	1.9	1.7	n.a.

Notes
The highest and lowest values are overlined and underlined, respectively.
1. Current sample of 24 large corporations. Perceptions for 1992.
2. As reported in Levin et al. (1987). Perceptions for mid-1980s, rescaled to the scale used in the current study.

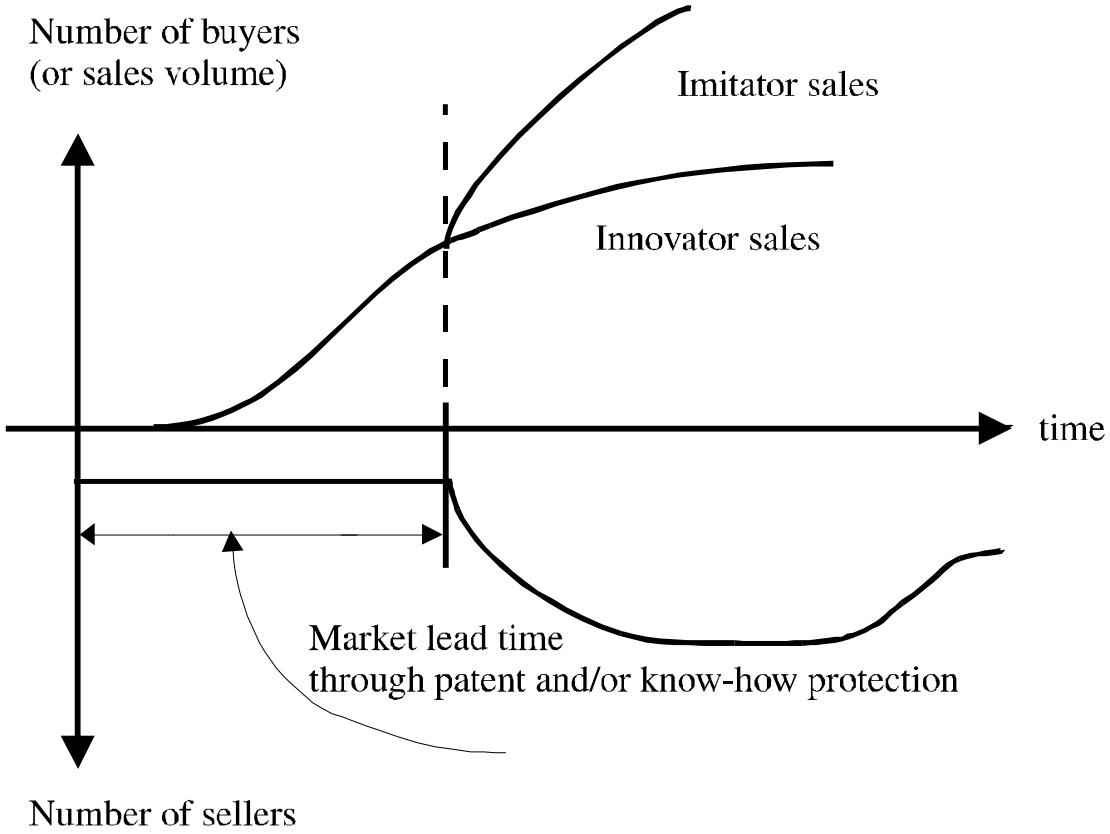
(Scale: No importance = 0, 1, 2, 3, 4 = Major importance)

Commercialization strategies for new product technologies

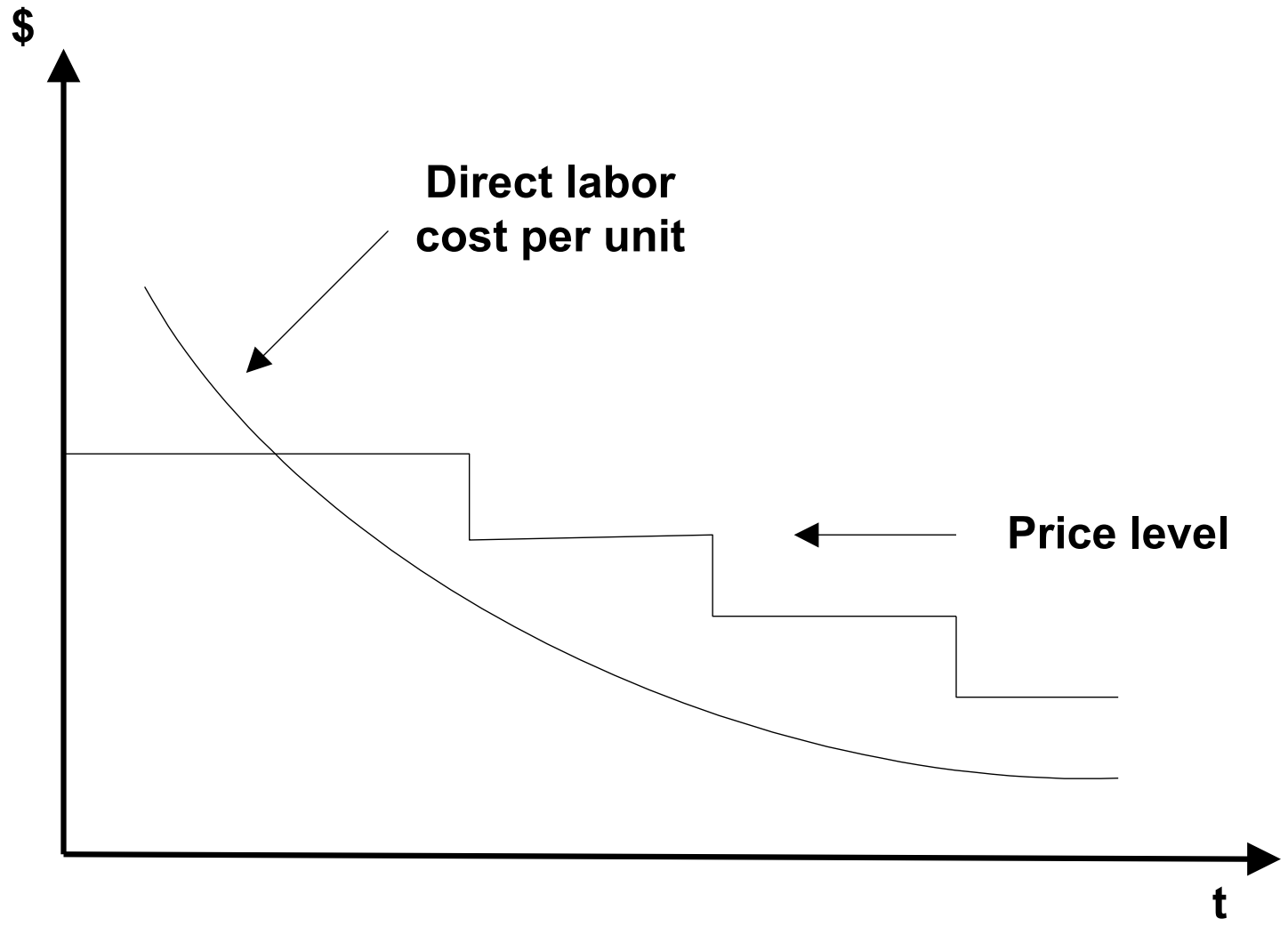
Question	Average
Q5.1.5a How important for your company, on average, are the following strategies in order to commercialize new product technologies?	
a) Taking out patents in order to delay or deter imitators	**2.82**
b) Selling licenses	1.22
c) Exercising secrecy	2.21
d) Creating market lead times	2.23
e) Creating cost reductions in production	2.63
f) Creating superior marketing and after-sales service	2.59
g) Creating costs for the customer to change supplier	1.28

(Scale: No importance=0, 1, 2, 3, 4=Major importance)

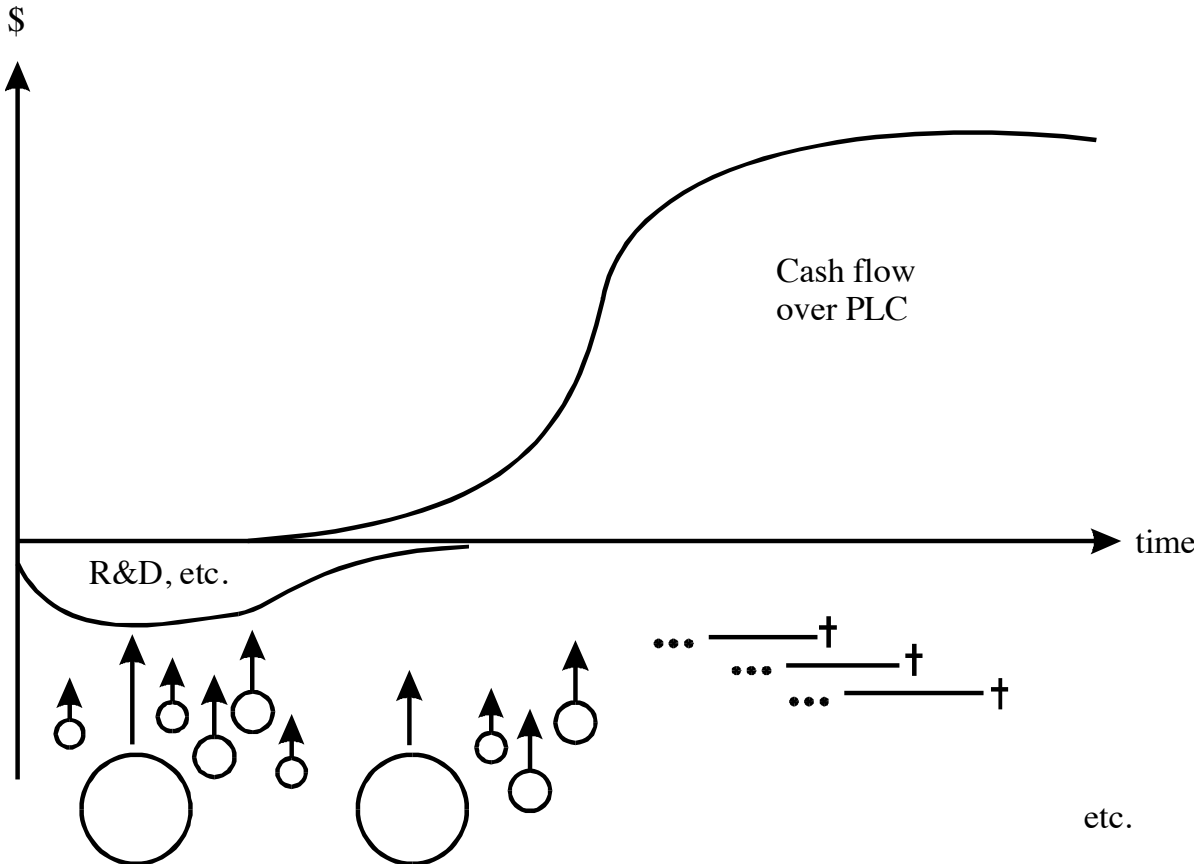
Complementarities across commercialization strategies



Complementarities across commercialization strategies



Complementarities across commercialization strategies



Empirical results

Q5.1.5b How important for your company, on average, are the following means for creating and maintaining lead times on the market in relation to the competitors?

	Average
a) Continually taking out patents in order to delay and increase costs for competitors	2,55
b) Using secrecy to delay and increase costs for competitors	1,84
c) Increasing resource efforts to increase own R&D pace	2,17
d) Using new technology in the R&D work (e.g. for simulation, experiment acceleration)	2,72
e) Using new organizational solutions in the R&D work (e.g. concurrent engineering)	2,37
f) Conducting ongoing development	3,11
g) Outsourcing	1,89
h) External R&D cooperation	2,39
i) Other (please specify):	2,00

Theoretical examples

$$V = \int_0^L \rho S(t) e^{-rt}\, dt - DI = (1/r)\cdot \rho \hat{S}(1 - e^{-rL}) - \frac{1}{(\lambda + r)} \rho \hat{S}(1 - e^{-(\lambda + r)L}) - DI$$

$$EV = EV^{pat} + EV^{sec} - EDI$$

$$EV^{sec} = E\left[V^{sec} \middle| L > \hat{L}\right] \cdot P(L > \hat{L}) = \left(\pi \cdot e^{-\mu \hat{L}} / (\mu + r)\right) \cdot e^{-r\hat{L}}$$

Granstrand, O. (1999). *The Economics and Management of Intellectual Property – Towards Intellectual Capitalism*. Edward Elgar Publishing Ltd, London.

Conclusion

Past studies of commercialization/appropriation strategies for innovations do not imply an inferior role of patents.

Strategic implications

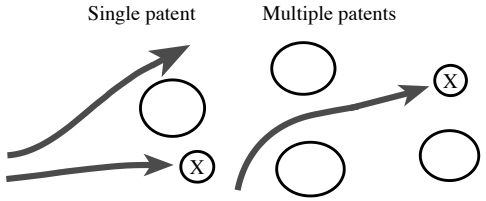
1. Multi-protection, using various complementary IPRs for different innovation components.

2. Strategy mix, using various complementary commercialization strategies in tandem.

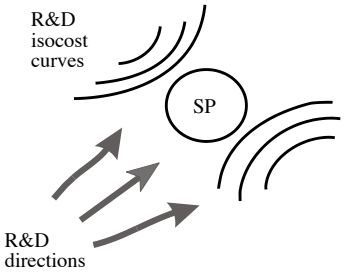
Do patents hinder commercialization?

Patent strategies

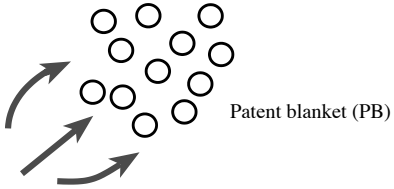
1) Ad hoc blocking and "Inventing around'



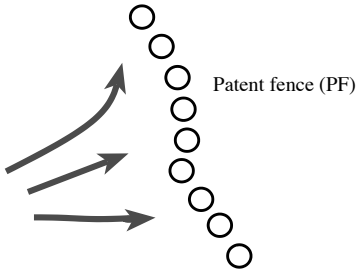
2) Strategic patent (SP searching)



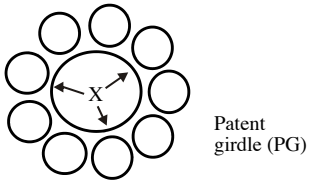
3) "Blanketing' (or "flooding')



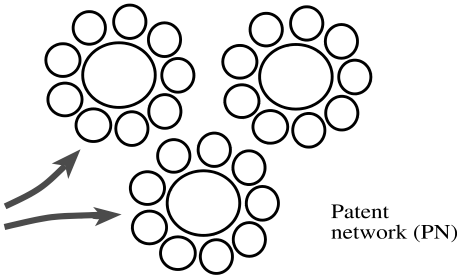
4) "Fencing'



5) "Surrounding'



6) Combination

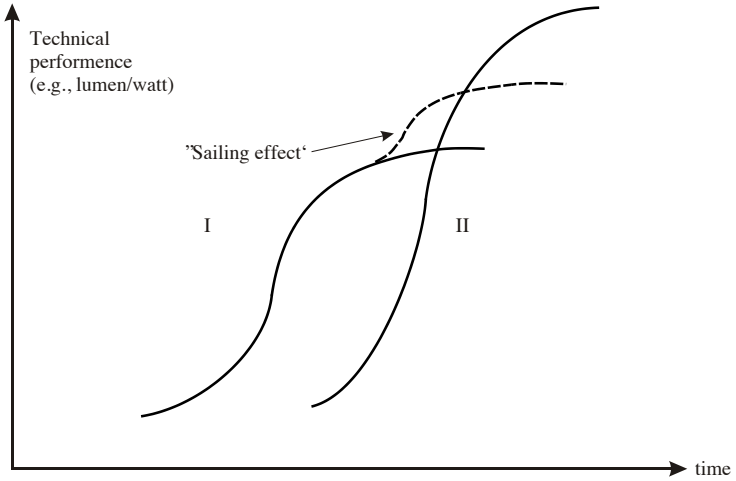


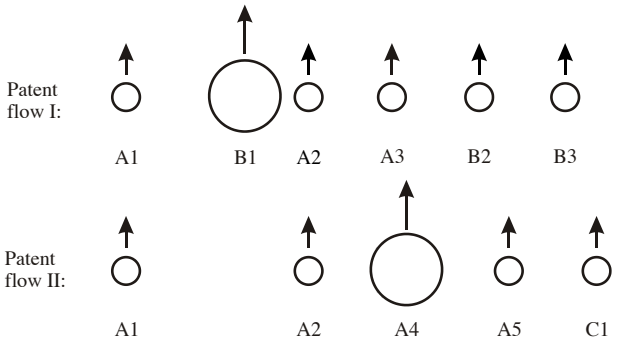
Legend

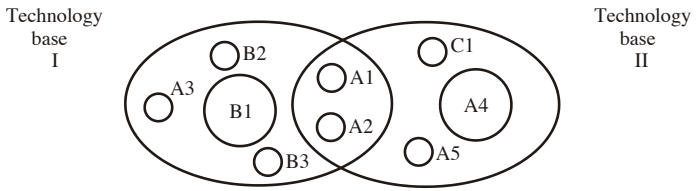
O = Own patent.

X = Competitor's patent.

→ = R&D direction of competitors.





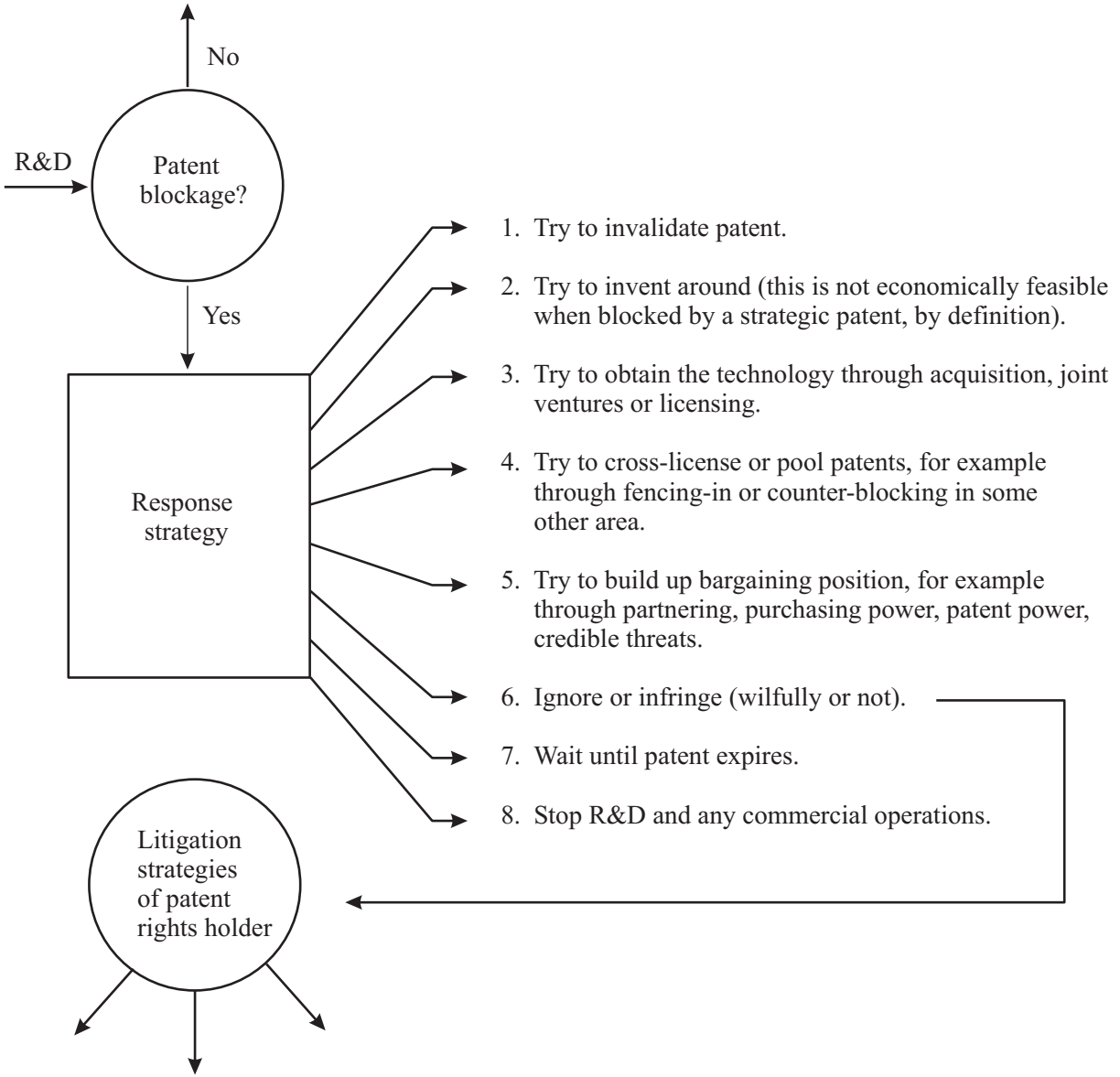


Legend: A1, B2 etc = Company A's first patent in the area, Company B's second patent in the area etc.

I, II = Two technical performance curves, corresponding to technology base I and II, represented by two overlapping sets of technologies, being partly protected in technology space by two patent flows over time. The <sailing effect= refers to improvements in old technical performance in response to threats from new technologies.

Circles denote scope of patents

Arrows denote patent granting dates


No
R&D
Patent blockage?
Yes
Response strategy
1. Try to invalidate patent.
2. Try to invent around (this is not economically feasible when blocked by a strategic patent, by definition).
3. Try to obtain the technology through acquisition, joint ventures or licensing.
4. Try to cross-license or pool patents, for example through fencing-in or counter-blocking in some other area.
5. Try to build up bargaining position, for example through partnering, purchasing power, patent power, credible threats.
6. Ignore or infringe (wilfully or not).
7. Wait until patent expires.
8. Stop R&D and any commercial operations.
Litigation strategies of patent rights holder
Legend: = Decision point. = Chance point.

The influence of other companies' patenting on company R&D

Question	Average
Q5.1.4 How is your company affected on average by other companies' patenting? (Yes=1, No=0)	
a) Our R&D needs are reduced because duplication is avoided and cooperation and licensing can occur	0.19
b) Our R&D needs are increased because we must invent around the patent or acquire the technology concerned	0.45
c) We are hindered in our R&D and discontinue it	0.27
d) We do not allow ourselves to be affected	0.09

Theoretical example of IP Assembly problem: Cumulative invention

Simplest case:

x_1 Essential product patent held by agent A

y_1 Improvement of x held by agent B

x_2 Substitute technology to x_1

y_2 Substitute technology to y_1

Patenting options for agent B

Invent around: y_1 ➔ x_2

Surround with application patents

Fence in process technology|

$$V_A(x_2 | x_1) = V_B(y_2 | y_1) = 0$$

Licensing options

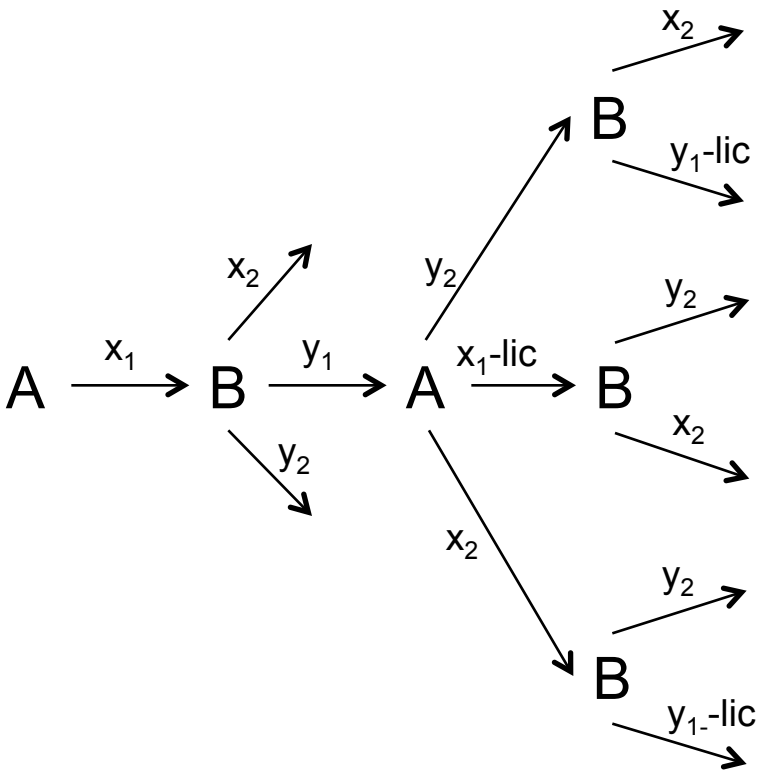
A sells license of x_1 to B

B sells license of y_1 to A

A and B cross-license

Compulsory licensing

Decision tree



etc.

Extensions to more agents, substitutes and complements become cumbersome.

Counterfactual thought experiment

Pick the most cumulative S&T area, i.e. mathematics.

Assume inventive mathematical theorems were patentable.

Would the mathematical developments be halted?

Conclusion

Patents may increase as well as decrease R&D of others.

Patents may delay (also by design) commercialization of others.

The problem of patents impeding cumulative invention is, so far, probably overstated.

Technology markets may fail, as any markets.

Strategic implications

Policy-level

1. **Filter out patents (reduce volumes) by raising:**
   - Fees (base + renewal fees)
   - Examination quality
   - Standards of non-obviousness and usefulness
2. **Filer out patents by reducing:**
   - Patents scope
   - Patentable subject matter
   - Length of patent protection
3. **Improve technology markets by enabling:**
   - Patent pooling and technology sharing
   - Block licensing and cross-licensing
   - ”Open-licensing”
   - Rights collection and clearance
4. **Reduce strategic behavior and abuse by:**
   - Compulsory licensing
   - Injunctive reliefs
5. **Reduce legal uncertainty regarding**
   - Validation
   - Dispute resolution
6. **Enable integration and internalizing of interdependent R&D.**
7. **Employ alternatives to private rights approaches** (e.g. procurement contracts or public finance).

Company level

1. **Try to invalidate blocking patents.**
2. **Try to invent around blocking patents.**
3. **Try to obtain blocked technologies through acquisition, joint ventures or licensing.**
4. **Try to cross-license or pool patents** (e.g. through fencing-in or counter blocking in some other area).
5. **Try to build up bargaining position** (e.g. through partnering, purchasing power, patent power and create credible threats).
6. **Ignore or infringe blocking patents.**
7. **Wait until blocking patents expire.**
8. **Stop R&D and related commercial operations.**

Strategic implications

Thus: Technology market failures must be monitored and addressed, e.g. by fair pricing and compulsory licensing, esp. in standard setting.

Summary and Conclusions

1. Macro-level background
   a. Convergences in the world economy
   b. New view of the IPR system as a tool for governance of markets and firms in a new type of globalized knowledge market economy.

2. Micro-level
   a. Patents and innovations for growth
   b. Semi-open technology and innovation strategies governed by IPRs
   c. Complementary commercialization/appropriation strategies
   d. Cumulative invention and remedies for IP assembly problem

Thank you for your attention!

Questions?