Innovation in services

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(How) are services different?

- Most studies of innovation examine manufacturing
- Innovation = creation of new types of artifacts
  - Patent indicators
- Organizational innovation; process innovation

  →Measurement issues

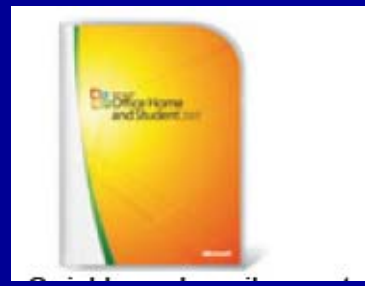
  →Survey approaches

Trends in manufacturing, services

- Services are 70-80% of economic activity in the OECD area – and growing
- Services are intangible?
- Services are time-sensitive?
- Services are co-produced with clients?
- Manufacturing firms manufacture?

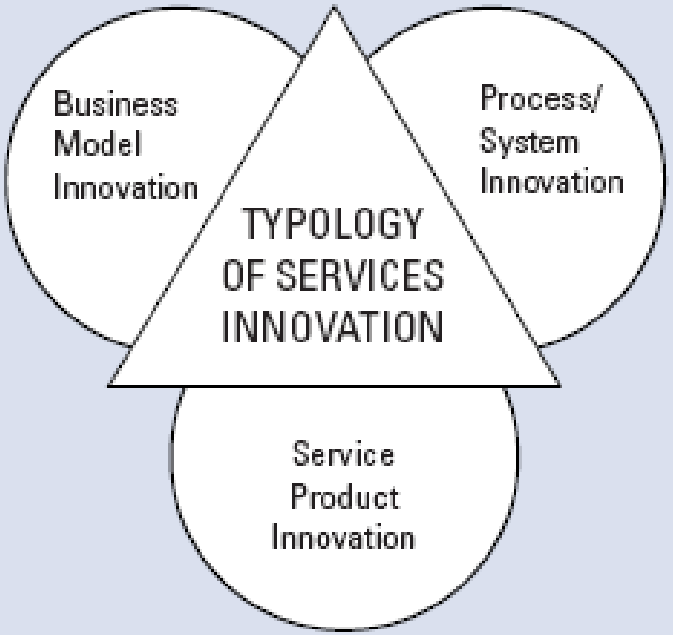
➔ Blurring of boundaries between services & manufacturing innovation; opportunities to learn across the boundaries

  - Games vs. cell phone development



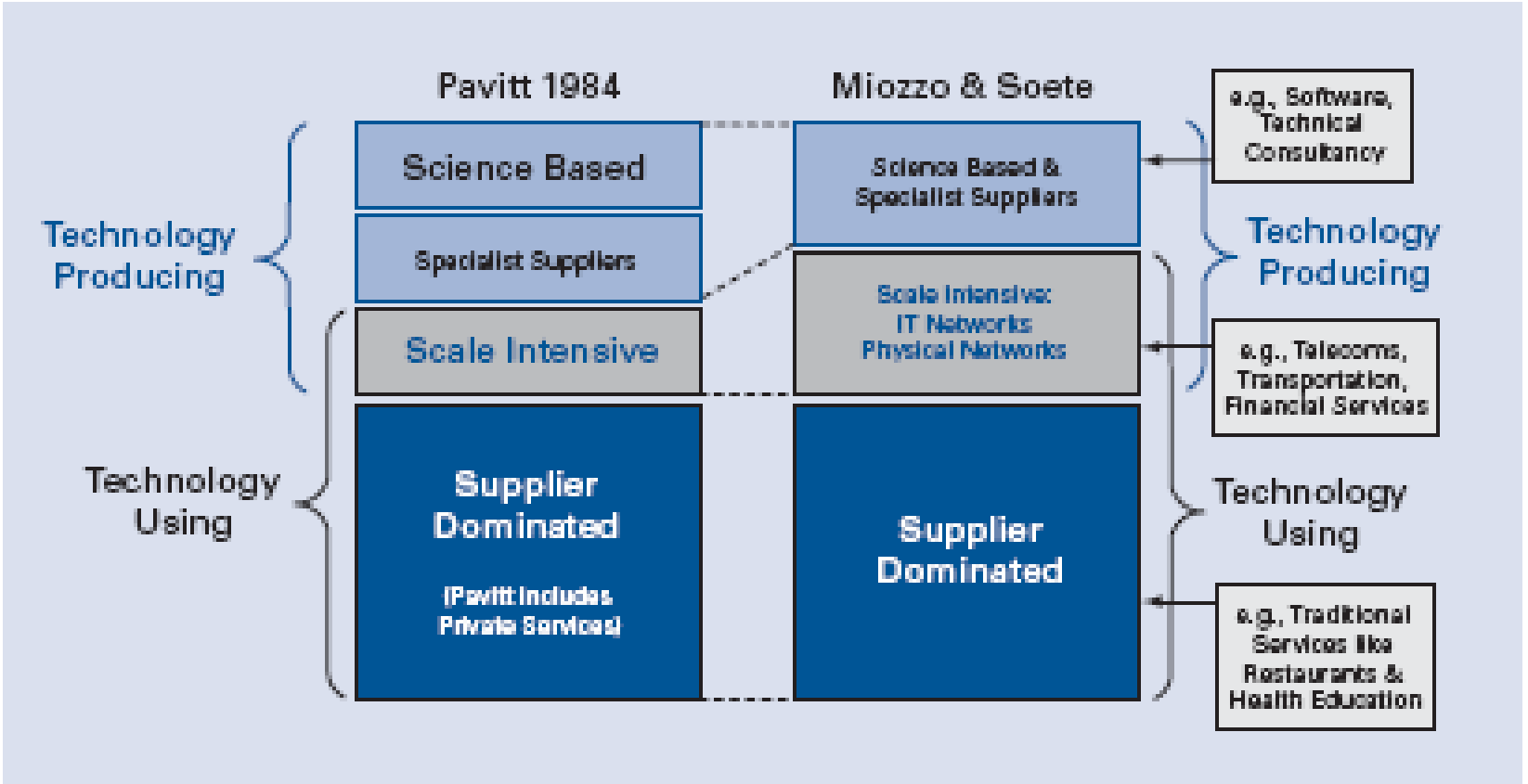
metso
minerals

Figure 4.5: A typology of services innovation



Source: adapted from Forfás (2006).

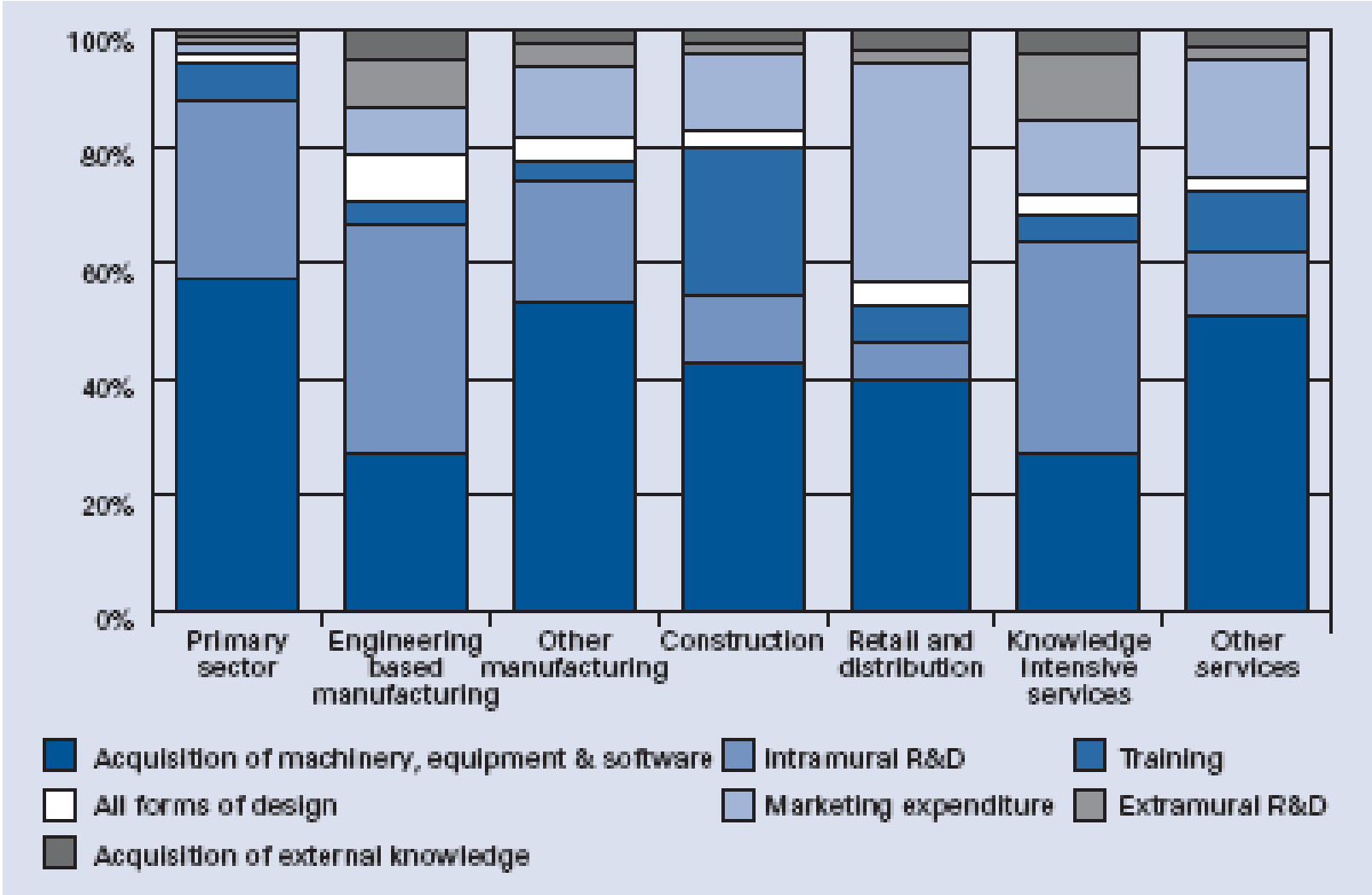
Figure 2.1: Pavitt, Miozzo and Soete's Taxonomies of Innovation and Technology Trajectories



Source: Adapted from Pavitt (1984) and Miozzo & Soete (2001)

Source: Howells, Tether et al. 2007: Fostering Innovation in Services. Report of the expert group on innovation in services. DTI UK.

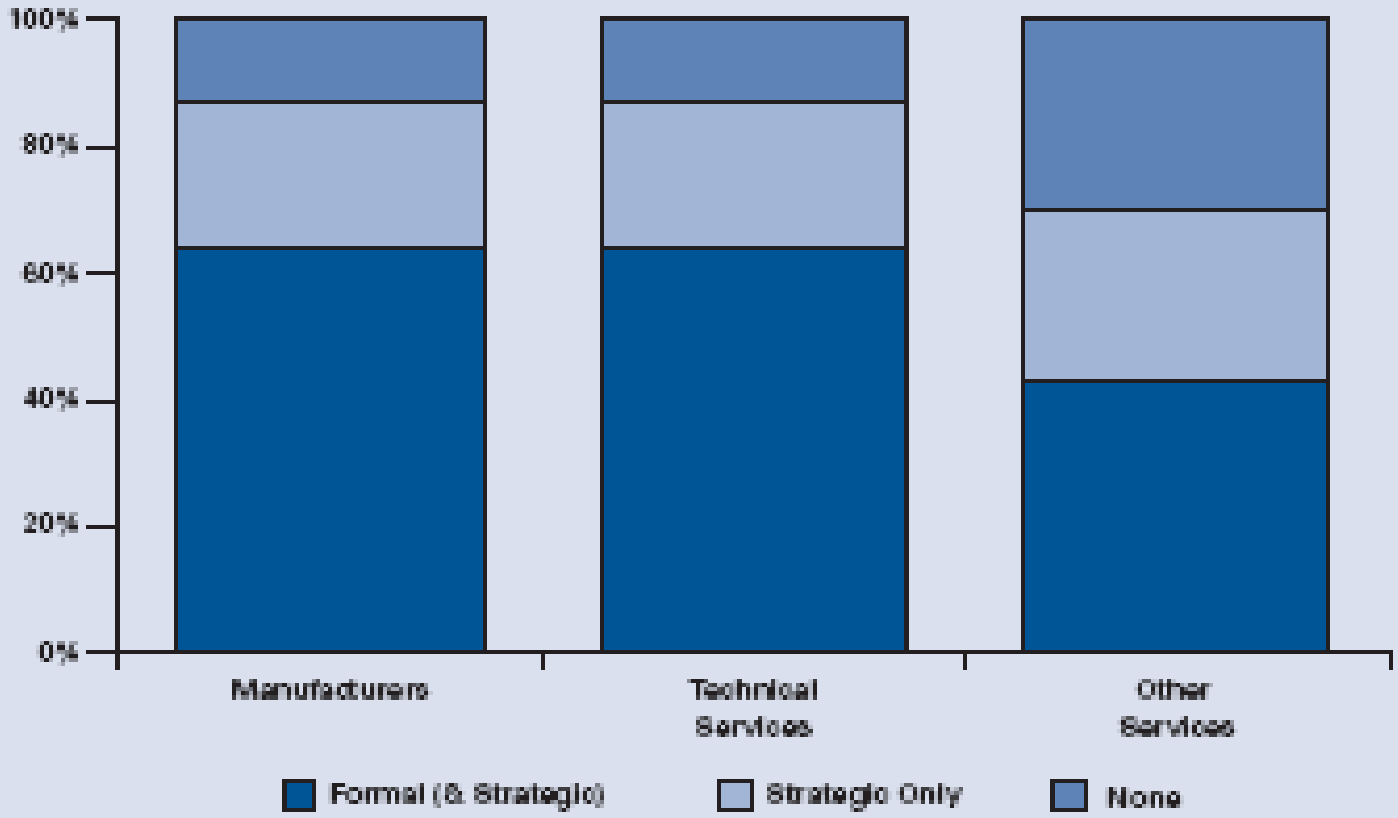
Figure 1.2: Shares of innovation expenditure by sector



Source: Innovation in the UK: Indicators and Insights, DTI Occasional Paper No.6, July 2006.

Source: Howells, Tether et al. 2007

Figure 1.3: Protecting innovations



Source: Community Innovation Survey (CIS4).

Note: Technical services – telecommunications, computer services, R&D services, architecture and engineering services.

Source: Howells, Tether et al. 2007

Survey evidence (1)

- A small scale survey of Finnish knowledge-intensive business services' innovation activities and organization
  - Industrial design
  - Advertising
  - Machine & process engineering
  - Electrical engineering
  - Management consulting
  - R&D services
- 167 responses, 42% response rate

Questions on…

- Goals of in-house training (e.g., internal cooperation, technology adoption)
- Sources of information for innovation (e.g., clients, suppliers, competitors, universities)
- Sources of competitiveness (e.g., knowledge residing in teams, reputation, training, learning on-the-job, innovation, formal education, marketing)
- Innovation output (service improvements; new services; sales of new services)
- Contractual practices with clients, employees

Table 4 Strategies to create knowledge assets (Industry & Innovation 2005)

Rotated Factor Pattern	Factor1	Factor2	Factor3	Factor4	Factor5
	"Internal cooperation"	**"Vertical & horizontal information"**	**"Technology adoption"**	**"Incremental learning"**	**"Scientific knowledge"**
Training goals: **Internal cooperation**	0.65	-0.07	0.11	0.09	0.24
Competitiveness: **Teams**	0.80	0.10	0.01	-0.01	-0.19
Competitiveness: **Marketing**	0.65	0.14	0.03	0.12	0.10
Information sourcing: **Customers**	0.03	0.88	-0.07	0.13	0.01
Information sourcing: **Competitors**	0.32	0.63	0.14	-0.28	-0.04
Training goals: **Technology adoption**	0.10	-0.07	0.85	-0.09	0.04
Information sourcing: **Suppliers**	-0.23	0.47	0.50	0.09	0.33
Competitiveness: **In-house training**	0.26	0.16	0.53	0.43	-0.03
Competitiveness: **Learning on the job**	-0.03	0.06	0.14	0.82	0.03
Competitiveness: **Reputation**	0.30	-0.14	-0.30	0.60	0.00
Information sourcing: **Universities**	0.12	0.02	0.05	0.01	0.93
Eigenvalue	2.24	1.60	1.29	1.09	0.93
Proportion of variance	0.20	0.15	0.12	0.10	0.08
Cumulative variance	0.20	0.35	0.47	0.56	0.65

Note: Exploratory Factor Analysis with Principal Components as the initial factor method. Rotation method: Orthogonal Varimax.

Estimation results for service innovation outcomes (Industry & Innovation 2005)

Estimation method	Probit ML				Tobit ML	
Dependent Variable	IMPROVEMENT		INNOVATION		% SALES from NEW SERVICES	
	Coeff.	(Std. error)	Coeff.	(Std. error)	Coeff.	(Std. error)
Intercept	-1.41**	(0.58)	-1.03*	(0.55)	-8.75	(8.97)
Log(EMPLOYEES)	0.23*	(0.14)	0.23*	(0.13)	1.11	(2.04)
BUSINESS GROUP	0.55**	(0.28)	0.04	(0.27)	-3.55	(4.38)
R&D INTENSITY	5.32	(3.62)	1.13	(1.54)	11.28	(18.89)
HIGHER EDUC	0.004	(0.005)	0.008*	(0.005)	0.16**	(0.08)
Internal cooperation + marketing	0.33**	(0.16)	0.11	(0.15)	1.57	(2.39)
Knowledge from customers, competitors	0.21*	(0.13)	0.41***	(0.13)	8.55***	(2.36)
Technology adoption	-0.09	(0.13)	-0.15	(0.12)	-2.26	(2.03)
Incremental learning	0.01	(0.12)	-0.15	(0.12)	-2.34	(1.99)
Scientific knowledge	0.12	(0.14)	-0.15	(0.14)	-4.74**	(2.36)
Industry dummies	Incl.		Incl.		Incl.	
Sigma	n.a.		n.a.		18.14***	(1.89)
Observations	135		136		133	
Log likelihood	-69.9		-75.7		-264.8	

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- External sourcing of knowledge particularly important for (knowledge-intensive) services?
- R&D is not all that important?
- Universities play a different or unimportant role?
- In-house training matters more?

Survey evidence (2)

- 1996 Finnish Community Innovation Survey (CIS)
- Representative sample of manufacturing sector
- 194 service firms from 12 two-digit industries
  - Electricity, gas, water supply
  - Wholesale trade
  - Transport
  - Telecommunications
  - Financial intermediation
  - Computer
  - Technical services (engineering, architecture, R&D)

Leiponen & Drejer (ResPol 07): "What exactly are technological regimes"

- Based on Pavitt's classic study (1984) use the following dimensions of innovation activity:

Variable	Description
Employees	Full-time employees, 1996
Innovation intensity	Innovation expenditures divided by sales revenue
S: Internal sources	Importance of firm-internal *sources* of information for innovation
S: Clients[a]	Importance of clients as a *source* of information for innovation
S: Suppliers[a]	Importance of suppliers as a *source* of information for innovation
S: Universities[a]	Importance of universities as a *source* of information for innovation
COL: Clients	Clients are *collaboration* partners in innovation projects
COL: Suppliers	Suppliers are *collaboration* partners in innovation projects
COL: Universities	Universities are *collaboration* partners in innovation projects
OBJ: Improve	Importance of improving product quality as an *objective* of innovation
OBJ: Extend	Importance of expanding product range as an *objective* of innovation
OBJ: Open	Importance of opening new markets as an *objective* of innovation
OBJ: Labor	Importance of reducing labor costs as an *objective* of innovation
OBJ: Inputs	Importance of reducing raw materials and other inputs as an *objective* of innovation
Patent application[b]	Application for a patent filed during the period 1994-1996

The ordinal scale of 0–3 ranges from 'not important' to 'very important'.

Service vs. manufacturing firms

- Similar “innovation regimes” (or strategies) emerge from PCA for service & manufacturing subsamples
- When you cluster firms based on their PCA (regime) scores, find little evidence of service “peculiarity” – both service and manufacturing firms are found in all clusters, except:
  - Few service firms are scale & science based (large firms sourcing information from and collaborating with universities, using formal IPRs)
  - Relatively more service firms are market driven (information from clients; innovation objective to open new markets and extend old ones)

New study: “Benefits of breadth in service innovation?”

- In the above studies, a few distinguishing characteristics of services stand out:
  - Formal/institutionalized R&D isn’t crucial (?)
  - Science yields relatively few inputs to service innovation
  - Innovative service firms tend to be domestically oriented
- Novelty: a closer look at sources of information, innovation objectives, and geographic reach of service innovators; lagging innovation outputs by 2 years

“Breadth” in innovation

- Manufacturing firms appear to benefit from broad strategies in innovation (Leiponen & Helfat 2005, 2006)
  - Knowledge sourcing
  - Innovation objectives
  - R&D locations
  - R&D cooperation
- Do service firms benefit?

Yes.

Data

NACE	Industry	N	Share %	Subsample group
15-16	Food, beverages and tobacco	33	*6.4%*	Discrete manufacturing
17-19	Textiles, wearing apparel and leather	19	*3.7%*	Discrete manufacturing
20-22	Wood, pulp, paper, printing and publishing	54	*10.5%*	Discrete manufacturing
23-25	Petroleum, chemicals, rubber and plastic products	57	*11.1%*	Discrete manufacturing
26-28	Metals, metallic and non-metallic min. products	59	*11.5%*	Discrete manufacturing
29	Machinery and equipment n.e.c.,	70	*13.6%*	Complex manufacturing
30-33	Electrical and optical equipment	73	*14.2%*	Complex manufacturing
34-35	Transportation equipment	20	*3.9%*	Complex manufacturing
36-37	Manufacturing n.e.c.	9	*1.8%*	NA
40-41	Electricity, gas and water supply	15	*2.9%*	Network service
51	Wholesale trade and commission trade	21	*4.1%*	Network service
60-62	Land, water and air transport	19	*3.7%*	Network service
64.2	Telecommunications	21	*4.1%*	Network service
72	Computer and related activities	24	*4.7%*	KIBS
74.2	Architectural, engineering and related technical	20	*3.9%*	KIBS
	Total	*514*	*100.0%*	

Table 3. Means for service and manufacturing subsectors (1996 except 1998 for innovation outcomes)

Variable	Business service	Network service	Complex manuf.	Discrete manuf.
Employees	135.977	649.156	309.574	519.480
Export share	0.153	0.023	0.400	0.286
Higher technical skills	0.222	0.048	0.064	0.061
Any innovations (1998)	0.591	0.377	0.760	0.601
% of sales from product innovations (1998)	18.727	4.948	21.273	9.466
% of sales from novel product innovations (1998)	7.045	2.519	9.503	4.045
Training expenditure/sales	0.005	0.001	0.001	0.001
R&D expenditure/sales	0.092	0.017	0.058	0.014
Any patents	0.159	0.078	0.508	0.350
Any domestic R&D cooperation	0.773	0.584	0.683	0.717
Any foreign R&D cooperation	0.523	0.260	0.552	0.543

Services also…

- cooperate less frequently with universities
- rely more on consulting firms, databases
- rely less on competitors, patents, trade fairs for information
- emphasize replacing outdated products, improving quality, expanding assortment and market share rather than production efficiency as innovation objectives

- But overall, objectives, knowledge sources, cooperation patterns about equally broad in services and manufacturing

Table 5 Does R&D matter for service innovation?

	Log(ALL INNOVATION SALES 1998)			Log(NOVEL INNOVATION SALES 1998)		
	Coeff.	SE	p	Coeff.	SE	p
Intercept	-3.072	1.512	0.042	-1.883	1.485	0.205
Log(employees 1996)	0.943	0.233	<.0001	0.675	0.229	0.003
Business group	-0.554	0.650	0.394	-1.292	0.639	0.043
Exports/sales	0.935	1.038	0.368	0.749	1.019	0.462
Any R&D cooperation	1.311	0.720	0.069	1.143	0.707	0.106
Institutionalized R&D	2.835	0.717	<.0001	2.093	0.704	0.003
Log(R&D expenditure)	0.274	0.171	0.108	0.019	0.167	0.910
Log(training expenditure)	0.327	0.126	0.009	0.589	0.123	<.0001
Service*Log(R&D)	0.158	0.232	0.496	0.274	0.228	0.229
Service*Any R&D cooperation	-4.222	1.477	0.004	-3.256	1.450	0.025
Sigma	5.887	0.180	<.0001	5.782	0.177	<.0001
Log likelihood	-1701.00			-1692.00		

Notes: Tobit ML models include 2-digit industry dummies. 533 observations.

Table 7 Do service firms benefit from breadth of innovation objectives and knowledge sources?

Dependent variable: Log(all innovation sales 1998)

	(1)			(2)		
	Coeff.	SE	p	Coeff.	SE	p
Sum of important objectives	0.229	0.145	0.115	0.109	0.155	0.482
Service*sum of objectives	-0.550	0.332	0.097	-0.635	0.328	0.053
Sum of important knowledge sources	0.350	0.169	0.038			
Service* Sum of important knowledge sources	0.097	0.315	0.758			
Institutionalized R&D*sum of important objectives				0.372	0.123	0.003
Institutionalized R&D*sum of objectives*service firm				0.293	0.223	0.190

In words…

- R&D and training inputs are relevant in both main sectors
- Service firms' ability to benefit from broad strategies related to objectives and cooperation may depend on innovation management capabilities
- It appears important to use an appropriate time lag b/w inputs and outputs

Conclusions

- Innovating service and manufacturing firms don't look so different...
- ...and don't innovate so differently, controlling for relevant observables
  - But benefits of service R&D cooperation may depend on "alliance capabilities"
- Do we need new survey questions to better understand *both* manufacturing and service innovation?