

The UK Intangibles Programme and “Investment in Intangible Assets” Survey (IIA)

Part of the Innovation Index (NESTA/Imperial College) +

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Innovation & Intangible investments

No intangibles

$$\textit{Tech: } V' = V(L, K^{TAN})A',$$

$$\Delta K^{TAN} = I^{TAN} - \delta^{TAN} K^{TAN}$$

$$\textit{Growth a / c: } \Delta \ln V' = s_L \Delta \ln L + s_{K^{TAN}} \Delta \ln K^{TAN} + \Delta \ln TFP'$$

$$\textit{Know invest} = 0$$

$$\textit{Innovation: } Inn' = \Delta \ln TFP'$$

So output a function of labour and tangible capital, and technical change, A

Growth in capital stock accounts for investment and depreciation (δ)

If we don't account for intangibles, the only measure of innovation is TFP

Innovation & Intangible investments

With intangibles

$$\text{Tech: } V = V(L, K^{TAN}, K^{INTAN})A,$$

$$\Delta K^{INTAN} = I^{INTAN} - \delta^{INTAN} K^{INTAN}$$

$$\text{Growth } a/c: \quad \Delta \ln V = s_L \Delta \ln L + s_{K^{TAN}} \Delta \ln K^{TAN} + s_{K^{INTAN}} \Delta \ln K^{INTAN} + \Delta \ln TFP$$

$$\text{Know invest} = I^{INTAN}$$

$$\text{Innovation: } Inn = s_{K^{INTAN}} \Delta \ln K^{INTAN} + \Delta \ln TFP$$

Adjusted output now a function of: L, tangible **AND** intangible capital, and tech change

Can again measure growth in intangible capital

Innovation estimated as contribution of intangible capital plus TFP. Better understanding of innovation and sources of economic growth

Data Requirements

Therefore need data on:

1) Nominal Intangible Investment: I^{INTAN}

2) To build real+stock K^{INTAN} we need real investment:

- Therefore need price index for intangible assets,
- Real I = I^{INTAN} / P^{INTAN}
- Depreciation rate of Intangible Capital

$$K^{INTAN}(t) = I^{INTAN}(t) + (1 - \delta^{INTAN})K^{INTAN}(t-1)$$

3) The income share of intangible capital: $S_{K^{INTAN}}$

Which we can also estimate with information from above

Current & Recent Work

On 1), / INTAN, progress in measuring investment
e.g. improved measurement of artistic originals:

www.ceriba.org.uk/bin/view/CERIBA/IPOArtisticOriginals

- Films & TV (based on production costs for UK-owned assets)
- Books and Music (based on royalty payments received by UK creators)
- Will be used to revise the UK National Accounts in near future.
- Upward revision from ~£3bn to ~£6bn

But less done on 2) %real+measures

i.e. asset prices & life-lengths.

Until now, relied on CHS assumptions:

- Asset prices follow general output prices (GDP deflator)
- Depreciation rates: 20% p.a. geometric rate

On prices: Corrado, Goodridge, Haskel (2011)

<http://spiral.imperial.ac.uk/bitstream/10044/1/9028/1/Haskel%202011-07.pdf>

- Suggests price of R&D has fallen over time (~10% p.a.), compared to typical +4% p.a. growth of GDP deflator - big impact on contribution of R&D (approx 8 times higher)
- Significant implications for other intangibles - R&D is only one small component of investment, therefore important area for future work

On life-lengths

- Typically assume 20% p.a., geometric rate
- Convenient, but geometric maybe particularly inappropriate for intangibles
- One way of estimating implied depreciation rates is to look at revenues over time, where data on transactions exist
- UK data for artistic originals suggest v.fast declines in first 2 years, as much as 40-50% in first year, but steady depreciation after, with long-lives
- Soloveichik (BEA) produces similar results
- Therefore more work needed on life length and profile. Hope that IIA survey should help here

IIA SURVEY

IIA Survey

www.nesta.org.uk/publications/reports/assets/features/investing_in_innovation

Funded by NESTA, conducted by ONS

“ 2nd run: (2009 & 2011)

“ 2011 returns being processed now, data due shortly

“ Today will focus on 2009 results

Structure:

- Voluntary postal survey
- ~2000 firms; 10+ employees; production & services
- Sample stratified by industry & employment
- Linkable to other surveys via business register

IIA Survey

Objectives, to measure:

- . Purchased (external) and Own-account (internal)
- . R&D,
- . software,
- . training,
- . branding,
- . design,
- . organisation or business process improvement

- . Life lengths / depreciation rates

Features that may help other surveys

- “ Pilots important to test questions and definitions and make sure survey is understood
 - “ Clear questions (Poor response rates to UK Innovation survey suggest some of those questions not well understood)
 - “ Clear distinction in questions between In-house (own-account) and Purchased investments - Firms tend to assume purchased unless the question emphasises in-house
- “ We used a mild industry bias informed by pilot survey and UK Innovation Survey:
 - “ Over-sample to knowledge intensive industries: Engineering; ICT; Financial Services
 - “ Under-sample: Construction; Utilities; Distribution; Accomodation

Features that may help other surveys

- “ With funds limited, surveys need clear link to policies of interest and other economic variables.
 - “ Preferred approach: extend official R&D surveys to incorporate questions on other intangibles
- “ Running through official stats agency helps:
 - “ Responses (42% response rate)
 - “ Linkable to register - vital for analysis and comparing with other sources
 - “ Use of the official register helps quality in terms of the representative sampling weighting up to the full population

Layout of questionnaire

Distinct section for each asset

Clear distinction between own-account and purchased for each section (asset)

Information required

This questionnaire is divided into short sections and asks for information on investment in:

- employer funded training
- software
- reputation and branding
- research and development (R&D)
- design of new and/or improved products/services
- organisation or business process improvement

Each section has a filter (Yes/No) question which defines asset with examples

Section D - Reputation and Branding

- 12.** During the year, did this business fund any external or internal work intended to enhance reputation or brand values, either of the business as a whole or individual products or service lines?

For example, product launches, promotional campaigns, 'rebranding' of business, development of promotional materials, etc.

Yes → Go to question **13**

No → Go to question **16**

Then asks for separate data on purchased & own-account:

13. During the year, what was this business's expenditure on activities undertaken by other organisations to enhance reputation or brand values?

Include:

- external costs of advertising and marketing campaigns to agencies, media organisations, trade fairs, suppliers of marketing databases, etc

£

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14. During the year, what was this business's spending on activities carried out by its own staff to enhance reputation or brand values?

Include:

- staff costs of all staff involved, e.g. product managers, sales and marketing personnel
- associated costs, including office facilities, overheads and materials but not capital items.

Note: Estimates based on proportions of staff time are acceptable . . .

£

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Finally, question on expected life length of investment:

15. On average, how long does the business expect to benefit from a typical investment intended to enhance reputation and branding?

Years

Months

Response Rates

- “ Reasonable response rate: 42% provided spending information
- “ Similar across industries
- “ Firms who replied more likely to be small
- “ Firms who refused to respond more likely large. BUT of those that did respond, large firms more likely to report spending

Key findings from responses

1. Spending

- . R&D, software, branding and training look close to macro figures
- . Design and organisational capital do not

2. Life lengths

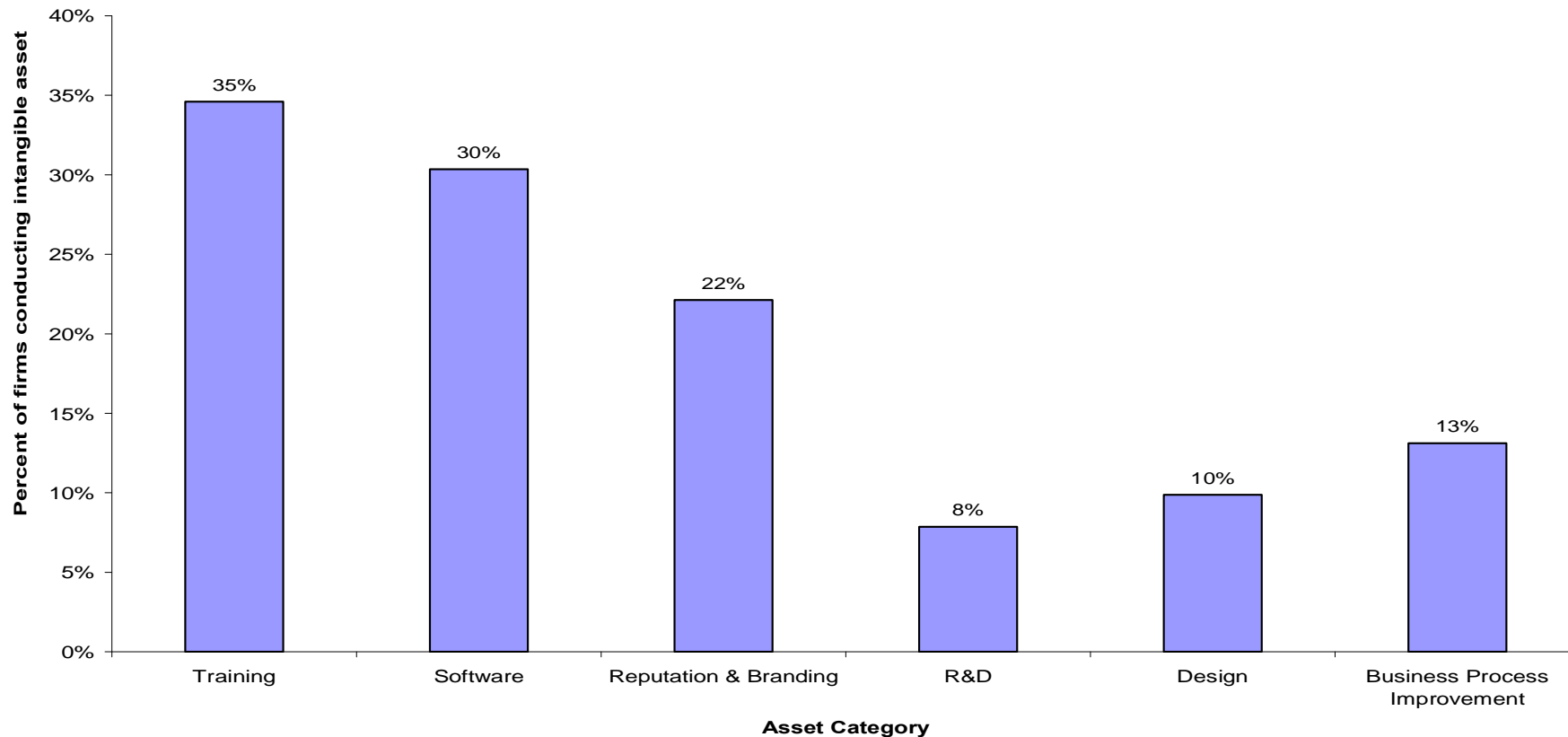
- . Depreciation rates support key assumptions
 - ” 8.6 years for R&D
 - ” 5 years for other intangibles
 - ” Longer life lengths in production than services

3. Correlations with Innovation Survey

- good correlation for R&D: +0.75
- zero/negative correlation elsewhere
- UK CIS questions and IIA questions different

INCIDENCE OF INVESTMENT

% conducting intangible investment by asset category



- Most firms do not invest in intangibles
 - Non-R&D intangible spending much more widespread than R&D spend.
 - Training is the most common form of investment, and R&D least common.
- In weighted terms,:
- almost all firms active in R&D also active in other categories. But converse not true
 - 42 % of firms not active in R&D, but active in other categories

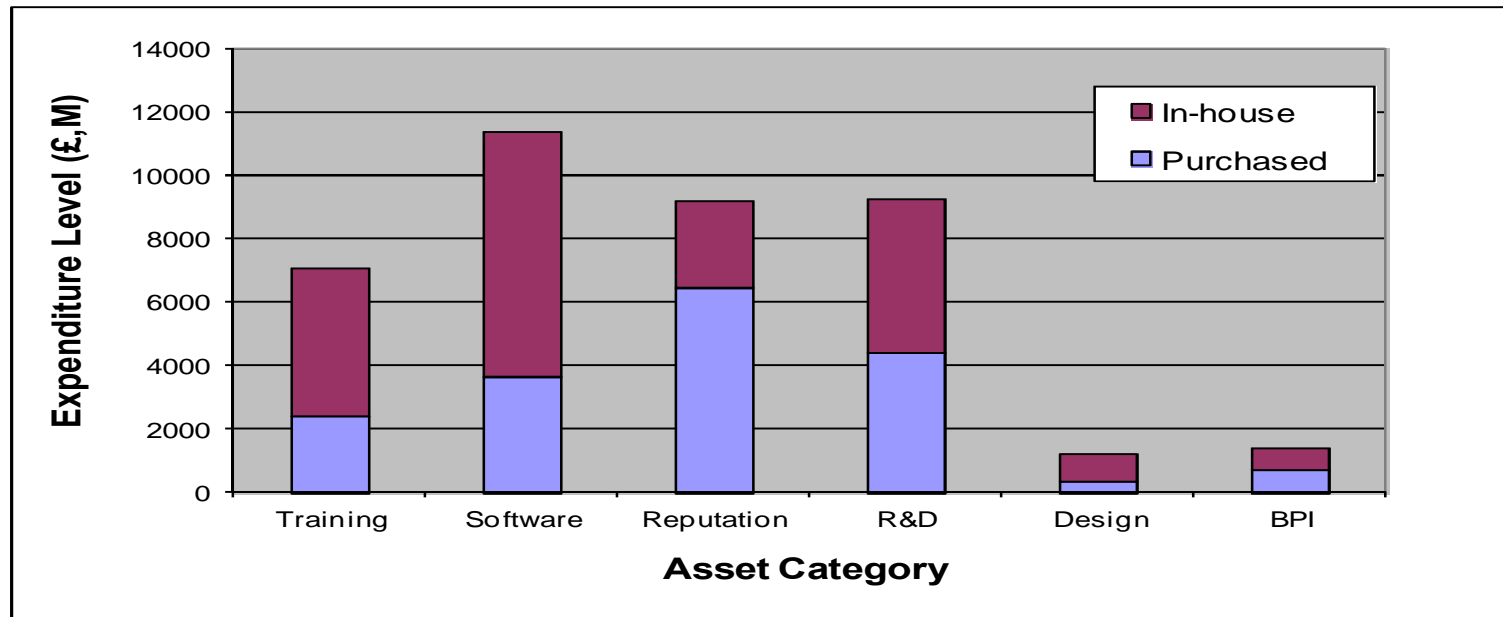
Incidence

- “ Larger firms more likely to invest, especially true for training, less so for design

- “ Little difference in incidence between firms in production/services for most assets except:
 - “ R&D . more likely in production sector
 - “ Branding . more likely in services

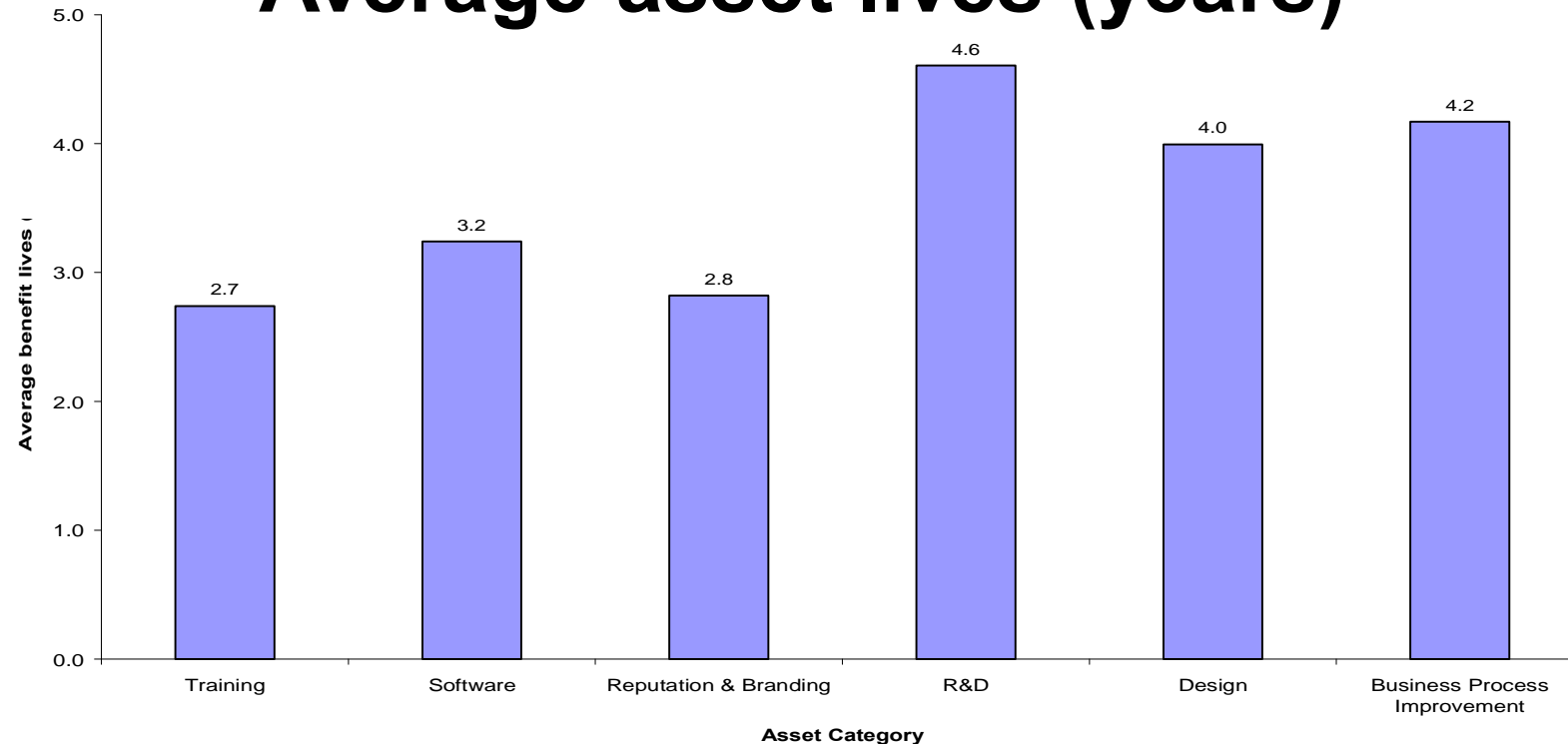
**SURVEY:
WEIGHTED EXPENDITURE**

In-house .vs. Purchased Expenditure



- “ Total Investment = £39bn (weighted)
 - “ Software = £11bn, R&D = £9bn, Branding = £9bn, Training = £7bn
- “ Broadly comparable to macro estimates except design & Bus. Proc.
 - “ BP based on assumption of 20% of managerial time . casts doubt on that
 - “ But design more of a puzzle
- “ In-house investment an important component in all categories especially design, software & training: accounts for 73%, 68% & 67% respectively
- “ In total, ~55% of expenditure is in-house, ~45% is purchased.

Average asset lives (years)

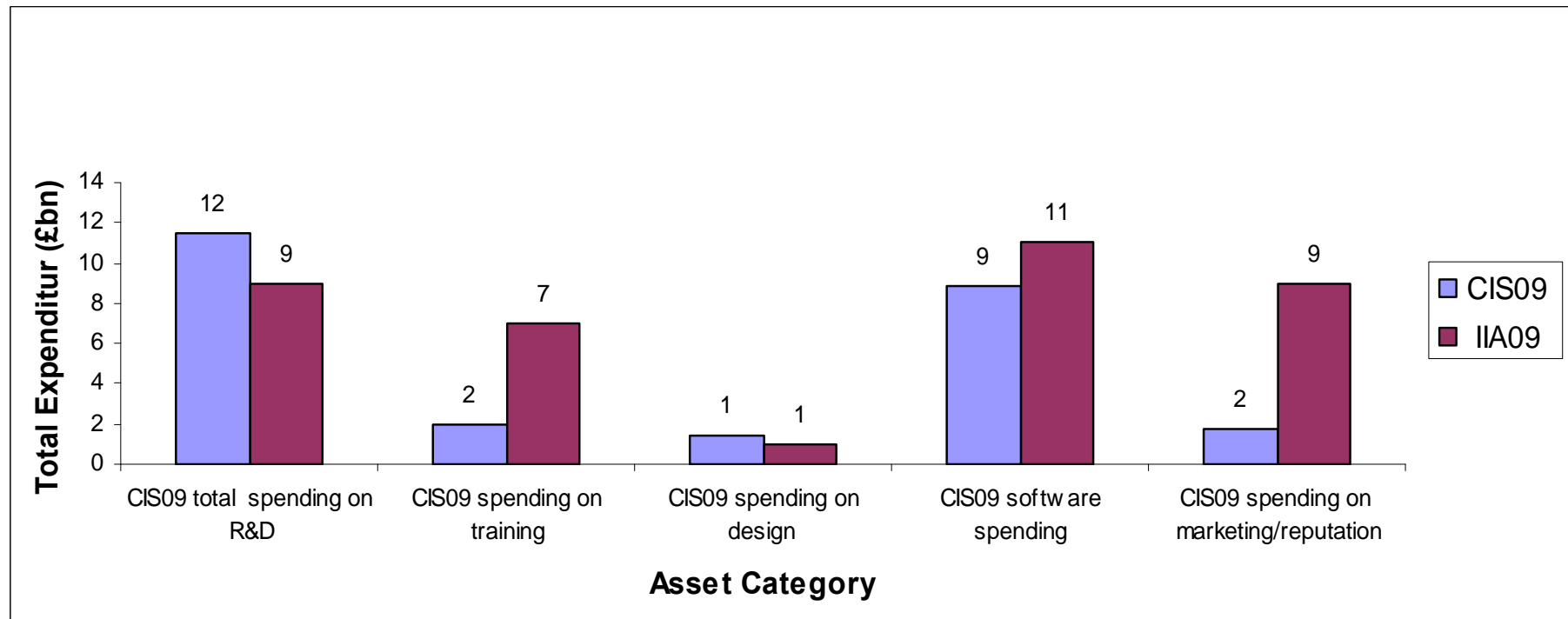


- “ Good news! All life-lengths > 1 year... And at least 2 years
- “ Range from 2¾ years (training & branding), to ~4½ years (R&D). Strong support for capitalisation
- “ Production reports longer life lengths than services. But no clear pattern of difference by firm size
- “ Suggests that nature of asset differs by industry. E.g: R&D in pharma .vs. aerospace. So different depreciation rates, implicit prices etc. for each. BEA produces different R&D dep rates by industry

COMPARISON WITH OTHER DATA

IIA09 and UKIS09 comparison

Total weighted expenditure by category (£m) – Total Samples (unmatched)



R&D . similar

Training: CIS asks about expenditure related to innovation, so lower

Design: similar but CIS asks about design related to innovation. Therefore would expect IIA to be higher ÷ . puzzle

Branding: CIS refers to % branding for innovation+so lower

The IIA and BERD comparison

Correlation coefficients between IIA and BERD intangible spending

	BERD08 Internal spending on R&D	BERD08 External spending on R&D
IIA Internal spending on R&D	0.7921**	
IIA Extrnal spending on R&D		0.3843**
**Significant at 5% significance level		

Concluding Remarks

- “ For some assets, nominal investment data and method is good e.g. training, R&D, software, and survey results supportive of macro data after applying confidence intervals
- “ For others, further work is required. Especially %Organisational Processes+ Large component of UK data (~£20bn). Possibly also design
- “ Much more needs to be done to understand asset prices and depreciation rates, and how they differ for each asset
- “ **Insights gained from the IIA Survey: Intangible spending - incidence and amount**
- “ Incidence of non-R&D intangible spend much more widespread than R&D
- “ Incidence of both non-R&D and R&D spend is higher among large & older firms. But non-R&D spend is much more common in services, especially financial services
- “ On average 55% of investment is in-house . so the majority - and purchased 45%

Concluding Remarks

Life lengths

- “ Average benefit lives for all intangibles were >1 year, supporting idea that intangible investment brings long lived benefits
- “ Intangible asset with longest life-length is R&D

Adding estimates of time for development and implementation suggests depreciation rates of:

- 23% for R&D (compared to standard range of 15-20%)
- 40% for other intangibles (compared to 20% in CHS)

Going forward

Still issues to resolve

- “ Definitions of similar activities vary across inds
 - “ i.e. R&D (manuf), design (services)
 - “ So should survey be tailored for each industry?

- “ Difference in values for BP/Design.vs. other methods
 - “ Possible overcounting when use macro assumptions and occupational data
 - “ Or firms just have trouble answering for these assets?

- “ Treatment of life lengths

- “ But clear future agenda

Thank you!

Spares

Response rates by industry

Industries	Total number of questionnaires sent	No reply and Dead	Replied	Refused
AgMin-Utl-Cstr	212	81	88	43
Mfc	551	168	268	115
HTR	613	269	213	131
Fin	195	77	77	41
BSv	433	167	192	74
Total	2004	762	838	404

38% of firms did not respond at all of which some were dead

20% of firms responded to say they would not provide information

The remaining 42% percent of firms (838 firms) provided spending information

Response rates by firm size

Firm Size	Usable Response Rate (%)	% Positive Response*
10-99	47	50
100-499	48	68
500-4999	33	80
5000+	21	76
Total	42	58

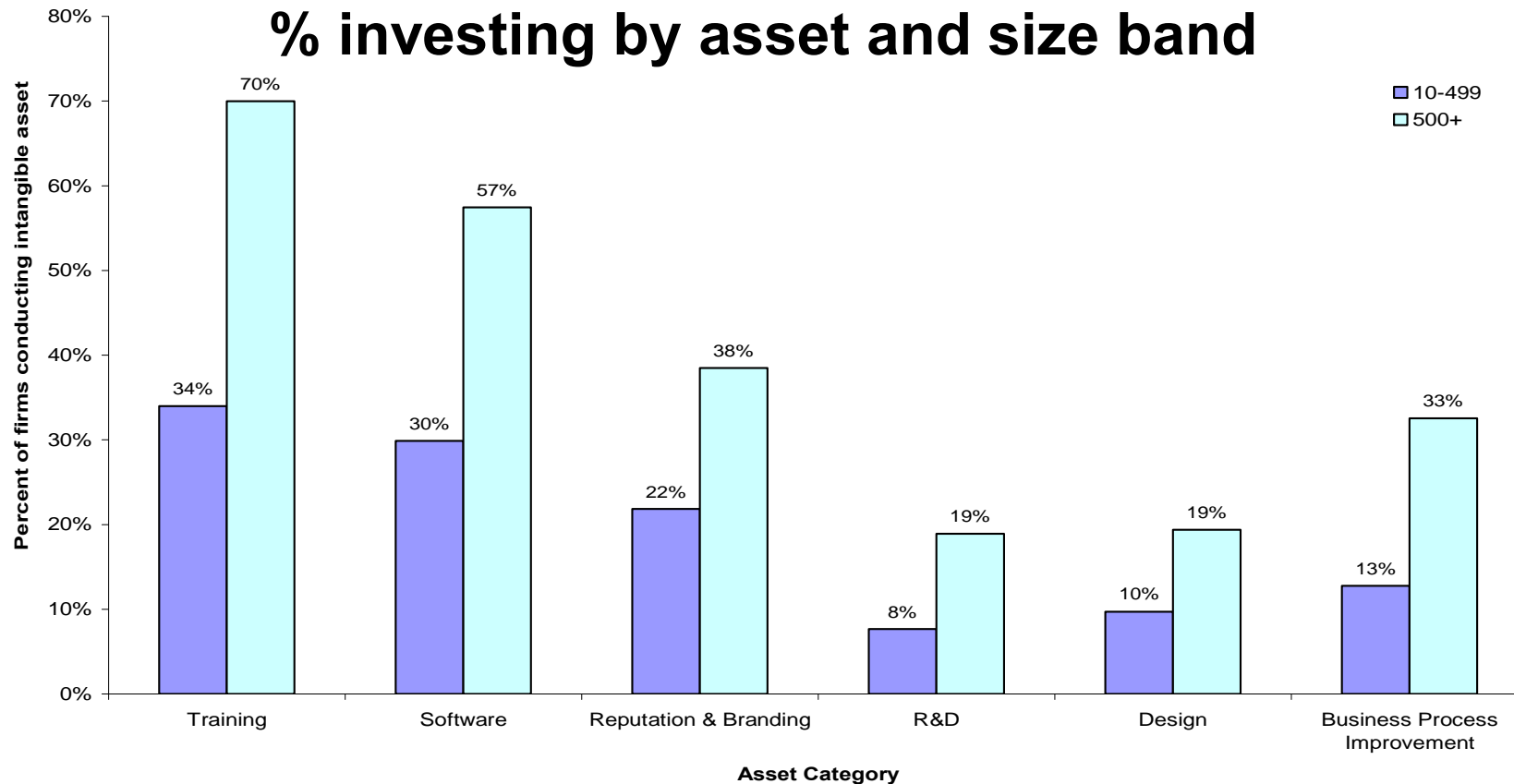
Furthermore, Probit regression analysis shows that:

“Firms who replied were more likely to be small, whereas firms who refused and did not reply at all were more likely to be large

“Among firms that have replied to the survey, large firms are more likely to report positive spending to one or more assets than smaller firms

Thus,

Data are weighted to reflect the characteristics of the population from which the sample was drawn and the pattern of responses received



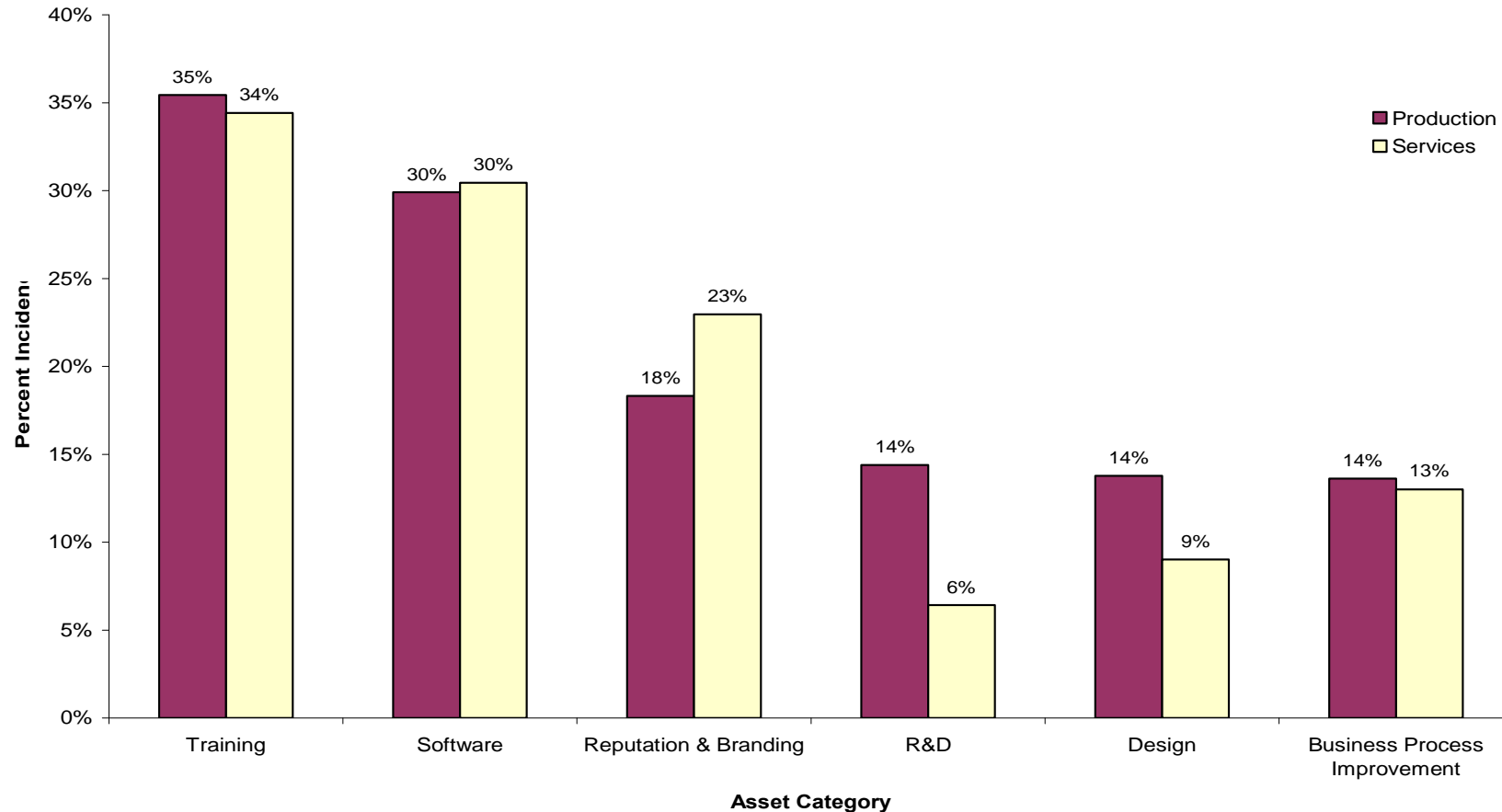
“ Incidence of investment increases with size band.

“ ~70% of all firms with 500+ employees report some employer-funded training, compared with 34% of smaller firms. For software: 57% .vs. 30%

“Less of a differential for Design: 19% .vs. 10%

“ For total intangibles, intangible investment per employee a little higher in larger than smaller firms.

% incidence by broad sector

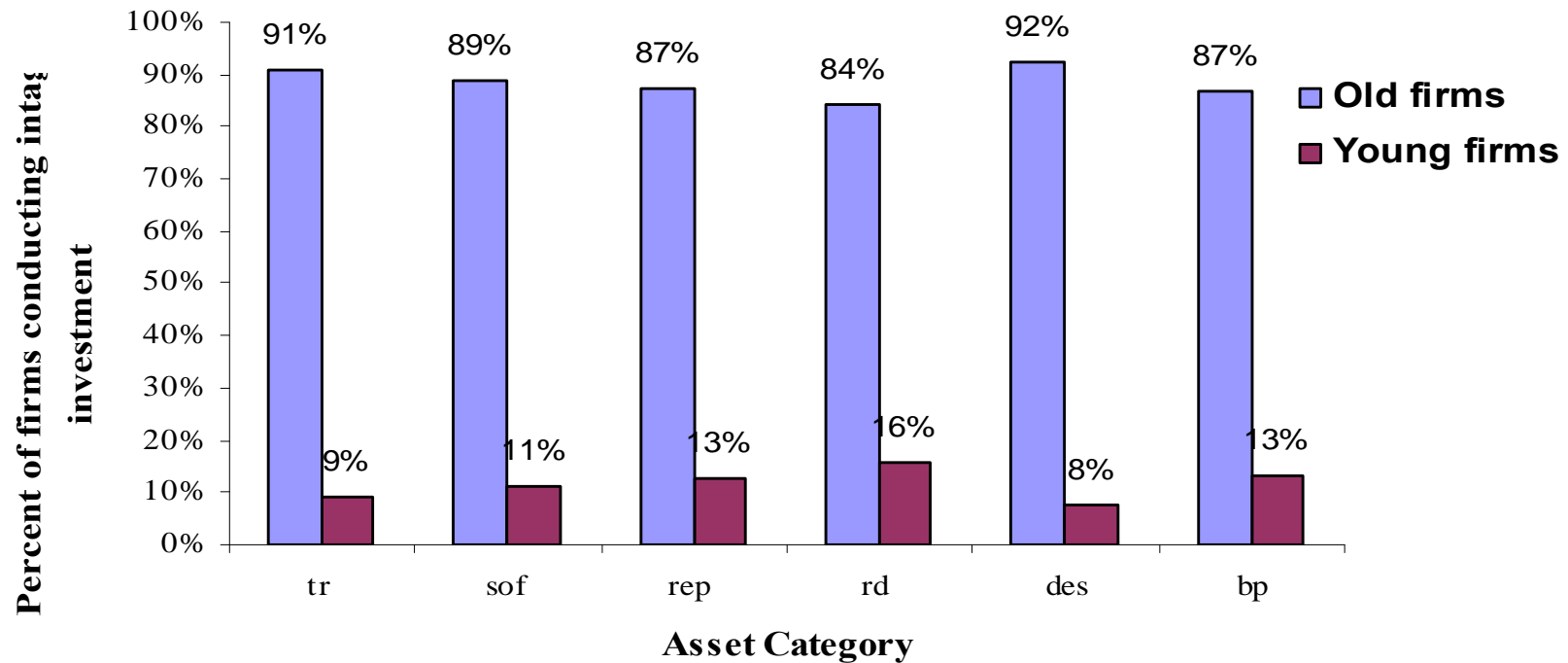


“ Little difference in incidence between firms in production/services for training, software & business process improvement

“ Firms in production have higher incidence of investment in R&D and design

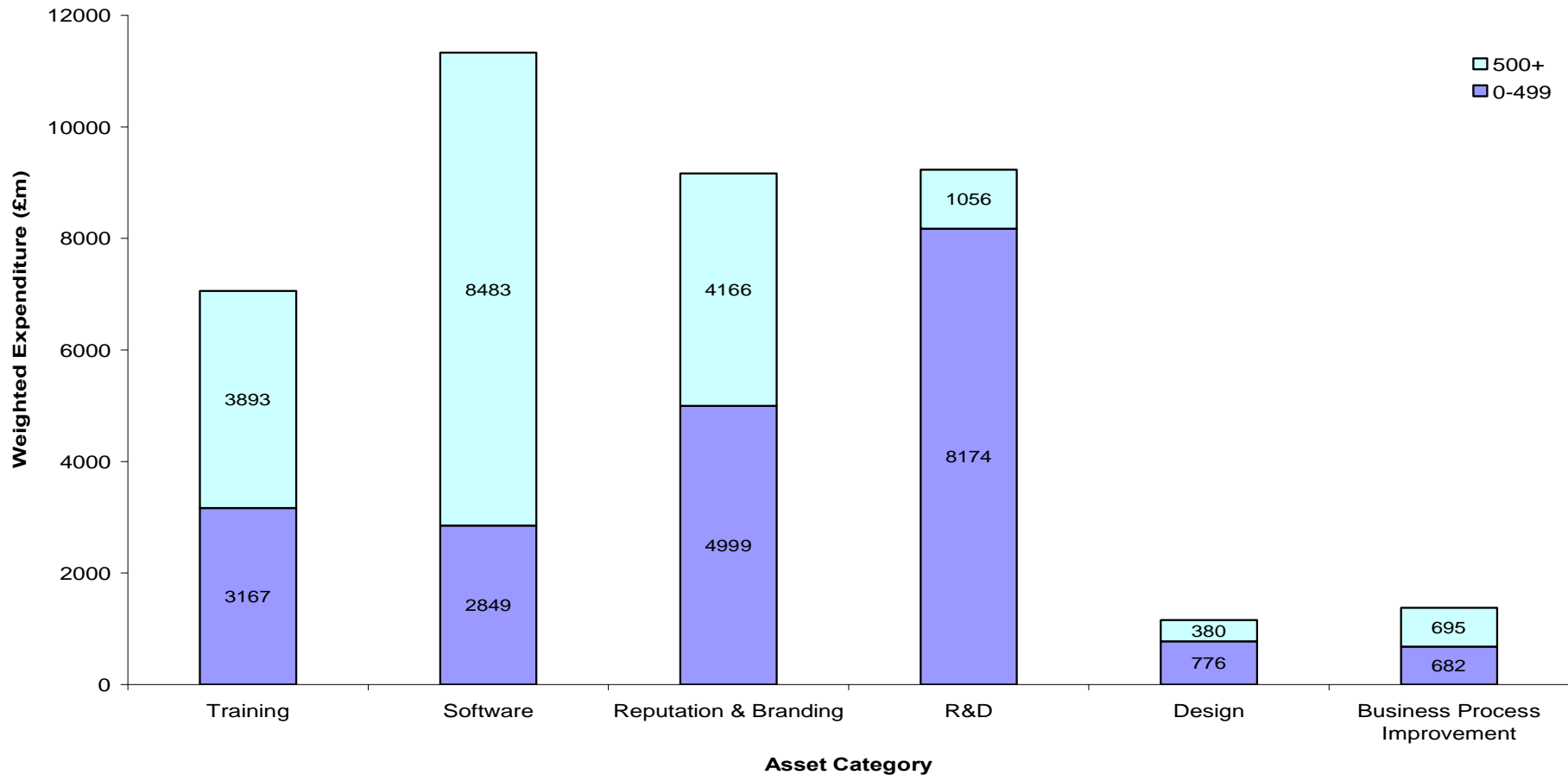
“ Firms in services have higher incidence in branding

% incidence by age



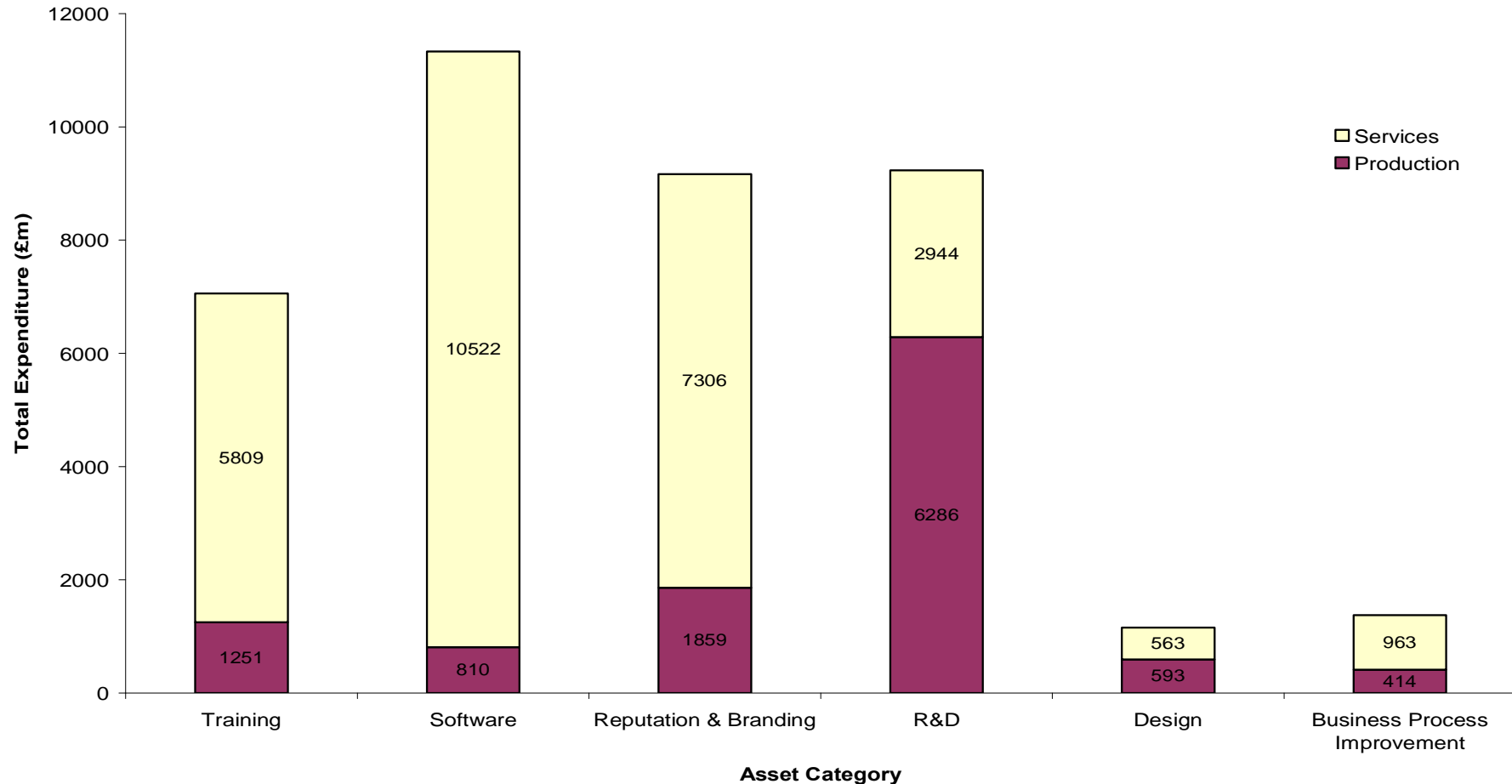
Old firms have the highest incidence in all intangible assets, accounted for 84% or more for each asset

Weighted expenditure by broad size class (£m)



- “ For software and, to a lesser extent, training, there is a bias towards larger firms (500+)
- “ Whereas R&D and design show a bias towards smaller firms (<500)
- “ Almost equal spend by small and large firms

Weighted expenditure by broad sector (£m)



- “ Expenditure is generally higher in the service sector – only exceptions are Design and R&D
- “ Services account for ~80% of UK firms and GVA
- “ Expenditure on R&D and design is higher in the production sector.

Comparison of asset life lengths in years

Intangible Asset	Whittard et al (2009: Small Pilot survey)	IIA
R&D (of which)	8.6	4.6
Production	5.6 - 12.3	5.5
Services	4.7	4.3
Other Intangibles (of which)	5.0	2.7 - 4.2
Production	4.2 - 7.5	2.9 - 5.4
Services	3.2 - 4.1	2.6 . 4

Intangible Asset	UK National Accounts	IIA	IIA 95% conf. Intervals
Software	5	3.2	2.3 - 4.2
R&D	10	4.6	2.9 - 6.3
Training	n.a	2.7	2 - 3.5
Rep.& Branding	n.a	2.8	1.9 - 3.7
Design	n.a	4.0	2.4 - 5.6
Bus. Pr.Impro	n.a	4.2	3 - 5.3

Comparison with other data: Macro Estimates

	IIA survey					CIS07			Haskel et al (2009)		
	Internal	External	Total	95% confidence intervals		Internal	External	Total	Internal	External	Total
				Low	High						
Training	2.3	4.7	7	6	8	-	-	1	-	-	32
Software	7.7	3.6	11	4	18	-	-	10	10	10	20
Reputation and Branding	3	6	9	7	11	-	-	5	-	-	14
R&D	5	4	9	2	16	6.5	1.5	8	26	17	15
Design	0.8	0.3	1	1	2	-	-	1	0	0	22
Business Process Improvement	0.7	0.6	1	1	2	-	-	-	20	8	26

- “ Between 2007-09, ONS market sector data on nominal software and hardware investment fell; indicative of general intangible spending
- “ IIA is a small, voluntary survey, which excludes firms with <10 employees
- “ 89% of design consultancies and in-house teams have <10 employees (Design Council)
- “ Business Process Impr.: the internal macro numbers are from an assumed fraction (20%) of managerial time and the external ones from 80% of management consultancy earnings in sales to the private sector

Comparison of off-the job training expenditures

£bn	NESS07	IJA09
Total	14.0	7.1
Of which		
In-house	11.0	4.7
External	3.0	2.4
Breakdown of In-house		
Imputed labour costs	4.8	3.8
Other In-house	6.2	0.9

	External		In-house			
	Production	Services	Imputed labour costs		Other In-house	
			Production	Services	Production	Services
NESSS (£bn)	0.8	2.2	1.5	3.4	1.3	4.9
IJA (£bn)	0.4	1.9	0.6	3.1	0.2	0.7
NESS as % of IJA	200%	116%	229%	108%	672%	687%

Comparison of software estimates

£bn	National Accounts (2009)		IIA (2009)	
Own-account	12.5		7.7	
<i>Of which:</i>				
<i>Production</i>	2.8	▼ (22%)	0.3	▼ (4%)
<i>Services</i>	9.7	▼ (78%)	7.4	▼ (96%)
Purchased	8.7		3.6	
<i>Of which:</i>				
<i>Production</i>	1.6	▼ (18%)	0.5	▼ (14%)
<i>Services</i>	7.1	▼ (82%)	3.1	▼ (86%)

- “ **For software: IIA estimates lower than National Accounts**
- “ **Difference more marked for purchased, but sector splits are similar**
- “ **Very big difference in the sector split for own-account**
- “ **Possibly due to lack of response from larger firms**

Design Council .vs. IIA Survey (private sector)

UK Design Council Estimates:

“ **Weighted total spend:**

. **Purchased: £11.2bn**

(£7.6 bn design consultancies and £3.6 for freelancers)

. **In-house: £3.8 bn**

(59% of in house teams located within a private sector business)

“ **large firms are defined as having 100 or more employees**

“ **Design Council uses a wider design definition**

	In-house design expenditures	
	Design Survey (£bn)	Intangibles Investment Survey (£bn)
All firms (838)		0.8
Only large firms (274)	2.24	0.4