Globalinto Survey on Intangible Investments: Main Findings and Key Messages

Yannis Caloghirou, Prof. LIEE/NTUA
Dr. Aimilia Protogerou, Senior Researcher, LIEE/NTUA
Aggelos Tsakanikas, Asc.Prof. LIEE/NTUA
Panagiotis Panagiotopoulos, Post-doc Researcher LIEE/NTUA

Workshop: Intangibles and COVID19 –
Results from the GLOBALINTO Survey of Intangibles
Tuesday April 5, 2022, 14.00-16.00 CET (online)

This project has received funding from the *European Union's Horizon 2020 The mechanisms to promote smart, sustainable and inclusive growth* under grant agreement No 822259.

Fritz Matchup's book (1962): The Production and Distribution of Knowledge in the United States, Princeton University Press

- An attempt to measure the size of the information economy, based a) on a **very wide definition of knowledge industries** and b) the share of "**information occupations**" in these industries. He estimated that **over 30% of the US labor force** were engaged in occupations essentially concerned with producing and handling information rather than goods. He also estimated that, in 1958, the knowledge economy accounted for $ 136.4 million or one-third of the economy (29% of GNP).
- Machlup was the first to measure information and knowledge as a broad concept, while other earlier measurements were concerned with the production of scientific knowledge, namely R&D [e.g. Bernal (1939), R&D expenditures in Britain] not its distribution.
- Matchup's calculations gave rise to a whole literature on the knowledge economy, the information economy and the information society, its policies, and its measurement [i.e. **Porat (1977), The Information Economy: Definitions and Measurement, vols 1-9, USGPO**].
- The **Information Society** is considered as a long process of growth of **Intangible Investment in information-based activities (Freeman & Soete, The Economics of Industrial Innovation, 1997).**

The significance of Investment in Intangible assets

- According to a 2006 Federal Reserve Board analysis, investment in intangible assets in the United States exceeds all investment in tangible property and, if properly accounted for, would raise measured productivity growth significantly (Corrado et al., 2006a, 2006b).
- *Even though economic disruptions, IAs investments have increased.* Over the past 25 years**, the investment mix has shifted towards intangibles**. Specifically, the investment share of intangibles increased by 29%, while the relevant share of investment in tangibles decreased by 13% (the US and 10 European Economies, 1995-2019) (McKinsey Global Institute, 2021)

GLOBALINTO

Why surveying business investments in intangible assets is hard, but necessary (Martin and Baybutt, 2021)*

- Although IAs are gradually recognized as significant sources of business growth and productivity gains, **the measurement** of their value and contribution are still in their **infancy**.
- Despite the need for **regular** and **systematic** measurement of intangibles, their treatment is frequently inconsistent and uncoordinated resulting in **severe limitations** in measurement.
- In particular, **business surveys are relatively scarce** and entail several challenges both for respondents and data collectors.

*IARIW-ESCoE Conference "Measuring Intangible Capitals and their Contribution to Growth", November 11-12, 2021, RSA House

Challenges of surveying businesses

There are a number of measurement challenges characterized as 4 Fs (Martin and Baybutt, 2021)

First, data on intangibles are difficult to collect from businesses given the lower chance of data on these being regularly and consistently recorded: these intangible assets can be ***forgotten*** by businesses.

Second, with precise data on intangible investment rarely recorded and retrievable by businesses, their responses might often be 'best guesses or estimates: the ***framing*** of surveys on intangible might be especially important.

Third, the measured concept of intangibles is not always clear to researchers, let alone businesses: These terms, for businesses and researchers: they are ***fuzzy***.

Fourth, unlike most investments, the creation of intangible assets (especially for internally developed intangibles) can take a long time. Providing investments data in any given period might cause problems: the **frequency** of surveys can therefore be key.

Business Surveys

- Business Surveys **measuring in a direct and integrated way intangible assets investments**
  - ONS (Office for National Statistics), Imperial College London and NESTA (UK), 2009 & 2011
  - INAPP and ISTAT (Italy), 2013
  - Innobarometer survey, 2013 & 2015
  - European Investment Bank Investment Survey (EIBIS), 2016 onwards (annually)
- Business Surveys **touching on specific dimensions of intangibles**:
  - **EU's Community Innovation Survey**, 1992 – onwards (every two years since 2006): Intangibles are simply treated as activities in which enterprises might have engaged for innovating (e.g. *Did your enterprise engage in the following innovation activities: a) In-house R&D, b) External R&D, c) Acquisition of existing knowledge from other enterprises or institutions, d) Training for innovation activities, e) Market introduction of innovations, f) design*)
  - **National surveys** e.g.:
    - UK (e.g. Annual Business Survey: software and other IPPs; Business Enterprise R&D Survey; Employer Skills Survey: Training and Organisational Capital; Annual acquisitions and disposals of Capital Assets Survey: Software, mineral exploration and evaluation)

GLOBALINTO

Business Surveys on intangible assets spending

Survey	Components of IAs	Measurement Approach	Other issues under Investigation	Sample
ONS (Office for National Statistics), Imperial College London and NESTA (UK), 2009 & 2011	• Training (employer funded) • Software • Reputation & Branding • R&D • Design • Organisation / Business Process Improvement	• Expenditures ➢ In-house ➢ Purchased • Assets life-lengths / depreciation rates		• 838 UK firms with 10+ employees (Sample Source: firms participated in CIS) • Sample stratified by industry & employment ➢ Over-sample to knowledge-intensive industries: Engineering; ICT; Financial Services ➢ Under-sample: Construction; Utilities; Distribution; Accommodation
INAPP and ISTAT (Italy), 2013	• Training • Software/Databases • Reputation & Branding • R&D • Design • Organisation and Management & Production Processes Improvement • Other (sector specific) IAs	• Expenditures ➢ In-house ➢ Purchased • Assets life-lengths / depreciation rates • Ratio of internal/external use for specific IAs (R&D, Software/Databases, Design)	• Effect of the economic crisis on Intangible Assets Investments	• 10.631 Italian firms with 10+ employees • Sectors: ➢ Manufacturing ➢ Services
Innobarometer Survey, 2013	• Training • Software • Reputation & Branding • R&D • Design • Organisation / Business Process Improvement	• Expenditures <u>but via qualitative scales</u> ➢ In-house ➢ Purchased	• Investments in IAs ➢ Expected Benefits ➢ Motivation / Obstacles ➢ Impact ➢ Relation to innovation projects • Innovation	• 11.317 firms with 1+ employees in EU28 and other 8 non-EU countries • Sectors: ➢ Manufacturing ➢ Services ➢ Utilities

GLOBALINTO

Business Surveys on intangible assets spending

Survey	Components of IAs	Measurement Approach	Other issues under Investigation	Sample
Innobarometer Survey, 2015	• Training • Software • Reputation & Branding • R&D • Design • Organisation / Business Process Improvement	• Expenditures <u>but via qualitative scales</u> ➢ In-house ➢ Purchased	• Investments in tangibles • The use of design within the firm • Use of innovative manufacturing technologies • Innovation ➢ Investments for innovation activities ➢ Innovation performance ➢ Barriers, obstacles and public support for innovation commercialisation ➢ Role of public procurement in innovation development	• 14.118 European firms with 1+ employees in EU28 countries, Switzerland and the United States • Sectors: ➢ Manufacturing ➢ Services ➢ Utilities ➢ Construction
European Investment Bank Investment Survey (EIBIS), 2016 onwards (annually)	• R&D • ICT • New skills • Organizational improvements	• Decision to invest • Investments intensity	• Tangible investments, • Future investment plans, • Sources of finance, • Financing issues and other challenges-obstacles that businesses face, • Firm performance, e.g. ➢ Innovation behaviour	• Approximately 13.300 firms with 5+ employees in EU27, the United Kingdom and, since 2019, in the United States • Sectors: ➢ Manufacturing ➢ Services ➢ Construction ➢ Utilities
Globalinto Survey	• R&D and External knowledge acquisition • Training • Organisation / Business Process Improvement • Software & Databases • Design • Reputation & Branding	• Decision to invest • Investments intensity ➢ In-house ➢ Purchased	• Business strategy and export activity • Human & Technological Resources • Dynamic, digital and design capabilities • Firm performance: Innovation and Economic • Policy measures: Tax incentives and direct subsidies • Impact of Covid-19 pandemic on intangible investments, economic performance and digital transformation	• 1.796 firms with 20+ employees in Germany, France, UK, Denmark, Greece, Finland and Slovenia • Sectors: ➢ Manufacturing ➢ Services ➢ Energy

Positioning of Globalinto Survey among other Intangible Surveys

- The Globalinto Survey **adds to the existing studies** by:

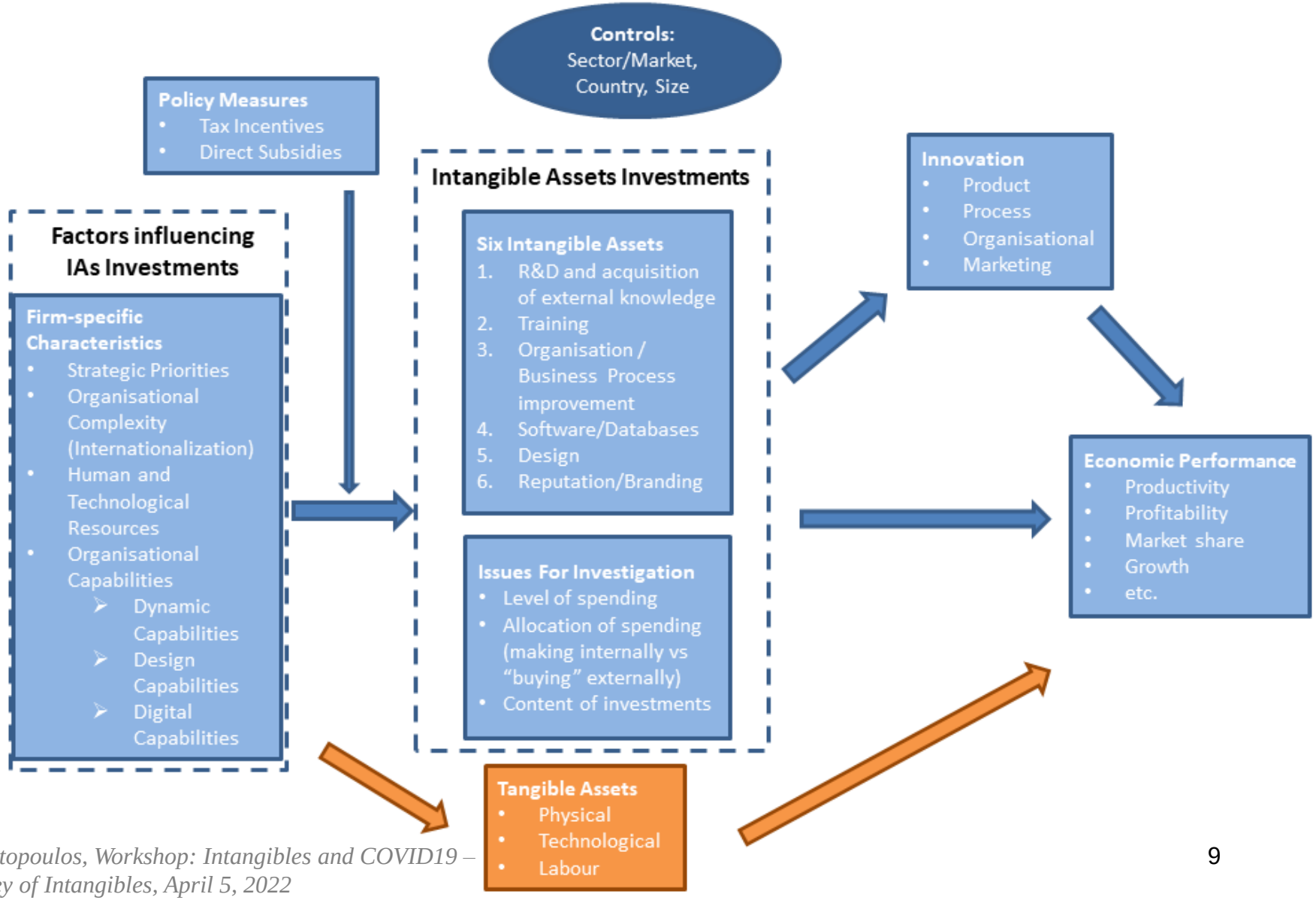
a) developing **a more comprehensive view of business' spending on intangible assets** contributing to the improvement of the micro level measurement approach,

b) identifying the **factors influencing these investments**,

c) assessing their **impact on enterprise (economic and innovation) performance**, and

d) investigating the **role of relevant policies** and **impact of Covid-19 pandemic** on the level of these investments.

Conceptual Framework



The Impact of the Survey
Using the Survey results in Papers and Book Chapters (indicatively)

- Papers in Special Issue of Science and Public Policy:
  - Intangible Investments and Innovation: Evidence from the Globalinto Pilot Survey (Aimilia Protogerou, Panagiotis Panagiotopoulos, Aggelos Tsakanikas, Yannis Caloghirou)
  - Intangibles and strategic agility in the COVID crisis, analysis, and policy implications (Ahmed Bounfour, Alberto Nonnis)
  - Intangibles creating technical advance and knowledge – Evidence from Nordic countries and Slovenia (Hannu Piekkola)
  - Intangibles in firms and public policy. Evidence from the Globalinto Pilot Survey (Jakob Edler, Sarada Gadepalli)
- Chapters in the Book: "Measuring intangibles and productivity – a micro, meso and macro perspective" (eds): C. Bloch, A. Protogerou, N. Vonortas)
  - The impact of intangibles on firm performance and the role of the COVID-19 crisis: new findings from the Globalinto large-scale survey on intangibles investments (LIEE-NTUA and UL teams)
  - Intangibles and entrepreneurial management for higher growth in the digital age (Hannu Piekkola, Ahmed Bounfour)
- Other manuscripts:
  - Academic article on intangibles in GVC and export performance (LIEE-NTUA team)

An additional challenge of Globalinto Intangible Survey: The Covid-19 pandemic

- The fieldwork progress was significantly affected by the **Covid-19 pandemic**
  - **Many businesses were closed** [e.g., many companies with answering machines informing that company was closed due to Covid-19]
  - **Difficulty to reach the appropriate respondent** due to teleworking [e.g., numerous respondents worked from home, and were only contactable by email]
  - **Lower availability of time** for questionnaire completion [e.g., many businesses reduced staff and opening hours, thus had less time for their usual, day-to-day business responsibilities]

Implications of Survey Findings

- **Academic Community**
  - Providing insights about the role of intangibles in firms' operation and performance, as well as the internal and external factors that influence the existence and intensity of these investments (business strategy and organisational characteristics, competition intensity, policy measures etc.)
- **Surveys for Intangible Assets**
  - Methodological and empirical contribution
- **Business firms**
  - Informing strategic decisions on the appropriate mix of IAs investments and developing specific organisational capabilities so as to improve innovation and long-term economic performance.
- **Public administration and other public organizations**
  - Informing strategic decisions on the appropriate mix of IAs investments and developing specific organisational capabilities so as to improve public organisations efficiency, effectiveness and accountability.
- **Public Policies**
  - Informing policy formulation (system of policies & mix of measures diversified per sector, firm type etc.) at a EU and national level to support IAs development and effective use.
- **Civil Society**

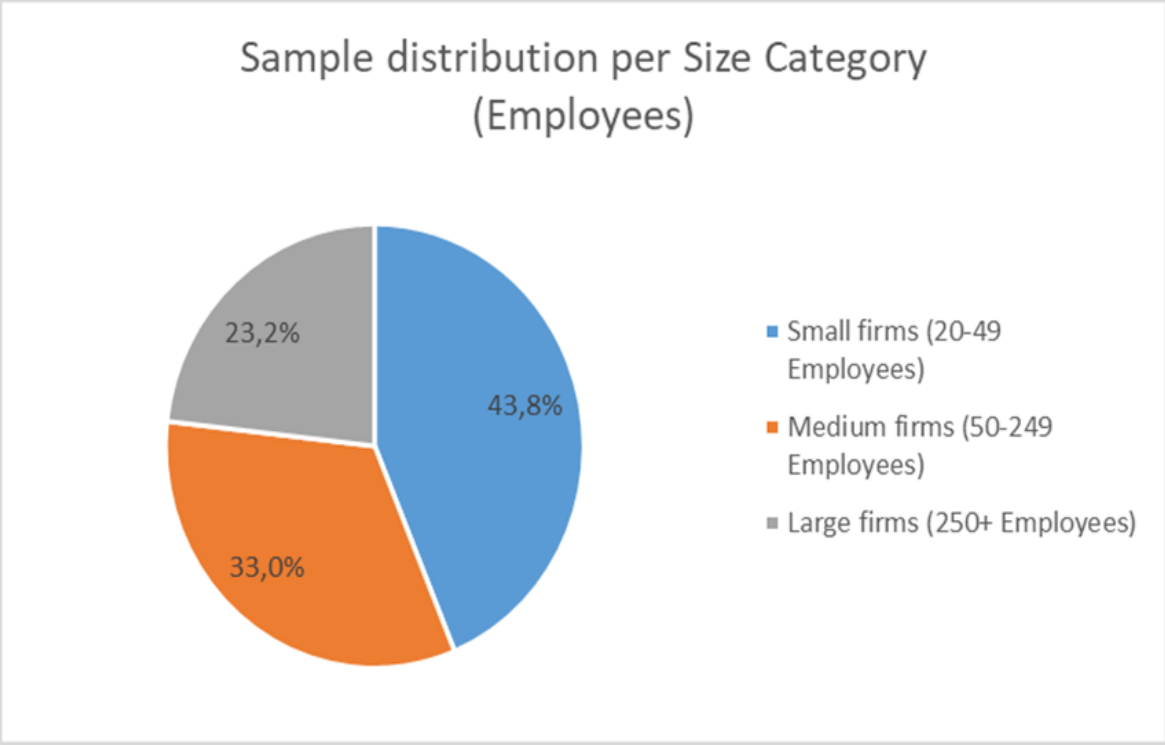
Sample Characteristics

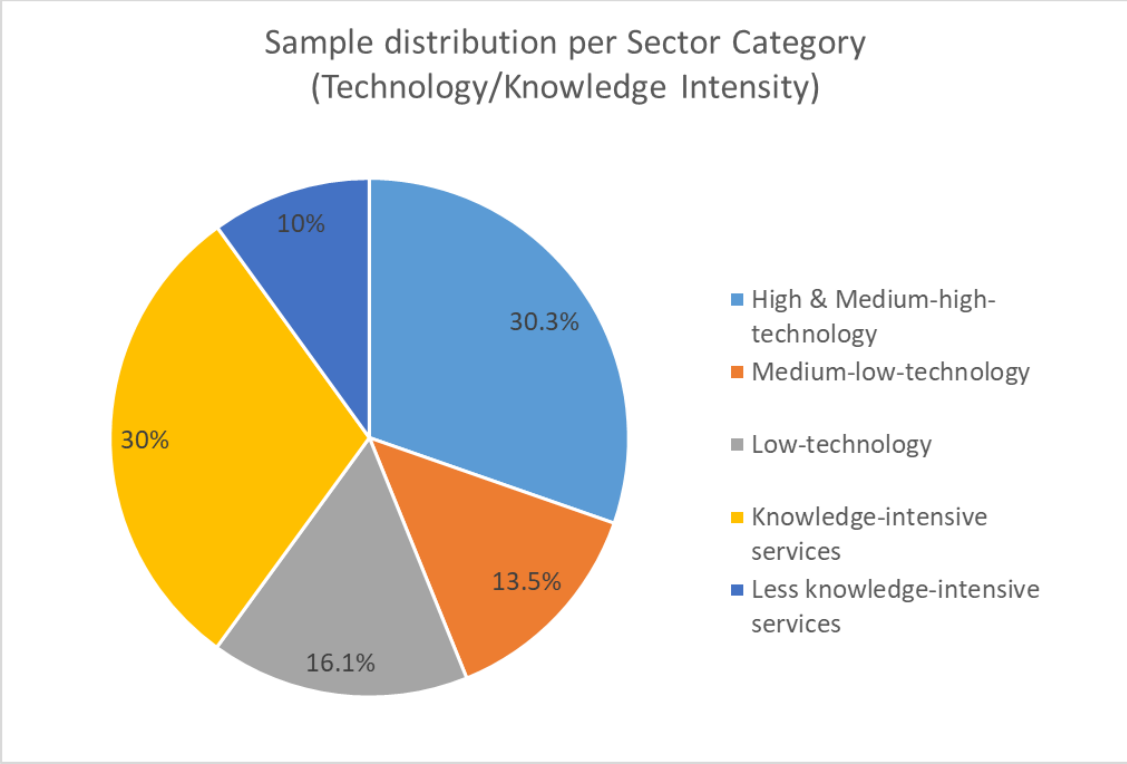
Globalinto Survey Sample: 7 countries and 1796 SMEs and Large Firms from Manufacturing and Services

	Manufacturing SMEs (20-249 employees)	**Manufacturing Large** (250+ employees)	**Services SMEs** (20-249 employees)	**Services Large** (250+ employees)	**TOTAL**
Denmark	99	30	66	20	215
Finland	99	29	66	21	215
France	145	43	96	30	314
Germany	143	43	95	29	310
Greece	98	30	67	20	215
Slovenia	99	33	66	17	215
UK	144	43	96	29	312
TOTAL	**827**	**251**	**552**	**166**	**1796**

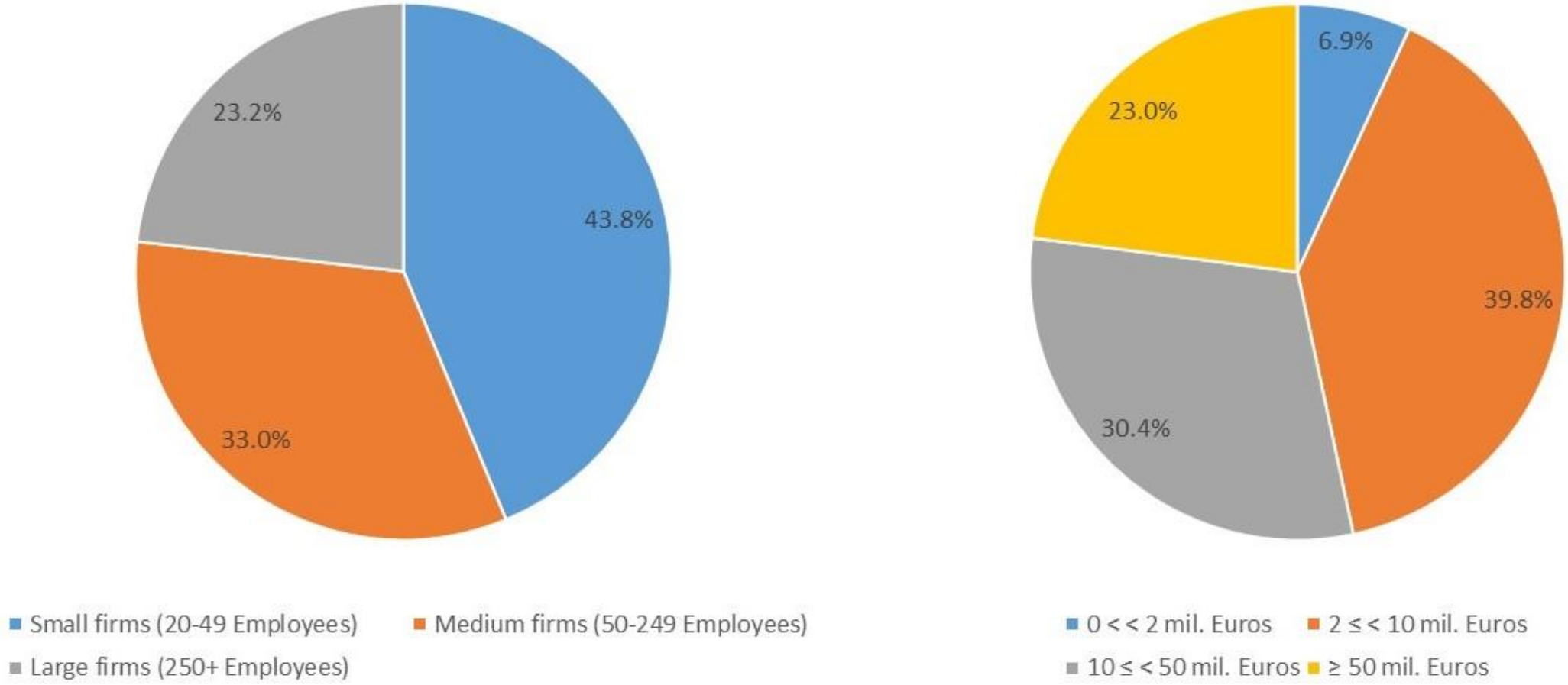
Sample characteristics

- Manufacturing: 60%, Services: 40%
- 60% are high and medium-high tech manufacturing firms and knowledge-intensive services
- Almost two thirds (63.6%) have less than 100 full-time employees

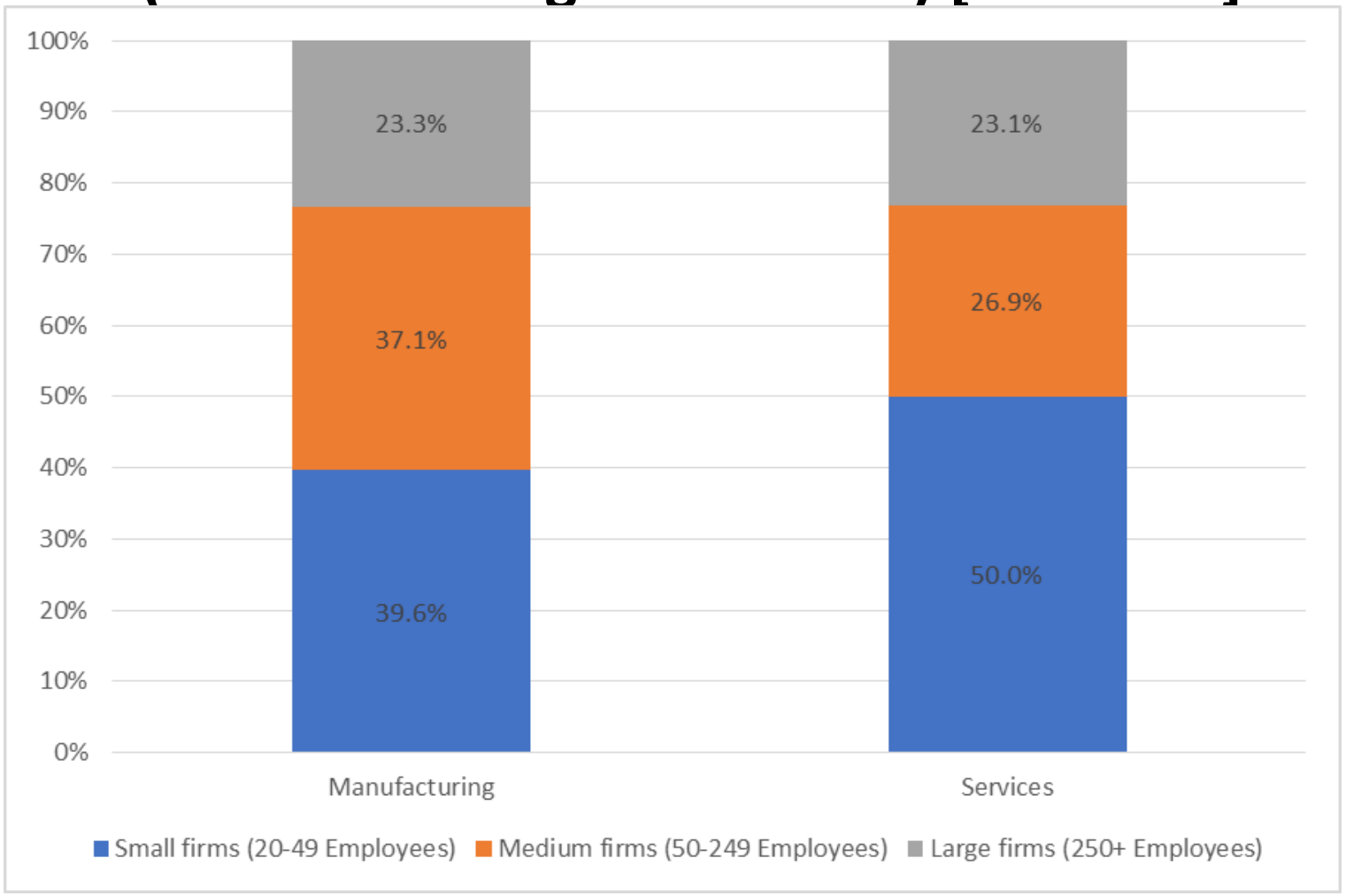




Sample distribution by firm size (number of employees & annual turnover) [N = 1796]



Sample distribution by firm size (number of employees) and sector (manufacturing vs. services) [N = 1796]

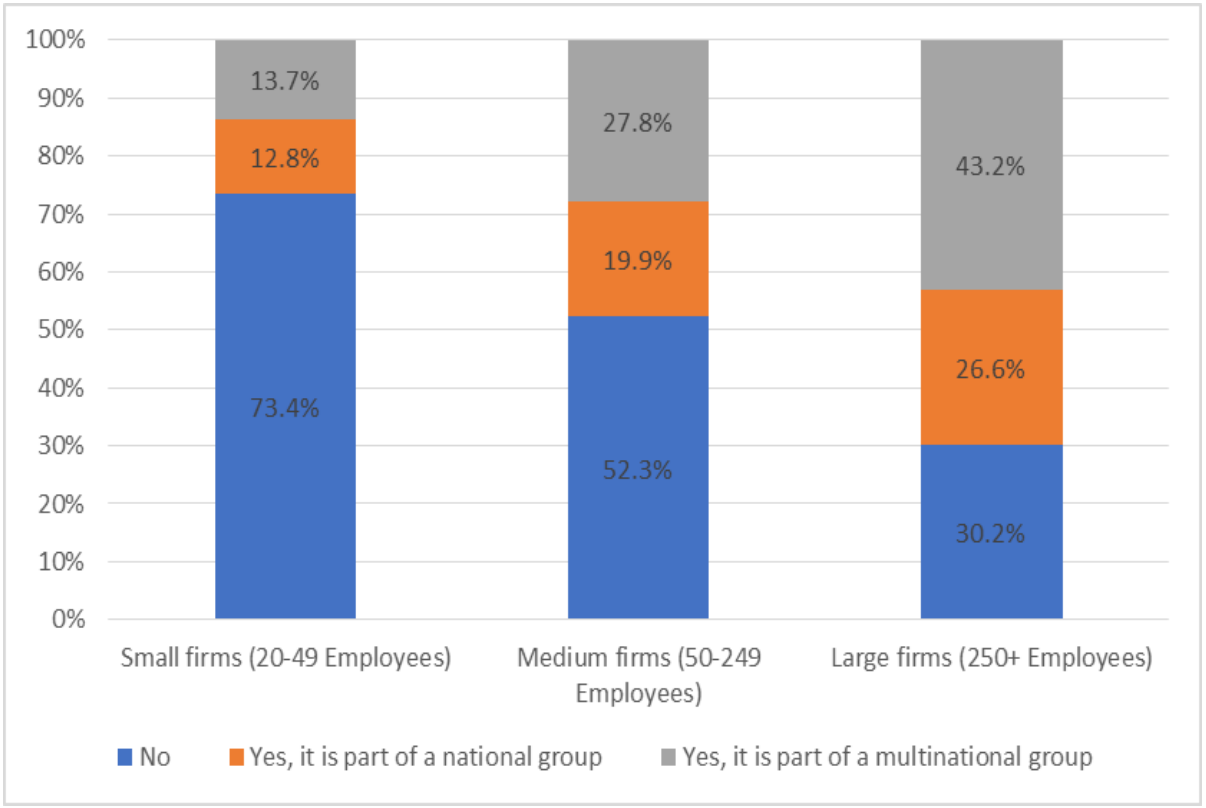


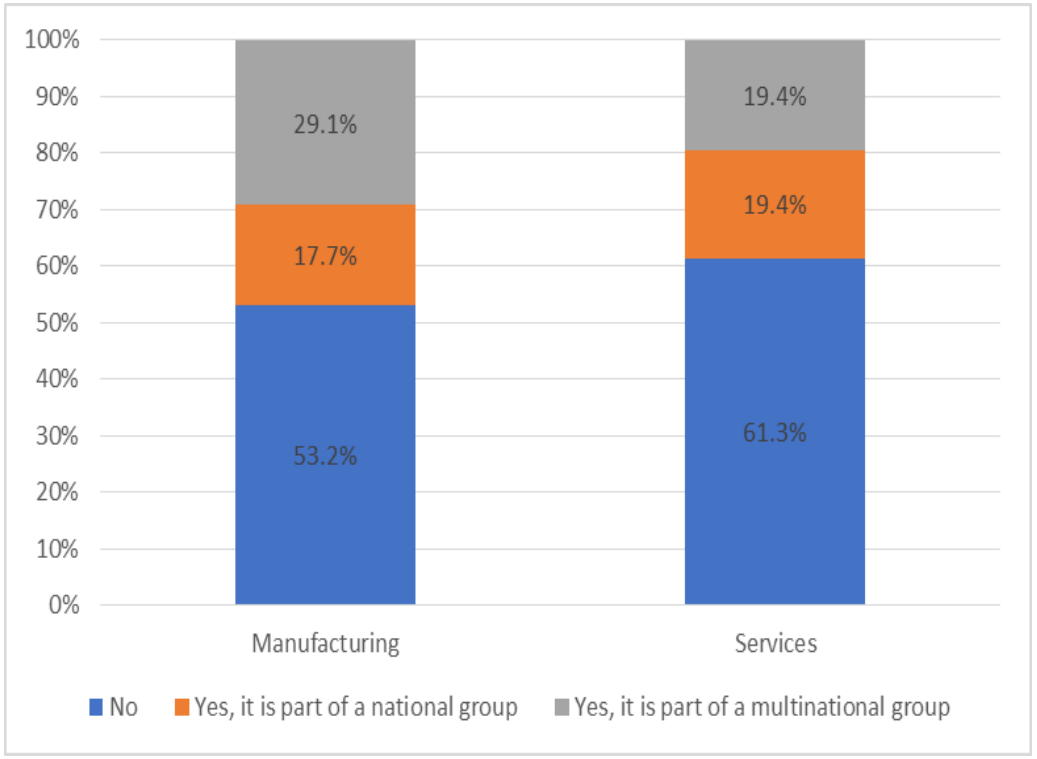
Sample characteristics

	High & Medium-high-technology	Medium-low-technology	Low-technology	Knowledge-intensive services	Less knowledge-intensive services	TOTAL
Denmark	35.8%	12.6%	11.6%	37.7%	2.3%	100%
Finland	30.7%	18.6%	10.2%	34.4%	6.0%	100%
France	31.2%	11.8%	16.9%	19.1%	21.0%	100%
Germany	33.9%	13.2%	12.9%	36.5%	3.5%	100%
Greece	18.1%	10.7%	30.7%	18.6%	21.9%	100%
Slovenia	24.7%	20.9%	15.8%	24.7%	14.0%	100%
UK	34.3%	9.6%	16.0%	37.8%	2.2%	100%

Sample distribution by enterprise group and firm size [N = 1796]

- The majority of firms (56.4%) do not belong to a business group.
- Size matters: 7 out of 10 large firms belong to a business group.



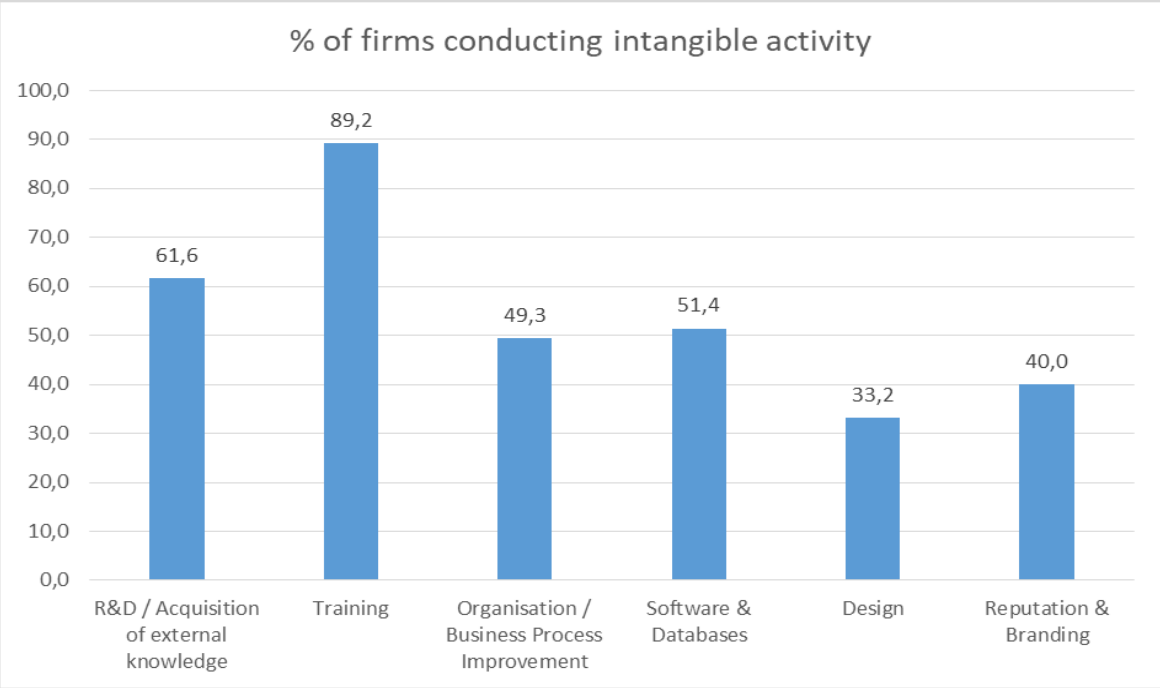


Main Findings

Intangible activity per asset category

The **vast majority** of firms report some **training activity** (9 out of 10 firms)

- The **majority** of firms (over 61%) also **spend on R&D**
- **Design** is characterised by the **lowest percentage of firms** (1 out of 3 firms)
- Only 65 firms (3,6%) report no intangible activity
- **Size matters:** Larger firms exhibit higher intangible activity

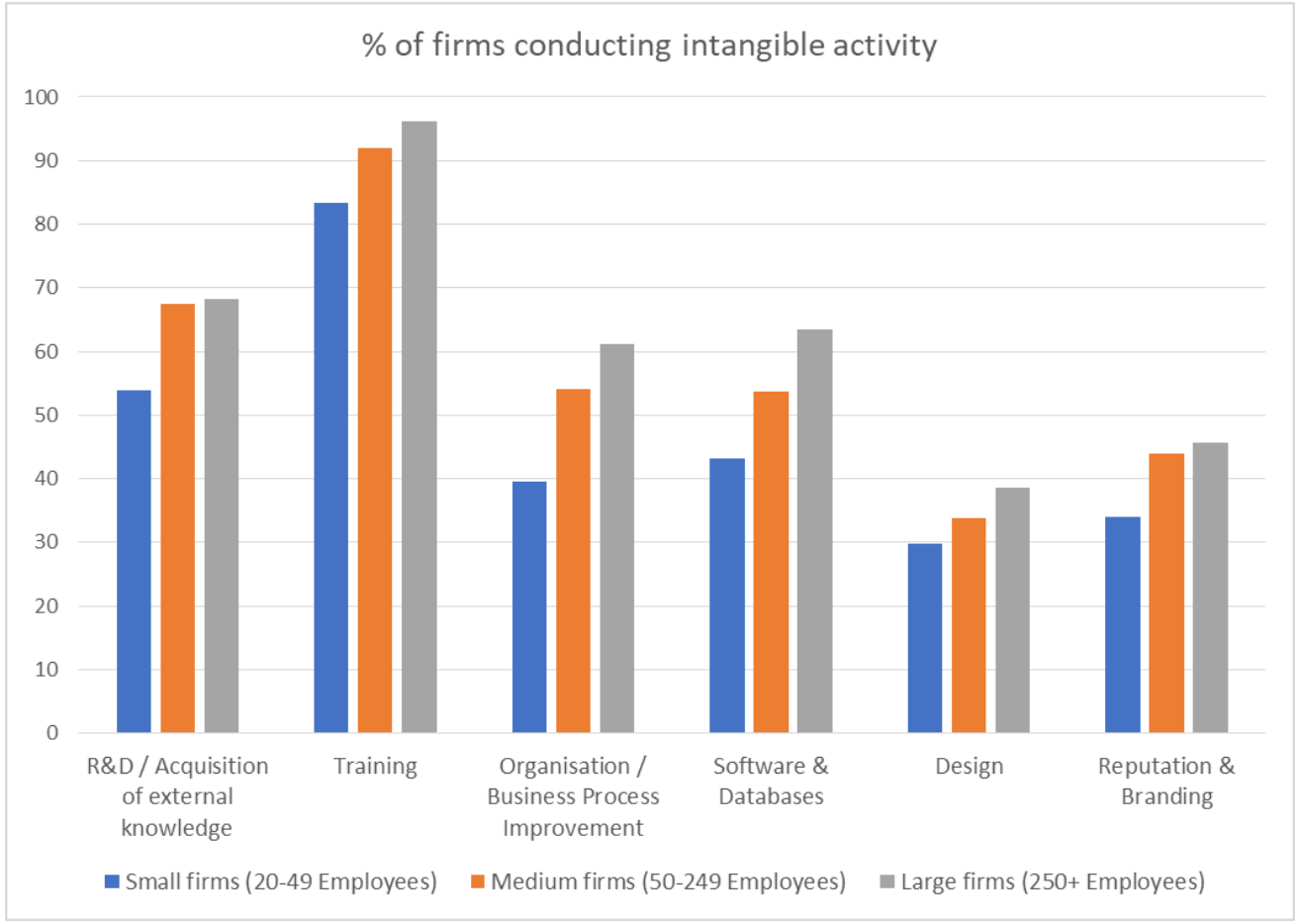


- **Almost half of firms** (45.9%) make investments in **3 or 4 intangible categories**

Number of intangible categories	Firms (%)
0	3.7
1	10.4
2	17.7
3	23.4
4	22.5
5	15.2
6	7.2

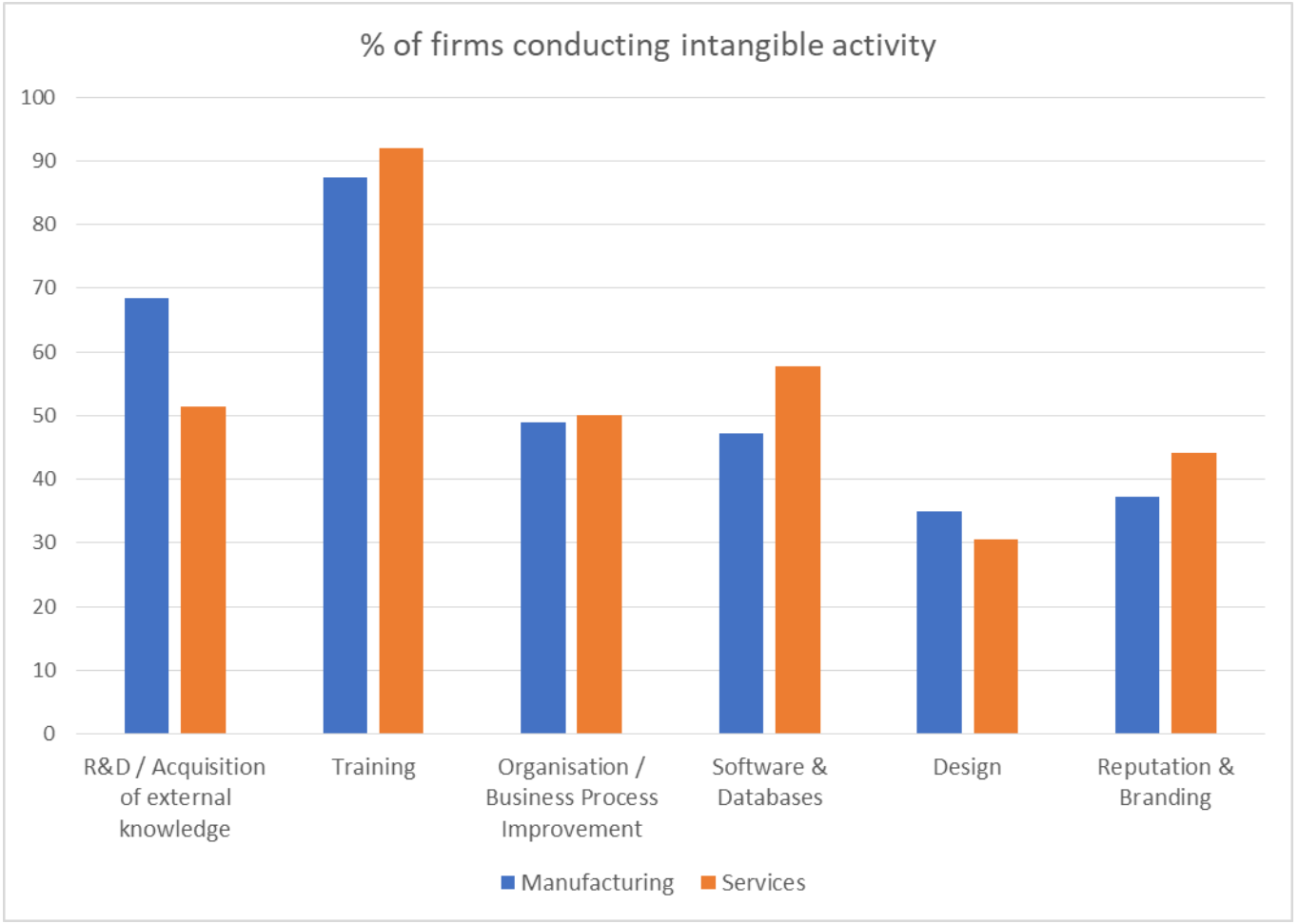
Intangible activity per asset category and firm size

- Larger firms exhibit higher intangible activity, especially in:
  - ➢R&D
  - ➢Organisation / Business Process Improvement
  - ➢Software & Databases



Intangible activity per asset category and firm sector

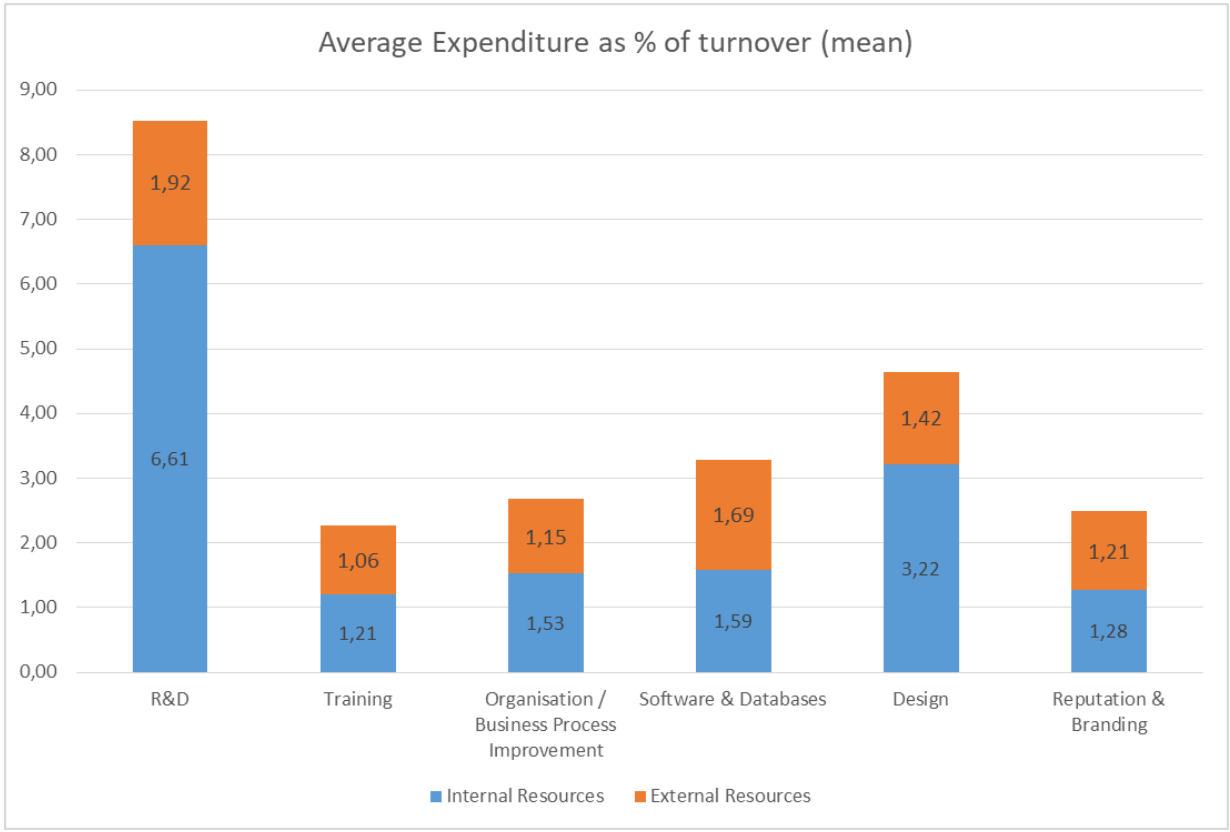
- Manufacturing firms exhibit much higher R&D activity
- A higher share of service firms invest in:
  - ➢Software & Databases
  - ➢Reputation & Branding



Average spending (in-house and purchased) as percentage of turnover by asset type

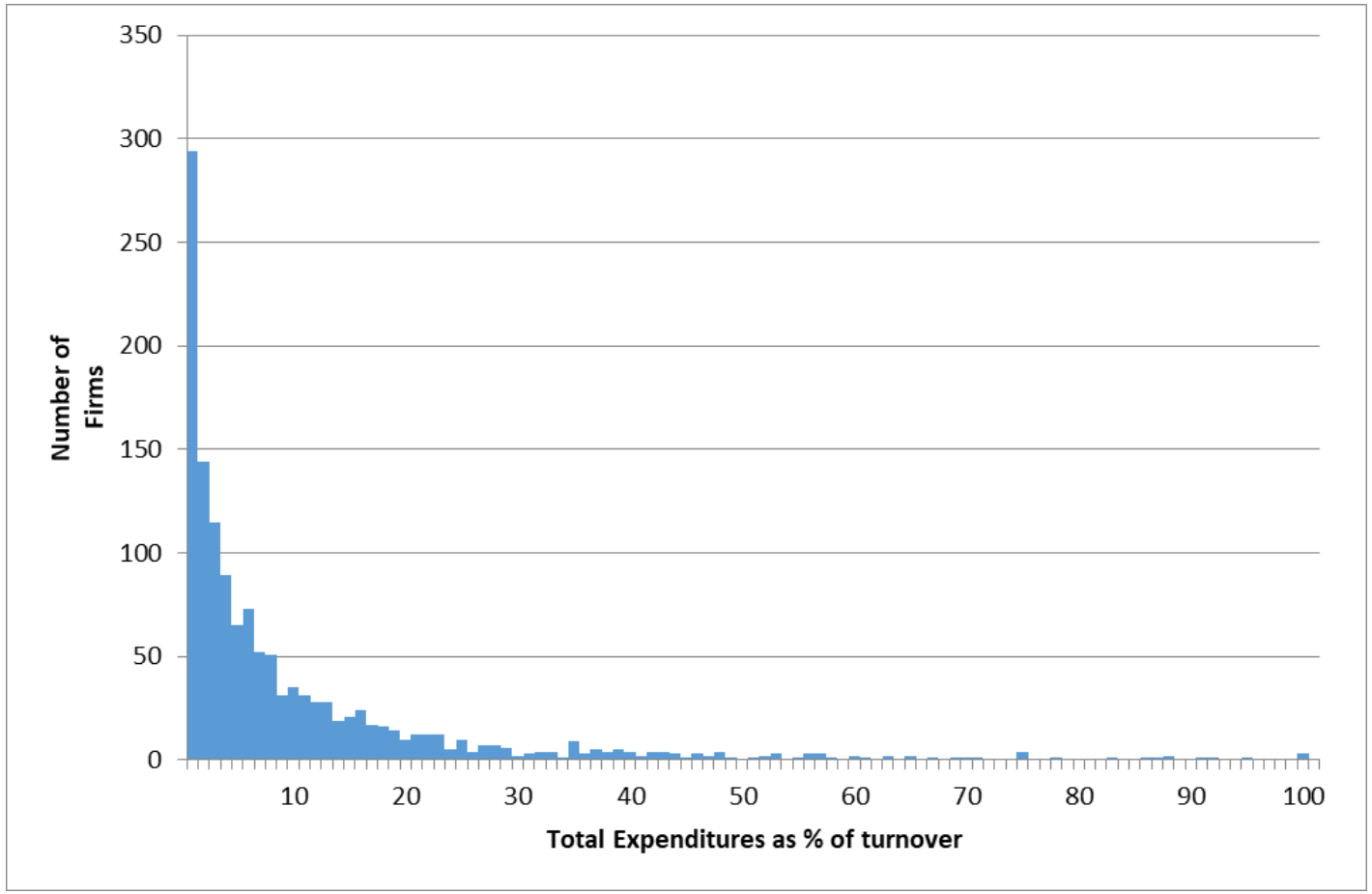
- **In-house R&D spending** prevail followed by in-house design and purchased software and databases

Type of Intangible Asset	In-house			Purchased		
	Number of Firms	Mean	Median	Number of Firms	Mean	Median
R&D*	894	6.61	3	386	1.92	1
Training	996	1.21	0.5	1255	1.06	0.5
Organisation / Business Process Improvement	706	1.53	0.5	749	1.15	0.4
Software & Databases	777	1.59	0.18	804	1.69	0.9
Design	499	3.22	0.5	518	1.42	0.3
Reputation & Branding	612	1.28	0.5	641	1.21	0.5



*The mean and median values regarding the expenditures in **acquisition of external knowledge** as % of turnover are **1.84% and 0.5%** respectively (N=288).

Total investment in intangible assets (all IA types)



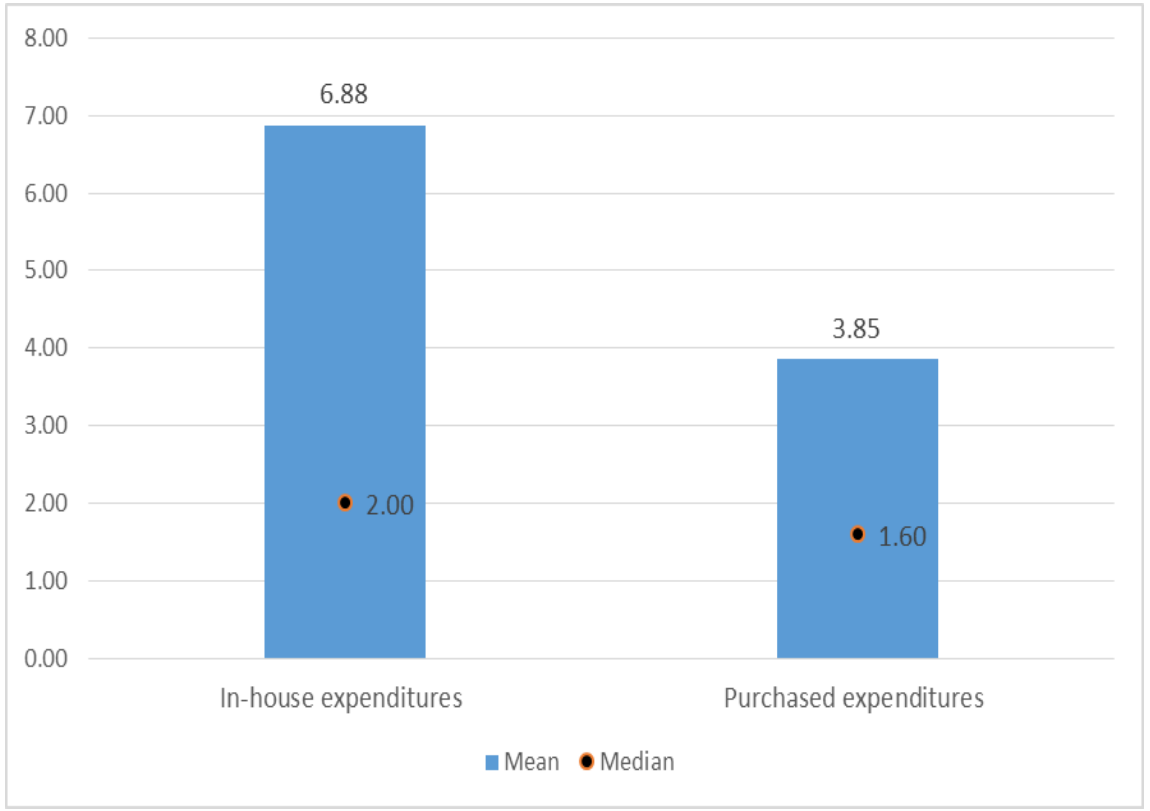
Spending (as % of turnover)	Firms (%)
0 - 1%	21.8
1 - 5%	30.5
5- 15%	27.3
15 - 25%	9.8
25 - 50%	6.8
> 50%	3.8

N = 1351

- **445 firms** could not estimate their intangible spending in at least one of the asset categories

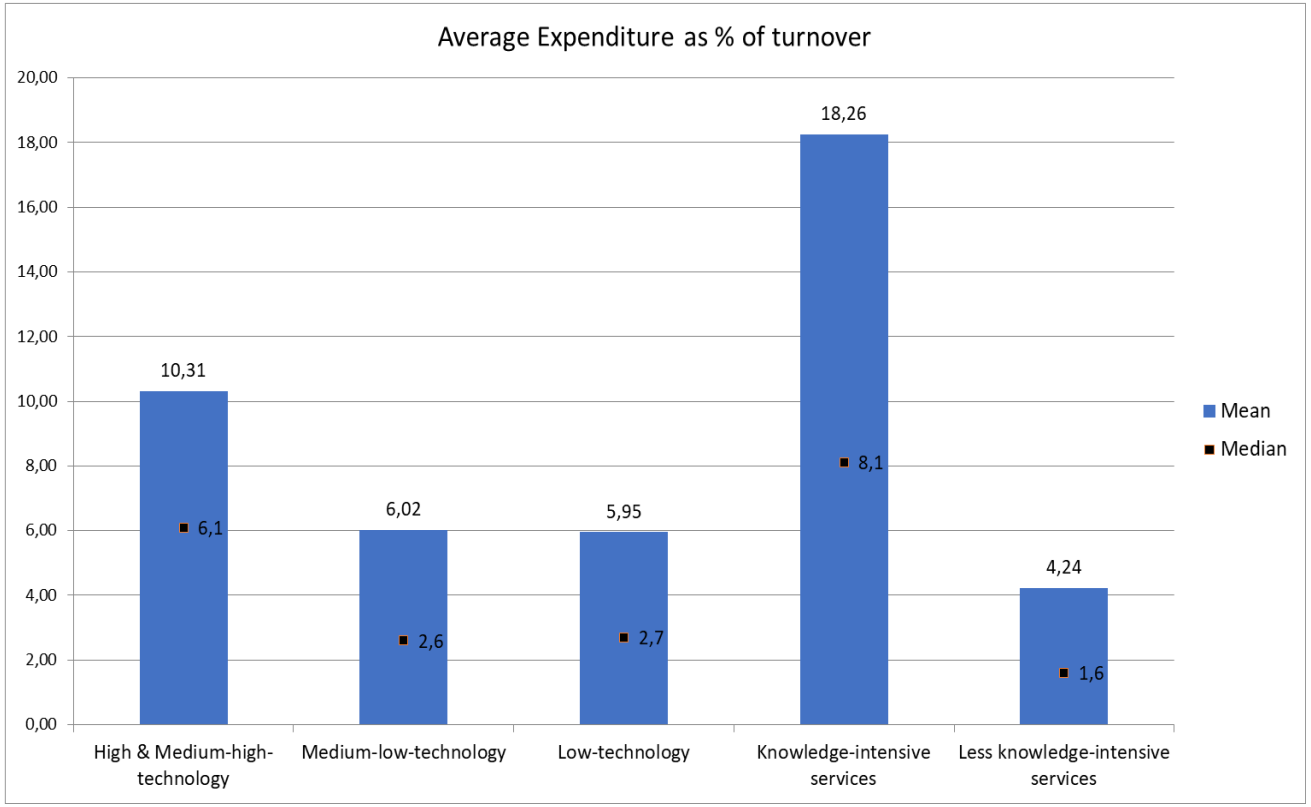
In-house and purchased average expenditures as percentage of turnover (N=1351)

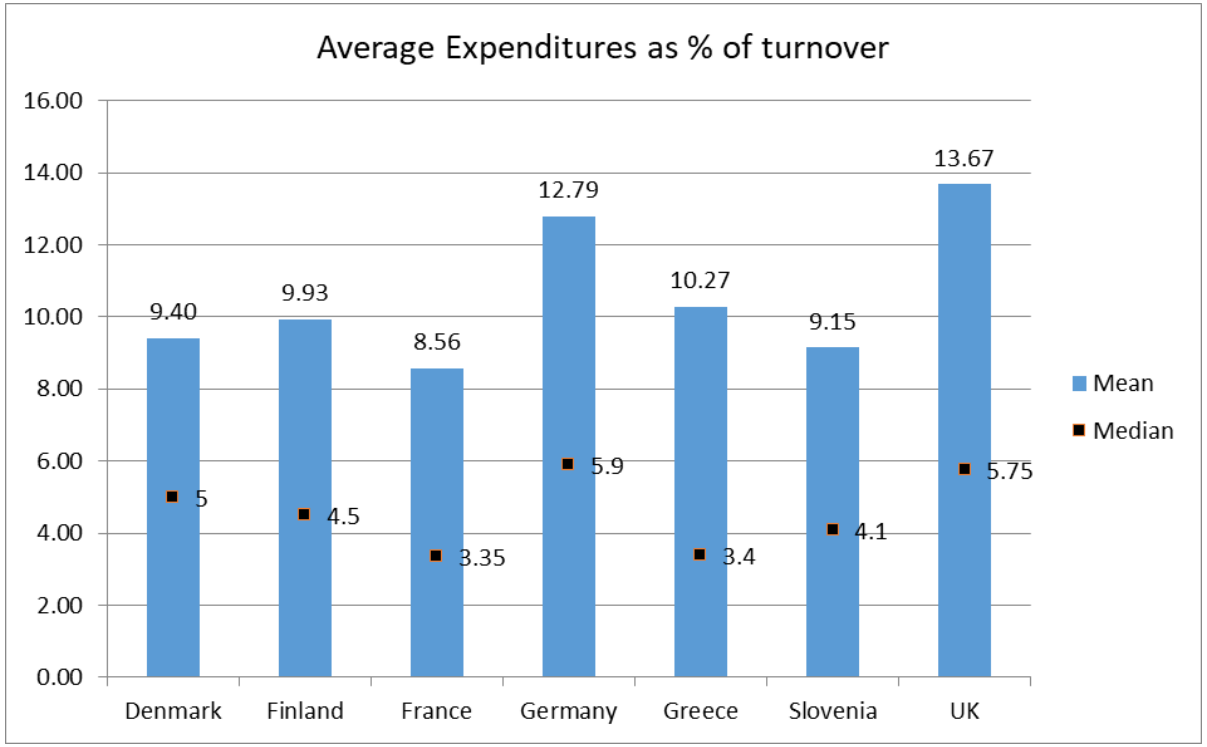
- **In-house intangible investments outweigh** investments in intangibles purchased from external providers



Intangible spending per sector and country (N = 1351)

- Sector knowledge intensity matters: Knowledge-intensive services (KIS) and High- and medium-high (H&MHT) manufacturing firms invest more
- Large countries invest more (France is an exception)
- Among small countries, DK and FI invest more

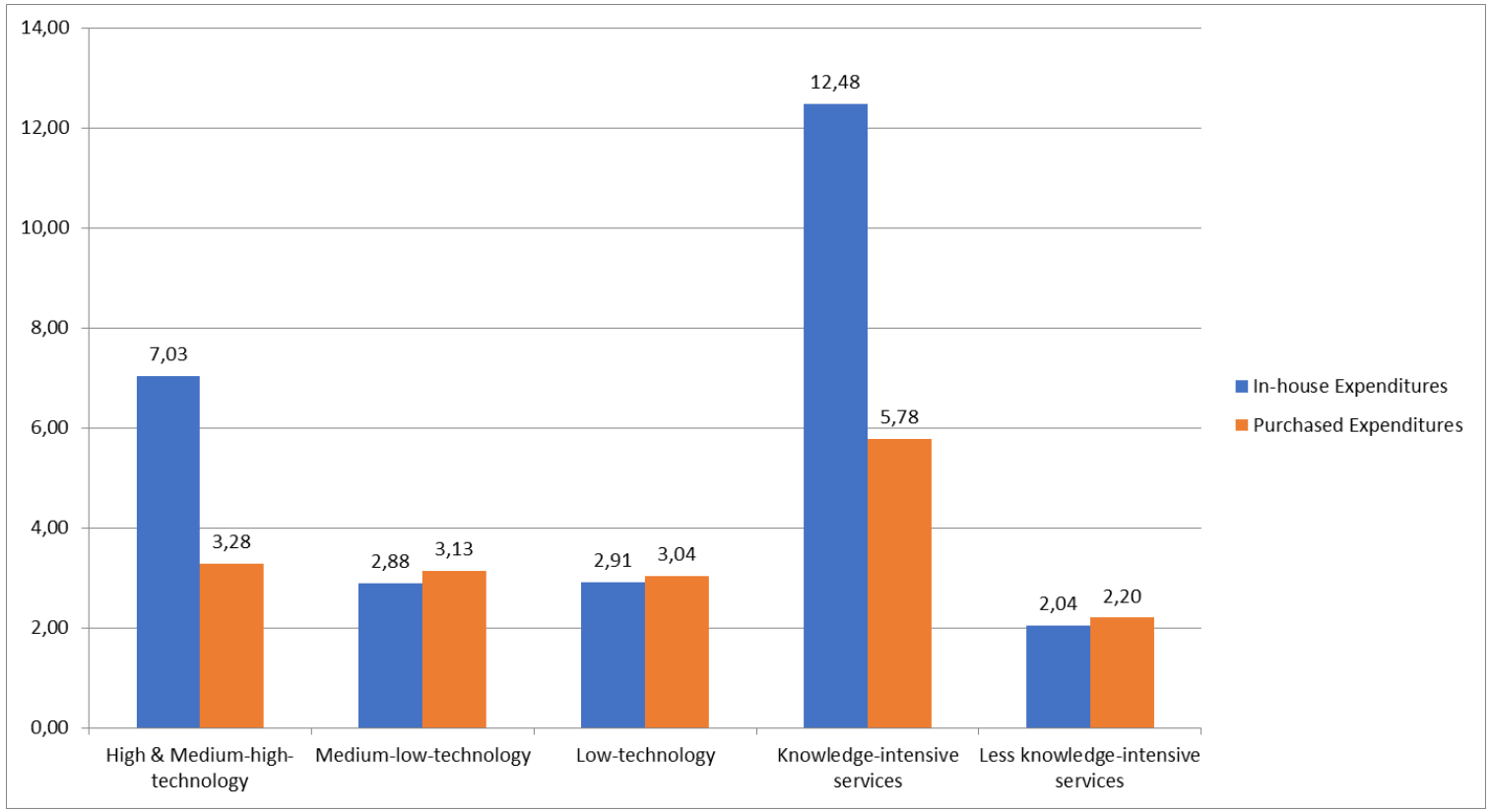




In-house and purchased average expenditures as percentage of turnover per sector (technology/knowledge intensity) (N = 1351)

- Firms in **high knowledge/technology-intensive** sectors make **much higher in-house investments** in intangibles

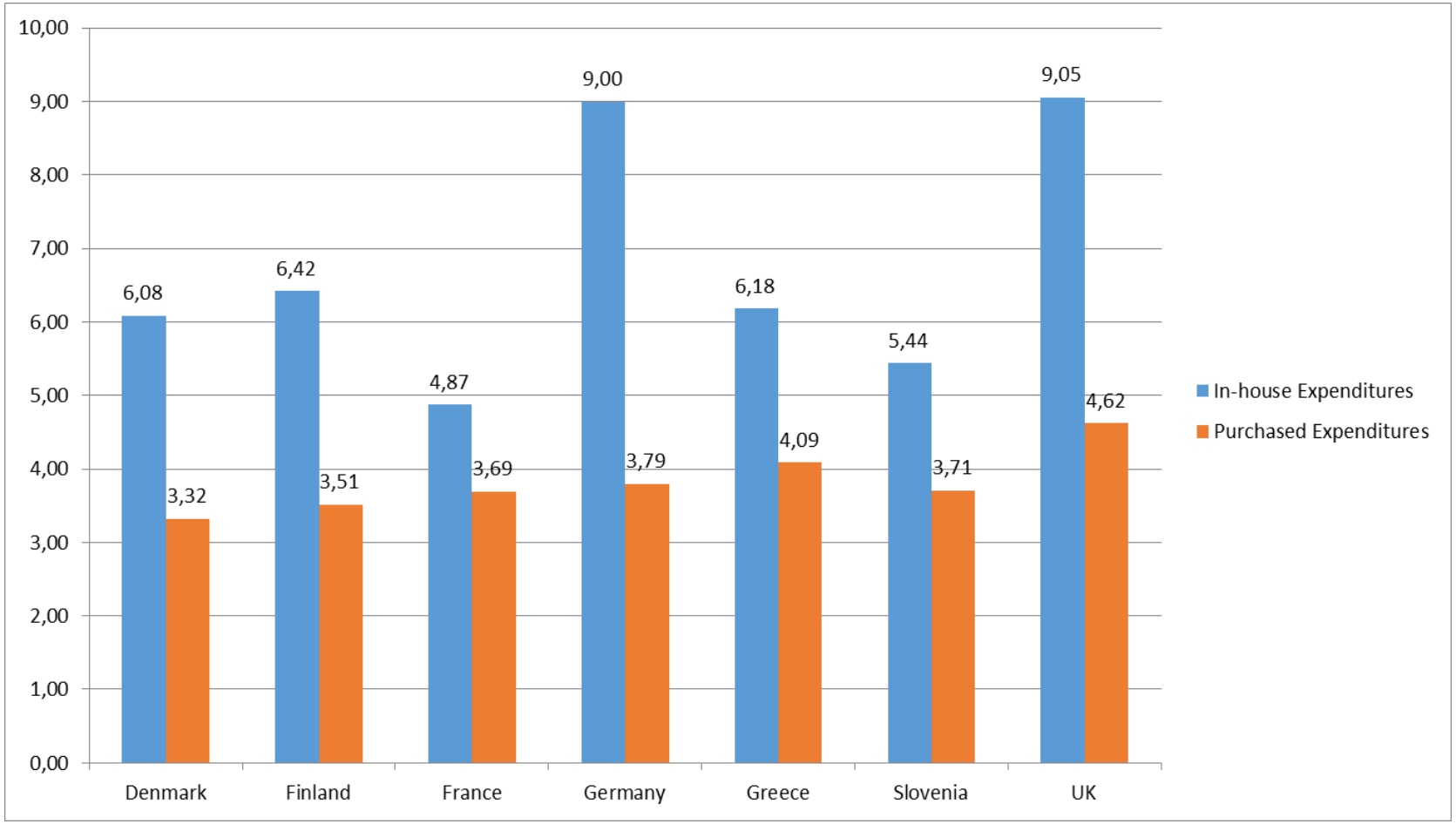
		H&MHT	MLT	LT	KIS	Less KIS
In-house Expenditures	Mean	7.03	2.88	2.91	12.48	2.04
	Median	3.80	1.00	1.00	3.70	0.50
Purchased Expenditures	Mean	3.28	3.13	3.04	5.78	2.20
	Median	1.68	1.00	1.10	3.00	1.00



In-house and purchased average expenditures as percentage of turnover per Country (N = 1351)

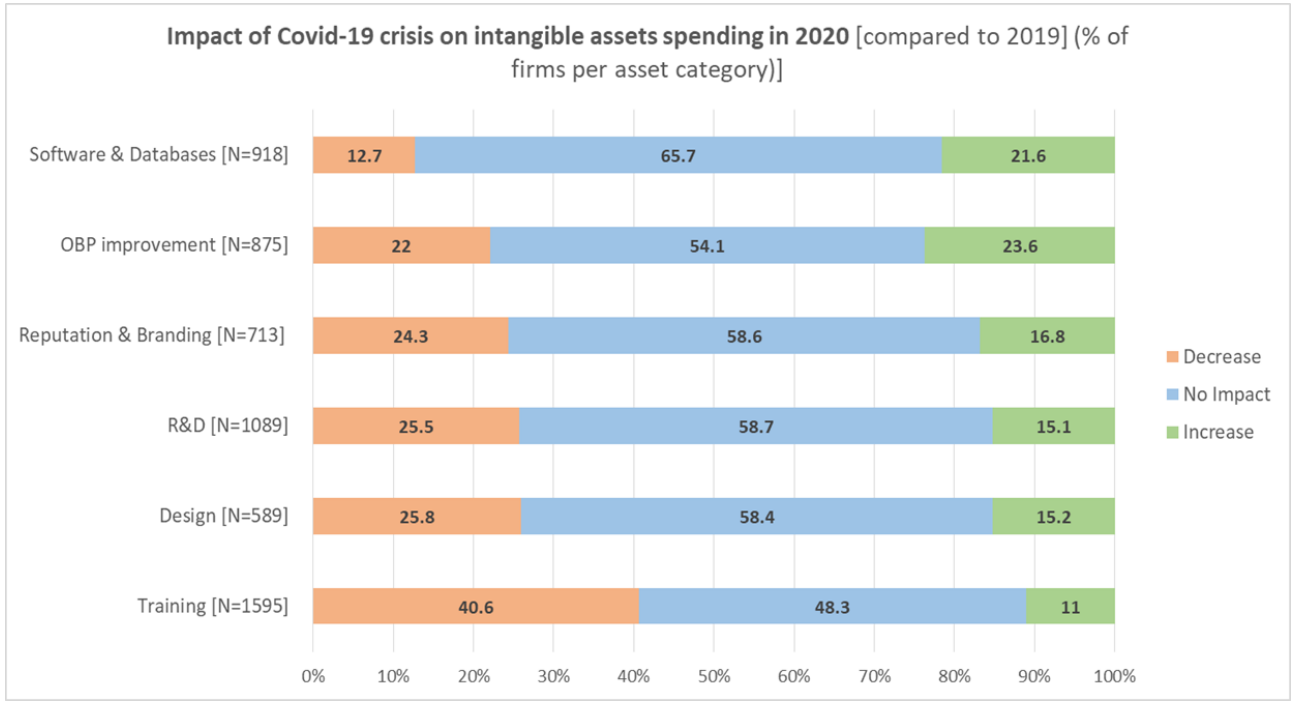
- **Germany and UK** are characterized by **much higher in-house investments**, followed by **Finland and Denmark.**

	In-house Expenditures		Purchased Expenditures	
	Mean	Median	Mean	Median
Denmark	6.08	2.5	3.32	1.8
Finland	6.42	2.3	3.51	1.5
France	4.87	1	3.69	1.25
Germany	9.00	3	3.79	1.8
Greece	6.18	1.5	4.09	1.5
Slovenia	5.44	2	3.71	1.6
UK	9.05	3	4.62	1.6



Impact of Covid-19 crisis on IAs spending
(for the firms with investments in 2019)

- **Most firms reported "no impact"** on IAs spending across types
- **Training is most affected** by Covid-19 followed by design and R&D.
- **Higher number of firms reported "increase"** of expenditures **in Software & Databases and OBP** improvement than "decrease"



- **The level of spending decrease is quite higher** than the level of increase across categories

IA type	Covid-19 impact on spending (2020)	N	% of Firms	N	% of Change (Mean)	% of Change (Median)
R&D	Decrease	280	25,7	263	-34,8%	-30%
	No Impact	643	59,0			
	Increase	166	15,2	161	35,8%	15%
Training	Decrease	648	40,6	609	-46,7%	-50%
	No Impact	772	48,4			
	Increase	175	11,0	162	29,8%	10%
Organisation	Decrease	193	22,1	177	-43,4%	-50%
	No Impact	475	54,3			
	Increase	207	23,7	188	39,5%	15%
Software & Databases	Decrease	117	12,7	114	-46,5%	-50%
	No Impact	603	65,7			
	Increase	198	21,6	185	29,6%	10%
Design	Decrease	153	26,0	143	-42,3%	-40%
	No Impact	346	58,7			
	Increase	90	15,3	85	36,5%	20%
Reputation & Branding	Decrease	174	24,4	165	-40,7%	-40%
	No Impact	419	58,8			
	Increase	120	16,8	108	26%	10%

Covid-19 impact on Economic Performance

- Firms (%) that invest in multiple intangibles' categories were **less affected by Covid-19 pandemic in terms of economic performance**, especially in terms of profit margin and employment

	Covid-19 impact on performance	Total Sample	Number of intangible categories						
			0	1	2	3	4	5	6
Turnover	Decrease	**53.9**	52.3	58.7	58.3	56.4	52.7	48.1	48.8
	No Impact	**25.9**	26.2	24.6	22.8	27	24.6	30.9	23.2
	Increase	**20.2**	21.5	16.8	18.9	16.6	22.8	21	28
Profit margin	Decrease	**45.6**	46.2	44.9	49	50.5	44.7	40.5	37.7
	No Impact	**35.1**	38.5	34.7	35.9	32.6	33.7	38.2	36.1
	Increase	**19.3**	**15.4**	**20.5**	**15.1**	**16.9**	**21.6**	**21.2**	**26.2**
Employment	Decrease	**31.4**	25	29.7	34.1	31.7	35.7	28.9	24
	No Impact	**49.8**	62.5	53.3	48.7	52.1	44.9	49	47.2
	Increase	**18.8**	**12.5**	**17**	**17.2**	**16.2**	**19.4**	**22.1**	**28.8**
Overall investment	Decrease	**32.8**	16.9	31.1	33.9	33	35.6	36.6	27.2
	No Impact	**49**	69.2	51.1	53.4	48.3	46.7	42.8	43.2
	Increase	**18.3**	13.8	17.8	12.7	18.7	17.7	20.6	29.6

Covid-19 and digital transformation

- The share of **firms that renewed to high extent their business processes and practices** to use more efficiently ICTs (27,3%) is somewhat **higher than firms that increased their spending in ICT infrastructure** (23,5%).
  - **Service firms have higher percentages** (28,6% and 31,7%) than manufacturing firms in both issues (20,1% and 24,3%).
- Almost **4 out of 10 firms** sees **Covid-19 crisis as an opportunity** to accelerate their digital transformation
  - **The share of firms in services (47,6%) is much higher** than firms in manufacturing (32%)
- **1 out of 4 firms** sees **Covid-19 crisis as a threat to survive** in the short term
  - KIS are characterized by the lowest percentage (18,3%)
- **2 out of 3 firms** refer that they **will sustain the changes implemented** (in business processes and practices) to adapt and respond to the Covid-19 challenges in the long run

To sum up

- **Large heterogeneity of firms** regarding the existence and intensity of intangible activity
  - ➢ A large share of firms have low expenditures and a smaller share of firms exhibit high expenditures intensity.
- **In-house intangible investments outweigh** investments in intangibles purchased from external providers.
- **Size and sector matter:**
  - ➢ **Larger firms tend to have higher activity** in all types of IAs
  - ➢ Firms operating in technology/knowledge intensive sectors make **higher investments** in IAs having a higher share of **in-house** investments in their intangibles mix.
- In general, **large countries** appear to make higher expenditures than smaller countries, and particularly much higher in-house investments . **Among small countries, Denmark and Finland** follow the same trend.

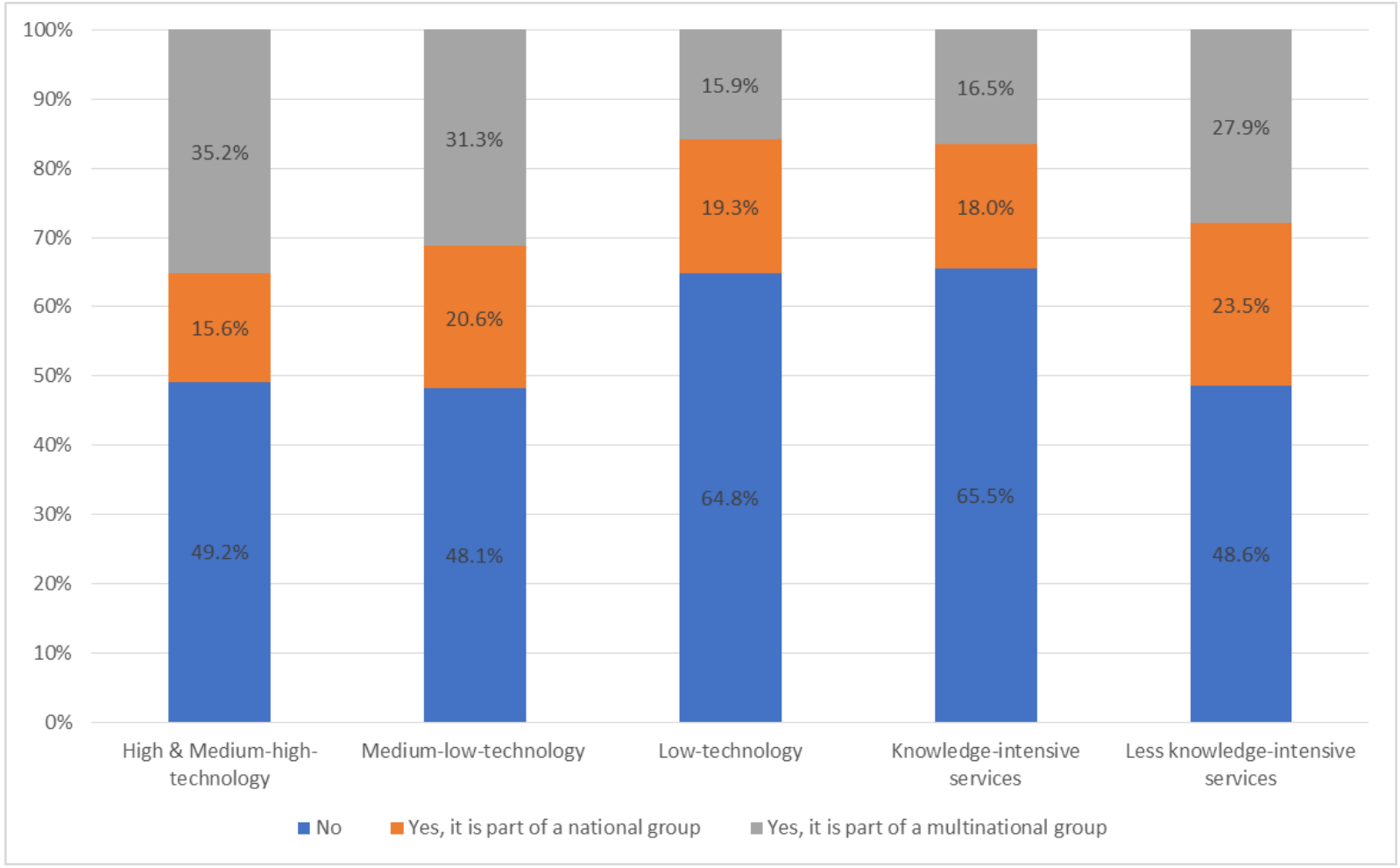
To sum up

- For the majority of firms, the **Covid-19 crisis had no impact on the level of intangible spending** in 2020 related to 2019 across asset types.
- **The acceleration of digital transformation by Covid-19 shock is clearer in services** than in manufacturing
- Firms with investments in **multiple intangibles'** categories were **less affected by the Covid-19 pandemic** in terms of **economic performance.**

Thank you very much

Appendix

Sample distribution by enterprise group and sector (technology/knowledge intensity) [N = 1796]



Intangible activity and spending per asset category and sector→

Knowledge-intensive services and high- and medium-high manufacturing firms invest more than less knowledge intensive sectors

Sector Category	R&D and External Knowledge acquisition		Training		Organisation / Business Process improvement		Software & Databases		Design		Reputation & Branding	
	% of Firms	% of Turnover*	% of Firms	% of Turnover*	% of Firms	% of Turnover*	% of Firms	% of Turnover*	% of Firms	% of Turnover*	% of Firms	% of Turnover*
High & Medium-high-technology	77,9	6,61 (4)	88,8	1,57 (0,9)	49	2,82 (1,5)	50,7	2,52 (1)	38	3,64 (1,5)	38,3	2,55 (1,3)
Medium-low-technology	60,2	2,72 (1,5)	87,6	1,40 (0,5)	46,7	2,96 (1)	44,4	2,38 (1)	26,4	2,34 (0,75)	25,5	1,34 (0,9)
Low-technology	57,6	2,92 (1,2)	84,4	1,34 (0,5)	50,5	2,89 (1)	42,7	1,28 (0,5)	36,5	1,98 (0,6)	44,8	1,78 (1)
Knowledge-intensive services	57,6	13,54 (5)	92,9	2,87 (1)	51,3	2,78 (1,5)	60,4	5,58 (2)	30	9,69 (2)	44,8	3,32 (2)
Less knowledge-intensive services	32,8	2,17 (0,9)	88,8	0,94 (0,45)	46,1	1,17 (0,4)	49,4	1,57 (0,5)	31,8	2,33 (0,9)	42,5	1,72 (0,9)
N	1778	975	1792	1337	1780	695	1787	758	1785	494	1788	609

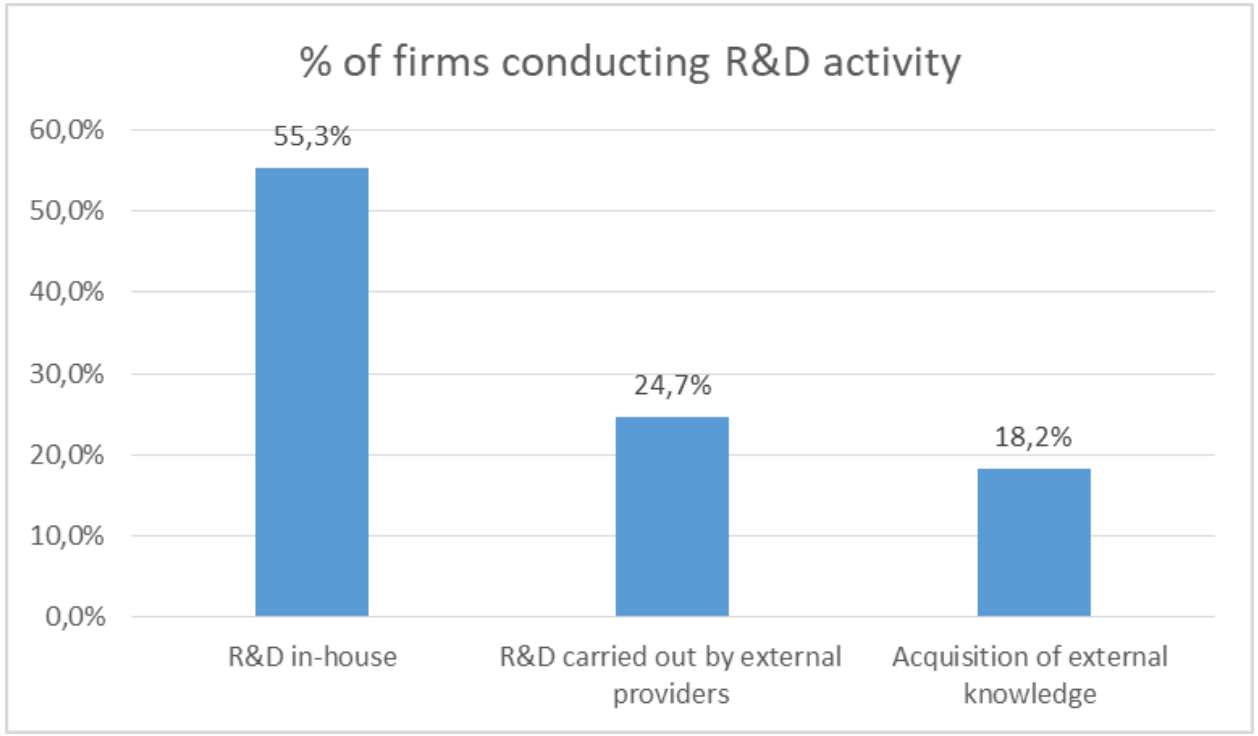
* Mean (Median)

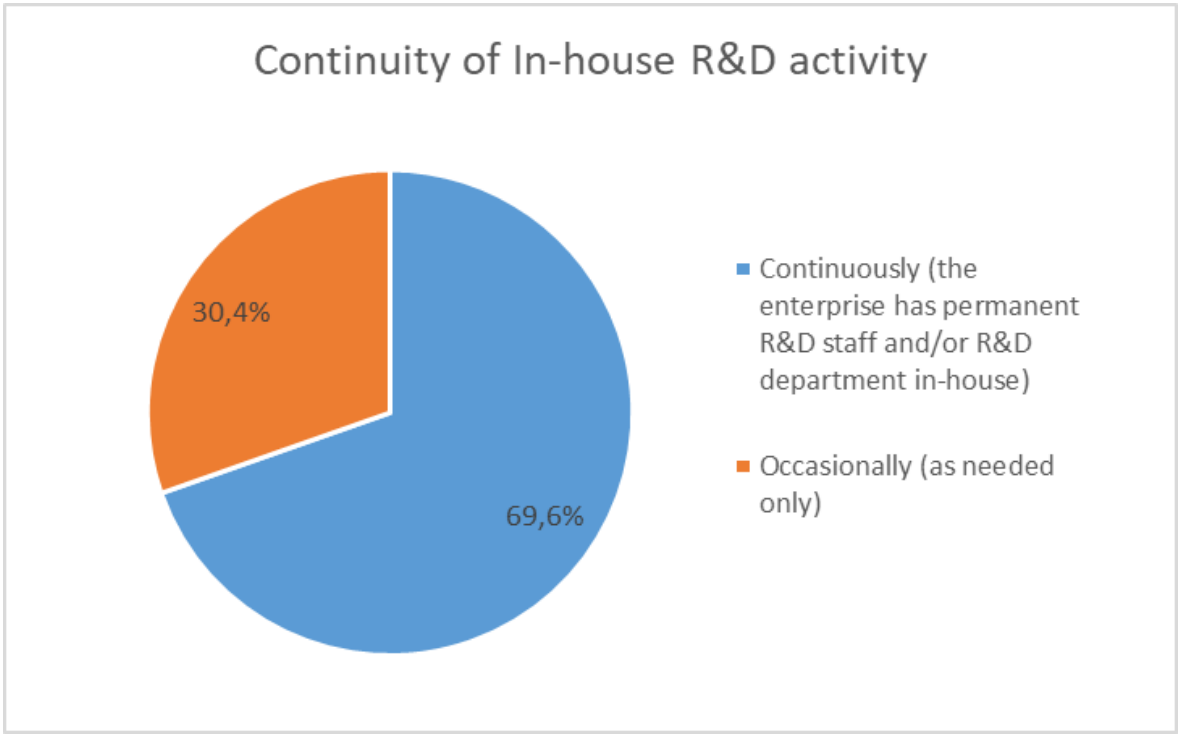
R&D activity and spending

Among all Firms	% of Firms	% of Turnover (Mean)	% of Turnover (Median)
At least one type of R&D activity	61,6	7,16	3
In-house R&D	**55,3**	**6,61**	**3**
R&D by external providers	**24,7**	**1,92**	**1**
External knowledge acquisition	**18,2**	**1,84**	**0,5**
Continuity of R&D (among firms with In-house R&D) [*Q9*]	69,6	9,19	4

- **38,4% of firms: No R&D activity**
- **The most "popular" type** of R&D activity **is In-house R&D**
- **Size matters:** Over 6 out of 10 medium-sized and large firms conduct in-house R&D activity (small firms: 46.9%)
- **Sector matters:**
  - **63% of manufacturing firms conduct in-house R&D** (service firms: 43,7%)
  - **H&MHT manufacturing: 3 out of 4 firms (**MLT, LT manufacturing and KIS: 1 out of 2, less KIS: 1 out of 4)
  - **Much higher expenditures** (as % of turnover) **in KIS** (mean: 13,54 , median: 5) and **H&MHT** manufacturing firms (mean: 6,61 , median: 4)

R&D activity

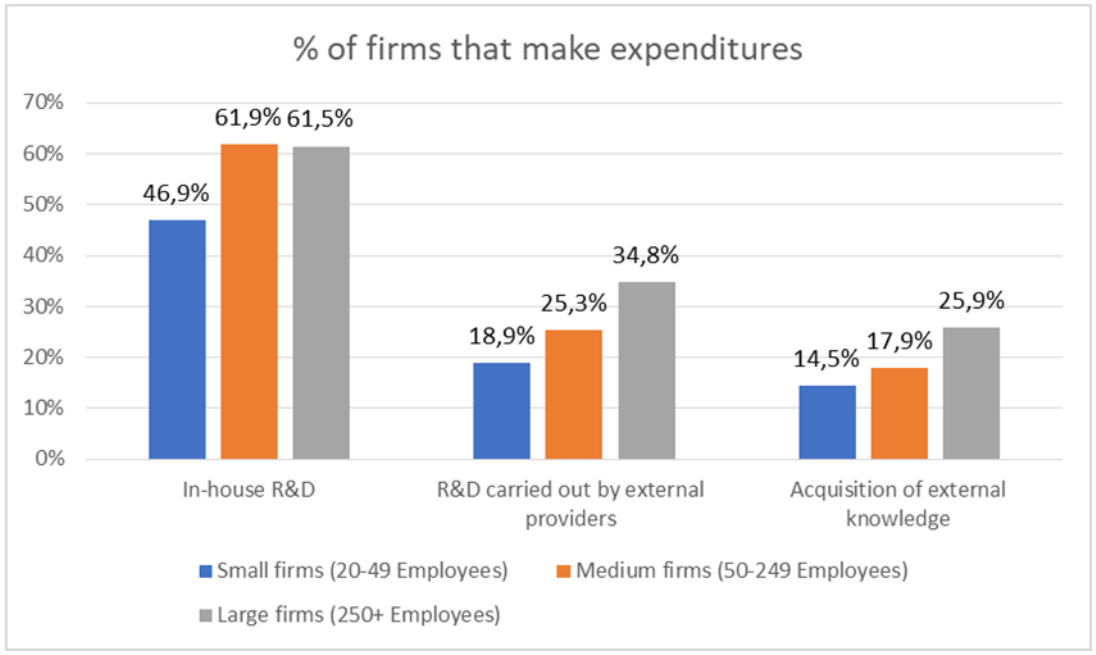


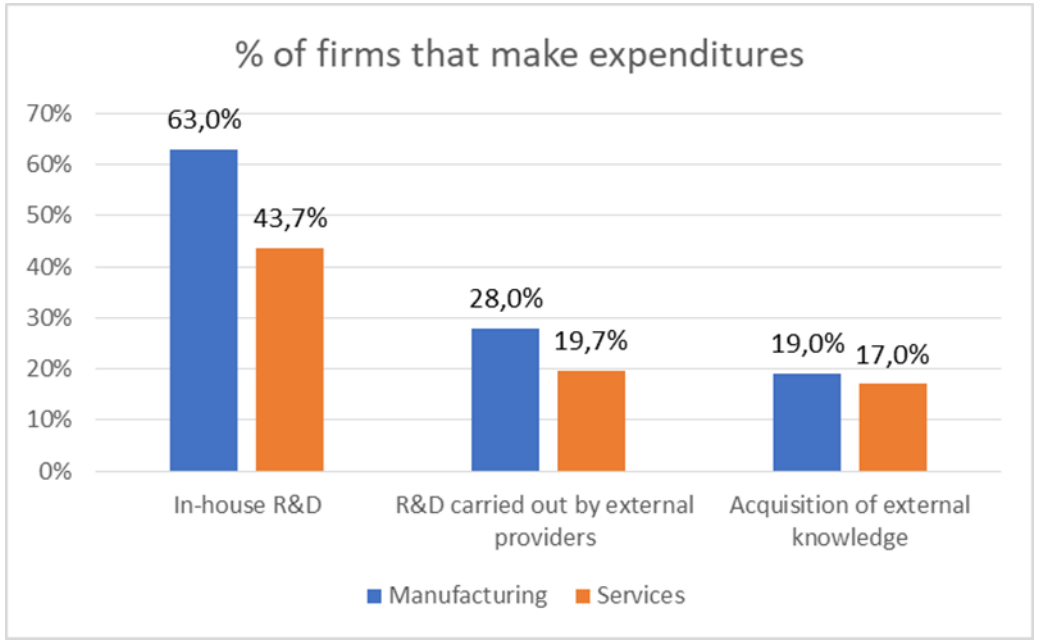


	% of Firms
No R&D activity	38,4
Both In-house R&D and R&D by external providers	21,7
All three types of R&D	8,1

Expenditures in R&D

- **Size matters:** Large and medium-sized firms exhibit higher in-house R&D activity
- **Sector matters:**
  - Manufacturing firms exhibit higher in-house R&D activity
  - Firms in knowledge intensive sectors exhibit higher R&D activity





Training activity and spending

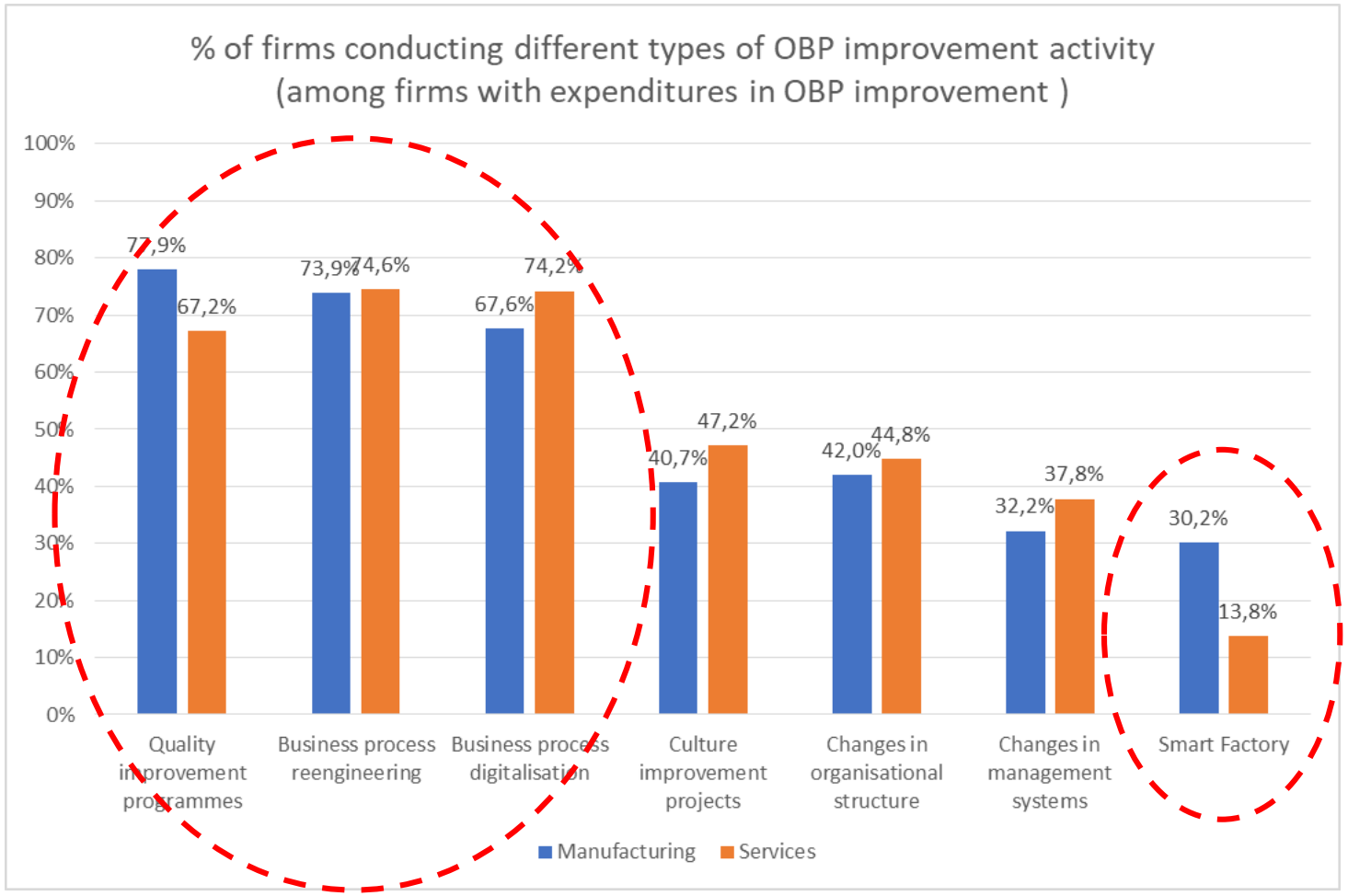
	% of Firms	% of Turnover (Mean)	% of Turnover (Median)
At least one of two activities	**89,2**	**1,84**	**1**
Training (by external organisations)	78,7	1,06	0,5
Training (using internal resources)	68,5	1,21	0,5

- **The vast majority of firms have training activity** in all size and sector categories.
- **Some differentiation between:**
  - Size Categories: 96,2% of large firms conduct training activity (medium firms: 91,9%, small firms: 83,4%)
  - Sector Categories: The highest share of firms with training activity is in knowledge-intensive services (92,9%) whereas the lowest is in low-tech manufacturing firms (84,4%)
- **Firms in Services make higher expenditures** (mean: 2,37%, median: 1) than firms in manufacturing (mean: 1,47%, median: 0,6%)

Organisation/Business Process (OBP) improvement: activity and spending

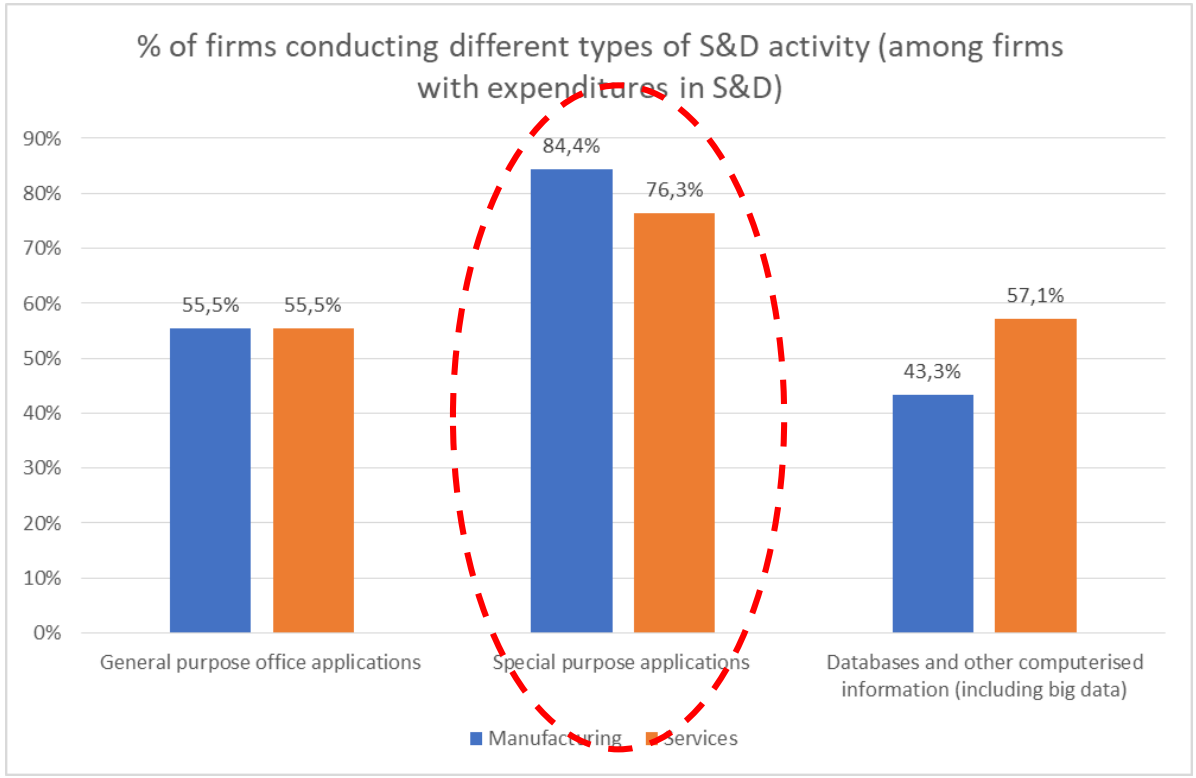
% of Firms	% of Turnover (Mean)	% of Turnover (Median)
49,3	**2,69**	**1**
By external providers	1,15	0,4
Using internal resources	1,53	0,5

- **1 out of 2 firms have no activity**
- **No differentiation exists between manufacturing and services** regarding % of firms conducting OBP improvement activity.
- **Size matters:** only 4 out of 10 small firms spend on OBP (medium firms: 54%, large firms: 61,2%)
- **The most "popular" types** of OBP in both manufacturing and services are Quality improvement, BPR and Business process digitalization.



Software & Databases (S&D) activity and spending

% of Firms	% of Turnover (Mean)	% of Turnover (Median)
51,4	**3,27**	**1**
Purchased by external providers	1,69	0,9
In-house development	1,58	0,18

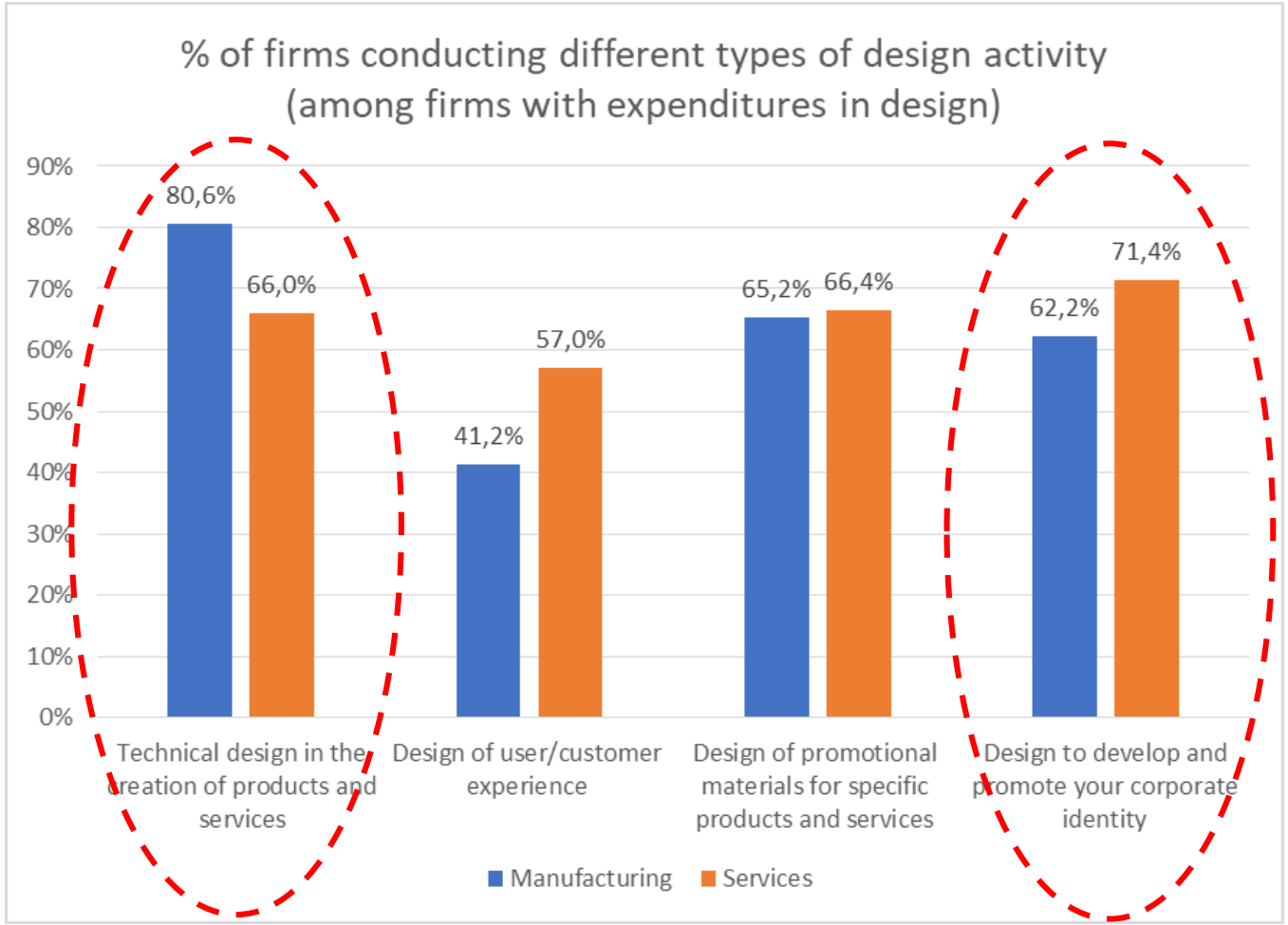


- **1 out of 2 firms have no S&D activity**
- **Size matters:** 63,5% of large firms spend on S&D (medium: 53,7%, small: 43,2%)
- **Sector matters:**
  - 57,7% of service firms spend on S&D (manufacturing firms: 47,2%)
  - Higher number of firms in more knowledge intensive sectors spend on S&D (e.g. KIS: 60,4%, Less KIS: 49,4%)
  - Much higher expenditures in KIS (mean: 5,58, median: 2)
- The most "popular" type of S&D is "special purpose applications".
- Much higher number of firms in services (57,1%) spend on Databases than manufacturing (43,3%)

Design activity and spending

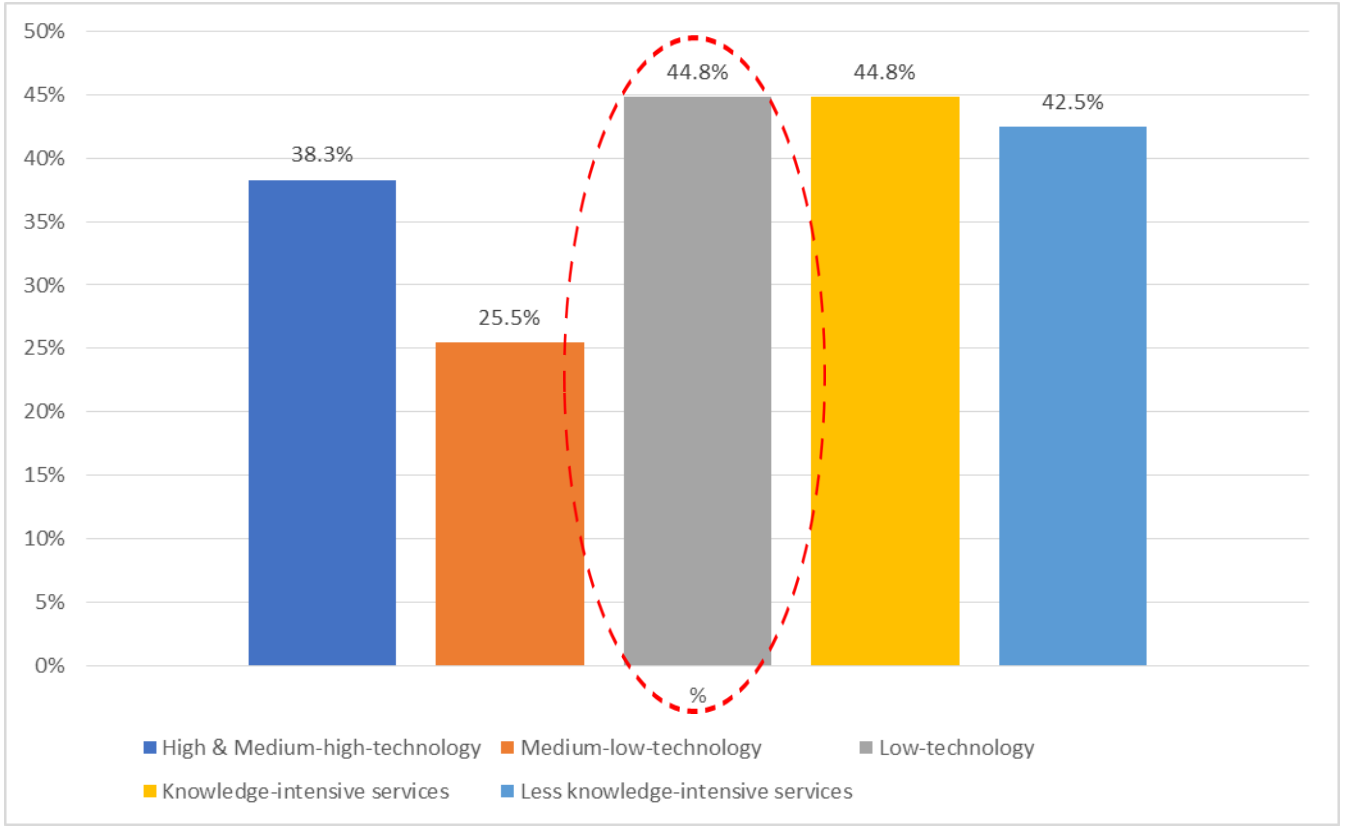
% of Firms	% of Turnover (Mean)	% of Turnover (Median)
33,2	**4,69**	**1**
By external providers	1,42	0,3
Using internal resources	3,22	0,5

- **2 out of 3 firms have no design activity**
- **Sector matters:**
  - Higher share of firms with design activity in H&MHT and LT manufacturing firms (38% and 36,5%)
  - Much higher expenditures in KIS especially using internal resources (mean: 7,36 , median: 1)
- The most "popular" type of design activity in manufacturing is "technical design" and in services is "design for corporate identity"
- Much higher share of firms in services invest on design of user/customer experience (57%) than manufacturing (41,2%)



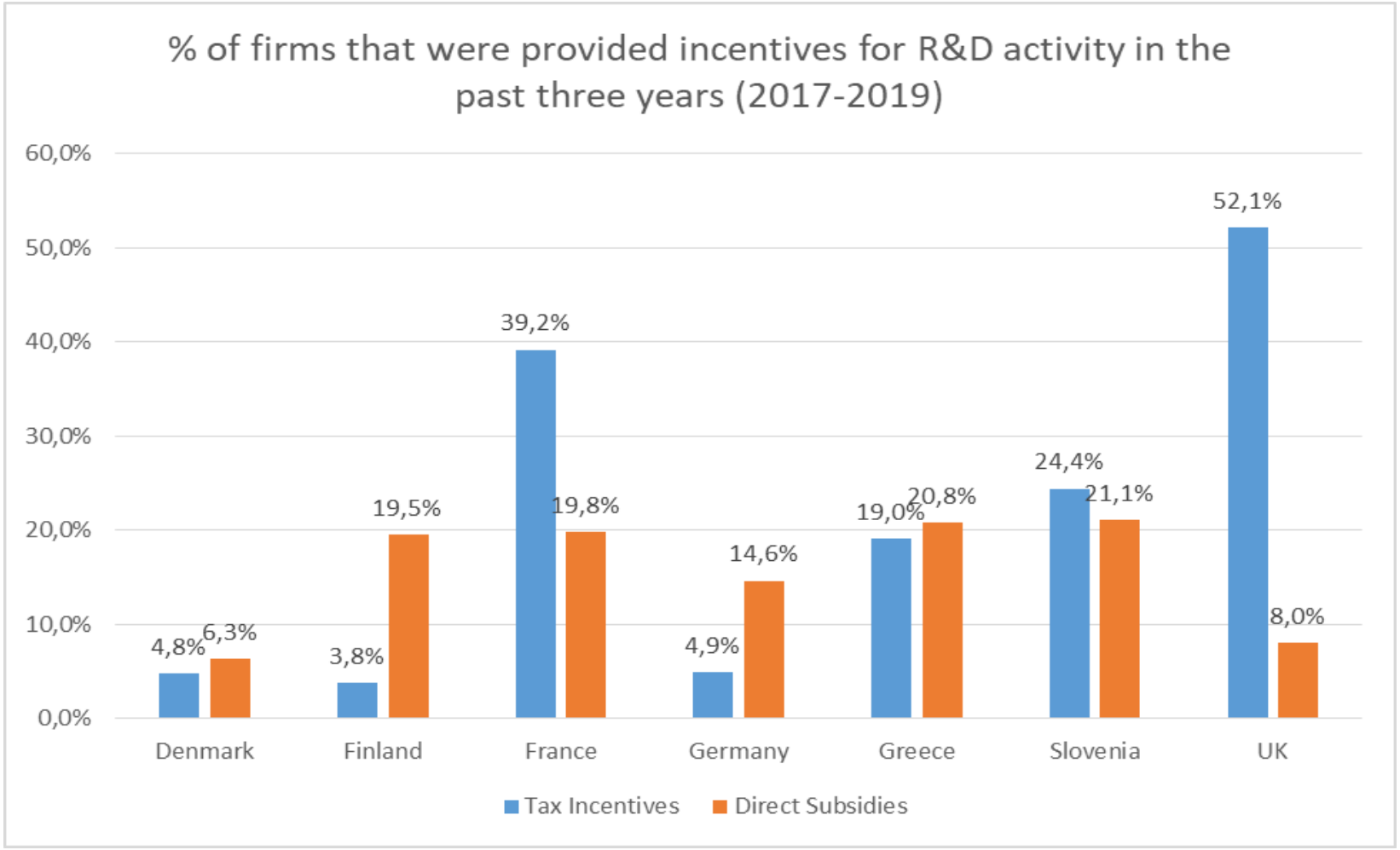
Reputation & Branding activity and spending

% of Firms	% of Turnover (Mean)	% of Turnover (Median)
40	**2,48**	**1**
By external providers	1,21	0,5
Using internal resources	1,28	0,5

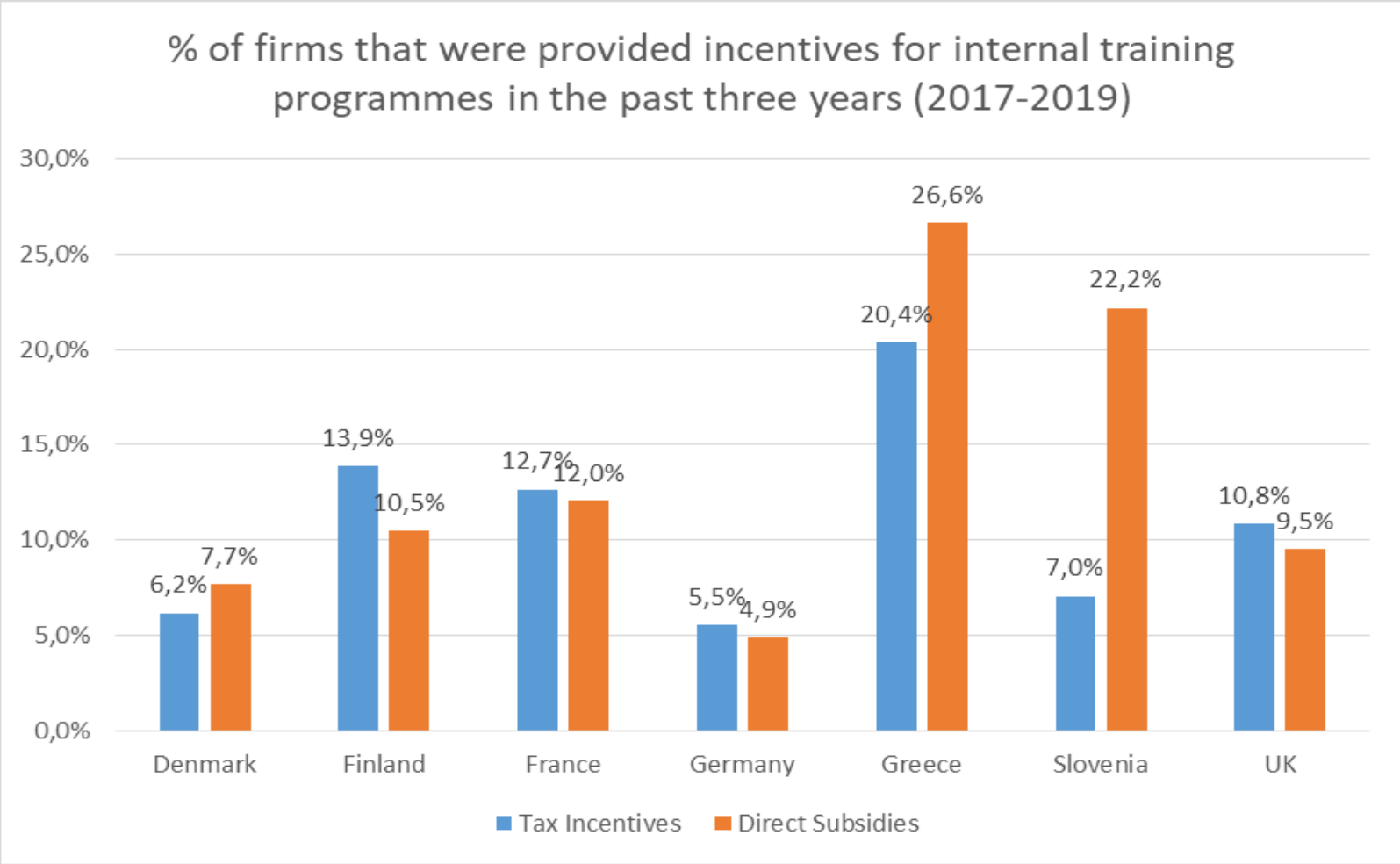


- **6 out of 10 firms have no activity in R&B**
- **Size matters:** 44% of medium and 45,7% of large firms conduct Reputation & Branding activity (small firms: 34%)
- **Sector matters:**
  - Higher share of service firms (44,2%) invest on R&B than manufacturing firms (37,2%)
  - Low-tech manufacturing firms (44,8%) exhibit higher activity than H&MHT (38,3%) and MLT (25,5%) manufacturing firms
  - Higher expenditures in KIS (mean: 3,32 , median: 2)

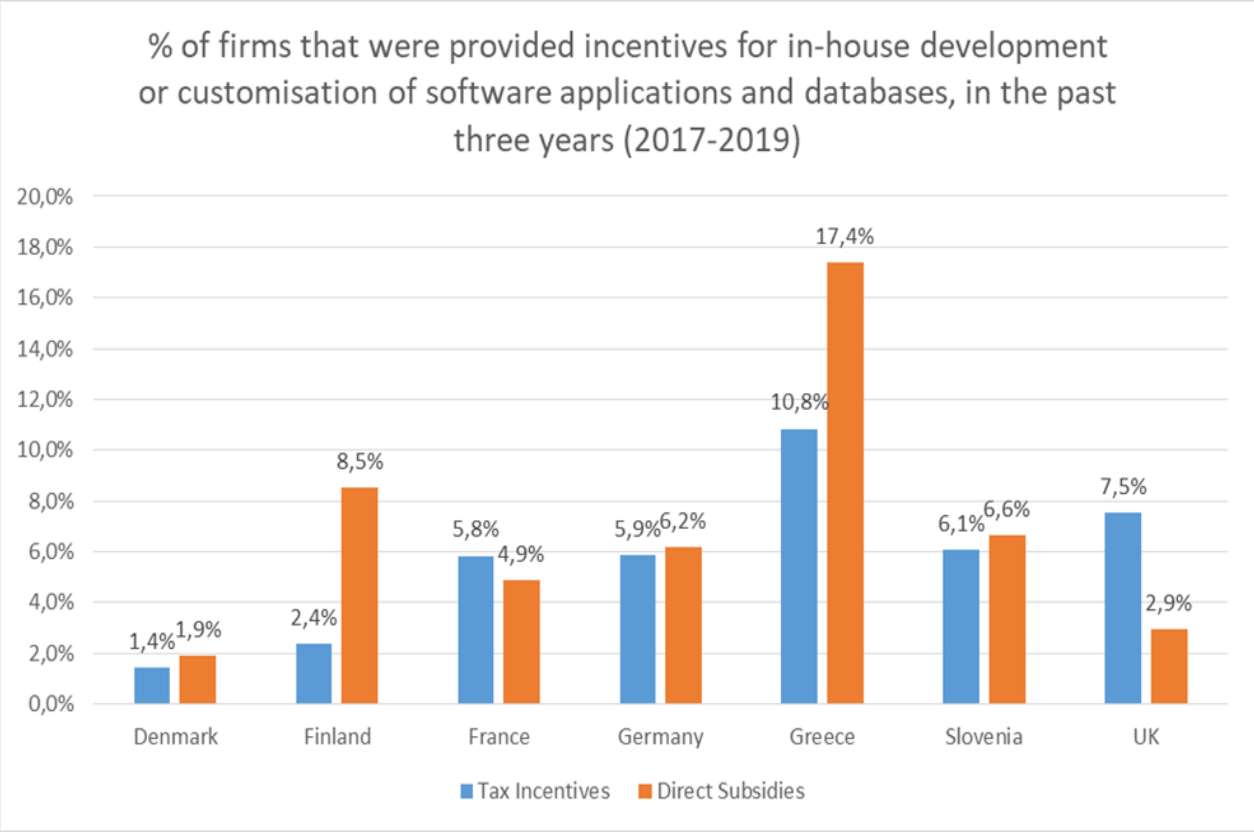
Policy Measures
R&D

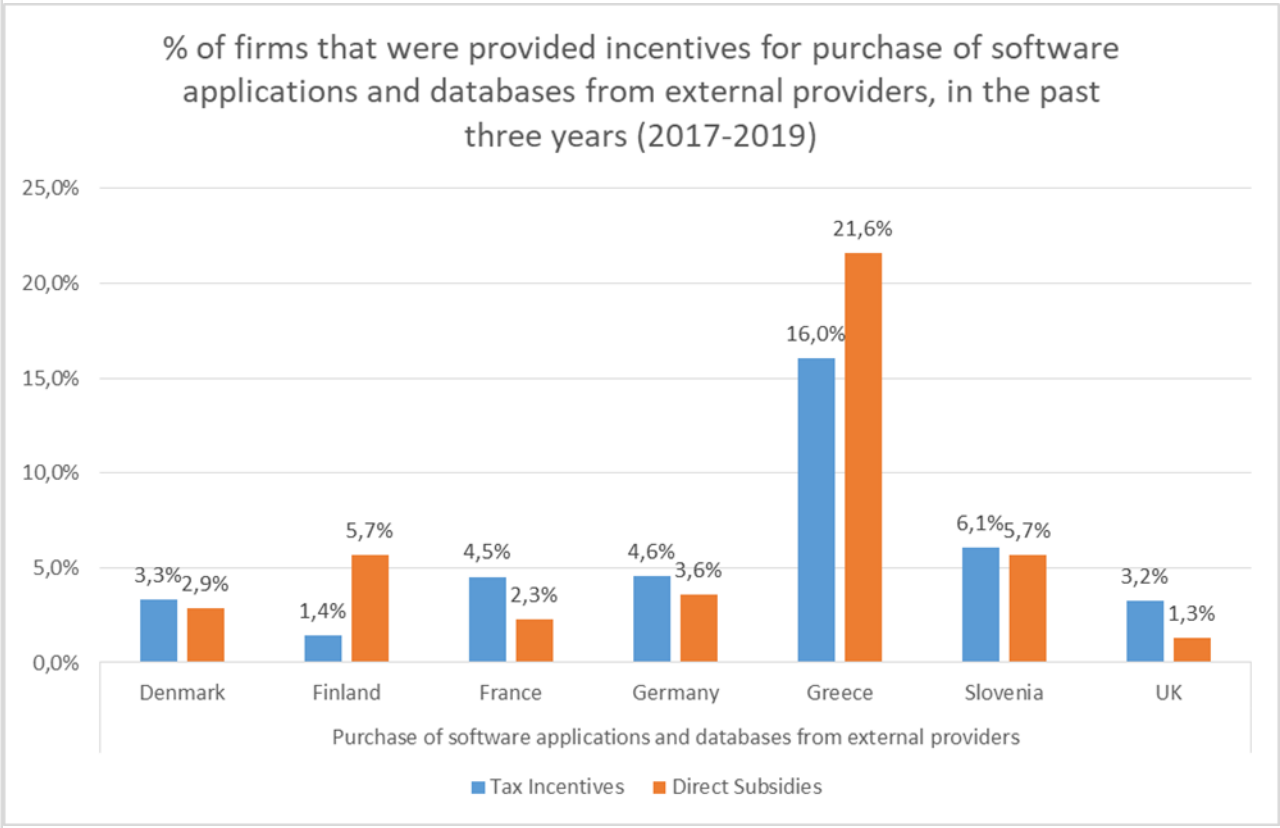


Policy Measures
Training

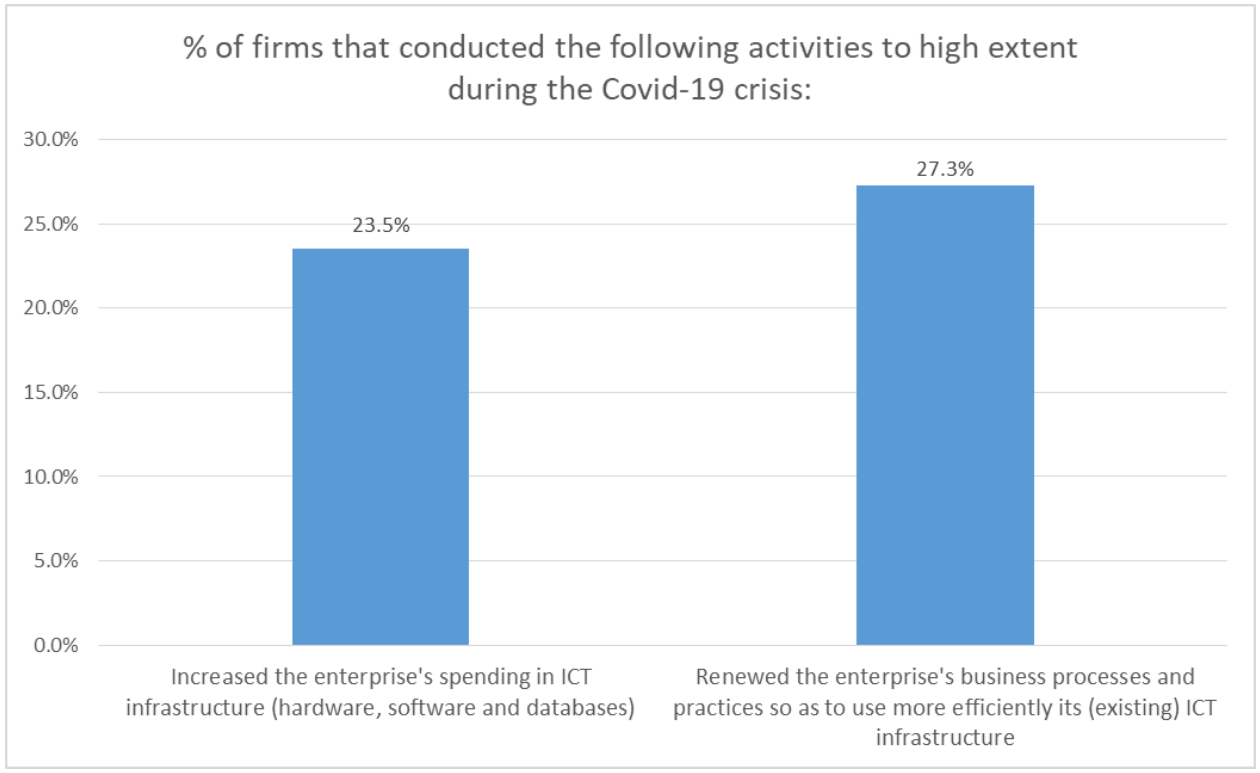


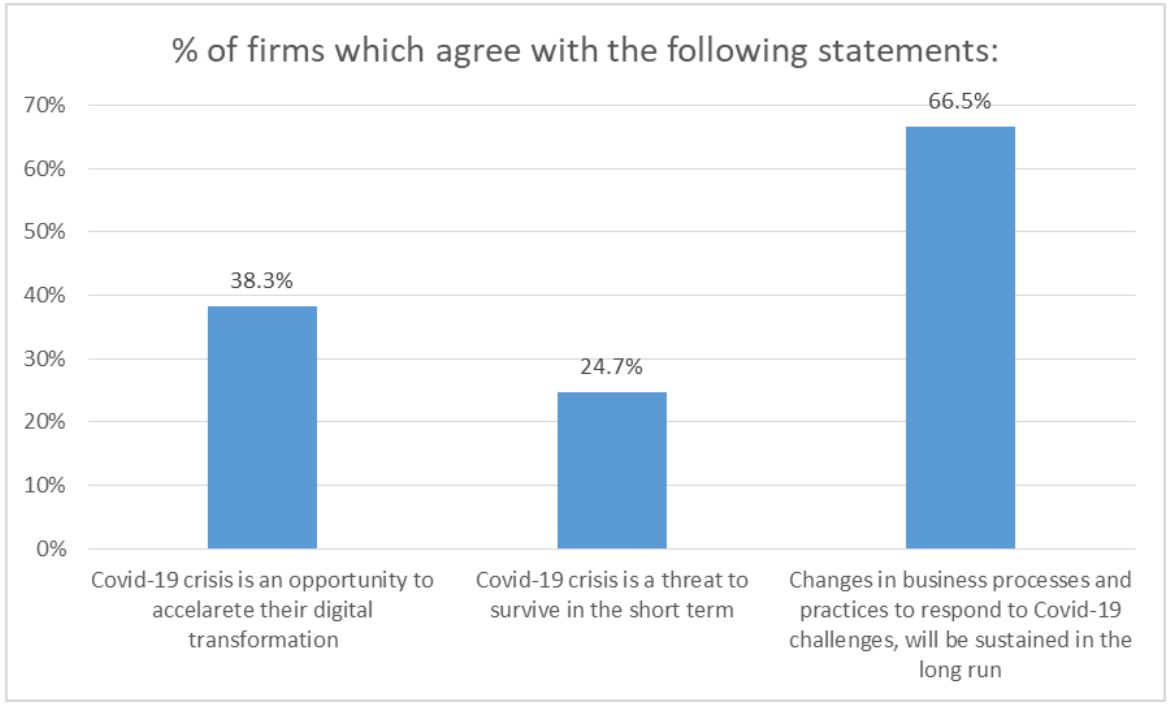
Policy Measures
Software & Databases



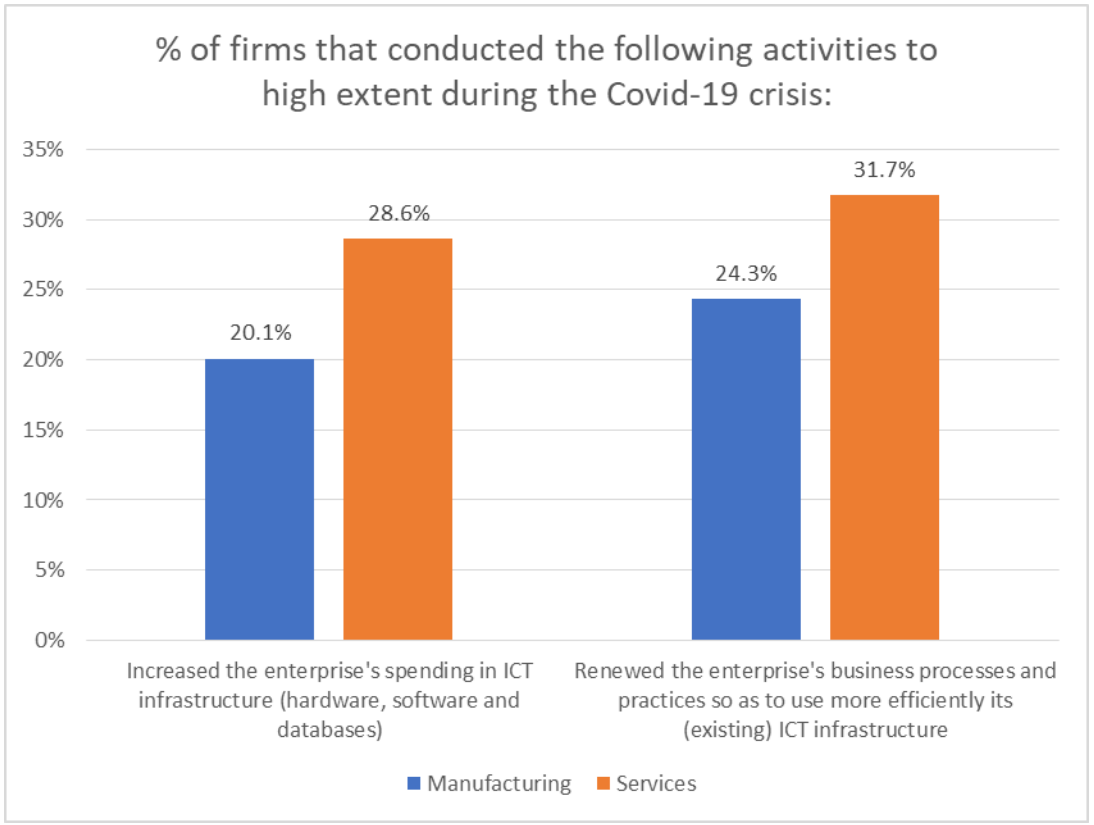


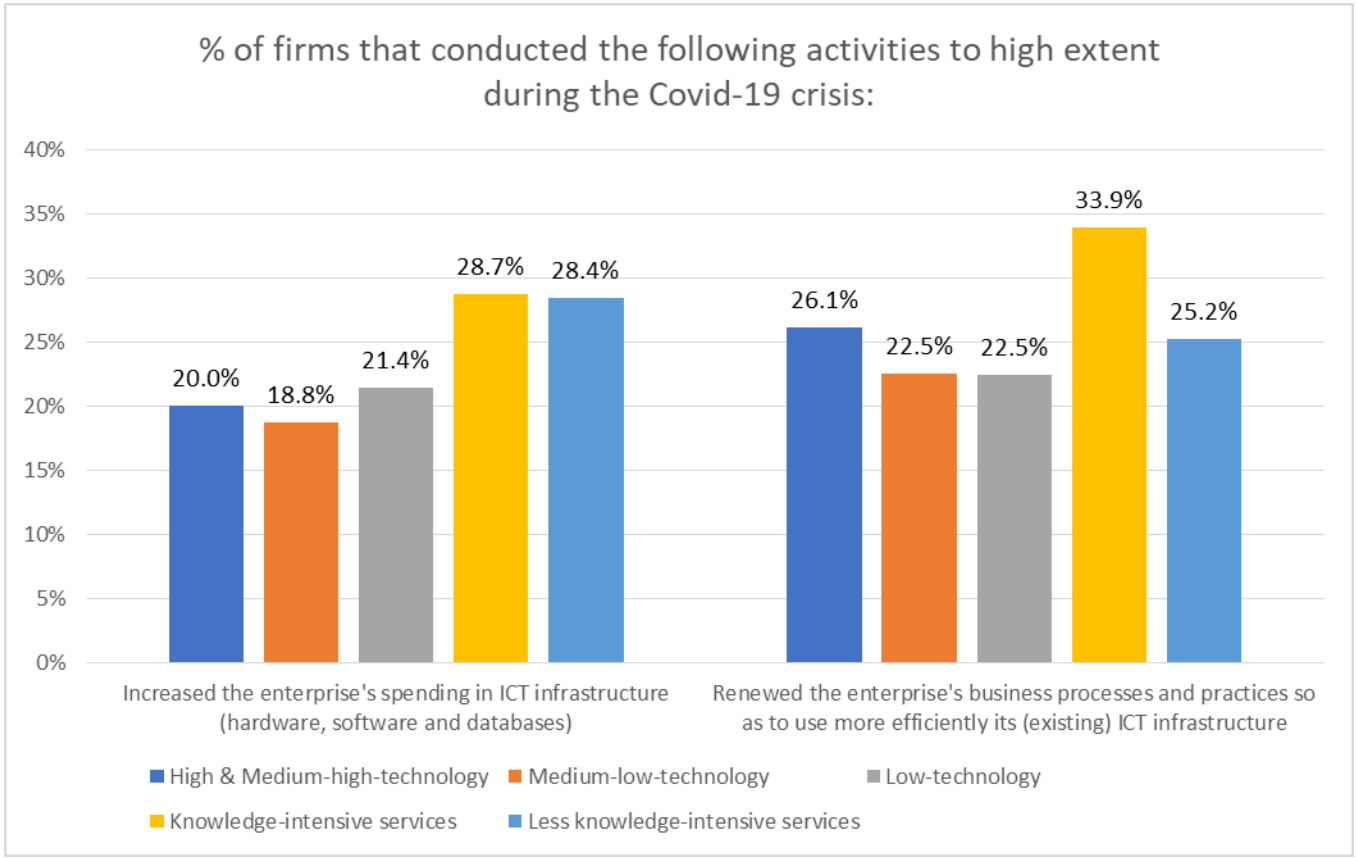
Covid-19 and digital transformation





Covid-19 and digital transformation





Covid-19 and digital transformation