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Access to intellectual property for innovation: Evidence on problems and coping strategies from German firms

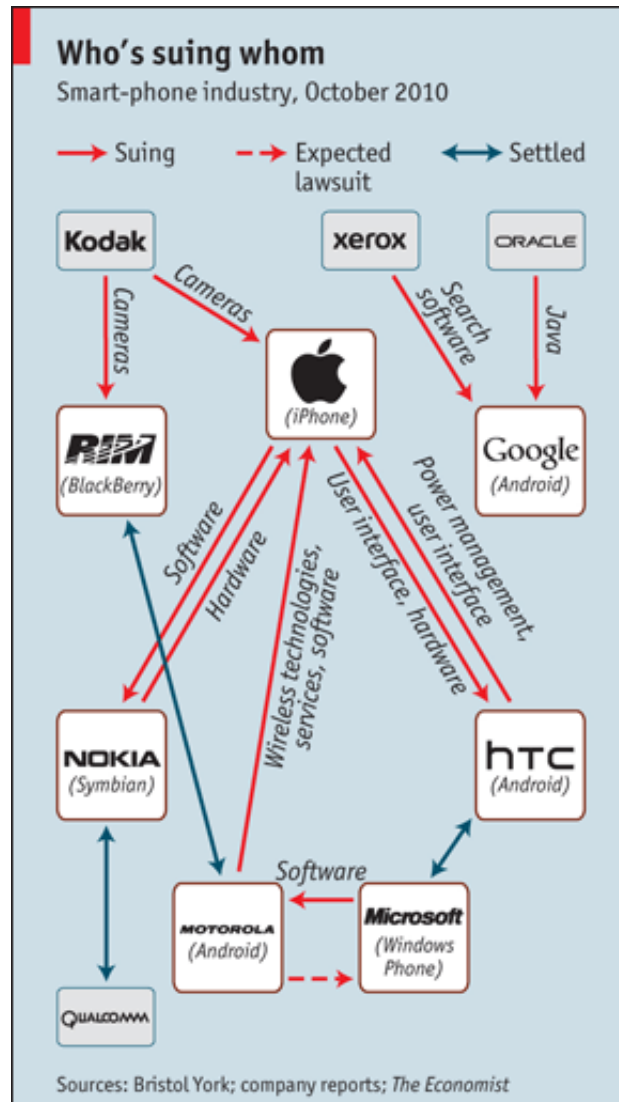
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Introduction

- Patent system designed to give incentives for innovation
 - Right to exclude others from using the patented invention
 - Temporary monopoly right of up to 20 years
 - Allows firms to reap returns on their R&D expenditure
- But patent system can also stifle innovation
 - Products increasingly complex
 - Strong increase in the number of patent applications
 - ↓
 - Firms more likely to require access to intellectual property (IP) of other players for commercialization of own products
 - ↓
 - Small royalties to many patents add up (royalty stacking)
 - High transaction costs to negotiate access to many patents

How innovators deal with IP – The smart phone battle



- Makers of handsets and related software in patent battle
 - Smart phones are complex
 - Fully-fledged computer
 - Software
 - Digital camera
 - Entertainment center
 - Firms from different industries hold patents
 - Producers pay royalties for 200-300 patents per smart phone; royalty costs are 15-20% of selling price (*The Economist*, 2010)
- Smart phone producers need to buy access to patents and need to modify products in order not to infringe rights of others

How innovators deal with IP – Additional examples

- Lemke Software, Berlin (Source: Computerwoche)
 - Main product is a graphic converter to convert electronic pictures into different file formats
 - Statement of the owner on search of relevant IP: “We just developed the product and then waited what would happen.”
 - Payment of licensing fee for relevant patent after demand was made by US company Unisys
- Microsoft versus Eolas (Source: several internet sites)
 - Eolas files for infringement by Microsoft of its patent regarding the use of plug-ins in web browsers in 1999
 - Microsoft modified its Internet Explorer to appear to side-step the Eolas patent in 2006
 - Settlement of infringement suit between Microsoft and Eolas in 2007

Open questions

- Yes, there is anecdotal evidence of firms facing problems when dealing with IP
- But so far unclear how prevalent these problems are
- Contribution of the presented research lies in providing an answer to the following questions:
 1. How widespread are problems with access to IP?
 2. What is the prevalence of strategies used by companies to gain access?
- Representative study for Germany, including breakdown of results at industry level.

Background study

- Most of the material in this presentation is based on:
E. Mueller, I. Cockburn, and M. MacGarvie (2013), Access to Intellectual Property for Innovation: Evidence on Problems and Coping Strategies from German Firms, *Research Policy*, 42, 529-541.

What do we know so far ?

- Proliferation of patents can lead to gridlock among would-be-innovators (Heller & Eisenberg, 1998)
 - NO: Biomedical scientists report no problems with access to patented research tools (Cohen & Walsh, 2008)
 - YES: Patented biomedical inventions cited less frequently than non-patented inventions (Murray & Stern, 2007)
- Higher fragmentation in IP rights is related to
 - higher probability of in-licensing by firms
 - lower innovation performance for firms in need of in-licensing (Cockburn, MacGarvie, Müller, 2010)
- Larger number of patents and patent assignees in specific markets for software products negatively impact rates of entry into these markets, but firms with own patents more likely to enter (Cockburn and MacGarvie, 2009)

Data

- Survey of German firms conducted in 2008
- Questions specifically designed for this research project included in a general annual innovation survey (Mannheim Innovation Panel)
- Analysis is based on responses from more than 2,500 companies
- Wide coverage of industries (manufacturing and service sector)
- Minimum size requirement of five employees
- Combination of survey responses with information on the patent holdings of the firms at the EPO

Descriptive statistics

	Firms with innovative activities		Firms with patent applications	
	Mean	Median	Mean	Median
Employees	1139.68	82	2989.70	274.5
Young (0/1)	0.23	0	0.22	0
R&D (in %)	2.95	0.74	3.95	1.23
Application (0/1)	0.38	0	1	1
Application stock	57.41	0	169.51	6.5
Sales share main product	66.29	70	60.92	60
ln(share technology)			-5.85	-5.93
ln(applications technology)			8.21	8.22
Patent protection high importance (0/1)			0.70	1
Concentration of IP ownership			0.06	0.05
Concentration of product market sales			0.05	0.02

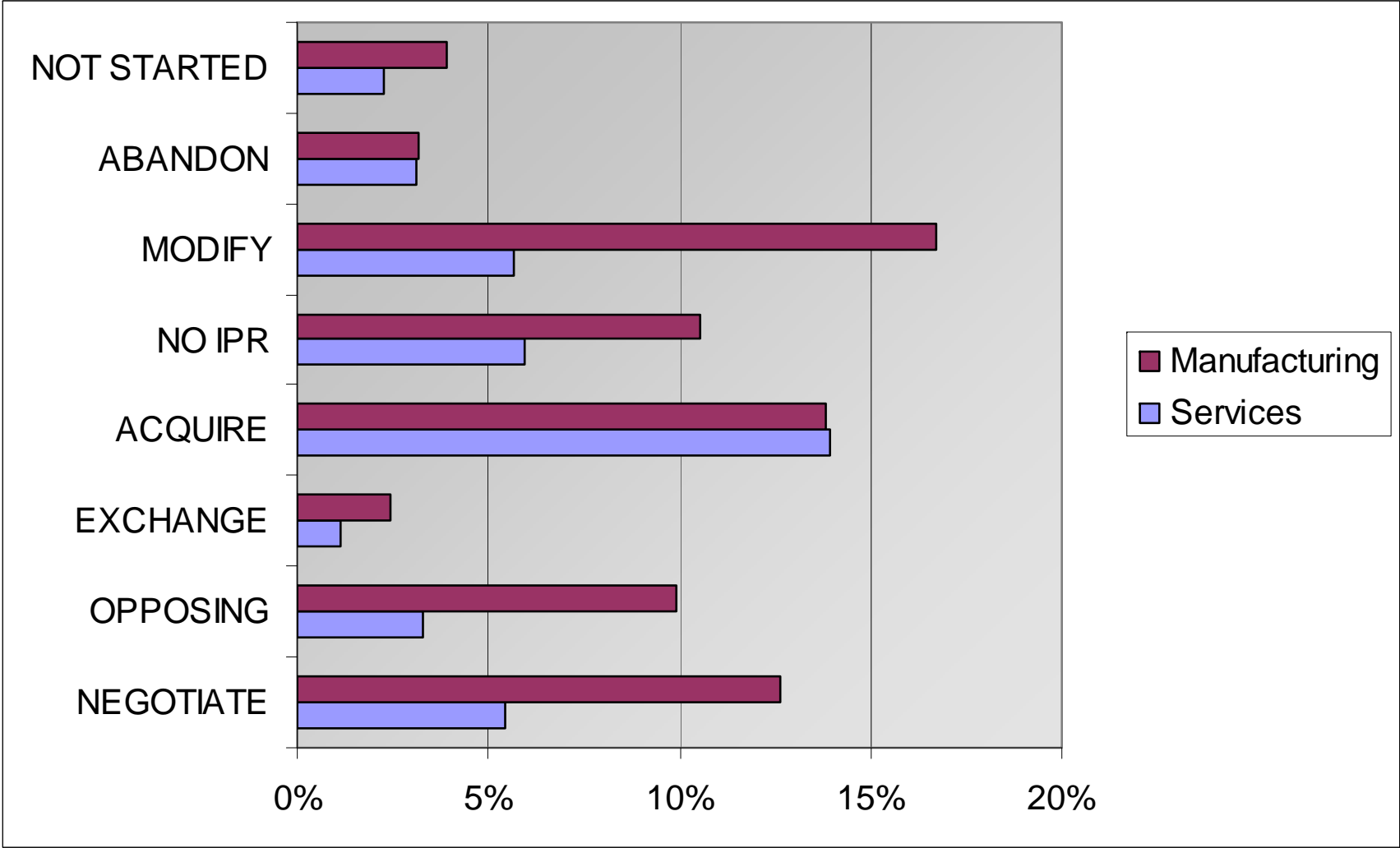
The values show the variation in the sample but are not representative for German firms.

Survey questions

Did any of the following events happen in your firm in conjunction with the access to intellectual property rights in the years 2005-2007?

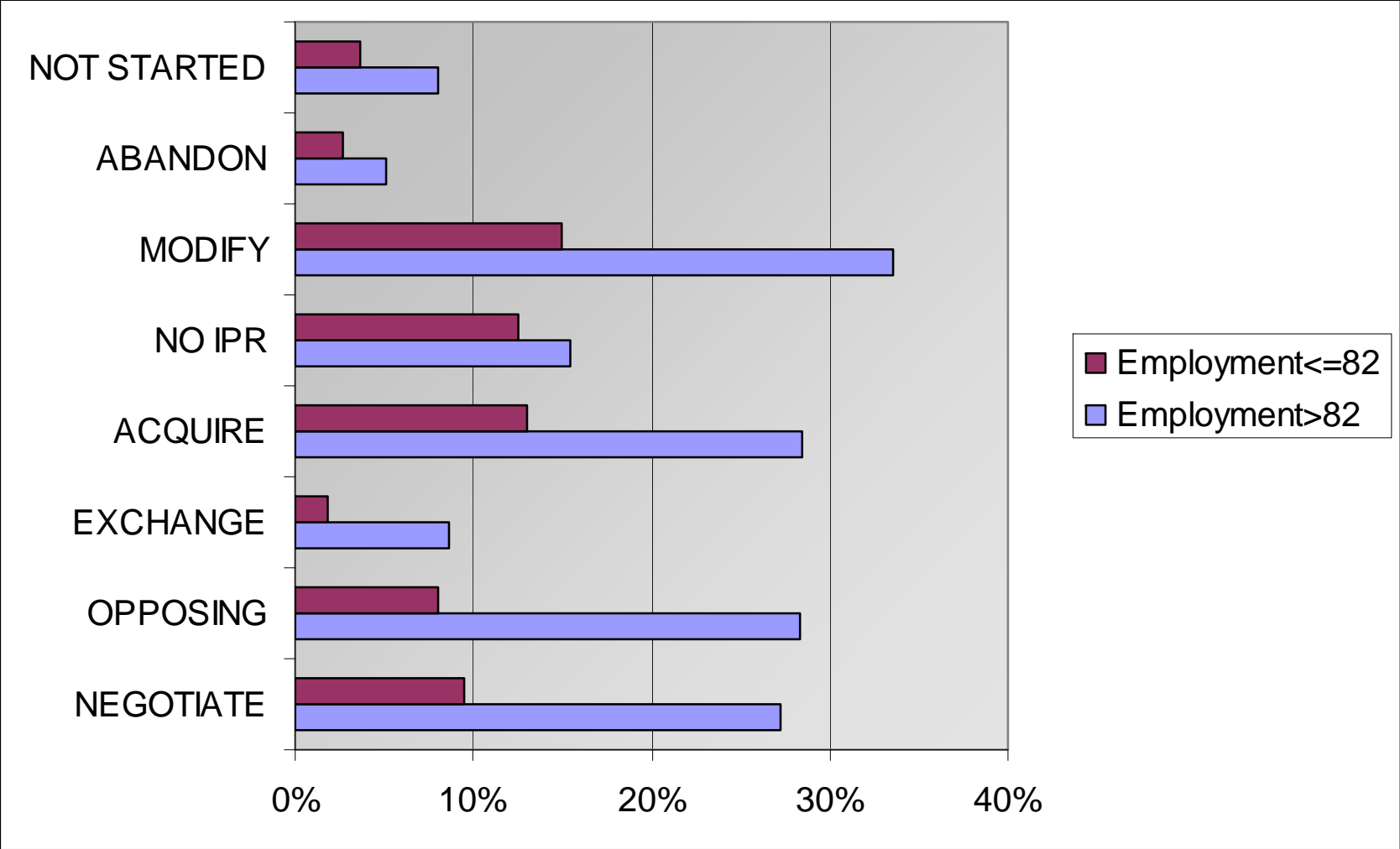
1. Innovation projects have not been started because there was no access to necessary IPR [*NOT STARTED*]
2. Abandonment of innovation projects that have already started because there was no access to necessary IPR [*ABANDON*]
3. Modification of innovation projects to comply with available IPR [*MODIFY*]
4. Conducting innovation projects without access to all necessary IPR [*NOIPR*]
5. Acquisition of IPR (purchase, licensing) [*ACQUIRE*]
6. Exchange of IPR (cross licensing, patent pools) [*EXCHANGE*]
7. Opposition/litigation of your firm against IPR hold by other firms/institutions [*OPPOSING*]
8. Negotiations/out-of-court settlements to avoid disputes about IPR [*NEGOTIATE*]

Percentage of firms with IP related events – breakdown according to sector



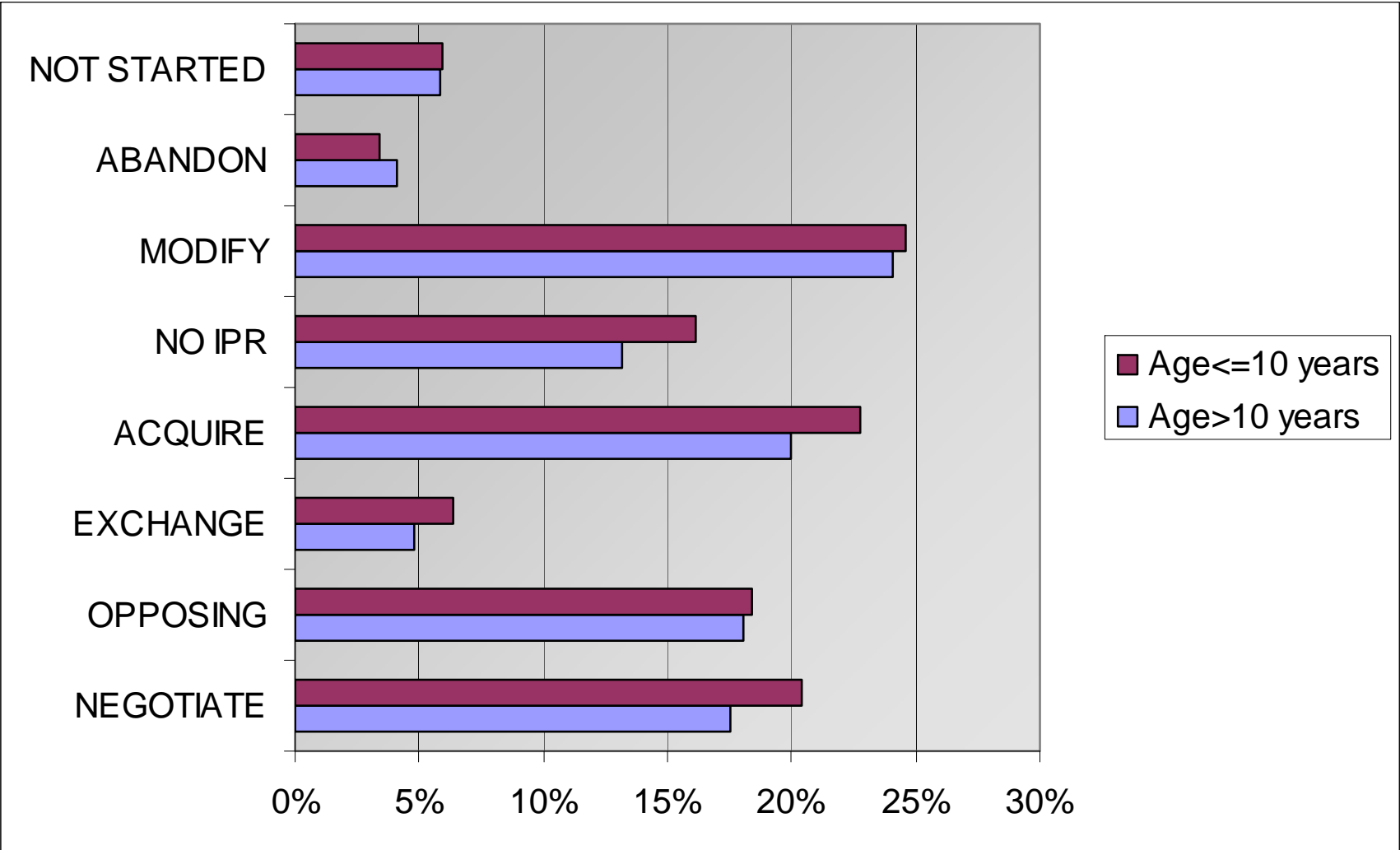
Results are representative for the German economy

Percentage of firms with IP related events – breakdown according to firm size



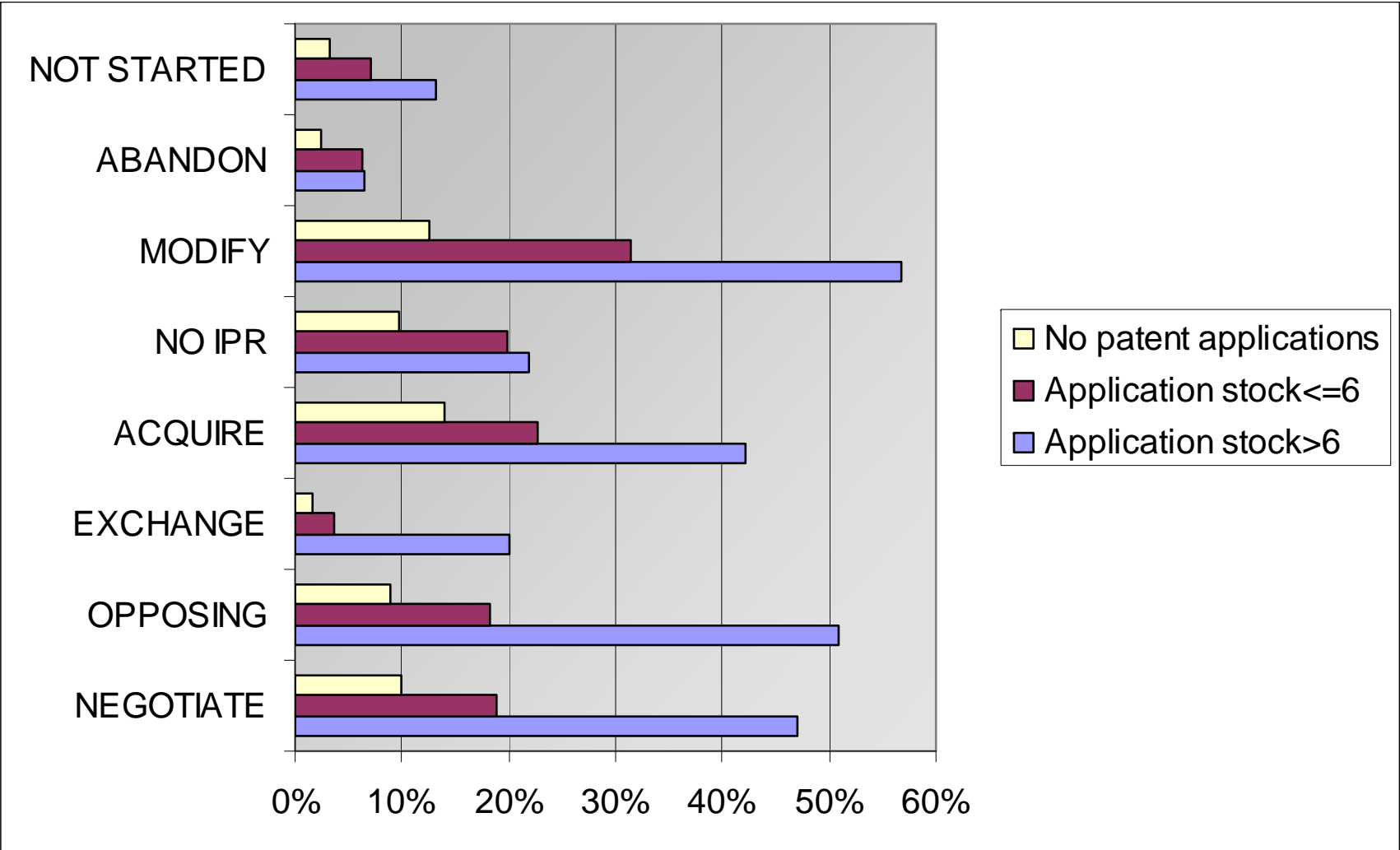
Half of the respondent firms have <=82 employees; half are above this value. Results are representative for the respondents to the survey.

Percentage of firms with IP related events – breakdown according to firm age



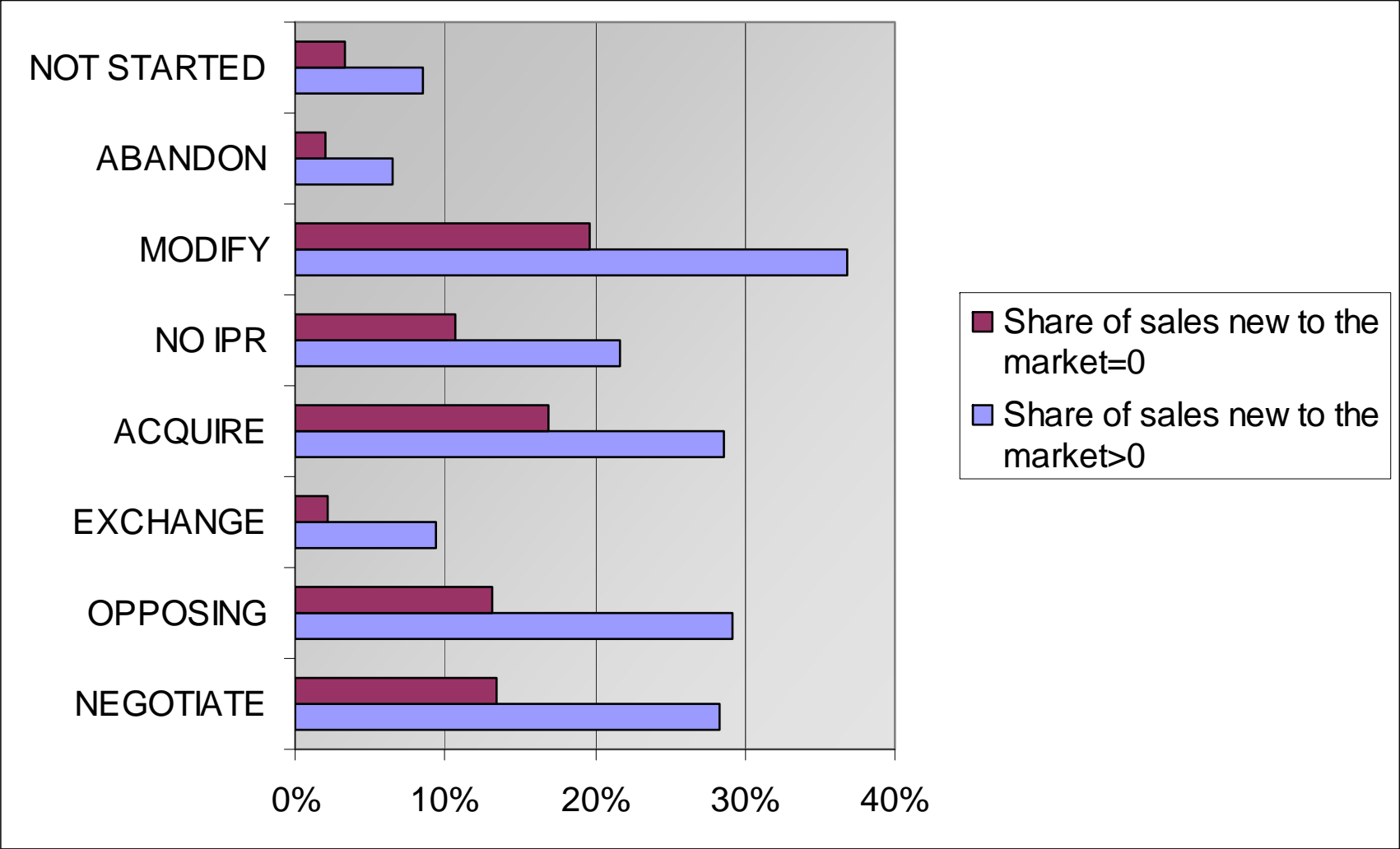
Results are representative for the respondents to the survey

Percentage of firms with IP related events – breakdown according to patent holdings



Results are representative for the respondents to the survey

Percentage of firms with IP related events – breakdown according to share of sales with products that are new to the market



Results are representative for the respondents to the survey

Prevalence of events according to industry (in %)

	NOT STARTED	ABAN DON	MODIFY	NO IPR	ACQUIRE	EX CHANGE	OPPO SING	NEGO TIATE
Mining and quarrying	0.0	1.0	1.3	1.3	5.9	0.0	3.0	0.0
Chemicals/ pharmaceuticals	10.0	5.4	26.2	18.1	29.6	5.3	17.7	21.0
Mechanical engineering	3.6	1.2	22.8	11.1	9.8	2.5	12.6	15.3
Electrical eng./ electronics	3.8	5.3	23.4	18.2	19.1	4.9	14.9	15.7
Electricity/gas/ water supply	0.0	0.0	3.0	1.2	12.0	1.0	2.9	6.7
Computer act./ telecomm.	6.4	7.8	16.1	17.2	27.9	1.2	6.1	9.3
Consultancy/ advertising	3.7	3.7	3.8	7.9	9.6	0.0	0.2	3.5

Note: Percentage of firms in a given industry experiencing the event. Values are representative for German firms with innovative activities. Values reported from Rammer and Bethmann (2009).

Marginal effects of probit models on problems – firms with innovative activities

	(1)	(2)	(3)	(4)
Dep. variable	NOT STARTED	ABANDON	MODIFY	NOIPR
Young (0/1)	-0.002	-0.008	-0.018	0.022
ln(employees)	0.010***	0.001	0.048***	0.001
ln(R&D/sales)	0.007	-0.005	0.079***	0.043***
Patent application (0/1)	0.036***	0.027**	0.154***	0.076***
Sales share main product	-0.000	-0.000**	-0.000	-0.000
No finished inno project (0/1)	0.003	0.013	0.012	0.011
Product inno only (0/1)	-0.015	0.007	0.072**	0.063**
Product and process inno (0/1)	0.006	0.029	0.135***	0.100***
Log likelihood	-337.94	-251.99	-749.17	-623.72
Observations	1647	1647	1647	1647

Robust standard errors used. Industry dummies included. Process inno only (0/1) is used as basis category.

For dummies effect size for change from zero to one calculated.

* Significant at 10%, ** significant at 5%, *** significant at 1%

Marginal effects of probit models on problems – firms with patent applications

	(1)	(2)	(3)	(4)
Dep. variable	NOT STARTED	ABANDON	MODIFY	NOIPR
Young (0/1)	0.026	-0.004	-0.004	0.052
ln(employees)	0.021***	0.009	0.045**	-0.011
ln(R&D/sales)	0.018	-0.018	0.069**	0.036*
Sales share main product	0.000	-0.001**	-0.001	-0.000
ln (applications technology)	0.004	0.001	0.062*	0.009
ln (share technology)	0.000	-0.008	0.064***	0.007
Patent protection high imp. (0/1)	0.002	0.018	0.068	-0.022
Concentration of IP ownership	-0.658*	-0.669**	-1.555**	0.441
Log likelihood	-174.58	-127.97	-340.29	-283.56
Observations	568	568	568	568

Robust standard errors used. Industry dummies and dummies for innovation activities included. For dummies effect size for change from zero to one calculated.

* Significant at 10%, ** significant at 5%, *** significant at 1%

Marginal effects of probit models on coping – firms with innovative activities

	(1)	(2)	(3)	(4)
Dep. variable	AQUIRE	EXCHANGE	OPPOSING	NEGO TIATE
Young (0/1)	0.024	0.004	-0.002	0.030
ln(employees)	0.057***	0.015***	0.056***	0.048***
ln(R&D/sales)	0.048***	0.017***	0.019*	0.026**
Patent application (0/1)	0.037	0.017**	0.099***	0.093
Sales share main product	-0.001***	0.000	0.000	-0.000*
No finished inno project	0.006	-0.016	-0.013*	-0.085*
Product inno only (0/1)	0.045	-0.002	0.060	-0.001
Product and process inno (0/1)	0.050	0.010	0.109***	0.030
Log likelihood	-740.96	-254.67	-635.62	-669.32
Observations	1647	1647	1647	1647

Robust standard errors used. Industry dummies included. Process inno only (0/1) is used as basis category. For dummies effect size for change from zero to one calculated.

* Significant at 10%, ** significant at 5%, *** significant at 1%

Marginal effects of probit models on coping – firms with patent applications

	(1)	(2)	(3)	(4)
Dep. variable	AQUIRE	EXCHANGE	OPPOSING	NEGO TIATE
Young (0/1)	-0.010	0.019	-0.025	0.002
ln(employees)	0.073***	0.036***	0.074***	0.036*
ln(R&D/sales)	0.078***	0.046**	-0.008	0.014
Sales share main product	-0.001	0.000	0.001	-0.001
ln(applications technology)	0.012	0.028	0.092***	0.106***
ln (share technology)	0.019	0.034***	0.063***	0.071***
Patent protection high imp. (0/1)	0.053	0.054*	0.071*	0.033
Concentration of IP ownership	-0.599	0.516	-0.591	-0.236
Log likelihood	-327.22	-148.15	-311.07	-316.03
Observations	568	568	568	568

Robust standard errors used. Industry dummies and dummies for innovation activities included. For dummies effect size for change from zero to one calculated.

* Significant at 10%, ** significant at 5%, *** significant at 1%

What influences experiencing problems and using coping strategies?

- Firms experience a **Problem** if at least one of the following events has happened:
 - NOT STARTED
 - ABANDON
 - MODIFY
- Firms use a **Coping** mechanism if at least one of the following events has happened:
 - ACQUIRE
 - EXCHANGE
 - OPPOSING
 - NEGOTIATE
- Combination of IP related events for analysis of interdependence between the strategies (bivariate probit model)

Marginal effects for bivariate probit model

Dep. variable	Firms with innovative activities		Firms with patent applications	
	PROBLEM	COPING	PROBLEM	COPING
Young (0/1)	-0.027	0.023	-0.020	-0.029
ln(employees)	0.043***	0.074***	0.045**	0.066***
ln(R&D/sales)	0.078***	0.062***	0.066***	0.059**
ln(applications technology)			0.052*	0.059**
ln(share technology)			0.049***	0.047***
Application (0/1)	0.149***	0.140***		
Sales share main product	-0.001*	-0.000	-0.001	0.001
No finished inno project (0/1)	0.023	-0.016	-0.120	0.034
Product inno only (0/1)	0.043	0.061	0.076	0.077
Product and process inno (0/1)	0.120***	0.113***	0.125	0.174*
Manufacturing, complex(0/1))	0.012	-0.029	0.022	-0.026
Chemical industry (0/1)	0.068	0.073*	0.148*	0.042
Patent protection high imp. (0/1)			0.044	0.094**
Concentration of IP ownership			-1.326**	-0.433
Conc. of product market sales			-0.304	-0.002
Rho	0.444		0.390	

Robust standard errors used. Industry dummies included. For dummies effect size for change from zero to one calculated. Manufacturing (discrete) and Process inno only are basis categories.

* Significant at 10%, ** significant at 5%, *** significant at 1%

Conclusions

- Firms rarely do not start projects or abandon them because of lack of access to IP
 - A rather high share of firms need to modify projects or needs to buy access to IP
 - No specific problems for young firms
- Firms benefiting from the patent system (e.g. firms with own patents) are also the firms that face problems

Limitations

- We do not observe the nature of not started or abandoned projects
 - Opportunity costs of forgone innovation not clear
 - We do not observe the costs of inventing around and of employing coping strategies
 - Financial costs not clear
- A full cost-benefit analysis is not possible
- Information only for Germany
- But in other countries also strong increase in patenting, problems for innovators also expected in other countries

Thank you very much
for your attention !

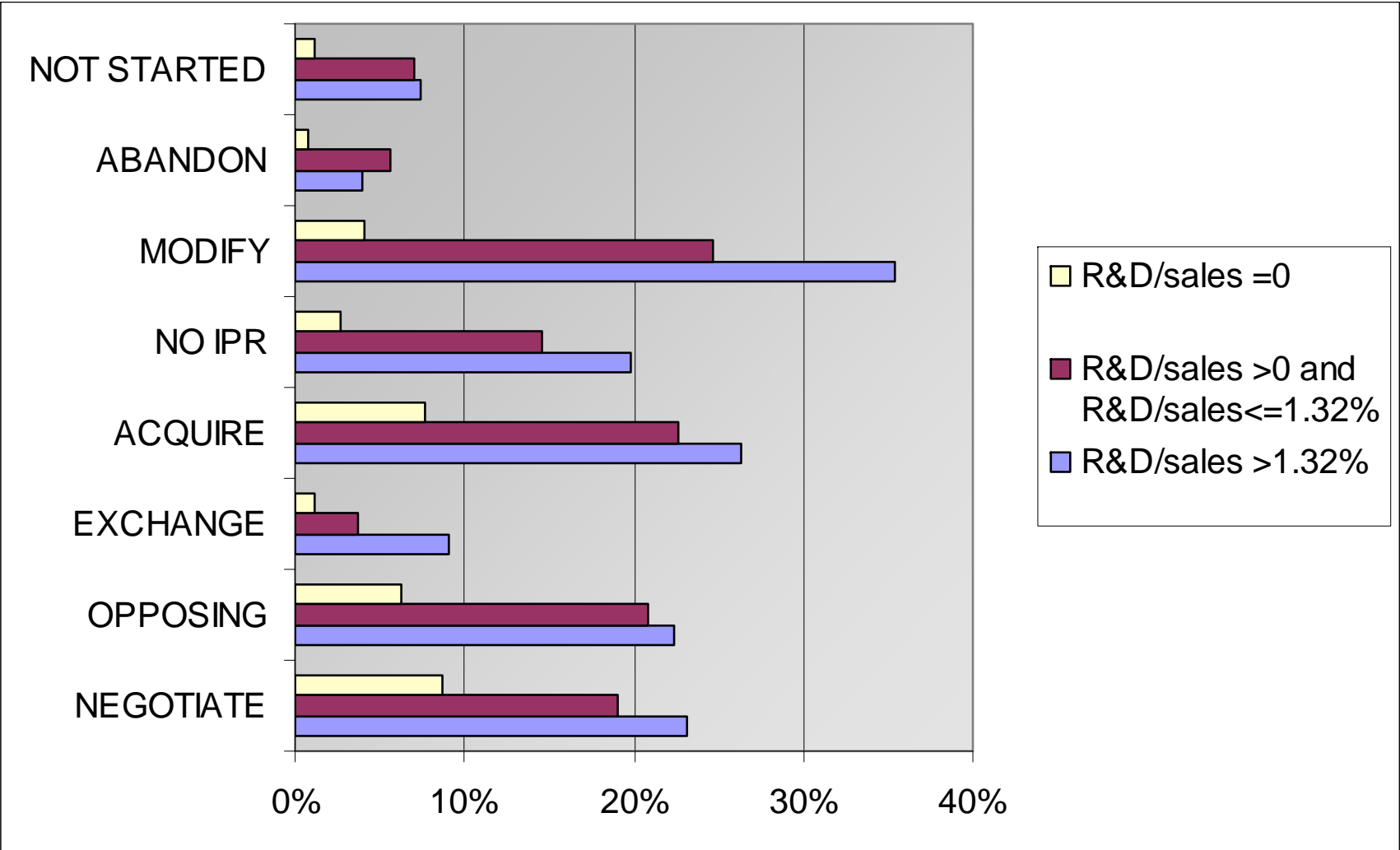
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additional explanation:

Measuring the concentration of IP ownership

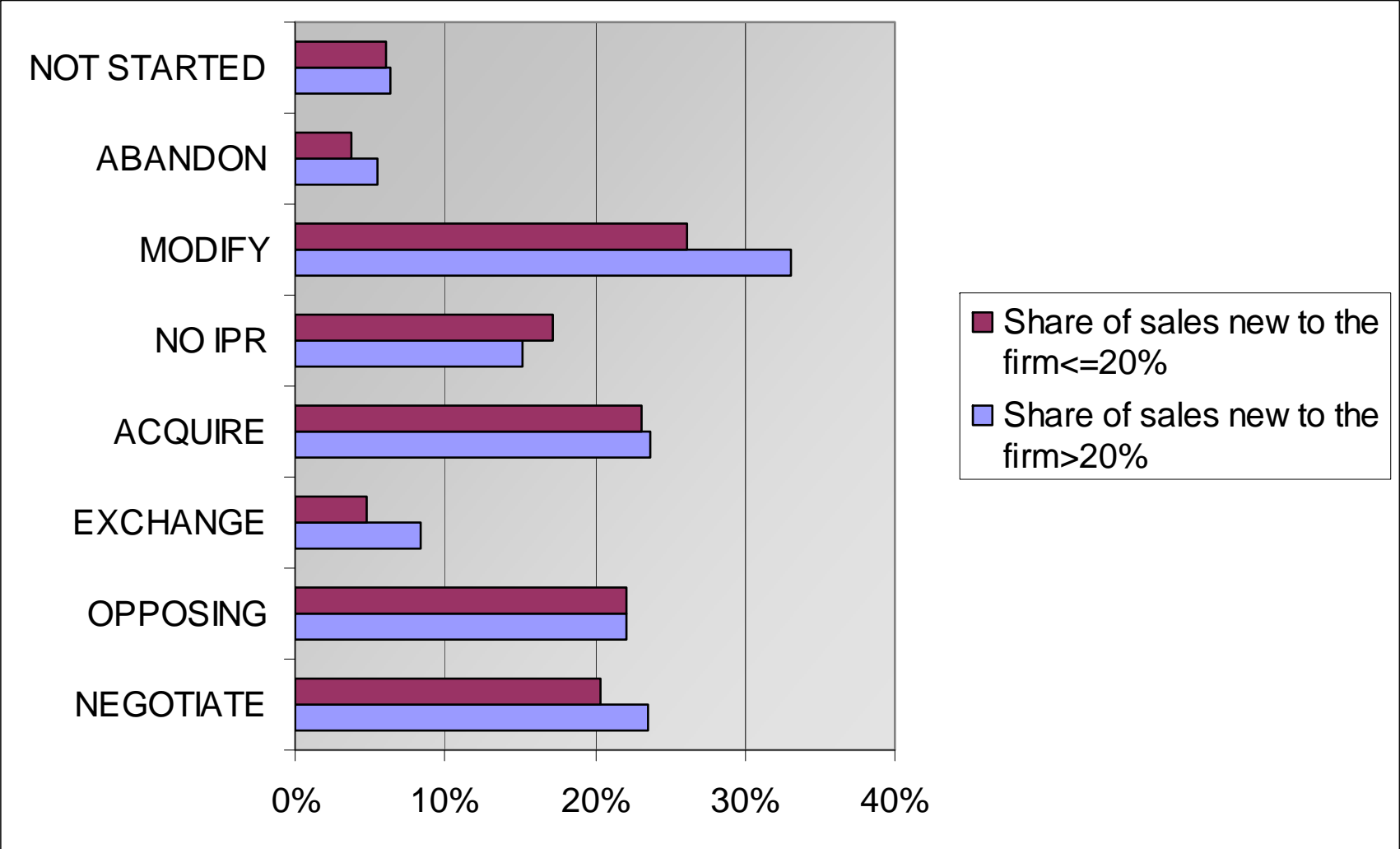
- Concentration of IP ownership is measured based on the share of patent applications in a given technology that the applicants hold
- Steps for the calculation:
 1. For all applicants of the EPO calculate the share of applications in a given technology (differentiate 30 technologies)
 2. Calculate the square of the share of applications
 3. Sum the square over all applicants
- Calculation done on an annual basis, average of the values for the years 2003 to 2007 is used
- Measure is also called a Herfindahl index

Percentage of firms with IP related events – breakdown according to R&D intensity



Results are representative for the respondents to the survey

Percentage of firms with IP related events – breakdown according to share of sales with products that are new to the firm



Results are representative for the respondents to the survey