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Alfred Kleinknecht

The Journal of Industrial Economics, Vol. 36, No. 2 (Dec., 1987), 253-256.

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MEASURING R & D IN SMALL FIRMS: HOW MUCH ARE WE MISSING?

ALFRED KLEINKNECHT*

The OECD surveys on R & D are considerably biased towards underestimating R & D in small firms. This conclusion is derived from the author's comparison between the official Dutch R & D survey and the findings of his own survey among 3000 firms. Although being based on Dutch observations only, the author's considerations have an impact on other OECD countries, since the official Dutch R & D survey is fully compatible with those in other countries. The findings call into question the results from a number of empirical studies, bearing on subjects such as market structure and R & D, firm size and R & D or R & D and growth.

THIS PAPER draws from the author's innovation survey in Dutch manufacturing industry which is based on a sample of some 3000 firms of which 1842 (= 63.1%) responded. The principal outcomes of our survey as compared with the official Dutch R & D survey are summarized in Table I. While, in the category of firms having 500 and more employees, man-years of R & D in both surveys are by and large compatible, there are differences in the categories of firms having less than 500 employees, and these differences increase as firm size diminishes. Similar differences exist in the numbers of firms performing any R & D, which are not documented here (see Kleinknecht [1987] for more complete information).

It should be mentioned that the differences in Table I show up in spite of an extremely cautious extrapolation of our data: Since we could not exclude the possibility that a positive correlation exists between the innovativeness of a firm and its readiness to respond to an innovation survey, we assumed that firms which did not respond (36.9% of the sample) have *no* R & D. Because of this extreme assumption, our extrapolation clearly involves a downward bias (see also footnote (b) in Table I).

It should be noted that in our survey we used exactly the same definition of R & D (according to the Frascati-Manual of the OECD) which is used in the official Dutch R & D survey. Our survey, however, does differ from the official survey in that it is restricted to the most simple R & D indicator possible, i.e.

*My research was sponsored by the Dutch Ministry of Economic Affairs. I am indebted to my student assistants, Hans Bieshaar, Aat Keet, Jos den Ronden and Bart Verspagen, for administrative support of the mailing survey and computer processing of the data. Moreover I wish to express my gratitude to J. T. Kolfoort, R. Lujendijk and J. van der Steen from the Department of R & D Statistics of the Dutch Central Statistical Office, whose comments very much facilitated comparison of my results with their data.

TABLE I
MAN-YEARS OF INTRAMURAL R & D BY SIZE OF FIRM (OUR RESULTS COMPARED WITH THE DATA FROM THE OFFICIAL SURVEY).

<i>R & D Man-years in 1981 and 1983</i>					
<i>Firm Sizes (employees)</i>	<i>According to official survey in 1981^(*)</i>		<i>According to our most cautious extrapolation (with downward bias)^(b)</i>		
	<i>Man-years</i>	<i>Percentages</i>	<i>Man-years</i>	<i>Percentages</i>	<i>Percentages</i>
10 to 19	n.a.	n.a.	534	2.2%	—
20 to 49	n.a.	n.a.	967	4.0%	—
50 to 99	301	1.2%	903	3.7%	3.9%
100 to 199	650	2.7%	1386	5.7%	6.1%
200 to 499	1228	5.1%	1745	7.2%	7.6%
500 and more	21 992	91.0%	18 839	77.3%	82.4%
Total	24 171	± 100%	24 374	± 100%	± 100%

Notes:

(*) Source: telephone information from the Department of R & D Statistics of the Dutch Central Statistical Office (CBS).

(b) The original data have only been extrapolated in order to adjust the difference between sample size and population. No extrapolation has been made to correct for non-responding firms, i.e. firms which did not respond (36.9% of the sample) are assumed to have no R & D activities.

R & D man-years. Moreover, we included the following question for firms which have no formal R & D department:

"If your enterprise does *not* have an R & D department, R & D activities might be carried out by other departments within your enterprise. For example: the sales department might develop a new product, or the production department might introduce improvements to a production process.

Have any R & D activities been carried out within your enterprise during 1983 even though you do not have a formal R & D department?

—No.

—Yes. If so, can you give an estimate of the number of man-years that were devoted to such activities in 1983 (if necessary, give a *rough* estimate)?

Man-years devoted to R & D during 1983:"

The above question was designed in order to avoid reactions such as: we have no R & D department, hence there is no R & D. Our attempt to capture the rather informal R & D work was encouraged by evidence from a growing number of field studies which suggest that in small firms, development work is often mixed with other activities and done without even having a formal R & D budget (R & D being paid for out of the cash-flow), frequently occurring outside regular working hours. It is conceivable that such R & D cannot be captured by means of the rather detailed questionnaires in the official surveys: some entrepreneurs, having small amounts of R & D, may fill in 'zero R & D',

simply in order to get rid of the complicated questionnaire. Even those willing to respond correctly may have difficulties in doing so because of insufficient internal accounting of their R & D. The perfectionism of the official questionnaires is likely to be counter-productive.

To be fair, we should mention two possible causes of an upward bias in our estimates. First, the Ministry of Economic Affairs was mentioned in our survey questionnaire as having financially sponsored our survey, and a letter of recommendation by the Minister was included. Although firms were assured that no information concerning individual respondents would be given to the Ministry, we cannot exclude the possibility that there have been companies which have overestimated their innovation activities in order to make a good impression on the Ministry, which is a source of subsidies for innovation. Secondly, in doubtful cases, the Dutch Central Statistical Office sometimes phones up firms in order to check their interpretation of the definition of R & D. This occasionally leads them to disregard the R & D reported. No such control was built into our survey. However, these two considerations can explain only a small fraction of the discrepancies between the official survey and our data. Neither can the differences in Table I be wholly explained by the fact that our data refer to the year 1983, while the official survey covers 1981, although there has been a certain increase in R & D activities in recent years.

We believe the principal explanation for the differences between the two surveys lies in the previously quoted question which tries to take into account the often rather informal character of R & D work in small firms. This may have led many small firms to report even quite small-scale R & D work which they would (and often could) not have reported in the official surveys. And this small-scale R & D work appears to be quite important: for example, among the firms which report any R & D work, 71% of firms having 10 to 49 employees (and 39% of firms having 50 to 199 employees) report having one man-year or less of R & D (for more details see Kleinknecht [1987]). It is obvious that much (if not all) of this R & D refers to the "D" rather than to the "R" component of R & D.

Our attempt to capture such R & D work leads to a notable shift in the observed concentration of R & D in large firms. Table I shows that according to the official R & D survey, 91% of private R & D in Dutch manufacturing firms is done by large firms (having 500 and more employees). According to our estimate, this percentage would fall to 82.4% (when considering only firms having 50 and more employees). The percentage would fall even lower to 77.3% when adding the R & D done in firms having 10 to 49 employees which are not covered in the official survey.

From the above we can conclude that even the most cautious (and probably downward biased) extrapolation of our data gives a clear indication that the official Dutch R & D survey is missing a considerable amount of small-scale industrial R & D. Because of the aim of international comparability of

R & D data, the methods of accounting for R & D in the Netherlands are in principle compatible with those in other OECD countries. Therefore, our findings and conclusions are likely to apply to the other OECD surveys as well, although our investigation was restricted to the Netherlands. Judging from our survey experience, we can say that there is a real need to improve the present R & D surveys and that this can be achieved by altering the survey methods so that more account is taken of the specific organizational settings of R & D in small firms. This would imply first of all a radical simplification of the survey questionnaires.

If R & D in small firms was more adequately measured in the official surveys, this would not only have implications for innovation policy, but also for innovation research. A whole range of empirical studies in which the biased figures of the OECD have been used as an input indicator of the innovation process (e.g. studies on the relationship between firm size and R & D, market structure and R & D, or R & D and growth) would appear to be obsolete and will have to be repeated as soon as better figures are available.

ALFRED KLEINKNECHT,
Faculty of Economics,
Rijksuniversiteit Limburg,
PO Box 616,
NL-6200 MD Maastricht,
The Netherlands.

ACCEPTED MAY 1987

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