

professional inventors, and by men of all sorts. They turned out wonders for their age, and helped bring a vast economic growth. But however precious, their inventing and patenting was almost always a simple, amateurish, tossed off thing, compared to the thorough, elaborate, perfected, scientific product of thousands, even millions of man-hours of labor by highly trained scientists, engineers and their assistants, that constitutes the great and valuable bulk of the invention industry today.

[86] It is quite an industry, you know, today, with its own press, such as the journals *Industrial Laboratories* and *Research Management*, and a budget for all R&D of 14 billions of 1961 dollars, 2.78% of the Gross National Product. Since so little of all this existed in 1880, and it is what our indices chiefly measure, a growth to 345-fold is easily possible with this virtual creation of a new industry, that of scientific invention. Kreps said that the invention of invention, as A. N. Whitehead called it, and the coming of science, make invention an inevitable product of scientific advance. Competition encourages carrying it possibly even beyond the proper economic limit, through optimism, pride in one's product, fear of being outstripped, and tax benefits.¹⁰³

[87] Similar rates of growth characterize other countries' R&D, Dedijer shows.⁶⁶² The American percentage of the GNP is nearly matched by Britain and Russia, and in descending order by Sweden (1.8%), West Germany, France and Canada, while the smaller and the poorer countries usually find it easier to copy than create. Price⁶⁶³ also presents convincing measurements of the growth of the world's science, through counting scientists, scientific journals, abstracting journals, discoveries, and R&D funds. Cf. also ¶ 54.

[88] We have always thought that much of the growth registered in our indices has been in organization, science, and literacy, rather than in inventing proper,¹⁰⁴ so that our growth measure would be exaggerated if taken for invention alone. The modern invention industry reaches backward into science, making the discoveries needed, and sometimes reaches forward into designing, perfecting, and marketing; and much of this figures in our indices, unavoidably. Those aspects are all necessary for invention; but probably they were not so much represented in our indices for the early years. These wider reaches have never been patentable. Kottke¹⁰⁵ points out the difficulty of separating research and invention from designing and innovational engineering. Since it is a modern fashion in industry, and possibly in government, to boast of the amount spent on research and development, it is likely that many expenses and personnel which do not belong under our concept of invention plus invention-oriented research have got into our statistics, inflating their rise with this

¹⁰⁴ While we distrust definitions in social science, it will be evident that our working definition of invention is a broad one, including all manner of new practical ideas, big and little, that are useful to produce goods or services, up to the boundary of Science, and far wider than the scope of patentability, to which technical people are apt to restrict the word's use. (¶ 111, 576.)

¹⁰⁵ "In compiling its directories of industrial laboratories the Nat. Research Council has attempted to segregate research from innovational engineering. These directories contain ample evidence that businessmen are not agreed where the distinction is to be drawn, accordingly. The dissociation of industrial research from innovational engineering is in the main historical rather than functional. One cannot understand the relation of business concerns to technology if he has eyes only for the work of men who hold advanced academic degrees." Kottke, N 211.