THE ORGANISATION OF INDUSTRY[1]

I

I WAS once in the habit of telling pupils that firms might be envisaged as islands of planned co-ordination in a sea of market relations. This now seems to me a highly misleading account of the way in which industry is in fact organised. The underlying idea, of course, was of the existence of two ways in which economic activity could be co-ordinated, the one, conscious planning, holding sway within firms, the other, the price mechanism, operating spontaneously on the relations between firms and between firms and their customers. The theory of the firm, I argued, had as its central core an elaboration of the logic of this conscious planning; the theory of markets analysed the working of the price mechanism under a variety of alternative structural arrangements.

I imagine that this account of things might be acceptable, as a harmless first approximation, to a large number of economists. And yet there are two aspects of it that should trouble us. In the first place it raises a question, properly central to any theory of economic organisation, which it does not answer; and, secondly, it ignores the existence of a whole species of industrial activity which, on the face of it, is relevant to the manner in which co-ordination is achieved. Let us deal with each of these matters in turn.

Our simple picture of the capitalist economy was in terms of a division of labour between the firm and the market, between co-ordination that is planned and co-ordination that is spontaneous. But what then is the principle of this division? What kinds of co-ordination have to be secured through conscious direction within firms and what can be left to the working of the invisible hand? One might reasonably maintain that this was a key question—perhaps the key question—in the theory of industrial organisation, the most important matter that the Divine Maker of market economies on the first day of creation would have to decide. And yet, as I hope soon to show, it is a matter upon which our standard theories, which merely assume but do not explain a division between firm and market, throw little light.

Let me now turn to the species of industrial activity that our simple story, based as it is on a dichotomy between firm and market, leaves out of account. What I have in mind is the dense network of co-operation and affiliation by which firms are inter-related. Our theoretical firms are indeed islands, being characteristically well-defined autonomous units buying and selling at arms' length in markets. Such co-operation as takes place between them is normally studied as a manifestation of the desire to restrict competition and features in chapters about price agreements and market sharing.

[1] I am grateful to Mr. J. F. Wright, Mr. L. Hannah and Mr. J. A. Kay, each of whom gave helpful comments on a draft of this article.

But if the student closes his textbook and takes up a business history, or the financial pages of a newspaper, or a report of the Monopolies Commission, he will be presented with a very different picture. Firm A, he may find, is a joint subsidiary of firms B and C, has technical agreements with D and E, sub-contracts work to F, is in marketing association with G—and so on. So complex and ramified are these arrangements, indeed, that the skills of a genealogist rather than an economist might often seem appropriate for their disentanglement.[1] But does all this matter? Theories necessarily abstract and it is always easy to point to things they leave out of account. I hope to show that the excluded phenomena in this case are of importance and that by looking at industrial reality in terms of a sharp dichotomy between firm and market we obtain a distorted view of how the system works. Before doing so, however, I wish to dwell a little longer on the several forms that co-operation and affiliation may take; although the arrangements to be described are no doubt well known to the reader, explicit mention may nevertheless help to draw attention to their variety and extent.

II

Perhaps the simplest form of inter-firm co-operation is that of a trading relationship between two or more parties which is stable enough to make demand expectations more reliable and thereby to facilitate production planning. The relationship may acquire its stability merely from goodwill or from more formal arrangements such as long-term contracts or shareholding. Thus, for example, the Metal Box Company used to obtain a discount from its tin plate suppliers in return for undertaking to buy a certain proportion of its requirements from them, and the same company owned 25% of the share capital of the firm supplying it with paints and lacquers. In the same way Imperial Tobacco owned shares in British Sidac, which made cellophane wrapping, and in Bunzl, which supplied filter tips. Occasionally shareholdings of this kind may be simply investments held for their direct financial yield, but more generally they give stability to relationships through which the activities of the parties are co-ordinated both quanti-

[1] The sceptical reader might care to look up a few cases in the reports of the Monopolies Commission. The following example is found in the report on cigarette filter tips. Cigarette Components Ltd. made filter tips for Imperial Tobacco and Gallaher using machines hired from these companies. It has foreign subsidiaries, some wholly and some partially owned. It was both licensee and licensor of various patents one of which was held by the Celfil Trust, registered in Liechtenstein, with regard to the ultimate control of which Cigarette Components told the Monopolies Commission they could only surmise. Nevertheless, this patent was of key importance in that the Celfil licensees, of which Cigarette Components was only one, were bound by price and market sharing arrangement. Cigarette Components was itself owned by Bunzl Ltd., in which Imperial Tobacco had a small shareholding. The raw material for the tips is cellulose acetate tow which was made by Ectona Fibres Ltd., a company in which Bunzl had a 40% interest and a subsidiary of Eastman Kodak 60%. Agreements had been made providing that, should Bunzl lose control of Cigarette Components, then Eastman could buy out their shares in Ectona . . . etc., etc.

tatively and qualitatively. Not only is it made easier to adjust the quantity of, say, lacquer to the quantity of cans which it is used to coat but the specification and development of the lacquers can be made appropriate to the use to be made of them. And in the synthetic fibre industry likewise, linkages between firms at the various stages—polymer manufacture, yarn spinning and finishing, textile weaving—help bring about the co-ordinated development of products and processes. The habit of working with models which assume a fixed list of goods may have the unfortunate result of causing us to think of co-ordination merely in terms of the balancing of quantities of inputs and outputs and thus leave the need for qualitative co-ordination out of account.

Co-operation may frequently take place within the framework provided by sub-contracting. An indication of the importance of this arrangement is provided by the fact that about a quarter of the output of the Swedish engineering industry is made up of sub-contracted components, while for Japan the corresponding figure is about a third and in that country's automobile industry almost a half. Sub-contracting on an international basis, moreover, is said to be becoming more widespread and now a dense network of arrangements links the industries of different countries.[1] Now the fact that work has been sub-contracted does not by itself imply the existence of much co-operation between the parties to the arrangement. The plumbing work on a building contract may be sub-contracted on the basis of competitive tenders for the individual job. Frequently, however, the relationship between the parties acquires a degree of stability which is important for two reasons. It is necessary, in the first place, to induce sub-contractors to assume the risks inherent in a rather narrow specialisation in skills and equipment; and, secondly, it permits continuing co-operation between those concerned in the development of specifications, processes and designs.

Co-operation also takes place between firms that rely on each other for manufacture or marketing and its fullest manifestation is perhaps to be found in the operations of companies such as Marks and Spencer and British Home Stores. Nominally, these firms would be classified as retail chains, but in reality they are the engineers or architects of complex and extended patterns of co-ordinated activity. Not only do Marks and Spencer tell their suppliers how much they wish to buy from them, and thus promote a quantitative adjustment of supply to demand, they concern themselves equally with the specification and development of both processes and products. They decide, for example, the design of a garment, specify the cloth to be used and control the processes even to laying down the types of needles to be used in knitting and sewing. In the same way they co-operate with Ranks and Spillers in order to work out the best kind of flour for their cakes and do not neglect to specify the number of cherries and walnuts to go into them.

[1] See the *Economic Bulletin for Europe*, Vol. 21, No. 1.

Marks and Spencer have laboratories in which, for example, there is development work on uses of nylon, polyester and acrylic fibres. Yet all this orchestration of development, manufacture and marketing takes place without any shareholding by Marks and Spencer in its suppliers and without even long-term contracts.

Mention should be made, finally, of co-operative arrangements specifically contrived to pool or to transfer technology. Surely the field of technical agreements between enterprises is one of the under-developed areas of economics. These agreements are commonly based on the licensing or pooling of patents but they provide in a quite general manner for the provision or exchange of know-how through the transfer of information, drawings, tools and personnel. At the same time they are often associated with the acceptance by the parties to them of a variety of restrictions on their commercial freedom—that is to say with price agreements, market sharing and the like.

This brief description of the varieties of inter-firm co-operation purports to do no more than exemplify the phenomenon. But how is such co-operation to be defined? And how in particular are we to distinguish between co-operation on the one hand and market transactions on the other? The essence of co-operative arrangements such as those we have reviewed would seem to be the fact that the parties to them accept some degree of obligation—and therefore give some degree of assurance—with respect to their future conduct. But there is certainly room for infinite variation in the scope of such assurances and in the degree of formality with which they are expressed. The blanket manufacturer who takes a large order from Marks and Spencer commits himself by taking the appropriate investment and organisational decisions; and he does so in the expectation that this company will continue to put business in his way. In this instance, the purchasing company gives no formal assurance but its past behaviour provides suppliers with reason to expect that they can normally rely on getting further orders on acceptable terms. The qualification "normally" is, of course, important, and the supplier is aware that the continuation of orders is conditional on a sustained demand for blankets, satisfaction with the quality of his manufacture and so on. In a case such as this any formal specification of the terms and conditions of the assurance given by the supplier would scarcely be practicable and the function of goodwill and reputation is to render it unnecessary.

Where buyer and seller accept no obligation with respect to their future conduct, however loose and implicit the obligation might be, then co-operation does not take place and we can refer to a pure market transaction. Here there is no continuing association, no give and take, but an isolated act of purchase and sale such, for example, as takes place on an organised market for financial securities. The pure market transaction is therefore a limiting case, the ingredient of co-operation being very commonly present, in some degree, in the relationship between buyer and seller. Thus although

I shall have occasion to refer to co-operation and market transactions as distinct and alternative modes of co-ordinating economic activity, we must not imagine that reality exhibits a sharp line of distinction; what confronts us is a continuum passing from transactions, such as those on organised commodity markets, where the co-operative element is minimal, through intermediate areas in which there are linkages of traditional connection and goodwill, and finally to those complex and inter-locking clusters, groups and alliances which represent co-operation fully and formally developed. And just as the presence of co-operation is a matter of degree, so also is the sovereignty that any nominally independent firm is able to exercise on a *de facto* basis, for the substance of autonomy may often have been given up to a customer or a licensor. A good alliance, Bismarck affirmed, should have a horse and a rider, and, whether or not one agrees with him, there is little doubt that in the relations between firms as well as nation states, the condition is often met.

III

It is time to revert to the main line of our argument. I had suggested that theories of the firm and of markets normally provide no explanation of the principle of the division of labour between firms and markets and of the roles within a capitalist economy of planned and spontaneous co-ordination. And I also maintained that these theories did not account for the existence of inter-firm co-operation and affiliation. It is upon the first of these two deficiencies that I now wish to concentrate.

Probably the simplest answer to the question as to the division of labour between firm and market would be to say that firms make products and market forces determine how much of each product is made. But such an answer is quite useless. If " products " are thought of as items of final expenditure such as cars or socks, then it is clear that very many different firms are concerned with the various stages of their production, not only in the sense that firms buy in components and semi-manufactures from other firms but also in that there may be a separation of manufacture and marketing (as in the case of Marks and Spencer and its suppliers) or of development and manufacture (as in the case of licensors and licencees). If, alternatively, we simply define " products " as what firms do, then the statement that firms make products is a tautology which, however convenient, cannot be the basis of any account of the division of labour between firm and market.

It is worth observing that we learn nothing about this division of labour from the formal theory of the firm. And this is perhaps not surprising as the theory, in its bare bones, is little more than an application of the logic of choice to a particular set of problems. It may be that the theory indeed makes it more difficult to answer our question in that, in order the better to exhibit this logic of choice, it is formulated on the assumption of " given

production functions" which represent the maximum output obtainable from different input combinations. However useful this representation of productive possibilities, it leaves one important class of ingredients out of account. It abstracts totally from the roles of organisation, knowledge, experience and skills, and thereby makes it the more difficult to bring these back into the theoretical foreground in the way needed to construct a theory of industrial organisation. Of course I realise that production functions presume a certain level of managerial and material technology. The point is not that production is thus dependent on the state of the arts but that it has to be undertaken (as Mrs. Penrose has so very well explained)[1] by human organisations embodying specifically appropriate experience and skill. It is this circumstance that formal production theory tends to put out of focus, and justifiably, no doubt, given the character of the optimisation problems that it is designed to handle; nevertheless, it seems to me that we cannot hope to construct an adequate theory of industrial organisation and in particular to answer our question about the division of labour between firm and market, unless the elements of organisation, knowledge, experience and skills are brought back to the foreground of our vision.

It is convenient to think of industry as carrying out an indefinitely large number of *activities*, activities related to the discovery and estimation of future wants, to research, development and design, to the execution and co-ordination of processes of physical transformation, the marketing of goods and so on. And we have to recognise that these activities have to be carried out by organisations with appropriate *capabilities*, or, in other words, with appropriate knowledge, experience and skills. The capability of an organisation may depend upon command of some particular material technology, such as cellulose chemistry, electronics or civil engineering, or may derive from skills in marketing or knowledge of and reputation in a particular market. Activities which require the same capability for their undertaking I shall call *similar activities*. The notion of capability is no doubt somewhat vague, but no more so perhaps than that of, say, liquidity and, I believe, no less useful. What concerns us here is the fact that organisations will tend to specialise in activities for which their capabilities offer some comparative advantage; these activities will, in other words, generally be similar in the sense in which I have defined the term although they may nevertheless lead the firm into a variety of markets and a variety of product lines. Under capitalism, this degree of specialisation will come about through competition but it seems to me likely to be adopted under any alternative system for reasons of manifest convenience. Mrs. Penrose has provided us with excellent accounts of how companies grow in directions set by their capabilities and how these capabilities themselves slowly expand and alter.[2] Dupont, for example, moved from a basis in nitro-cellulose

[1] E. T. Penrose, *The Theory of the Growth of the Firm* (Oxford University Press, 1959).
[2] E. T. Penrose, *ibid.*

explosives to cellulose lacquers, artificial leather, plastics, rayon and cellophane and from a basis in coal tar dyestuffs into a wide range of synthetic organic chemicals, nylon and synthetic rubber. Similarly, Marks and Spencer, having acquired marketing and organisational techniques in relation to clothing were led to apply them to foodstuffs.

There is therefore a strong tendency for the activities grouped within a firm to be similar, but this need not always be so. In the history of any business random factors will have left an influence, and the incentive to take up a particular activity will sometimes be provided, not by the prior possession of an appropriate capability, but by the opportunity of a cheap acquisition, through a family or business connection or because of management's belief that the profitability of investment in some direction was being generally under-estimated. There is no need to deny, moreover, that a variety of potential gains are provided by grouping activities irrespective of their character; risks can be spread, the general managerial capability of the firm can be kept fully employed and the allocation of finance can be planned from the centre. None of this is in contradiction with the principle that it will pay most firms for most of the time to expand into areas of activity for which their particular capabilities lend them comparative advantage. A firm's activities may also, on occasions, be more similar than they superficially appear. If a firm acquired companies irrespective of the character of their activities we should term it conglomerate; but if the motive for the purchases were the belief that the companies were being badly managed, the hope being to restore them to health before re-selling them at a profit, the management would be exercising a particular capability.

IV

I have argued that organisations tend to specialise in activities which, in our special sense of the term, are similar. But the organisation of industry has also to adapt itself to the fact that activities may be *complementary*. I shall say that activities are complementary when they represent different phases of a process of production and require in some way or another to be co-ordinated. But it is important that this notion of complementarity be understood to describe, for instance, not only the relationship between the manufacture of cars and their components, but also the relationship of each of these to the corresponding activities of research and development and of marketing. Now it is clear that similarity and complementarity, as I have defined them, are quite distinct; clutch linings are complementary to clutches and to cars but, in that they are best made by firms with a capability in asbestos fabrication, they are similar to drain-pipes and heat-proof suits. Similarly, the production of porcelain insulators is complementary to that of electrical switchgear but similar to other ceramic manufacture. And while

the activity of retailing toothbrushes is complementary to their manufacture, it is similar to the activity of retailing soap. This notion of complementarity will require closer definition at a later stage, but it will be convenient first to introduce one further (and final) set of conceptual distinctions.

It is clear that complementary activities have to be co-ordinated both quantitatively and qualitatively. Polymer production has to be matched, for example, with spinning capacity, both in terms of output volume and product characteristics, and investment in heavy electrical equipment has likewise to be appropriate, in scale and type, to the planned construction of power stations. Now this co-ordination can be effected in three ways; by *direction*, by *co-operation* or through *market transactions*. Direction is employed when the activities are subject to a single control and fitted into one coherent plan. Thus where activities are to be co-ordinated by direction it is appropriate that they be *consolidated* in the sense of being undertaken jointly by one organisation. Co-ordination is achieved through co-operation when two or more independent organisations agree to match their related plans in advance. The institutional counterparts to this form of co-ordination are the complex patterns of co-operation and affiliation which theoretical formulations too often tend to ignore. And, finally, co-ordination may come about spontaneously through market transactions, without benefit of either direction or co-operation or indeed any purposeful intent, as an indirect consequence of successive interacting decisions taken in response to changing profit opportunities. Let us now make use of this somewhat crude categorisation to re-interpret the questions with which we started.

V

What is the appropriate division of labour, we should now ask, between consolidation, co-operation and market transactions?

If we were able to assume that the scale on which an activity was undertaken did not affect its efficiency, and further that no special capabilities were ever required by the firm undertaking it, then there would be no limit to the extent to which co-ordination could be affected by direction within one organisation. If production could be set up according to "given" production functions with constant returns, no firm need ever buy from, or sell to, or co-operate with any other. Each of them would merely buy inputs, such as land and labour, and sell directly to consumers—which, indeed, is what in our model-building they are very often assumed to do. But, of course, activities do exhibit scale economies and do require specialised organisational capabilities for their undertaking, the result being that self-sufficiency of this kind is unattainable. The scope for co-ordination by direction within firms is narrowly circumscribed, in other words, by the existence of scale economies and the fact that complementary activities need not be similar. The larger the organisation the greater the number of capabilities

with which one may conceive it to be endowed and the greater the number of complementary activities that can, in principle, be made subject to co-ordination through direction; but even if a national economy were to be run as a single business, it would prove expedient to trade with the rest of the world. Some co-ordination, that is to say, must be left either to co-operation or to market transactions and it is to the respective roles of each of these that our attention must now turn.

Building and brick-making are dissimilar activities and each is undertaken by large numbers of enterprises. Ideally, the output of bricks ought to be matched to the volume of complementary construction that makes use of them and it is through market transactions that we expect this to come about. Brickmakers, in taking investment and output decisions, estimate future market trends; and errors in these estimates are registered in stock movements and price changes which can lead to corrective actions. As we all know, these adjustments may work imperfectly and I have myself argued elsewhere [1] that the model which we often use to represent this type of market is unsatisfactory. But this is a matter with which we cannot now concern ourselves. What is important, for our present purposes, is to note that impersonal co-ordination through market forces is relied upon where there is reason to expect aggregate demands to be more stable (and hence predictable) than their component elements. If co-ordination were to be sought through co-operation, then individual brick-makers would seek to match their investment and output plans *ex ante* with individual builders. Broadly speaking, this does not happen, although traditional links between buyers and sellers, such as are found in most markets, do introduce an element of this kind. Individual brick manufacturers rely, for the most part, on having enough customers to ensure some cancelling out of random fluctuations in their several demands. And where sales to final consumers are concerned, this reliance on the law of large numbers becomes all but universal. Thus we rely on markets when there is no attempt to match complementary activities *ex ante* by deliberately co-ordinating the corresponding plans; salvation is then sought, not through reciprocal undertakings, but on that stability with which aggregates, by the law of large numbers, are providentially endowed.

Let us now consider the need to co-ordinate the production of cans with tin plate or lacquers, of a particular car with a particular brake and a particular brake lining, of a type of glucose with the particular beer in which it is to be used, or a cigarette with the appropriate filter tip. Here we require to match not the aggregate output of a general-purpose input with the aggregate output for which it is needed, but of particular activities which, for want of a better word, we might call *closely complementary*. The co-ordination, both quantitative and qualitative, needed in these cases requires the co-operation of those concerned; and it is for this reason that

[1] In *Information and Investment* (Oxford University Press, 1961).

the motor car companies are in intimate association with component makers, that Metal Box interests itself in its lacquer suppliers, Imperial Tobacco with Bunzl and so on. Co-ordination in these cases has to be promoted either through the consolidation of the activities within organisations with the necessary spread of capabilities, or through close co-operation, or by means of institutional arrangements which, by virtue of limited shareholdings and other forms of affiliation, come somewhere in between.

Here then we have the prime reason for the existence of the complex networks of co-operation and association the existence of which we noted earlier. They exist because of the need to co-ordinate closely complementary but dissimilar activities. This co-ordination cannot be left entirely to direction within firms because the activities are dissimilar, and cannot be left to market forces in that it requires not the balancing of the aggregate supply of something with the aggregate demand for it but rather the matching, both qualitative and quantitative, of individual enterprise plans.

VI

It is perhaps easiest to envisage co-ordination in terms of the matching, in quantity and specification, of intermediate output with final output, but I have chosen to refer to activities rather than goods in order to show that the scope is wider. The co-operation between Marks and Spencer and its suppliers is based most obviously on a division of labour between production and marketing; but we have seen that it amounts to much more than this in that Marks and Spencer performs a variety of services in the field of product development, product specification and process control that may be beyond the capability of the supplying firms. And one may observe that inter-firm co-operation is concerned very often with the transfer, exchange or pooling of technology. Thus a sub-contractor commonly complements his own capabilities with assistance and advice from the firm he supplies. New products also frequently require the co-operation of firms with different capabilities, and it was for this reason that I.C.I. originally co-operated with Courtaulds in the development of nylon spinning and now co-operates with British Sidac in developing polypropylene film.

It is indeed appropriate to observe that the organisation of industry has to adapt itself to the need for co-ordination of a rather special kind, for co-ordination, that is to say, between the development of technology and its exploitation. A full analysis of this important subject cannot be attempted here but it is relevant to consider those aspects of it that relate to our principal themes. What then are the respective roles, in relation to this kind of co-ordination, of direction, co-operation and market transactions? Obviously there are reasons why it may be convenient to co-ordinate the activities of development and manufacture through their consolidation within a single organisation. Manufacturing activity is technology-producing as

well as technology-dependent; in the process of building aircraft or turbo-alternators difficulties are encountered and overcome and the stock of knowledge and experience is thereby increased. But there are also good reasons why a firm might not be content to seek the full exploitation of its development work through its own manufacturing activity. The company that develops a new product may itself lack sufficient capacity to manufacture it on the scale needed to meet the demand and may not have time enough to build up the required additional organisation and material facilities. It could, of course, seek to acquire appropriate capacity by buying firms that already possessed it, but this policy might prove unattractive if it entailed taking over all the other interests to which these firms were committed. The innovating firm might judge that its comparative advantage lay in developing new products and be reluctant therefore to employ its best managerial talents in increasing the output of old ones. It would be aware, moreover, that not only manufacturing but marketing capability would be needed and might properly consider that it neither possessed nor could readily acquire this, especially in foreign countries. All these considerations may lead firms to seek some indirect exploitation of a product development. And, in the case of the new process, the incentive might be even stronger in that there might be a wide variety of fields of production in which the process could be used.

The indirect exploitation of new technology could be sought, in terms of our nomenclature, either through market transactions or through co-operation with other firms. But technology is a very special commodity and the market for it a very special market. It is not always easy, in the first place, to stop knowledge becoming a free good. The required scarcity may have to be created artificially through a legal device, the patent system, which establishes exclusive rights in the use or the disposal of new knowledge. Markets may then develop in licences of right. But these are very special markets in that the commercial freedom of those operating within them is necessarily restricted. For suppose that A were to sell to B for a fixed sum a licence to make a new product, but at the same time retained the unfettered right to continue to produce and sell the product himself. In this case the long- and short-run marginal costs of production of the good would, for both parties, be below unit costs (because of the fixed cost incurred by A in the development work and by B as a lump sum paid for the licence) so that unrestrained competition would drive prices to unremunerative levels. It might at first seem that this danger could be avoided if licences were charged for as a royalty on sales, which, unlike a fixed sum, would enter into variable costs. But the licensee might still require assurance that the licensor, unburdened by this cost element, would not subsequently set a price disadvantageous to him or even license to others on more favourable terms. These dangers could be avoided if the parties were to bind themselves by price or market-sharing agreements or simply by the prudent adoption of the policy

of live and let live. But, in one way or another, it seems likely that competition would in some degree have been diminished.[1]

It would appear, therefore, on the basis of these considerations, that where the creation and exploitation of technology is co-ordinated through market transactions—transactions in licences—there will already be some measure of co-operation between the parties. The co-operation may, of course, amount to little more than is required not to rock, or at any rate not to sink, the boat. But there are reasons why it will generally go beyond this.

[1] Professor Arrow reaches a different conclusion. The matter is considered in his article " Economic Welfare and the Allocation of Resources for Invention " published in *The Rate and Direction of Inventive Activity*, (edited by National Bureau of Economic Research, Princeton University Press, 1962). Professor Arrow maintains that " an incentive to invent can exist even under perfect competition in the product markets though not, of course, in the ' market ' for the information containing the invention " and that " provided only that suitable royalty payments can be demanded, an inventor can profit without disturbing the competitive nature of the industry."

The issue is simplest in the case of a cost-saving invention. Professor Arrow considers a product made under constant costs both before and after the invention and shows how the inventor can charge a royalty that makes it just worth while for firms making the product to acquire a licence. On the face of it one might then conclude that the licensor would have no need to bind himself not to reduce price below the level that provided licensees with a normal profit or to re-license for a lesser royalty, for, if he were to do either of these things, existing licensees would make losses, stop producing and therefore discontinue royalty payments. But this conclusion is valid only under the highly special assumption of there being no fixed costs. For firms will in general continue in production so long as price does not fall below variable costs. Thus the licensor could find it in his interest, having sold as many licences as he could at the higher royalty, to license others at a lower royalty, or to enter the market himself. He would thus extend the market for the product and increase his earnings provided, of course, that price were kept above variable costs and therefore high enough to induce the original (and by then no doubt aggrieved) licensees to stay in business. It is true, of course, that *in the long run* fixed plant would wear out and firms deprived of their quasi-rents would cease producing, but the fact that an opportunity for exploitation is merely temporary does not warrant our assuming that it will not be seized. In general the licensor would stand to gain by " cheating " the licensees in the manner described and the latter would therefore want some measure of assurance (which need not be formal) that he would not do so. There would be a market for licences, that is to say, only if the commercial freedom of the licensor were in this way reduced.

It may be that Professor Arrow would not consider this to represent a significant restriction of competition; and indeed the important practical issue concerns the manner and degree in which the parties accept limitations on their freedom of action. I have suggested that the licensor would be in a position, having licensed other firms, subsequently to deprive them of expected profits. A firm will therefore seek a licence only if it believes that this will not happen, but it may consider that sufficient assurance is provided by the fact that the licensor, in his own long-run interest, will not wish to acquire the reputation for such sharp practice. Much the same situation obtains in the context of the relationship between a large purchaser and a small supplier. Marks and Spencer, having offered attractive enough terms to induce the blanket manufacturer to devote a large proportion of his capacity to meet its needs, might subsequently press for a price reduction that left him with a poor return. The hapless supplier, in the short run at any rate, might have no option but to give way. But although the purchaser could thus act, it could scarcely be in his own long-run interest to acquire the reputation for doing so.

The upshot would therefore seem to be this. A market for licences can function only if the parties to the transactions accept some restraints, but, in certain circumstances, no more restraint might be required than enlightened self-interest could be depended upon by itself to ensure. In practice, of course, licensing arrangements are commonly associated with much more—and often more formal—restraint of trade, the extent of which may or may not be greater than is necessary for the transfer of technology to take place.

Technology cannot always be transferred simply by selling the right to use a process. It is rarely reducible to mere information to be passed on but consists also of experience and skills. In terms of Professor Ryle's celebrated distinction, much of it is " knowledge how " rather than " knowledge that." Thus when one firm agrees to provide technology to another it will, in the general case, supply not only licences but also continuing technical assistance, drawings, designs and tools. At this stage the relation between the firms becomes clearly co-operative and although, at its inception, there may be a giver and a receiver, subsequent development may lead to a more equal exchange of assistance and the pooling of patents. Arrangements of this kind form an important part of the networks of co-operation and affiliation to which I have made such frequent reference.

VII

This article began by referring to a vision of the economy in which firms featured as islands of planned co-ordination in a sea of market relations. The deficiencies of this representation of things will by now be clear. Firms are not islands but are linked together in patterns of co-operation and affiliation. Planned co-ordination does not stop at the frontiers of the individual firm but can be effected through co-operation between firms. The dichotomy between firm and market, between directed and spontaneous co-ordination, is misleading; it ignores the institutional fact of inter-firm co-operation and assumes away the distinct method of co-ordination that this can provide.

The analysis I presented made use of the notion of activities, these being understood to denote not only manufacturing processes but to relate equally to research, development and marketing. We noted that activities had to be undertaken by organisations with appropriate capabilities. Activities that made demands on the same capabilities were said to be similar; those that had to be matched, in level or specification, were said to be complementary. Firms would find it expedient, for the most part, to concentrate on similar activities. Where activities were both similar and complementary they could be co-ordinated by direction within an individual business. Generally, however, this would not be the case and the activities to be co-ordinated, being dissimilar, would be the responsibility of different firms. Co-ordination would then have to be brought about either through co-operation, firms agreeing to match their plans *ex ante*, or through the processes of adjustment set in train by the market mechanism. And the circumstances appropriate to each of these alternatives were briefly discussed.

Let me end with two further observations. I have sought to stress the co-operative element in business relations but by no means take the view that where there is co-operation, competition is no more. Marks and Spencer

can drop a supplier; a sub-contractor can seek another principal; technical agreements have a stated term and the conditions on which they may be re-negotiated will depend on how the strengths of the parties change and develop; the licensee of today may become (as the Americans have found in Japan) the competitor of tomorrow. Firms form partners for the dance but, when the music stops, they can change them. In these circumstances competition is still at work even if it has changed its mode of operation.

Theories of industrial organisation, it seems to me, should not try to do too much. Arguments designed to prove the inevitability of this or that particular form of organisation are hard to reconcile, not only with the differences between the capitalist and socialist worlds, but also with the differences that exist within each of these. We do not find the same organisation of industry in Jugoslavia and the Soviet Union, or in the United States and Japan. We ought to think in terms of the substitutability of industrial structures in the same way as Professor Gerschenkron has suggested in relation to the prerequisites for economic development. It will be clear, in some situations, that co-ordination has to be accomplished by direction, by co-operation or through market transactions, but there will be many others in which the choice will be difficult but not very important. In Great Britain, for example, the artificial textile industry is vertically integrated and the manufacturers maintain that this facilitates co-ordination of production and development. In the United States, on the other hand, anti-trust legislation has checked vertical integration, but the same co-ordination is achieved through close co-operation between individual firms at each stage. It is important, moreover, not to draw too sharp lines of distinction between the techniques of co-ordination themselves. Co-operation may come close to direction when one of the parties is clearly predominant; and some degree of *ex ante* matching of plans is to be found in all markets in which firms place orders in advance. This points, however, not to the invalidity of our triple distinction but merely to the need to apply it with discretion.[1]

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[1] In his article, " The Nature of the Firm," *Economica*, 1937, pp. 386–405, R. H. Coase explains the boundary between firm and market in terms of the relative cost, at the margin, of the kinds of co-ordination they respectively provide. The explanation that I have provided is not inconsistent with his but might be taken as giving content to the notion of this relative cost by specifying the factors that affect it. My own approach differs also in that I distinguish explicitly between inter-firm co-operation and market transactions as modes of co-ordination.